International Strategy for Disaster Reduction

THE WORLD BANK

South Eastern Europe Disaster Risk Mitigation and Adaptation Initiative

Risk Assessment for South Eastern Europe

Desk Study Review

United Nations

Preface

South East European (SEE) nations have history of devastating earthquakes, floods, landslides, drought, extreme temperature, wildfires and windstorms that have caused economic and human losses across the region. Often these disasters, which transcend borders, overwhelm the management capacity of a single country. Also, the level of preparedness and prevention varies from country to country, and regional cooperation does not exist to the extent necessary. Because of this high vulnerability, and the relatively small size of the countries in the SEE region, as well as the historical links between them, it will be more efficient and economically prudent for the region's countries to cooperate in the areas of civil protection and disaster preparedness and prevention.

Bearing in mind these challenges, but also the opportunities presented by SEE's historical and persisting areas of strength, the World Bank and the UN/ISDR secretariat, in collaboration with other international partners, initiated work on the program now known as the South Eastern Europe Disaster Risk Mitigation and Adaptation Initiative (SEEDRMAI), which proposes activities that are aimed at closing SEE's capacity gaps and that promote rapid introduction of both global best practices and closer regional cooperation. SEEDRMAI incorporates three focus areas: (i) hydrometeorological forecasting, data sharing and early warning; (ii) coordination of disaster mitigation, preparedness and response; and (iii) financing of disaster losses, reconstruction and recovery, and disaster risk transfer (disaster insurance). The initiative will build on the existing cooperation in the region, and will complement and consolidate the activities promoted by the European Union, the Council of Europe, the United Nations (World Meteorological Organization and United Nations Office for the Coordination of Humanitarian Affairs), the Stability Pact for South Eastern Europe, the Disaster Preparedness and Prevention Initiative, the Civil Military Emergency Preparedness Council and others to promote more effective disaster mitigation, preparedness and response.

As part of SEEDRMAI work on coordination of disaster mitigation, preparedness and response (focus area ii), the UN/ISDR secretariat, within the context of the Global Facility for Disaster Reduction and Recovery, has awarded a consultancy project to RMSI, India to prepare this synthesis report on risk assessment for the countries of South Eastern Europe. This report analyses risks at both the country and sub-regional levels, emphasizing transboundary disaster risks and their effects. Risk assessments for all the member countries have been prepared, and country-level and regional issues and potential areas of cooperation are addressed. The report concludes with recommendations on the way forward for SEEDRMAI.

Acknowledgements

The study review was developed within the context of the Global Facility for Disaster Reduction and Recovery (GFDRR), a partnership of Australia, Canada, Denmark, the European Commission, Finland, France, Germany, Italy, Japan, Luxembourg, Norway, Spain, Sweden, Switzerland, the United Kingdom, the United Nations International Strategy for Disaster Reduction, the USAID Office of U.S. Foreign Disaster Assistance, and the World Bank. GFDRR's mandate is to help developing countries reduce their vulnerability to natural hazards.

The UN/ISDR secretariat and the World Bank gratefully acknowledge the contributions made to this document by the many partners, institutions and individuals who have shared documents, reports and analyses covering South Eastern Europe, including:

Delivering a world of solutions

RMSI, which undertook the risk assessment desk review with great professionalism. The RMSI team members involved in preparing this report were Dr. Muralikrishna M and Mr. Sushil Gupta, with the support of RMSI colleagues who assisted with data analysis, map preparation and editing.

National interlocutors

Albania - *General Civil Emergency Directory of the Ministry of Interior:* Mr. Bujar Kapllani; Mr. Sali Kelmendi, CE Planning and Coordination Director; Mr. Alfred Olli, General Director; Mr. Alfred Prifti, Chief of National EOC. *Hydrometeorological Institute:* Ms Manjola Banja, Deputy Director; Dr. Miriam Ndini, Hydrologist; Prof Dr. Mitat Sanxhaku, Director.

Bosnia and Herzegovina - *Hydrometeorological Institute of Federation of Bosnia and Herzegovina:* Mr. Nino Rimac, Head of Department for Forecasting and Balance; Mr. Enes Sarac, Director. *Hydrometeorological Institute of Republika Srpska:* Mr. Drago Trkulja, Director. *Sector for Civil Protection of the Ministry of Security*: Mr. Samir Agic, Assistant to Minister, Head, HFA Focal Point; Mr. Idriz Brkovic, Head of Department for Strategic Planning and Protection and Rescue Measures; Mr. Samir Huseinbasic, Head of Department for Structure and Training; Mr. Milivoje Popovic, Head of Department for International Cooperation and Coordination

Bulgaria - *National Civil Protection Service of the Ministry of State Policy for Disasters and Accidents:* Ms Antoaneta Boycheva, Head of European Integration Department; Mr. Andrey Ivanov, Director, HFA Focal Point; Mr. Andrey Stoimenov, CoE Permanent Correspondent, Head of the Management Bodies, the Forces and the Population Department.

Croatia - *Meteorological and Hydrological Institute*: Mr. Ivan Cacic, Director; Mr. Kreso Pandzic, Assistant Director; Mr. Dusan Trninic, Assistant Director. *National Protection and Rescue Directorate:* Mr. Damir Cemerin, Head of the Director's Office; Mr. Djuro Poldrugac, Director, alternative HFA Focal Point; Ms Arabela Vahtaric, Head of International Relations.

The Former Yugoslav Republic of Macedonia - *Crisis Management Centre:* Mr. Pande Lazarevski, Director, Mr. Dusko Petrovski, Acting Head of Department, Ms Snezana Sokolova, Cabinet, Ms Mirjana Petrovic, Department for International Cooperation. *Protection and Rescue Directorate:* Ms Duska Celeska, Advisor, Mr. Kosta Jovcevski, Director, Mr. Trajko Todorcevski, Head of the Inspection Department. *Institute of Earthquake Engineering and Engineering Seismology, University "St. Cyril and Methodius" and European Center on Vulnerability of Industrial and Lifelines Systems – ECILS:* Prof Dr. Mihail Garevski, Director; Prof Dr. Zoran Milutinovic, Head of Risk, Disaster Management and Strategic Planning Department. *Hydrometeorological Service:* Mr. Gjorgji Kotev, Director. *Macedonian Red Cross:* Mr. Samet Ali, Disaster Management Coordinator; Mr. Dimitar Domazetovski, President of Disaster Commission.
Ministry of Defense: Mr. Kiro Atanasov, Advisor to the Minister on Civil Protection

Montenegro - *Emergency Situations and Civil Security of the Ministry of Interior:* Mr. Zoran Begovic, Assistant to Minister, Head. *Hydrometeorological Service:* Mr. Luka Mitrovic, Director; Ms Jasna Sekulovic, International Advisor. *Seismological Observatory:* Prof Branislav Glavatovic, General Manager

Moldova - *Department of Emergency Situations of the Ministry of Internal Affairs*
Ms Svetlana Drobot, International and Public Relations Office; Mr. Alexandru Oprea, Head of the International and Public Relations Office; Colonel Andrei Shumleansky, Head. *State Hydrometeorological Service:* Mr. Valeriu Cazac, Director General, HFA Focal Point.

Romania - *General Inspectorate for Emergency Situations of the Ministry of Administration and Interior:* Ms Rodica Botirca, Communication Department; Ms Roxana Branda, International Relations; Mr. Marius Dogeanu, Head of International Relations; Mr. Ionut Homeag, International Relations; General Vladimir Secara, Inspector General. *Ministry of Administration and Interior:* Mr. Aurel Bilanici, Director of the Project Management Unit; Mr. Radu Mircea Popescu, Counselor to the Minister *Ministry of Transport, Construction and Tourism:* Mr. Iuliu Bara, Personal Adviser to the Delegate Minister for Public Works and Territorial Planning.

Serbia - *Civil Protection Department of the Ministry of Defense:* Mr. Zivko Babovic, Head-Leader. *Hydrometeorological Service:* Ms Jovanka Andrejevic, Director; Mr. Dragan Jovanovic, Assistant Director, Sector for Meteorology; Mr. Miksa Jovanovic, Assistant Director, Environmental Control Department; Ms Dijana Minuskovic, Head for International Relations Department. *Protection and Rescue Sector from the Ministry of Interior:* Mr. Ivan Baras, International Relations; Mr. Predrag Maric, Assistant to Minister, Head; Mr. Dragan Stojanovic, Deputy Head, HFA Focal Point.

Slovenia - *Administration for Civil Protection and Disaster Relief of the Ministry of Defence:* Ms Milena Dobnik Jeraj, Head of International Department, Ms Natasa Horvat, Advisor Ms Biljana Zuber, Advisor.

Turkey - *European Natural Disasters Training Centre – AFEM:* Mr. Necdet SEYFE, Ministry Consultant, CoE Permanent Correspondent. *Turkish Emergency Management Agency:* TEMAD:Mr. Hasan Ipek, General Director. *Ministry of Public Works and Settlement:* Mr. Mustafa Taymaz, General Director, HFA Focal Point; Mr. Bekir Tuzel, Head, Earthquake Research Department.

Regional and international interlocutors

Civil-Military Emergency Preparedness Council for SEE: Mr. Andrew Bruzewicz, HQ USACE - CMEPC Programme Manager; Ms Joyce Augustyn, Operations Officer. Council of Europe: Mr. Eladio Fernandez-Galiano, Executive Secretary, European and Mediterranean Major Hazards Agreement (EUR-OPA); Ms Michele Meunier, CoE Development Bank; Mr. Francesc Pla, Secretary of the Committee of Permanent Correspondents. European Commission EC: DG Environment - Mr. Hans Das, Deputy Head of Civil Protection Unit; EuropeAid Co-operation Office - Mr. Jean-Marc Riegel, Head of Sector Energy and Environment. Danish Emergency Management Agency: Mr. Michael Elmquist, Senior Advisor; Mr. Steffen Schmidt, Senior Programme Officer. International Federation of Red Cross and Red Crescent Societies: Ms Slobodanka Curic, Regional Disaster Management Coordinator; Mr. Sune Follin, Acting Head of Regional Delegation, Budapest and Federation Representative to BiH. North Atlantic Treaty Organization: Civil Emergency Planning CEP - Mr. Carsten Fausbol, Head; Mr. Evert G.J. Somer, Operations Divisions. Euro-Atlantic Disaster Response Coordination Centre - Mr. Guenter Bretschneider, Head. Public Diplomacy Division (Science for Peace and Security Program) - Dr. Walter Kaffenberger; Dr. Susanne Michaelis; Dr. Chris De Wisplelaere, Head, Collaborative Programs Section. Organization for Economic Co-operation and Development: Mr. Timothy Bishop, Senior Expert on Finance and Insurance. The Royal Institute of Chartered Surveyors, President's Major Disaster Management Commission: Dr. David Owen, Chairman. Stability Pact SEE Disaster Preparedness and Prevention Initiative: Mr. Jiri Kalasnikov, Director, SP SEE Working Table III: Security; Mr. Miro Vujanic, SP SEE DPPI Head of Secretariat. Swedish Rescue Services Agency: Dr. Julia Fredriksson, Senior Executive Official. Swiss Development and Cooperation: Mr. Andreas Schiess, Policy Coordinator Civil Emergency Planning; Mr. Giacomo Solari, Programme Officer.

United Nations Office for the Coordination of Humanitarian Affairs: Mr. Dusan Zupka, Chief a.i., Surge Capacity & Contingency Planning Section. UNDP/Bureau for Crisis Prevention and Recovery: Ms Maria Olga Gonzalez, Disaster Programme Specialist. UN Country Team Albania: Ms Dolores Karriqi, UN RC office; Ms Gulden Turkoz-Cosslett, UN Resident Coordinator. UNDP Bosnia and Herzegovina: Ms Amela Gacanovic Tunjevic; Mr. Seid Turkovic, Portfolio Manager. UNICEF Bosnia and Herzegovina: Ms June Kunugi, Representative. UN Country Team Macedonia: Mr. Mislim Hasipi, UN Disaster & Avian Influenza Preparedness Officer; Ms Maria Luisa Silva Mejias, UN Resident Coordinator. UN Country Team Montenegro: Ms Tamara Vukovic, UN Coordination Assistant. UN Country Team Moldova: UNDP - Mr. Ignacio Artaza, Deputy Resident Representative; UNFPA - Mr. Boris Gilca, Programme Coordinator; UNICEF - Mr. Mohamed Azzedine Salah, Programme Officer. Country Team Montenegro: Milica Begovic, UN Coordination/Executive Associate to RR a.i.; Mr. Mirko Bracanovic, Procurement/Security Officer; Mr. Garret Tankosic Kelly, UNDP Resident Representative & UN Inter-Agency Coordination; Ms Tamara Vukovic, UN Coordination Assistant. UN Country Team Serbia: UN Office of the Resident Coordinator Serbia - Ms Borka Jeremic, Coordination Analyst; UNDP - Mr. Radomir Buric, Assistant Resident Representative; UNICEF - Mr. Lennart Kotsalainen, acting UN RC and UNHCR Representative; UNICEF - Mr. Oliver Petrovic, Early Childhood Development Specialist.

World Meteorological Organization: Mr. Dusan Hrcek, Representative for Europe, Regional Office for Europe; Mr. Petteri Taalas, former Director of Regional and Cooperation Department.

Particular thanks are due to Ms. Paola Albrito (the UN/ISDR Secretariat Coordinator for Europe) and Mr. Wael Zakout (the World Bank Coordinator for Europe and Central Asia) for their coordination, comments and suggestions at different stages of this study; and to Mr. Sergej Anagnosti (Consultant to SEEDRMAI), who shared his insights and coordinated on securing some of the crucial reports during the study.

Thanks also to the production team from the ISDR secretariat, headed by Mario Barrantes, and the editorial consultant Bonnie Galvin.

Table of Contents

List of Figures

List of Tables

Abbreviations Used

CMEPC	Civil-Military Emergency Preparedness Council
CRED	Centre for Research on the Epidemiology of Disasters
DPPI	Disaster Preparedness and Prevention Initiative
EM-DAT	The Emergency Events Database that has been developed by the Office of US Foreign Disaster Assistance and the Centre for Research on the Epidemiology of Disasters
GDP	Gross Domestic Product
NATO	North Atlantic Treaty Organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OFDA	Office of US Foreign Disaster Assistance
SEE	South Eastern Europe
SP SEE	Stability Pact for South Eastern Europe
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children’s Fund
UN/ISDR	United Nations International Strategy for Disaster Reduction

Executive Summary

This synthesis report was prepared as part of the initiative of the UN/ISDR secretariat and the World Bank, with other international partners, towards disaster risk management, in line with the Hyogo Frameworkfor Action, and aiming at reducing the vulnerability of the South Eastern European countries to the risk of disasters. The objectives of this initiative are to assess the risks for each member state and their common vulnerabilities; to assess existing capacities; and to identify needs, means of cooperation, and investment priorities to promote preparedness and to upgrade emergency response capabilities. This synthesis report aims to assess the disaster risks for SEE countries through a desk review of existing reports, studies, analyses and assessments regarding disaster risk (vulnerability and hazards) at the country and regional levels.

This report analyses disaster risks at country and regional levels, emphasizing the transboundary disaster risks and their effects. In addition, the report has reviewed existing documents to understand current legislation, awareness, capacity and institutional mechanisms towards disaster preparedness and prevention. Various reports like the national reports on the current status of disaster reduction that were developed for the 2005 World Conference on Disaster Reduction (held in Kobe, Japan); other project documents prepared at country and regional levels; documents prepared by the Civil-Military Emergency Preparedness Council; documents from the Disaster Preparedness and Prevention Initiative of the Stability Pact for South Eastern Europe; documents prepared by international organizations working in the area; and published research papers were all reviewed as part of this assignment. National initiatives, initiatives of international organizations and bilateral donor organizations towards disaster reduction, and case studies of best practices in the region were also reviewed in the study. Data from the EM-DAT database run by the Centre for Research on the Epidemiology of Disasters was used extensively for the risk (vulnerability and hazard) analysis. The number of disaster events, the number of people killed and affected, and the economic losses due to disasters were the main criteria used for risk assessment. In addition to EM-DAT, other global databases like online Disaster Risk Index tool of the United Nations Development Programme, World Bank statistics, country-specific individual studies by academic organizations, research publications, and online data from the National Geophysical Data Centre and the World Bank were also used.

The report looks at both natural and technological hazards. It finds that there has been an increase in the number of disaster events, particularly due to hydrometeorological hazards, in most of the countries in the region. Disasters due to technological hazards are also on the rise in many countries. Overall, the report shows a pattern of growing levels of economic loss, rather than growing mortality, due to disasters in this region. The region has experienced damaging and catastrophic earthquakes in the recent past, and seismological studies show that there is a high probability of future occurrence.

The existing transboundary regional initiatives in the region are also profiled. The report concludes with recommendations on the way forward for this initiative. The recommendations made include regional cooperation; improving/formulating legislation towards disaster preparedness and prevention; linking policies and operations; increasing coordination between central and local governments; political resolutions; awareness and training; integrating disaster risk management into national development; and developing risk management databases, risk modeling and a framework for sharing data.

1

Risk Assessment: An Overview

Disasters (due to natural and technological hazards) can have catastrophic impacts on nations and regions. These events can lead to economic, social and environmental damages affecting overall economic activity, lifestyles, the emotional and physical well-being of humans and animals, social unrest and homelessness; and can cause disruption of communities and natural resources.

The extent of damage caused by disasters depends on the vulnerability of affected areas. Harmful impacts of disasters result from the severity of hazard events and from the high vulnerability of the areas concerned. Therefore, prior hazard forecasting and improving the resilience of people and property can help to reduce hazard impacts.

Risk and vulnerability assessments were given lower priority than response in the 1980s. Since then, there has been a strategic shift in disaster management practices towards an integrated disaster risk reduction approach, which includes disaster risk reduction planning in the development process of a country. There are international initiatives, particularly those of the United Nations Development Programme (UNDP) and the World Bank, that encourage nations to integrate disaster preparedness and mitigation into their development plans. This has given a different dimension and perspective to facing disasters.

International initiatives in the South Eastern Europe (SEE) region have proclaimed that all countries should, as part of their plans to achieve sustainable development through prevention, preparedness, building codes and enforcement of legislation, develop and have access to local, national, regional and global warning systems. However, this effort is only in the early stages of development in many SEE countries, and SEE countries have yet to inculcate disaster risk management into their development plans.

Vulnerability and risk factors coalesce around the concept of risk reduction, or disaster risk management. Appreciating and implementing this concept requires proper understanding of these factors, including the history of disasters and the nature of impacts, trends, the severity of different disasters, and the vulnerability of population and property. Severity is sometimes assessed against a country's gross domestic product (GDP) based on its particular development front (e.g. agriculture or service sector). The UN/ISDR secretariat and UNDP are currently working to develop a core set of indicators and a methodology to guide and monitor disaster risk reduction for hazards like earthquake, flood, cyclone and drought (UNDP 2004).

There are a few initiatives working to develop global databases on various hazards. EM-DAT, developed by the Office of U.S. Foreign Disaster Assistance (OFDA) and the Centre for Research on the Epidemiology of Disasters (CRED, or the Centre) is one such effort, and is widely used for macro-level risk assessment. The Centre has classified hazards into two types - natural and technological hazards - based on their origins. (Even though many natural hazards may be triggered by various human activities, a hazard can be categorized by its nature of origin as natural or technological.) Disaster events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing. For some events that have lingering impacts on society, it can be difficult to define the exact date of event. Generally, disaster statistics tend to be more precise on a smaller scale, where the evaluation of damages is undertaken in a more systematic manner, based on agreed methodologies (UN/ISDR, 2004).

Academics and emergency managers are continuously working to develop appropriate methodologies for assessing disaster risks, and several methods are or have recently been published (Inter-American Development Bank 2005, UNDP 2004). There is a great deal of effort taking place in benchmarking and vulnerability/risk indexing (ProVention Consortium 2006). UNDP, for example, has recently published a global report entitled Reducing Disaster Risk: a Challenge for Development (2004), in which it has developed the Disaster Risk Index and a relative vulnerability assessment using various indicators. Vulnerability and risk indexing are challenging. It is always a difficult matter to weigh the catastrophic severity of a disaster that might occur at 50- or 100-year intervals against the annual spring flood or summer forest fire that will most certainly occur somewhere in the nation. Further, the possibility of technological disasters (such as hazardous material or nuclear incidents), which can impact generations, has to be weighed against the full range of natural disaster risks. For relative vulnerability assessments, various economic and social variables have been used. But in most of these methodologies, there are a few common variables, like the number of events, the number of deaths, the size of the affected population and the amount of economic loss.

2

Methodology

This report provides hazard risk assessments for 11 SEE countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Moldova, Montenegro, Romania, Serbia, Slovenia and Turkey. Risk assessment seeks to determine the nature and extent of risk by analysing historic hazards and evaluating existing conditions of vulnerability. Therefore, this report analyses historical data to understand common hazards and vulnerability at both country and regional levels.

2.1 Data sources

The study uses data published in the EM-DAT database for the last 33 years (1974-2006). To do so, it draws on the work of Guha-Sapir et al. (2004), who present hazards and related variables extracted from EM-DAT at country and regional levels for the period 1974-2003. The data is grouped into five-year terms. This data was used after validating it with data available in the EM-DAT website and updating it as required. This validation step was taken because the EM-DAT website (http://www.em-dat.net) mentions that EM-DAT is constantly being updated. The data for the last three years (2004-2006) was extracted from EM-DAT for the same variables, and presented as a separate three-year group. EM-DAT has defined the criteria for selecting an event to be included in the database (see annex 1).

As economic loss data for many countries is scanty in EM-DAT, other sources, like the UNDP Disaster Risk Index analysis tool (http://gridca.grid.unep.ch/undp/), the World Bank Global Natural Disaster Hotspots project (http://geohotspots.worldbank.org/ hotspot/hotspots/disaster.jsp), the National Geophysical Data Center and other published research papers on hazards and vulnerability in the region were also used. The World Bank Hotspots study provided the spatial distribution of hazards, helped identify "hotspots", or geographic areas with the highest relative disaster risk potential, and presented the World Bank projects in the region.

Country-level reports and other available documents were also reviewed to understand the relevant hazards and their impacts in the region. This data was used as supplementary information, because it may not be standardized. However, this supplementary data was important, because EM-DAT cannot be treated as complete. The data issues related to disaster risk assessment are discussed in a separate section (section 3), below.

2.2 Analysing hazards and vulnerabilities to assess risk

EM-DAT data was used to assess the incidence, or frequency, of hazards and hazard impacts at country and regional levels. The data is presented as absolute numbers, to understand the frequency and intensity of hazards with respect to death, victims and economic losses. The economic loss data was analysed against each country's GDP to describe the overall impact of hazards on the economy. For the vulnerability analysis, death data was compared with the total exposed population to understand the severity of hazard events. Vulnerability assessment was also performed using economic and social indicators like the Human Development Index, GDP and population density.

Many countries in the region were formed during the early 1990s, and retrospective country-specific data for such countries is available only from that period onwards in EM-DAT. This has restrained historic analysis of hazard trends for those countries. For hazards like earthquakes that have a longer return period, distinct and major events prior to 1974 were also included in the analysis.

The status of existing legislation, capacity, awareness, training, institutional frameworks for disaster risk management, and transboundary and regional cooperation were also assessed. Levels of awareness and training, legislation, infrastructure and institutional capacities to cope with disasters can all influence vulnerability.

2.3 Country profiles and risk assessments

Risk assessment is strongly linked to biophysical setting and socio-economic conditions of the region. Therefore, in this report a brief overview of each country is provided as background information prior to the risk assessment.

For the country risk assessments, indicators like number of events, deaths, victims and economic losses were considered. In addition, the legislation of the country, its capacity, its institutional structure and other economic and social variables were evaluated to help assess vulnerability.

To round out the individual country risk assessments, the report evaluates the existing disaster risk management and preparedness of each country. It analyses the areas and system components that need to be further addressed in order to strengthen and enhance country competences and performance expectations for addressing disaster prevention, mitigation, preparedness and response at national and regional level.

2.4 Regional risk assessment

The regional risk assessment for the SEE region was prepared using the analytic methods described above. In addition, the risk assessment indicators were ranked for each country based on their relative values. Only major hazards like earthquake, flood, drought, windstorm and technological hazards were considered in the regional assessment. These hazards are defined in section 3.2, below.

Disaster and disaster impact indicators were ranked separately, and a cumulative rank was also calculated. For disaster ranking, the number of events per year (incidence rate) considering the 33 years of events was used. The disaster rank shows disaster risk of each country, while disaster impact ranking gives a picture of its relative vulnerability. For disaster impact, the number of deaths, the total affected population, and the amount of economic loss all were used, along with total population, population density, population density in the affected area, urban population growth, percentage of arable land, the Human Development Index and GDP. The cumulative ranking is calculated from these variables to assess the risks faced and relative vulnerability of countries in the region.

Existing regional initiatives and cooperation are also reviewed. RMSI studies conducted in Turkey and Romania on earthquake and flood are also presented as case studies, to showcase how a high-quality database will help in risk modeling and detailed analysis, and how it can guide sub-national level risk and vulnerability assessments.

Based on the risk assessment and the review of existing legislation, institutional frameworks and capacities of the countries in the region, gaps were identified. Based on that, recommendations are provided in the end of the document.

Before going to country-level and regional assessments, some of the data issues and the terminology used in the report are explained. In reviewing the report, readers will need to keep the data issues and terminology in mind.

2.5 Data issues and terminology used

A. Data issues

Disasters (due to natural and technological hazards) are time and space reference events, but disasters don't follow political boundaries. For this reason, regional cooperation is very important in disaster preparedness and mitigation. The vulnerability of a nation or region to disaster events is often measured in terms of the total numbers of events, people killed, people affected and the economic losses. The impact diffusion of an event extends far beyond the visible physical damage. Vulnerability assessment is a means to develop appropriate mitigation measures and strategies at national, regional and international levels. Vulnerability assessment will help in prioritization of planning areas for disaster preparedness and prevention, and ultimately will assist with both sustainable development and poverty reduction.

Historic data plays a crucial role in hazard and vulnerability assessments of a country or region. Analysing the historic events and losses helps to identify the risks in a country or region. Harmonizing data and setting criteria are important parts of a quality risk assessment. Limits on the availability of standardized risk data often constrain quantitative assessments of countries and regions. Planners, policymakers, field agencies and others engaged in disaster preparedness have often expressed the need for good-quality data. When countries report an event, there may be a bias factor, as the reporting authority may provide higher figures to get attention and international support or may suppress or exaggerate critical information. Reinsurance companies also maintain loss data, but it is not accessible to public. Moreover, these companies focus on certain geographies and often won't give global or regional pictures.

Guha-Sapir et al. (2004) have highlighted the issues in the availability of disaster-related data in the report "Thirty Years of Natural Disasters 1974-2003: The Numbers". The key problems highlighted include:

1. Lack of a single organization performing data collection and compilation can lead to lack of standardization in collection methodologies and definitions.
2. Biased data can occur because of the rationale behind data gathering.
3. Prolonged disaster events (like famine over many years) may be recorded as multiple events.
4. Regional events which spread across different political boundaries (like flood, earthquake) will be recorded in all the affected countries, and may count as different events.
5. Change in national boundaries can also cause ambiguities and difficulties in comparing historic data. (This is applicable for the SEE region.)
6. Fragmented jurisdiction within a country over the different types of disasters can also cause a lack of quality data on the people killed and affected, and on the economic losses.

International initiatives recently started focusing on generating risk-related data at country, regional and global levels. The Centre for Research on the Epidemiology of Disasters has developed the EM-DAT global database on disasters (due to natural and technological hazards), and has complied data from different sources, including humanitarian and disaster agencies, governments, specialized agencies and the media. It has also recently started using increasing amounts of information from insurance company reports (http://www.em-dat.net/). EM-DAT has been constantly improved over the last 30 years.

EM-DAT has defined criteria for including events in the database. But it is worth mentioning that there are some inconsistencies in the data within EM-DAT. For example, there is a mismatch in the number of deaths in Romania during 1975, as the country profile report mentions no deaths, while EM-DAT shows six deaths. Additionally, some events have been reported in country-level documents but are not found in EM-DAT. For this report, EM-DAT was used as the main data source for risk assessment, because it provides standardized data, which is important when analysing the risks for individual countries and regions. The events and impacts in country-level reports and other published documents are also presented for the country-level assessments, while EM-DAT was used for analysing the hazards and vulnerabilities of the countries and the region.

B. Terminology used in the report

The majority of the terminology used in this report is taken from the definitions presented by the UN/ISDR secretariat. Several additional terms used are defined, as noted below, by RMSI.

Associated hazard: Hazards that occur as associated events to main hazards. For instance, landslide is an associated hazard with flood and earthquake. Sometimes certain epidemics can occur due to prolonged floods (RMSI).

Disaster: A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Drought-related hazards: Drought-related hazards include drought, extreme temperature and wildfire (RMSI).

Economic loss: Total loss caused due to hazard in USD based on a value of particular year. In this report the year chosen is 2003 (RMSI).

Hazard: A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hydrometeorological hazards: Natural processes or phenomena of atmospheric, hydrological or oceanographic nature, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hydrometeorological hazards include flood, debris and mud floods; tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wildland fires, temperature extremes, sand or dust storms; permafrost and snow or ice avalanches.

Natural hazards: Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. Natural hazards can be classified by origin namely: geological, hydrometeorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.

Number of deaths: Number of dead and missing reported (RMSI).

Number of victims: Total number of dead, missing and affected people (RMSI).

Risk assessment/analysis: A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

Technological hazard: Danger originating from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Note: events like political turmoil affecting a nation's economy, or economic disturbance due to arrival of a large number of refugees/immigrants, are not considered in this report for analysing risk even though these have an adverse impact on the economy of a nation.

Vulnerability: The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

3

Country-Level Risk Assessment

This section deals with the preliminary assessment of risks (derived from vulnerability and hazards) in the SEE region. The assessment is done from both vertical (country-level) and horizontal perspectives (for SEE sub-region).

There is an increase in the occurrence of disaster events in the region, along with growing vulnerability to populations due to population pressures on land, increasing urbanization and industrialization and unfair land-use practices, marginalization of populations, and civil unrest.

During the last three decades, there has been a continuous evolution in the practice of disaster management towards an emphasis on disaster mitigation. International organizations like the United Nations and the World Bank are encouraging countries to shift relief, response and humanitarian support towards disaster preparedness, and to integrate disaster management into country planning policies. The efforts towards this new development paradigm have been well received in many countries. Many nations have formulated national and local bodies for disaster mitigation activities, and have integrated disaster mitigation into all the development sectors of the country. In SEE regions, these bodies have different names, such as civil defense, civil emergency services, disaster response and relief, humanitarian assistance, emergency management, civil protection, disaster mitigation and prevention, and total disaster risk management; but all work towards same goal.

Before presenting the country-level risk assessments, a brief profile of each country is provided. This will give a background for the probable risks faced.

- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Macedonia, The Former Yugoslav Republic of
- Moldova
- Romania
- Serbia
- Montenegro
- Slovenia
- Turkey

3.1 Albania

3.1.1 Country profile

Albania is situated in South-Eastern Europe, bordered by the Adriatic Sea and the Ionian Sea, between Greece, Serbia and Montenegro. It has a total area of 28,750 square kilometres, with a coastline of 362 kilometres.

Albania has a population of 3,129,678 (World Bank 2005) with a population density of 109 people per square kilometre. The free and uncontrolled movement of population allowed since 1990 has changed the urban/rural population ratio in Albania. Albania has a recorded growth rate in the annual GDP of 0.6 per cent. The percentage annual population growth recorded is 0.58 per cent. Agricultural land constitutes 41 per cent of the geographical area of the country and contributes to 23 per cent of the country's GDP. Service sectors contribute to 56 per cent of the GDP. Nearly 30 percent of Albanians live below a poverty line of 2 USD per capita a day.

With the political changes in 1990, Albania has launched new economic programs, including price and exchange system liberalization, fiscal consolidation, monetary restraint, and a firm income policy to move towards a more open-market economy. The economy is encouraged by annual remittances from abroad of USD 600-800 million.

Figure 1

Map of Albania

3.1.2 Risk assessment

Albania is vulnerable to flood, earthquake, landslide, drought, extreme temperature, windstorm and high snowfall (including avalanche and epidemic). The country is highly vulnerable to earthquake, flood and landslide. EM-DAT shows (figure 2) that, during 1974-2006, floods accounted for the major share of disaster events (32 per cent), followed by earthquakes (18 per cent). There were two technological hazards reported during this period; one transport accident and one industrial accident, in 1991 and 2004 respectively.

Incidence of hazard events in the country (1974-2006) shows that there has been a steady increase in the number of events. There could be two compound reasons for this: (i) the data recording mechanisms became more organized during recent years, and events are being more systemically recorded; and/or (ii) there has been an (apparent) increase in the number of various natural and technological hazards in the country.

The detailed hazard analysis is dealt with in detail below. Only two technological hazards have been reported during this period, hence the data is insufficient to interpret the trend over the period.

Occurrence of different hazards over the period 1974-2006 in the country shows that 62 per cent are hydrometeorological hazards: flood- and drought-related events. Interestingly, while analysing events vis-à-vis death data, it is observed that there is a decreasing trend in absolute number of deaths due to natural hazards. Over this period, flood has killed more people than any other hazard. The September 2002 flood alone affected 16,971 families, inundated 30,000 hectares of agricultural land, damaged 494 houses (126 were heavily damaged) and affected areas of Lezha, Shkodra (northern), the district of Berat, Skrapar, Permet, Tepelena, Gjirokastra, Saranda and Korça (southern), with reported damages of USD 17.5 million. In terms of victims, the 1989-1991 drought affected almost the entire nation (Kapllani 2006): as per EM-DAT, 3.2 million people were affected. Hydrometeorological disasters affected 3.32 million people and incurred an economic loss of USD 24.67 million.

During the last 33 years, EM-DAT reports four earthquakes killing 36 people and affecting 2,790 people. There are other major earthquake events recorded in Albania in the past. The 15 April 1979 Skodra (Montenegro) earthquake alone killed 35 people, injured 383 and rendered 100,000 homeless. There is evidence of earthquakes in Albania starting from the third to second century B.C. In the nineteenth century alone, there are reported occurrences of 55 strong earthquakes of intensity VIII on the MSK (Medvedev-Sponheuer-Karnik) scale.[1] or above. Landslides often occur as associated hazards

1 The MSK, or Medvedev-Sponheuer-Karnik, scale of seismic intensity is an old-fashioned means of ranking earthquakes on a scale of 1-12, according to the intensity experienced.

Figure 2

Distribution of different hazards in Albania (1974-2006)

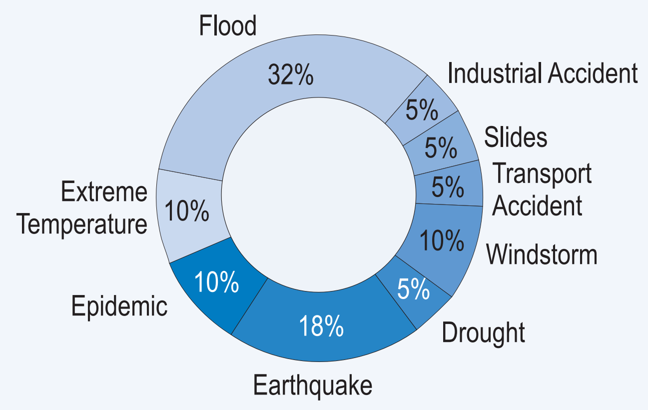
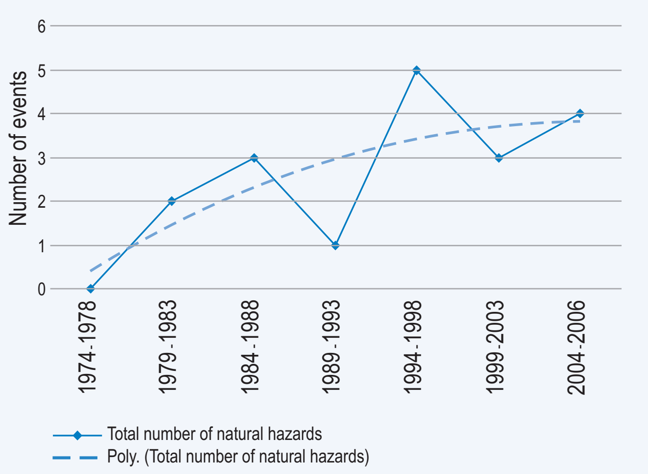


Figure 3

Trends in natural hazards in Albania: 1974-2006



of floods or earthquakes. During the period 2003-2006, there are 45 reported cases of massive landslides (Kapllani, 2006).

Extreme temperature and technological hazards have severe impacts in the country, which is indicated by a large number of deaths compared to number of events. Landslides and earthquakes are the next most severe hazardous events in the country. Based on the EM-DAT data, the country is more vulnerable to disasters due to hydrometeorological hazards.

Analysing vulnerability across time (1974-2006) shows that number of deaths reported has reduced drastically, while economic losses, due to both natural and technological hazards, have been increasing. The period 1999-2003 has reported the highest economic losses incurred in last 33 years of hazards recorded in Albania. The vulnerability indicators across time - number of events, deaths, victims (affected and deaths) and economic loss - are presented in the figure 4 (a, b and c).

The incidence of flood-related hazard is high in Albania (one event in every six years). Economic loss due to flood, drought and earthquake during the last 33 years is USD 2.3 billion. Converting this amount into an annual average, it comes to 68.67 million (2.49 per cent of GDP). About 10 per cent of the population is exposed to flood and earthquake.

According to the World Health Organization, Albania is facing increasing pollution levels caused by poisonous gases released from industries and transport. The current levels are 10 times above the set tolerance limits.

According to a scenario analysis carried out in 2003 (Kapllani 2006) estimating human casualties due to earthquake, the mortality rate is highest in Durres, followed by Vlora, Elbasan, Pogradec, Diber, Berat, Tepelena, Shkoder, Kukesh, Saranda, Himara, Lezhe, Tirana, Petrovac, and then the Leskovic Quark (Quark is a local word for region), for an earthquake scenario of a 475-year return period.[2] From a structural point of view, it is estimated that the maximum percentage of building collapses will occur in Quark Diber, followed by Durres, Fier, Gjirokastra, Berat, Korça, Elbasan, Tirana, Shkoder, Kukes, Vlora and Lezha, for a scenario earthquake of 475 years. From the expected maximum flood potential for a 100-year return period, Gjirokastra, Tirana, Elbasan and Shkoder Quarks are in extreme flood risk zones.

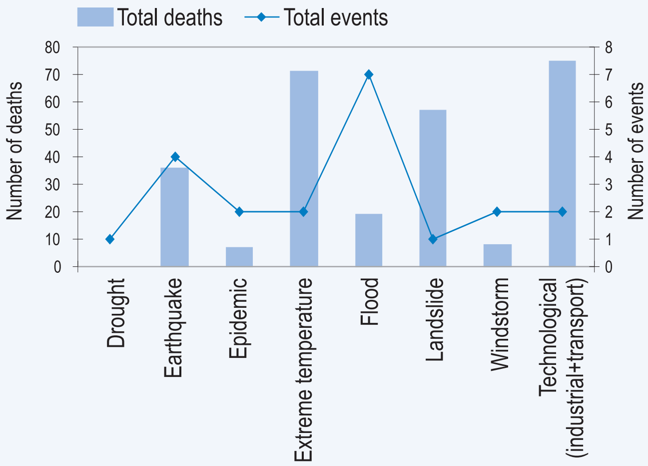
More than 30 per cent of the country is vulnerable to natural unstable slopes along road and rail networks. Road and rail network slopes of most parts of Tirana, Elbasan and Berat Quark are unstable for a scenario earthquake excitation of a 200-year return period. The Quarks Shkoder, Kukesh and Diber are particularly vulnerable to snow avalanche. From a forest-fire risk point of view, the Quarks that are under very high risk are Kukes, Tirana, Korça, Fier, Gjirokastra and Vlora. The Global Fire Monitoring Center reports that, between 1981 and 2000 in Albania, there were 667 fire events, affecting 21,456 hectares of land.

2 A return period is a way of expressing the probability of events that occur infrequently. An event like the one described here, with a 475-year return period, is likely to occur once every 475 years: it has an annual probability of occurrence of 1/475 per year.

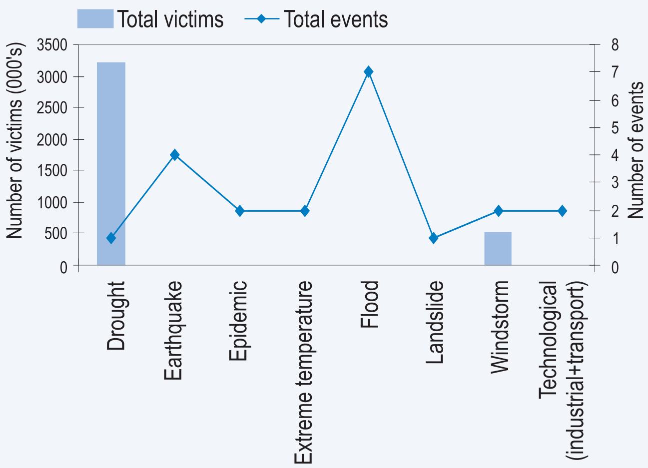
Figure 4

Albania: Hazard incidence, human and economic impact of hazards (1974-2006)

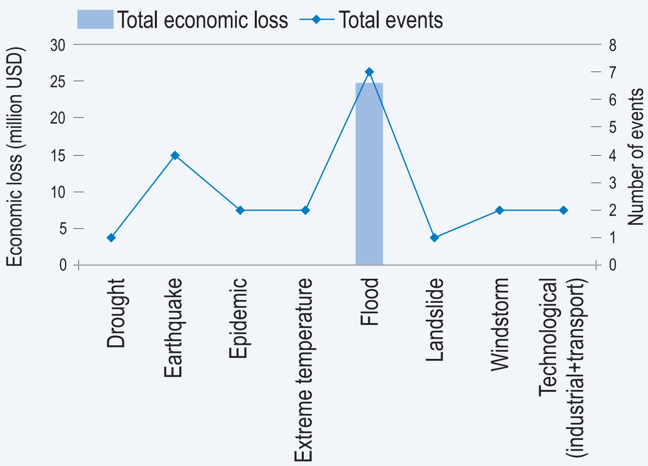
4a Hazard incidence and number of deaths due to each hazard in Albania (1974-2006)



4b Hazard incidence and number of victims due to each hazard in Albania (1974-2006)



4c Hazard incidence and economic losses due to different hazards in Albania (1974-2006)

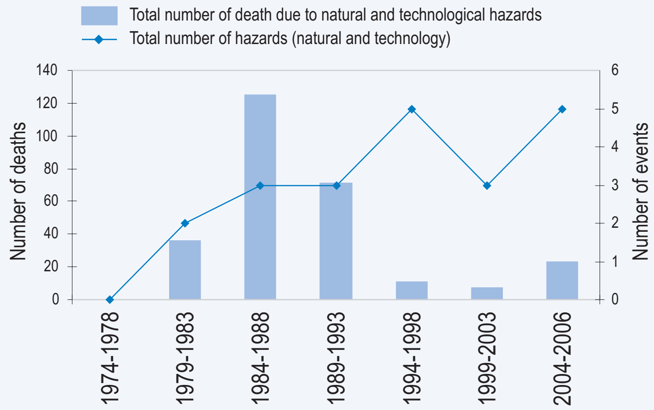


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

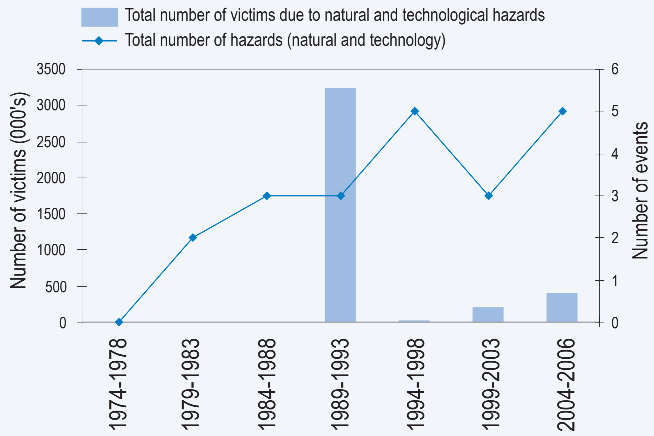
Figure 5

Albania: Occurrence of hazards, their human and economic impacts (1974-2006)

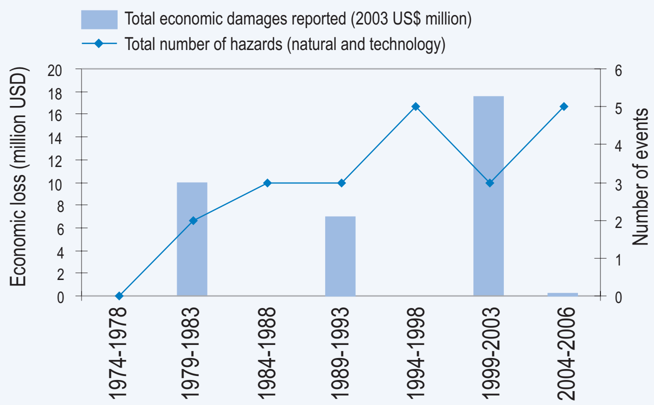
5a Total number of hazards and total number of people killed in Albania (1974-2006)



5b Total number of hazards and total number of population affected in Albania (1974-2006)



5c Total number of hazards and economic losses reported due to hazard in Albania (1974-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.1.3 Observations

Forty percent of Albania's geographical area is under agriculture, contributing 23 per cent of the nation's GDP. As the country is more susceptible to hydrometeorological hazards, the impact of such hazards on agriculture will have an adverse impact on the nation's GDP. Higher incidence of flood- and drought-related hazards, and the historic earthquake events, all need to be given due emphasis while planning disaster preparedness and mitigation. The vulnerability of the nation is aggravated by factors like poor infrastructure and public services, uncontrolled land use, an insufficiently regulated building construction boom, poor watershed management, and a range of other environmental factors. This development paradigm needs to be examined and the development model shifted to support hazard risk management of the region.

In 2003, GIS-based risk zone maps for earthquake, flood, landslide, forest fire, snowfall, avalanche and diarrhea were prepared for the country (Kapllani 2006). This data, in its GIS format, can be utilized with other variables like population density and land use to develop location-specific vulnerability assessments for various hazards.

Some of the challenges faced by Albania are: setting up an integrated communication, early warning and notification system; improvement of response capacities at the local level; establishing, strengthening and supporting structures for planning, monitoring and operations; enhancing capacities of staff at all levels; and community training systems. The institutional structure for disaster management needs strengthening at the national level and regional level. In one of the surveys conducted as part of a UNDP study on local vulnerability and capacity assessment in Albania, two-thirds of the surveyed population showed a relatively clear understanding of the roles and mandates of local government, emergency services and civil society organizations in disaster management. However, a majority thought that these organizations were not active or were inexperienced (55.4 per cent). Seventy-one point five per cent said that they were "not pleased" with the performance of these services before, during and after disasters. Seventy-four point seven per cent were also dissatisfied with national-level organizations and services (UNDP 2004). The Seismological Institute of Albania had proposed to set up in 2003 a fully integrated digital seismograph system for the nation, with the ability to link to regional systems, and data-sharing facilities for stakeholders and regional organizations, as part of the earthquake monitoring in support of disaster preparedness in SEE region.

3.2 Bosnia and Herzegovina

3.2.1 Country profile

Bosnia and Herzegovina is located on the western part of the Balkan Peninsula, with a total area of 51,280 square kilometres. It has a common border with Croatia in the north, west and south; Serbia in the east; and Montenegro to the south. Bosnia and Herzegovina has a coast line of 26 kilometres along the Adriatic Sea. Bosnia occupies the northern areas of the country, roughly four-fifths of the nation, which is mountainous and covered with thick forests. Herzegovina occupies the southern part of the country, which is largely rugged and flat farmland. The Sava River is the largest river in the country, and makes a natural border between Bosnia and Herzegovina. About 87 per cent of the land is above 200 metres in altitude, while 25 per cent is above 1,000 metres. The territory of Bosnia and Herzegovina is characterized by a complex geological structure and tectonic system. Topographic, geologic, climatic and other conditions create a diverse hydrologic picture. These unique physiographic and hydrologic conditions, including the presence of seven rivers (the Una, Sava, Vrbas, Bosna, Drina, Spreča and Neretva) draining the nation, significantly determine development as well as natural hazards in the country.

Bosnia and Herzegovina has a population of 3,907,074 (2005) with a population density of 76 people per square kilometre. The country has recorded a negative population growth rate; its annual average is -0.06. Agricultural land constitutes 42 per cent of the geographical area and contributes 10 per cent of the country's GDP. The service sector contributes 65 per cent of GDP (World Bank 2005).

Figure 6

Map of Bosnia and Herzegovina

3.2.2 Risk assessment

Hazard data for the country from the EM-DAT database is only available from 1989 onwards, as the country was previously part of former Yugoslavia. This data is analysed here to understand the risks in the country.

Bosnia and Herzegovina has historic records for both natural and technological hazards. Available data from EM-DAT for the period 1989-2006 shows that flood- and drought-related hazards contribute the major share of hazards experienced (figure 7). The country is affected by natural hazards related to earthquake, hail storm, windstorm with lightning, snowstorm, flood, landslide and soil settling, drought, early and late frost, and forest fire.

EM-DAT shows that landslide constitutes 8 per cent of the hazards in the country. The numbers of natural hazards over the period are showing an increasing trend (figure 8). There are only two technological hazards recorded during this period and that number is insufficient for analysing the trend.

Hazard incidence shows that flooding has the highest number of events and victims in the country. Technological hazards (transport accidents) have contributed to the most deaths (56 people in two events). Flood has affected more of the population than any other hazard in the country. Only droughts have been reported as causing economic loss. The hazard incidence and its impact shows the country is more vulnerable to flood and drought-related hazards than any other hazards.

Analysing hazards through the time-series data shows that both hazard incidents and number of deaths are showing an increasing trend in the country. The number of victims recorded increased by more than double in 2004-2006, compared to 1999-2003, which indicates an increase in vulnerability. It should be noted that the last period is a three-year group, compared against the previous period of five years, and yet it is still showing that the number of victims more than doubles.

Economic losses have been reported only during 1999-2003 and 2004-2006. The hazard analysis shows that the losses reported are for two drought events of 2000 and 2003 which caused a total loss of USD 408 million. The annual average economic loss is about 1 per cent of country's GDP. (Note: in addition, the National Geophysical Data Center reports that the country has experienced an economic loss of more than USD 5 million due to earthquake during the last 33 years.) Exposed population data is only available for drought and is 71,397, two per cent of total population of the country.

No large earthquake event has been recorded in the near past in the country by EM-DAT, but this doesn't mean that the nation is free from earthquakes. The territory of Bosnia and Herzegovina represents one of the earthquake-prone areas of the Balkan Peninsula, which is part of the Mediterranean-

Figure 7

Distribution of different hazards in Bosnia and Herzegovina (1989-2006)

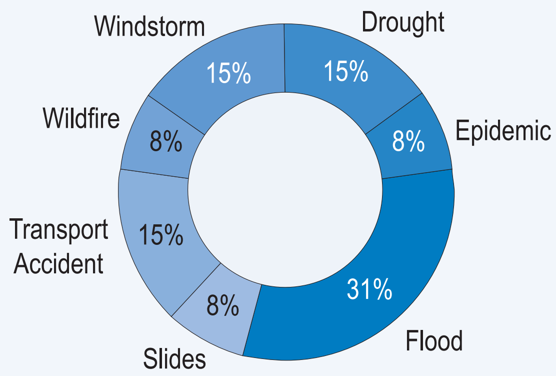
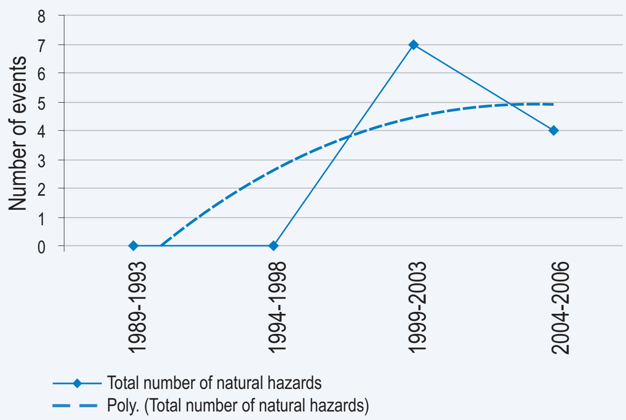


Figure 8

Trends in natural hazards in Bosnia and Herzegovina: 1989-2006



Transasian seismic belt. (The earthquake zones in the territory of former Yugoslavia are Dinarides, the Sar-Pind mountain area, Sava, Rodhop and the Carpathian-Balkans zone.) Many strong destructive earthquakes have occurred in the areas of Dinara Mountain, the lower Neretva River, Boka Kotorska, Dubrovnik, Podrinje, Sumadija, Metohija and Skopje.

The earthquake data shows that earthquakes of intensity IX on the MCS scale[3] occurred at Sinj, Makarska, Hvar Island, Peljesac Peninsula, Mljet Island to Boka Kotorska, Ulcinj, Skadar, Podgorica, Gacko and Mostar, as well as in the area of Banja Luka, near the west boarder with Croatia. Other parts of the territory of Bosnia and Herzegovina are characterized mainly by the maximum intensity of earthquakes up to VII degrees on the MCS scale.

3 The Mercalli-Cancani-Sieberg (MCS) scale is sometimes used to measure the intensity of earthquakes (their effect on the environment) on a scale of 1-12.

There is a possibility of destructive earthquakes in the next one hundred years, especially in the areas of Banja Luka, Livno and south-east Herzegovina. The Banja Luka region has reported earthquakes in the years 1884, 1935, 1969 and 1981. In a territory of 9,000 square kilometres, in 15 municipalities (Banja, Luka, Čelinac, Laktaši, Prnjavor, Gradiška, Kotor Varoš, Kneževo, Srbac, Ključ, Jajce, Prijedor, Sanski Most, Novi Grad and Dubica), earthquake intensity was VII, VIII and IX degrees on the MCS scale. The 1981 earthquake injured 1,117 people, killed 15 people and caused considerable damage to housing, health, culture, social protection, public and social services, and infrastructure affecting the economy. Forty-three point two per cent of the urban housing stock and 56.8 per cent in other residential areas were destroyed; 266 schools, 146 cultural institutions, 133 health institutions, 29 social institutions, 152 public and administrative institutions and a considerable number of structures of public and economic importance suffered great damage (Anonymous 2001).

The country has two watersheds: the Sava basin, covering 74 per cent of the country, and the Adriatic basin, covering 26 per cent. Fifty-eight per cent of water outflow goes towards the Sava River, and 42 per cent goes towards the Adriatic Sea. During the annual flood period, from 1976 to1980, about 16,260 square kilometres have been affected every year, inflicting tremendously harmful impacts on the population. In 1976, 43 out of 109 municipalities of the country were affected by flood. During 1976-1980, three catastrophic floods occurred, or one flood event almost every second year (Anonymous 2001). EM-DAT shows that, during 2001-2005, four major flood events were recorded. The flood event of April 2004 affected a large population (275,000) in the country.

The Sava River and its tributaries frequently flood. Smaller streams have a torrent character, and their water level frequently increases due to long and heavy rains and snow thaws. The upper, middle and lower water courses of the Sava tributaries are all prone to flood. Floods also occur in the great karst valleys, as a result of unequal water inflow and outflow of water in the karst topography.

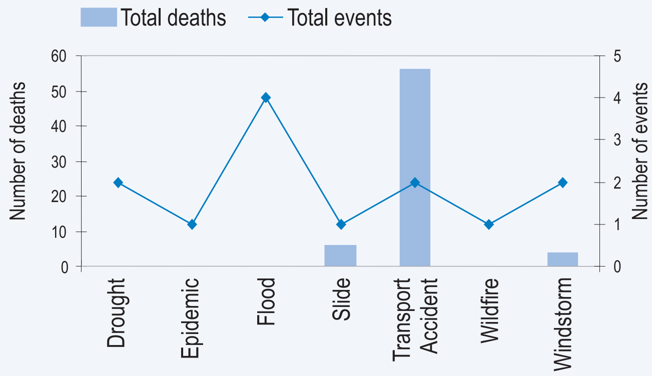
About 2,500 square kilometres (about 60 per cent of all plains and lowlands) are prone to floods in the country. There were enough flood protection structures to protect 50 per cent of the flood prone areas, but many of these were destroyed during the war. As per the urban plan of the country, 450 kilometres of embankment, about 210 kilometres of drainage, about 450 kilometres of partial regulation of water flows, and 23 pumping stations with the capacity of 120 cubic metres per second were all constructed. However, during the war, most of the systems created for the purpose of flood protection were damaged.

The occurrence of landslides in the mountainous parts of Bosnia and Herzegovina is very frequent due to subsurface water flow. Due to the landslides in the Zenica area in 2000, for example, seven people were killed; many families were left homeless,

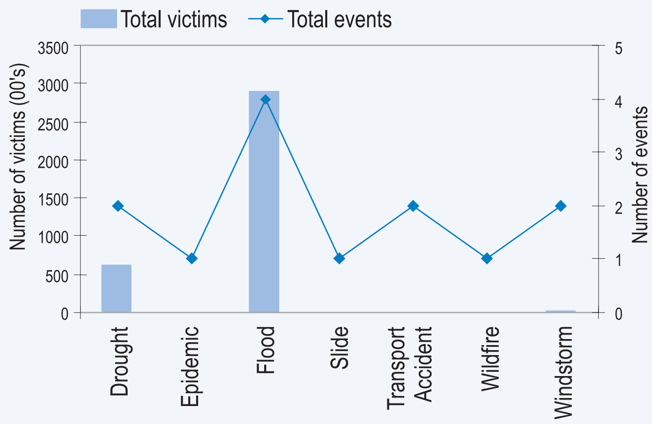
Figure 9

Bosnia and Herzegovina: Hazard incidence, human and economic impact of hazards (1989-2006)

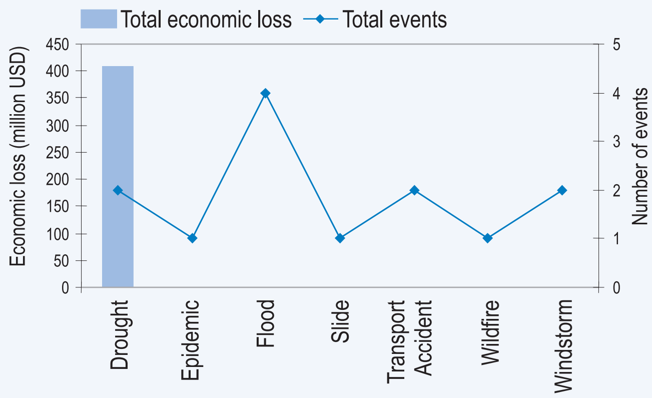
9a Hazard incidence and number of deaths due to each hazard in Bosnia and Herzegovina (1989-2006)



9b Hazard incidence and number of victims due to each hazard in Bosnia and Herzegovina (1989-2006)



9c Hazard incidence and economic losses reported due to each hazard in Bosnia and Herzegovina (1989-2006)

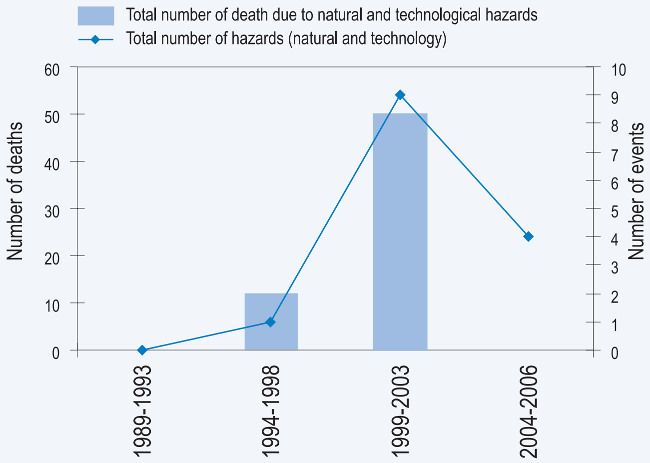


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

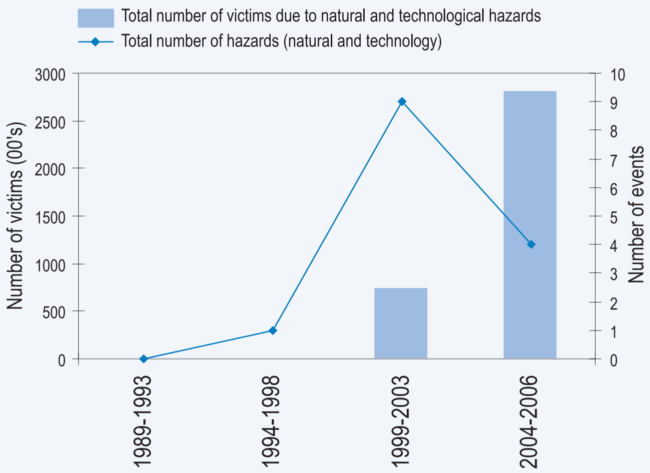
Figure 10

Bosnia and Herzegovina: Occurrence of hazards, their human and economic impacts (1989-2006)

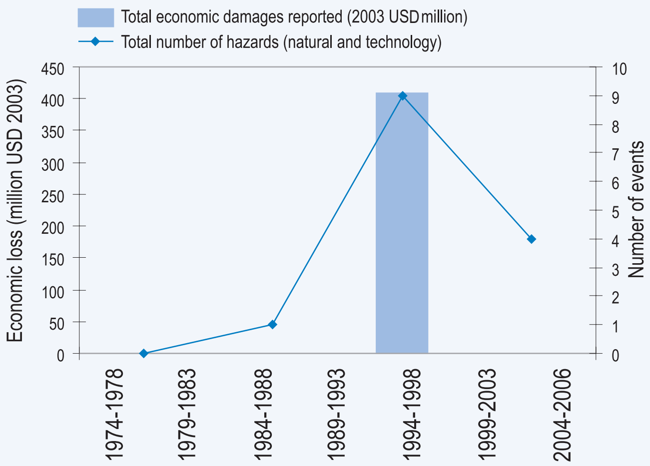
10a Total number of hazards and total number of people killed in Bosnia and Herzegovina (1989-2006)



10b Total number of hazards and total population affected in Bosnia and Herzegovina (1989-2006)



10c Total number of hazards and economic losses reported due to hazards in Bosnia and Herzegovina (1989-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

and the Sarajevo-Pale road was destroyed. The number of landslides increased considerably during the war and in its aftermath, due to both uncontrolled exploitation of forests and minerals, which changed water and land regimes, and to increased illegal and unplanned construction.

Soil settling due to underground exploitation of minerals leads to hazardous situations. The area most affected by soil settling, caused by salt mining, is Tuzla. Harmful consequences of soil settling have affected more than one-quarter of the Tuzla urban area. Large landslides also occur in mines such as the coal mine Breza, the open-cut mine “Koritnik”, the mine and steel factory “Vares” and the open-cut mine “Smreka”. In other open-cut mines, landslides of smaller size occur.

Drought risk is high in the north-east and south-west parts of the country compared to the central mountainous parts. The May 2003 drought affected large parts of the country, and triggered wildfires that caused damages of USD 250 million and affected 62,575 people.

3.2.3 Observations

The modern network of seismological stations which was built in Banja Luka was destroyed during the war, and remaining stations have now become obsolete due to a lack of proper maintenance. There is a need to install an earthquake monitoring network, which should be a part of a regional network for the SEE region.

Damage to flood protection structures has increased the flood vulnerability of the country. There is a need for close monitoring, and for developing an information system on flood-related data and projected flood risk. This will help to develop proper flood mitigation measures in the country. Early warning systems need to be in place as part of the hazard mitigation measures.

Mapping of landslide-prone areas, and land-use regulations, legislation and implementation can all reduce the landslide vulnerability of the country. The country does not have a disaster management plan. Joint firefighting groups with neighboring countries will help reduce the risk from fire-related hazards in the country. Bosnia and Herzegovina carried out joint firefighting exercises in 2004 with Croatia, Serbia and Montenegro. In this context, it is worth mentioning the efforts of DPPI towards initiating and supporting the joint firefighting system in the region.

There is an urgent need for improved regional cooperation on hazard mitigation, on harmonization of planning documentation for crisis situations, and on information dissemination among neighboring countries during disaster events.

3.3 Bulgaria

3.3.1 Country profile

Bulgaria is bordered by five countries: Romania to the north, along the Danube; Serbia and the Former Yugoslav Republic of Macedonia to the west; and Greece and Turkey to the south. The Black Sea forms its entire eastern border.

Geographically and climatically, Bulgaria is noted for its diversity, with a landscape ranging from the snow-capped peaks of Rila and Pirin in the south-west, and of the Balkan Mountains, to the mild and sunny weather of the Black Sea coast; from the typically continental Danubian Plain (ancient Moesia) in the north, to the strong Mediterranean influence in the valleys of Macedonia, and the lowlands in the southernmost parts of Thrace. Hilly country and plains are found in the south-east, along the Black Sea coast in the east, and along Bulgaria's main river, the Danube, in the north. Other major rivers include the Struma and the Maritsa River in the south. There are around 260 glacial lakes situated in the Rila and Pirin mountains, several large lakes on the Black Sea coast, and more than 2,200 dam lakes. Bulgaria comprises portions of the classical regions of Thrace, Moesia and Macedonia.

Bulgaria has a total surface area of 110,990 square kilometres, with a total population of 7,740,000. The population density is 70 people per square kilometre (World Bank 2005).

Bulgaria's economy contracted dramatically after 1989, with the loss of the market of the Council for Mutual Economic Assistance (COMECON) member states, to which the Bulgarian economy had been closely tied. The standard of living fell by about 40 per cent, but it regained pre-1990 levels in June 2004. United Nations sanctions against Yugoslavia and Iraq took a heavy toll on the Bulgarian economy. The first signs of recovery emerged in 1994, when the GDP grew and inflation declined. Since 1997, the country has been on the path to recovery, with GDP growing at a 4-5 per cent rate, increasing FDI, macroeconomic stability and European Union membership.

Figure 11

Map of Bulgaria

3.3.2 Risk assessment

Bulgaria is more vulnerable to flood than to any other hazard. As per EM-DAT, floods comprised 30 per cent of the hazards in the country during the period 1974-2006. The Danube River borders the country all along the northern part, and is susceptible to floods that affect both Bulgaria and Romania. Windstorms contribute 16 per cent of hazards in the country. Occurrence of windstorm, extreme temperature, earthquake and transport accident are also high in the country. Figure 12 shows the percentage share of various hazards during the period 1974-2006.

From the EM-DAT database, it is obvious that the total number of natural hazards is increasing over time. There is a steep rise in the number of events since 1999, and the last three-year period (2004-2006) recorded 10 events, an average of three events per year. Five technological hazards were recorded during this period; the data distribution is insufficient to analyse the trend.

Hazard incidence shows flood is more frequent in the country, while more deaths were caused by technological (transport accident) hazards. The number of victims per event is high for flood and windstorm, showing the severity of these events compared to other hazards.

EM-DAT reports four earthquake events during the 1974-2006 period. In addition, the Bulgarian Academy of Science's seismological institute reported several minor tremors of magnitudes ranging from 3.5 to 5 on the Richter scale. As these events are with less-to-no loss or casualty, they are not included in EM-DAT. These tremors show that the country is in a seismogenic zone and is vulnerable to earthquakes. According to the institute, 18 tremors hit the country from 5 April to 9 April 2002, with the city of Plovdiv being hardest hit. Plovdiv was also hit by a major earthquake on 14 April 1928, which killed 107 people. The earthquakes of 4 March 1977 affected Svishtov and Ruse (the northern part of Bulgaria), killing 20 people and injuring 165; and the 30 May 1990 earthquake of magnitude 6.7 in northern Bulgaria killed one person. The most damaging recent earthquake was the Strazhista 6 December 1986 earthquake; it had a magnitude of 5.7 (Pusch 2004) and killed 3 people, injured 60 and left 3,000 homeless in the Tymovo region. Though, from magnitude point of view, the 1986 earthquake event was small, the total loss exceeded USD 50 million (Pusch 2004).

Figure 12

Distribution of different hazards in Bulgaria (1974-2006)

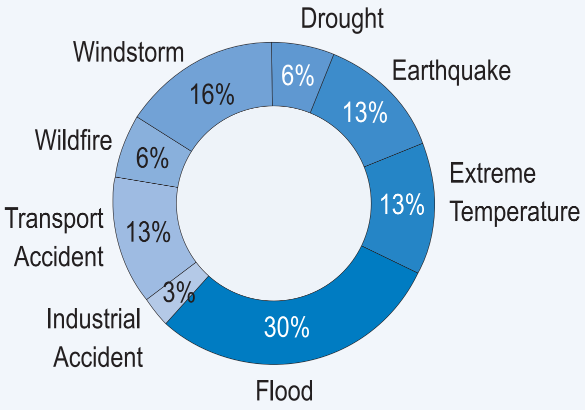
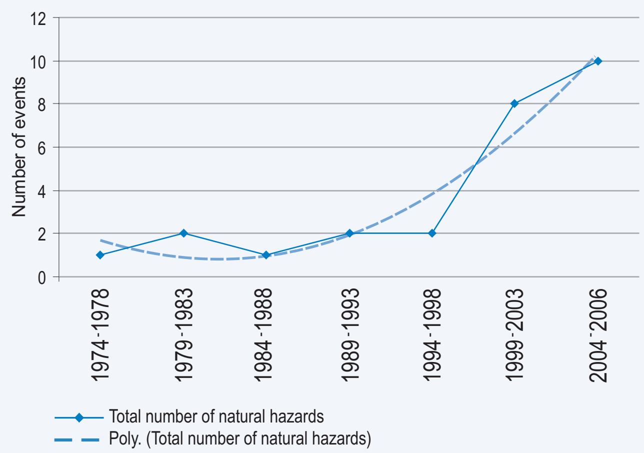


Figure 13

Trends in natural hazards in Bulgaria: 1974-2006



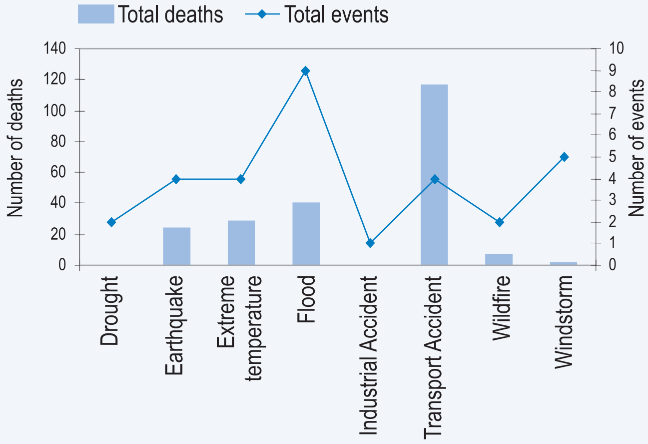
One severe flood event which occurred in the country was the flood from 25 May to 12 August 2005, the worst flooding in the past 70 years. The rivers Yantra, Kamchiya, Rusenski Lom and their subsidiary streams burst their banks (IFRC 2005). About 70 per cent of the territory of Bulgaria was affected. Losses were enormous in the affected 54,874 hectares of agriculture land, and about 10,599 animals drowned, according to the Ministry of Agriculture. Some 3,645 inhabited buildings were declared unsuitable to live in, directly affecting 60,137 people. In 62 municipalities, there were 258 houses totally destroyed and 1,143 partially destroyed; 44 municipalities declared a state of emergency, and 164 municipalities were affected by the floods (Source: National Association of Municipalities in the Republic of Bulgaria). Reported damage from the 2005 flood was more than USD 260 million (EM-DAT 2007). Other flood events that took place in the recent past occurred on 10 April 2006, 10 August 2002 and 14 December 1997.

Landslides are also common in Bulgaria because of its hilly and mountainous terrain. One major landslide occurred on 17 December 1965 in the Rila mountains, where 11 people

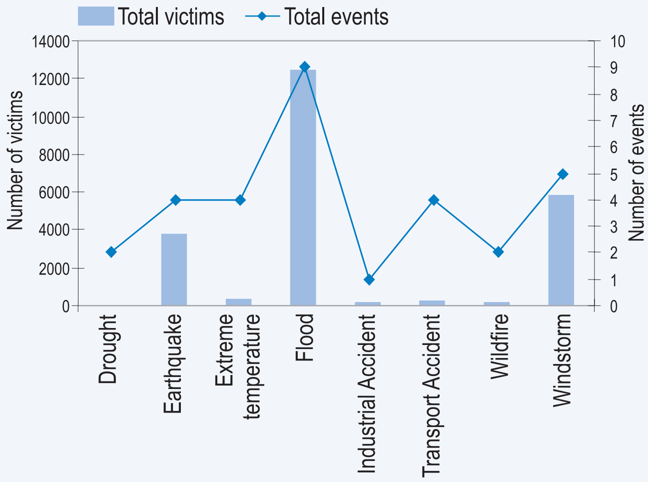
Figure 14

Bulgaria: Hazard incidence, human and economic impact of hazards (1974-2006)

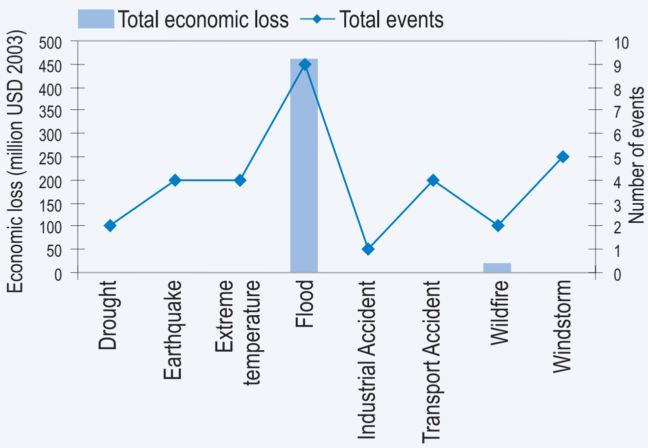
14a Hazard incidence and number of deaths due to each hazard in Bulgaria (1974-2006)



14b Hazard incidence and number of victims due to each hazard in Bulgaria (1974-2006)



14c Hazard incidence and economic losses reported due to each hazard in Bulgaria (1974-2006)

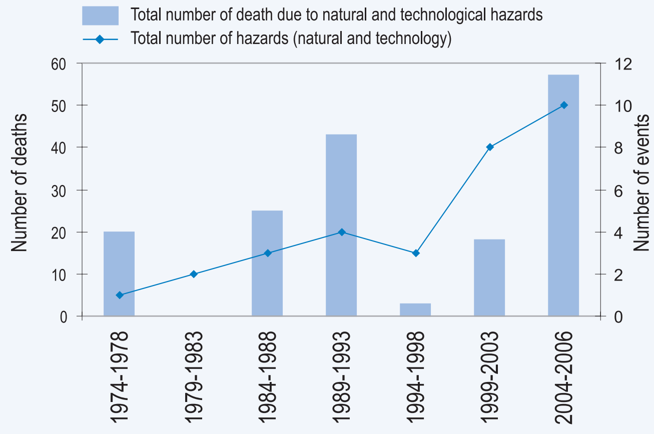


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

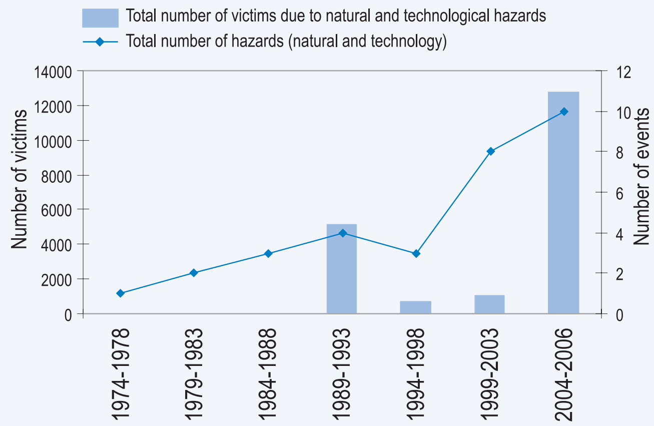
Figure 15

Bulgaria: Occurrence of hazards, their human and economic impacts (1974-2006)

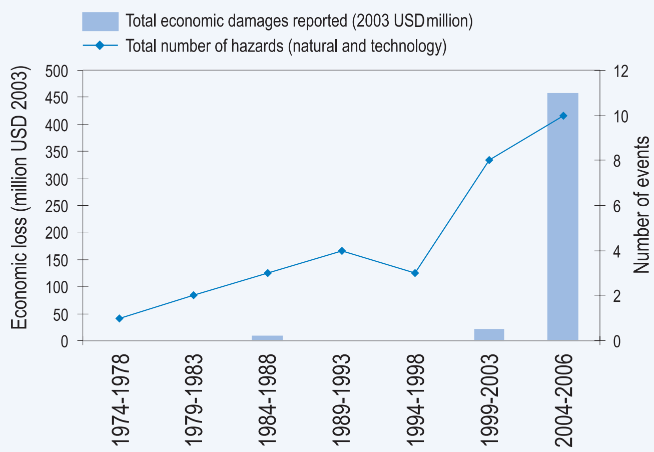
15a Total number of hazards and total number of people killed in Bulgaria (1974-2006)



15b Total number of hazards and total population affected in Bulgaria (1974-2006)



15c Total number of hazards and economic losses reported due to hazards in Bulgaria (1974-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

were killed. Windstorms associated with cold waves occur quite frequently in Bulgaria. On 24 December 2001, a windstorm affected Shumen, Dobrich, Stara Zagora and Sofia, killing two people. The 1998 (November-December) cold waves affected the Montana and Sofia regions, killing three people, injuring 23 and affecting 300. The 8 March 1993 windstorm affected 5,000 people in the Silistra, Rousse and Plovdiv regions. Wildfire events are also reported in Bulgaria. On 1 July 2000, wildfire affected Haskovo, Yambol, Bourgas, Stara Zagora and Plovdiv; killing seven people, injuring 17 and leaving 150 homeless; and causing damage worth USD 17.6 million (EM-DAT 2007). The Global Fire Monitoring Center reported an average number of 413 events, affecting an average area of 11,814 hectares, during the period 1978-2000 (Goldammer 2002).

EM-DAT reports economic losses of USD 477 million due to flood and wind, with flood contributing the major share. The National Geophysical Data Center reports that the country has incurred a loss of USD 5 million due to earthquake during the last 33 years. This economic loss equals about 0.3 per cent of the country's GDP (USD 14.76 million). The number of both deaths and victims has increased over the period, showing the increased vulnerability of the country to hazards. According to UNDP statistics, 600,943 people are exposed to flood and drought in the country. On average, about seven people were reported killed every year due to various hazards.

3.3.3 Observations

Bulgaria is more vulnerable to flood than to any other hazard. As the country has historic records of major earthquakes, there is a high probability of earthquake occurrence in the country. About 50 per cent of the geographic area of the country is used for agricultural activities, but this area contributes only 10 per cent of the national GDP. This low contribution could be due to the high vulnerability of the nation towards flood-related hazards.

The Ministry of State Policy for Disasters and Accidents is responsible for all disaster risk management activities in the country. The country has crisis management legislation in place, which focuses on disaster response to protect the lives and assets of the country. Ministry priorities include performing coordination among organizations, preliminary risk assessments, unified planning, enforcing regulations and management. The country lacks a national disaster management plan. Taking into consideration the hazard intensities and vulnerability, the country needs to prepare a disaster risk management plan as part of preparedness and prevention. Considering its flood and landslide vulnerability, the country should initiate loss assessments, and develop a risk funding strategy for catastrophic events. The country needs to upgrade river regulation, flood protection infrastructure and its mechanisms for early warning. Initiatives towards transboundary cooperation, particularly for flood mitigation, need to be strengthened in coordination with Romania.

3.4 Croatia

3.4.1 Country profile

Croatia is part of the former Yugoslav Republic. Croatia, with a total area of 56,542 square kilometres, shares land borders with Slovenia and Hungary on the north, Serbia on the east, Bosnia and Herzegovina on the south and east, and Montenegro on the south, as well as a sea border with Italy to the west. Its shape resembles that of a crescent or a horseshoe. At its south-west end, its mainland territory is split in two non-contiguous parts by the short Adriatic Sea coastline of Bosnia and Herzegovina, around Neum.

Croatia has a population of 4,443,350 (World Bank 2005) with a population density of 79 people per square kilometre. The economy is service-based, with its service sector accounting for 67 per cent of its total GDP. The industrial sector is dominated by shipbuilding, food processing and the chemical industry. The industrial sector represents 27 per cent of Croatia's total economic output, and agriculture represents 6 per cent.

The economy expanded by 5.6 per cent in 2002, stimulated by a credit boom led by newly privatized and foreign-capitalized banks, some capital investment (most importantly road construction), further growth in tourism, and gains by small and medium-sized private enterprises. These trends have continued, with credit growth fueling strong demand in construction and services, resulting in 4.8 per cent GDP growth in 2006.

Figure 16

Map of Croatia

3.4.2 Risk assessment

Disaster-related data for Croatia is available from 1989 onwards in the EM-DAT database. Hazard and vulnerability analysis is attempted mainly using this data for the period 1989-2006.

Flood, transport accidents, extreme temperature, wildfire, windstorm, earthquake and drought were the hazards reported by EM-DAT during the period 1989-2006 (figure 17). By category, the highest number of events during this period was flood events, followed by wildfires and transport accidents.

There was an increasing incidence of natural hazards in the country between 1989 and 2003. The last three years (2004-2006), however, have recorded fewer events compared to the previous five years. There were eight events reported during the period 1989-2003. The number of disasters related to technological hazards is not sufficient to extrapolate a trend.

An analysis of the number of events, along with deaths, victims and economic losses, shows that the country is highly vulnerable to drought and drought-related hazards.

The number of deaths is highest due to transport accidents, followed by extreme temperature. In terms of severity, or impact, the country has faced the highest risk from technological hazards (transport accidents). Floods and earthquakes have affected a relatively larger number of people, but economic losses have not been reported in the EM-DAT database. Drought and extreme temperature caused the highest economic losses.

The hazard data is not sufficient for derivation of any relation between the number of events, deaths, affected population and economic loss. The number of events and victims is highest for floods, while transport accidents show the highest number of deaths, and droughts caused the highest economic losses.

Analysis of data over time shows a steady increase in the incidence of events between 1989 and 2003. The number of deaths and victims show a decreasing trend. Economic losses are reported only during 1999-2003 period.

Among all the hazards, there is a high frequency of occurrence of flood and drought in the country for the period 1989-2006. At an average, nine people were killed every year due to disaster; and as per UNDP statistics, each year 30,928 people were exposed to earthquake and 108,929 people were exposed to flood. Reported economic loss is high for drought-related hazards, at USD 408 million. As per the National Geophysical Data Center, earthquake has caused an economic loss of more than USD 5 million in the country during the last 33 years. The annual average economic loss is about 0.5 per cent of the country's GDP.

Figure 17

Distribution of different hazards in Croatia (1989-2006)

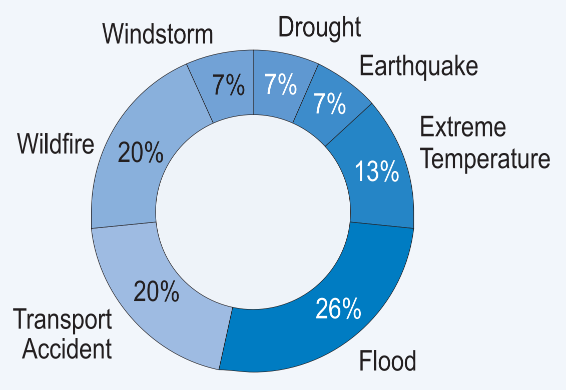
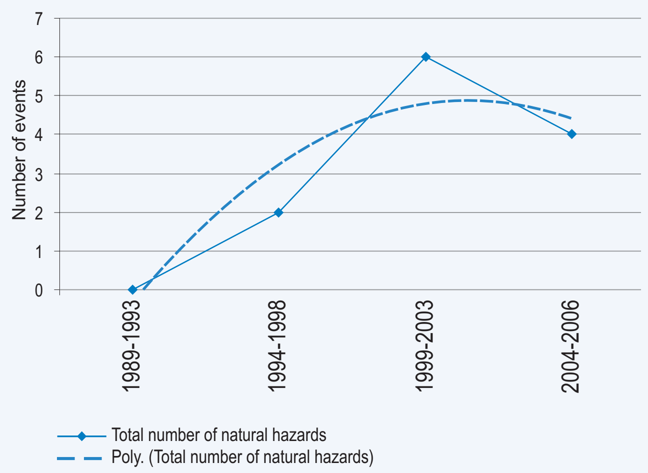


Figure 18

Trends in natural hazards in Croatia: 1989-2006



The seismicity of Croatia is unevenly distributed. Most of the earthquakes occur in the coastal area (the Dinarides). The Pannonian Basin exhibits a typical intraplate-seismicity, characterized by rare occurrence of large events. Several strong earthquakes of Intensity IX or X on the MCS scale occurred in Croatia before 1900, in the Dubrovnik area. Among eight historical earthquakes of Intensity IX or X (MCS) in the fifteenth, sixteenth and seventeenth centuries, the strongest and most important is the great Dubrovnik earthquake of 1667 (I=X on MCS). The main shock of the Kupa Valley earthquake, on 8 October 1909, is probably the most intense earthquake that occurred in Croatia, with a magnitude at the source of VIII (MCS). A. Mohorovičić was able to prove the existence of a discontinuity between the crust and mantle. The Biokovo Mountain earthquakes are one of the most important series of earthquakes that occurred in the last century (in 1962). In this zone, the two largest earthquakes had a magnitude of 5.9 and 6.1. These earthquakes caused huge damage in the Biokovo area, and practically define the earthquake hazard zone. The Ston-Slano earthquakes of 1996 (main shock magnitude 6) completely destroyed three villages, and caused heavy damage in a number of southern Dalmatian cities. It is the largest seismic series in the greater Dubrovnik area since the 1667 earthquake. The Jabuka Island earthquake (2003), one of the strongest ever recorded within the Adriatic micro-plate, occurred near Jabuka Island in the centre of the Adriatic Sea. The main shock, with a magnitude of 5.5, was preceded by foreshocks and followed by aftershocks in large numbers.

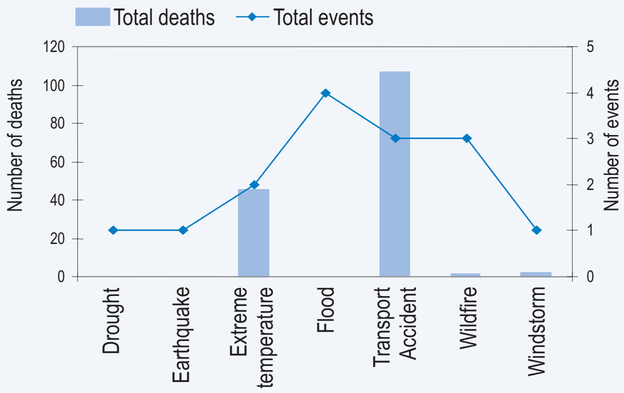
As mentioned earlier, Croatia is highly vulnerable to floods. The flood of 4 April 2006 affected the Vukovar and Osijek localities. In August 2005, flood affected 250 people in the district of Mediumurje, near the borders with Slovenia and Hungary. The level of the river Mura was 505 cm, bursting its banks near the village Podturen and flooding 30 houses; a state of emergency was proclaimed in Mediumurje County. The Roma settlement Loncarevo, which is situated close to Podturen village, was completely flooded (IFRC 2005). On 6 September 2001, floods affected 1,200 people in Orahovica, Nasice, Zdenci, Kutovi, Slavonske Bare, Cacinci, Staro Petrovo Polje, Pausinci, Crnac, Nova Bukovica, Djurdjenovac, Moticina, Boksic and Teodorovac. On 28 December 2000, floods affected the Senj, Metkovic and Otocac localities.

The February 2003 drought in Croatia particularly affected Vukovar-Srijem county. Reported damages due to the drought were around USD 330 million. The wildfires of August 2000 affected the Split, Metkovik and Slano (Omis) regions, and caused losses of USD 177.5 million; from 18 to 23 July 2003, wildfires also affected the Dubrovonik region, incurring losses of USD 20 million. Global Fire Monitoring Center data shows that the country had 256 fire events, affecting 10,000 hectares, between 1990 and 1997. The country is also prone to extreme temperature. In June 2000, a severe heat wave affected the Zagreb, Split, Osijek and Rijeka areas, killing 40 people and affecting 200 (EM-DAT).

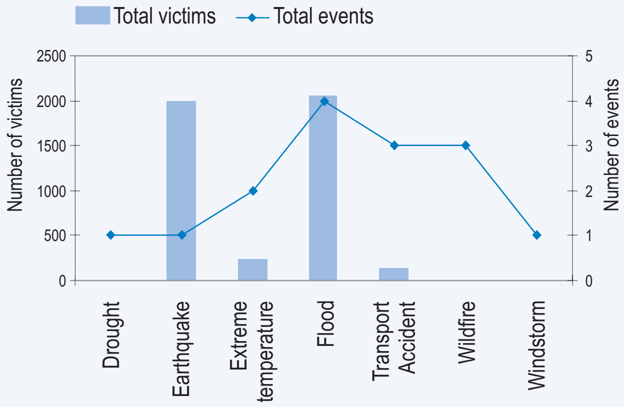
Figure 19

Croatia: Hazard incidence, human and economic impact of hazards (1989-2006)

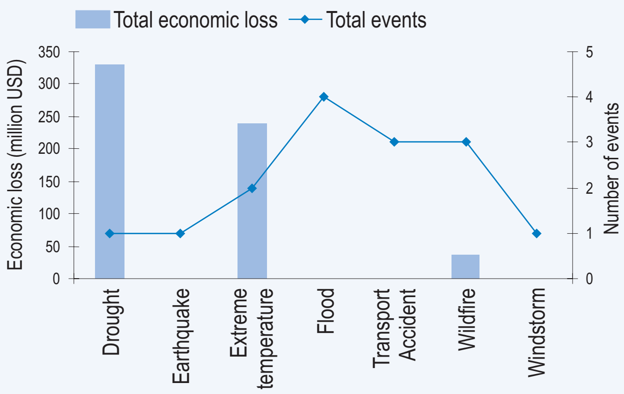
19a Hazard incidence and number of deaths due to each hazard in Croatia (1989-2006)



19b Hazard incidence and number of victims due to each hazard in Croatia (1989-2006)



19c Hazard incidence and economic losses reported due to each hazard in Croatia (1989-2006)

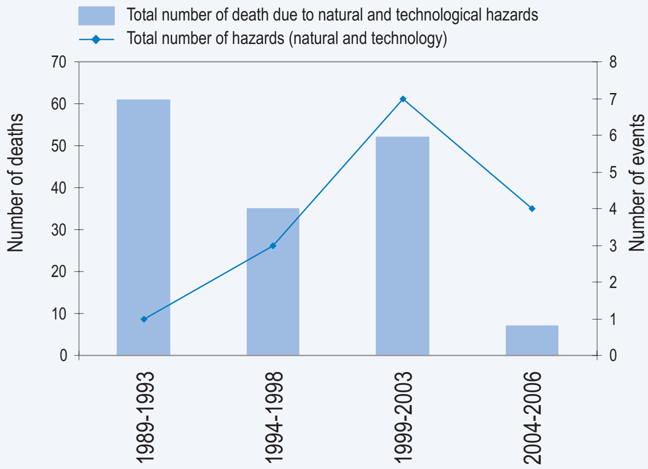


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

Figure 20

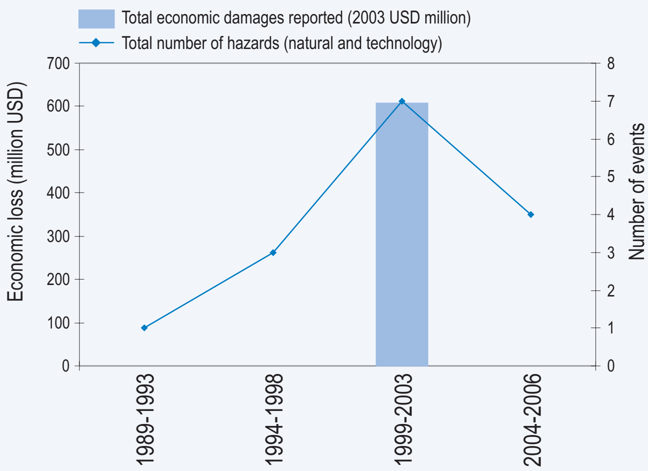
Croatia: Occurrence of hazards, their human and economic impacts (1989-2006)

20a Total number of hazards and total number of people killed in Croatia (1989-2006)



20b Total number of hazards and total population affected in Croatia (1989-2006)

20c Total number of hazards and economic losses reported due to hazard in Croatia (1989-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.4.3 Observations

Reviewing the country's existing legislation shows that its disaster-related legalization is oriented more towards crisis management than towards preparedness or mitigation. As 63 per cent of the GDP is contributed by the service sector, technological hazards can have direct impact on the economy of the country. Proper land-use planning to reduce the impact of floods on life and assets is required. Croatia is a member of the Sava River project for flood management, along with Albania, Bosnia-Herzegovina, Croatia, Montenegro, Slovenia and Serbia.

The incorporation of risk reduction measures into the development plans of various sectors seems weak in the country. Croatia does not have proper hazard mapping/assessment, or vulnerability or capacity assessment. Croatia has a history of earthquake events, most notably the Zagreb earthquake of 1880 and the Pokupsko earthquake of 1909. However, even though the country has building codes against seismic risks, there is no legal enforcement. The country does not have seismic risk preparedness in place.

There are non-governmental organizations, humanitarian and volunteer organizations, environmental groups and local departments providing service in disaster management in the country. Improving efficiency, however, will require a harmonized and coordinated mode of operation during crisis management.

3.5 The Former Yugoslav Republic of Macedonia

3.5.1 Country profile

The Former Yugoslav Republic of Macedonia[4] is located on the Balkan Peninsula, bordered by Serbia to the north, Albania to the west, Greece to the south, and Bulgaria to the east. Macedonia has a total surface area of 25,710 square kilometres. It is a landlocked country that is geographically defined by a central valley formed by the Vardar River, and that is framed along its borders by mountain ranges. The terrain is mostly rugged, located between the Šara and Osogovo mountains, which frame the valley of the Vardar River. Three large lakes - Lake Ohrid, Lake Prespa and Lake Dojran - lie on the southern borders of the Republic, spreading into the territory of Albania and Greece.

Macedonia has a population of 2,034,060 as per 2005 statistics (World Bank 2005), with a population density of 79 people per square kilometre. Macedonia is considered to be a country with intermediately-developed industry, with continuing growth in industrial production. The process of transition in the economy was triggered in 1995. The government has signed arrangements with the International Monetary Fund and the World Bank. It has

4 For the purposes of this report, the Former Yugoslav Republic of Macedonia will be primarily referred to in the text by the short name "Macedonia".

Figure 21

Map of Former Yugoslav Republic of Macedonia

an open economy that is integrating into international trade, with a total trade-to-GDP ratio of 79.5 per cent. The most important sectors are agriculture and industry, contributing 13 and 58 per cent respectively to the country's GDP.

3.5.2 Risk assessment

Macedonia is vulnerable to flood both in terms of flood severity, or impact, and flood intensity, or strength. Flood contributed to 44 per cent of the hazards during the period 1989-2006. The number of technological hazards (transport accident events) and extreme temperature hazards stands next to flood. During this period no earthquake event was reported in the EM-DAT database; however, this does not mean that Macedonia is not vulnerable to earthquake.

The EM-DAT database has recorded 16 events (both natural and technological) during 1989-2006. The data on incidence of natural hazards shows a steadily increasing trend over the last 17 years. There were two disasters due to technological hazards recorded, an insufficient number from which to extrapolate a trend for the period.

The number of events, affected population and economic losses are high due to flood during this period, indicating that the country is vulnerable to flood in terms of severity and intensity. The number of deaths is high due to technological hazards.

The incidence of hazards in the country shows an increasing trend, while death is following a decreasing trend. The period 2004-2006 shows the highest number of victims. Economic loss is highest during 1994-1998, which is not in line with the number of deaths and victims. This data characteristic needs to be validated and further data is required to understand it.

Economic loss data is very scanty in the EM-DAT database. Macedonia is incurring an annual average economic loss of USD 25 million (0.55 per cent of GDP). Based on data from the National Geophysical Data Center, the country has experienced an economic loss of about USD 5 million during the last 33 years due to earthquake. The loss due to flood is very high, at USD 354 million. UNDP statistics show that 17,784 people were exposed to flood. The annual average number of deaths due to all hazards in the country was 13 people.

The historic data prior to what is available in EM-DAT shows that Macedonia had two major floods during 1962 and 1979, with an estimated aggregate loss of about 7.2-7.4 per cent of GDP (Mulutinovic and Garevshi 2005). This same data shows that Skopje is exposed to flood wave from three rivers: (1) Upper Vardar, (2) Treska, and (3) Lepenec, due to intense rainfall and due to snow melting. Flood control measures through construction of dams have been proposed and constructed to control this situation.

Figure 22

Distribution of different hazards in the Former Yugoslav Republic of Macedonia (1989-2006)

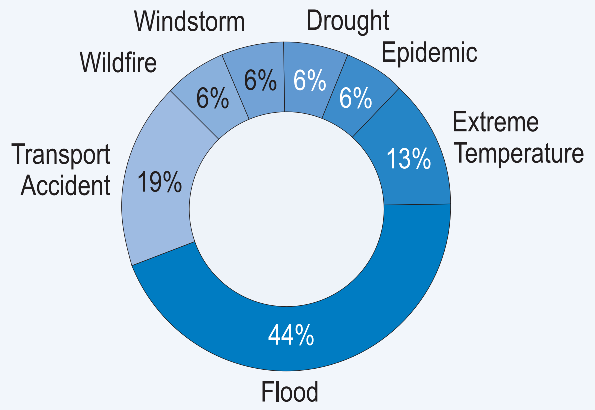
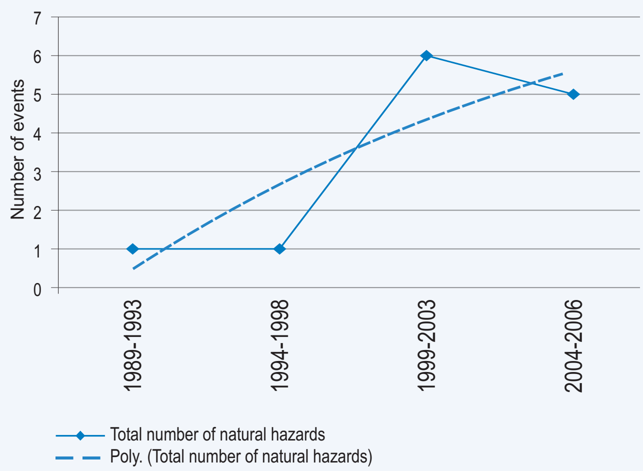


Figure 23

Trends in natural hazards in the Former Yugoslav Republic of Macedonia: 1989-2006



Even though there is no earthquake event recorded in EM-DAT, there are historic earthquake events recorded in other published documents. The territory of Macedonia, situated in the Mediterranean seismic belt, is named as an area of high seismicity. In the seismic history of Macedonia, the Vardar zone appears as a region where earthquakes occur quite frequently, and the Skopje region is considered to be the most mobile part of the Vardar zone. Historically, earthquakes of magnitudes 6.0-7.8, from ten seismic zones, have been experienced throughout the country. The strongest earthquakes occurred in the Pehcevo-Kresna (M=7.8, 1904) and the Valandovo-Dojran (M=6.7, 1931) seismic zones. The most recent and destructive earthquake was the July 26 earthquake of magnitude 6.1 in Skopje. The event killed 1,070 people and wounded 3,330, causing extensive damage to the city (Arsovski et al. 1968). The direct economic losses were estimated at USD 1 billion (15 per cent of Yugoslavia's GNP for 1963) (Pusch

2004; Mulutinovic 1998). During the last 100 years, a few destructive or even catastrophic earthquakes have affected the country. The studies on occurred seismic events indicate that, in this century, the entire territory of Macedonia has been exposed to intensities larger than VI, 97.8 per cent to intensities equal or larger than VII, 52.2 per cent to intensities equal or larger than VIII, 14.0 per cent to intensities equal or larger than IX, and 3.9 per cent to intensities equal or larger than X (Mulutinovic 1998). The earthquake of 1994, with a magnitude 5.2, hit the municipalities of Bitola, Demir Hisar, Resen and Ohrid. It affected about 230,000 people, and caused an estimated loss of 3.4 per cent of 1993 GDP.

3.5.3 Observations

Macedonia is vulnerable to flood and earthquake. Macedonia has one of the best-developed systems in the SEE region for seismic monitoring and emergency management, which served the former Yugoslavia (Pusch 2004). There are fewer measures adopted towards earthquake risk mitigation in the country, even though the country has history of destructive and catastrophic earthquakes. Macedonia has existing building codes, but since 1990, these regulations have often not been followed. Earthquake insurance existed in Macedonia till 1990. Due most probably to low economic and population growth, no building boom has occurred since the 1990s. But considering the present industrial growth in the country, urgent legislative intervention is needed to enact earthquake risk mitigation measures.

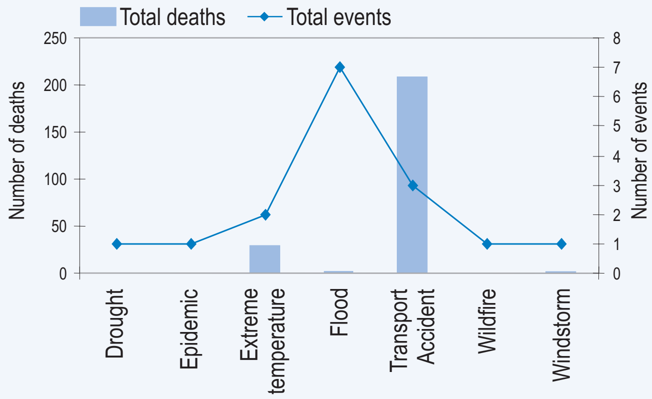
Legislation exists in different development sectors for planning, but it is not apparent that risk preparedness and mitigation are incorporated into development plans. However, the "Law for Protection and Improvement of Living Environment" and the "Law for Spatial and Urban Planning" are providing a general umbrella under which Macedonia's disaster risk reduction efforts can be integrated. The legislation is focused towards rescue and security aspects. There is an existing framework for an emergency management system, with regional and local headquarters and regional and local task forces. There also are efforts towards legislative harmonization with European Union legislation.

The country's initiatives to incorporate risk management into sectoral development plans that address both urban and rural areas are weak. The national report that was prepared for the 2005 World Conference on Disaster Reduction in Kobe, Japan, recommends scientific and research interaction and regional initiatives in implementing technologies for environmental management. The report also recommends improvement of existing monitoring technology, and development and installation of a countrywide GIS-based disaster risk information and environment management system. But even though there is a common consensus in the country supporting development of such a countrywide GIS-based system, it is not moving forward due to lack of funds.

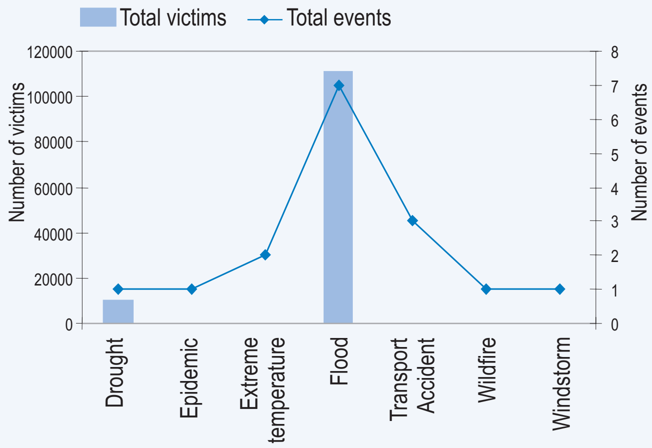
Figure 24

Former Yugoslav Republic of Macedonia: Hazard incidence, human and economic impact of hazards (1989-2006)

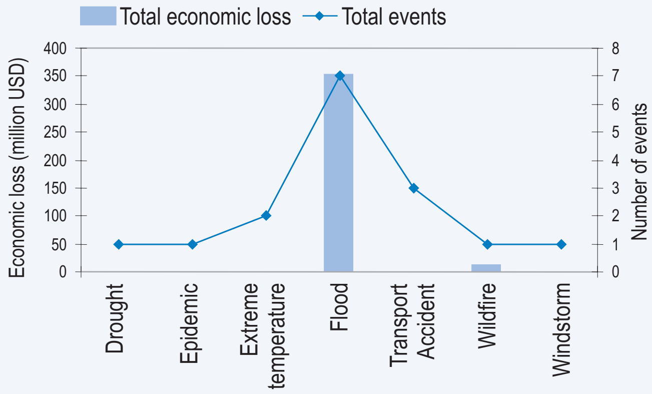
24a Hazard incidence and number of deaths due to each hazard in the Former Yugoslav Republic of Macedonia (1989-2006)



24b Hazard incidence and number of victims due to each hazard in the Former Yugoslav Republic of Macedonia (1989-2006)



24c Hazard incidence and economic losses reported due to each hazard in the Former Yugoslav Republic of Macedonia (1989-2006)

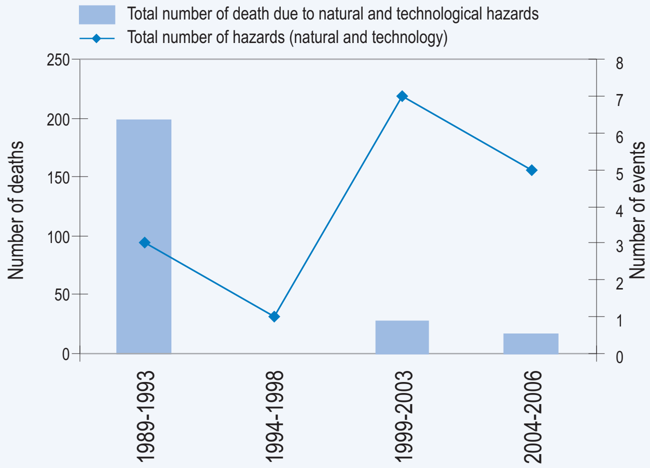


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

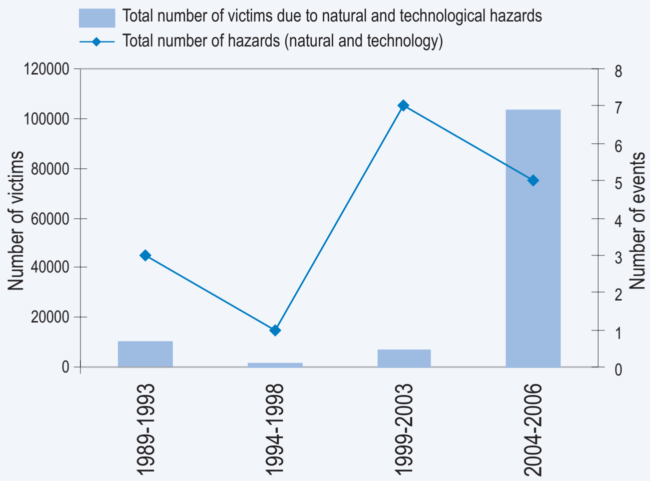
Figure 25

Former Yugoslav Republic of Macedonia: Occurrence of hazards, their economic and human impacts (1989-2006)

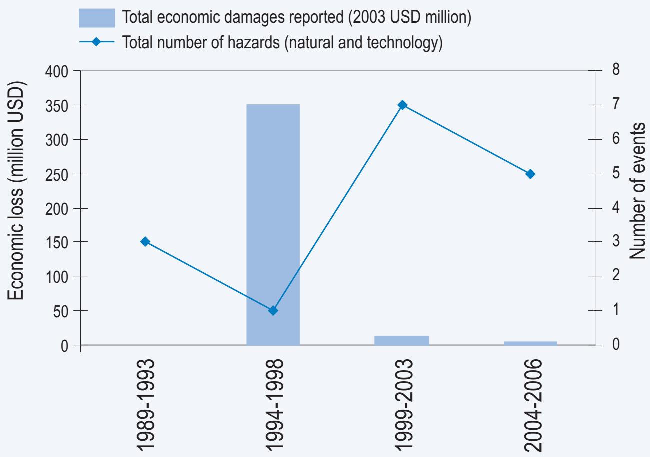
25a Total number of hazards and total number of people killed in the Former Yugoslav Republic of Macedonia (1989-2006)



25b Total number of hazards and total population affected in the Former Yugoslav Republic of Macedonia (1989-2006)



25c Total number of hazards and economic losses reported due to hazard in the Former Yugoslav Republic of Macedonia (1989-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.6 Moldova

3.6.1 Country profile

Moldova is a landlocked country, located between Romania to the west and Ukraine to the north, east and south, and with a surface area of 33,840 square kilometres. The largest part of the country lies between two rivers, the Dniester and the Prut. Moldova's rich soil and temperate continental climate (with warm summers and mild winters) have made the country one of the region's most productive agricultural areas, and a major supplier for its agricultural products. The western border of Moldova is formed by the Prut River, which joins the Danube before flowing into the Black Sea. In the north-east, the Dniester is the main river, flowing through the country from north to south. The geographic location of Moldova determines the moderate continental climate, which transitions from an Atlantic Ocean climate to an East-European continental one. This transitional climatic character causes hydrometeorological hazards, such as flood, drought, frost and windstorm, which adversely affect the national economy.

Moldova has a population of 4,205,747 (World Bank 2005) with a population density of 124 people per square kilometre. The economy depends heavily on agriculture, which contributes 17 per cent of country's GDP. Energy shortages contributed to sharp production declines after the breakup of the Soviet Union in 1991. The economy returned to positive growth of 2.1 per cent in 2000, and 6.1 per cent in 2001. Growth remained strong in 2002, because of the reforms and because it started from a small base. The service sector contributes 59 per cent of the country's GDP.

Figure 26

Map of Moldova

3.6.2 Risk assessment

Moldova is highly vulnerable to floods. EM-DAT data for the country, available only from 1984 onwards, shows that, for the period 1984-2006, floods made up 50 per cent of the total hazards. It is very interesting to note that the country reported only hydrometeorological hazards during this period. The country is also prone to other natural hazards, such as windstorm, drought, epidemic, extreme temperature, landslide and frost. Historic records shows earthquake events have occurred in the country.

The occurrence of natural hazards during this period (1984-2006) peaked during 1999-2003, with five events in five years; in the last three years (2004-2006), two events occurred. There were no technological hazards recorded in EM-DAT for Moldova during this period.

Hazard analysis shows that the number of events, deaths and economic losses are all high due to floods. There are relatively fewer deaths reported due to floods. Deaths due to earthquakes are the highest.

As mentioned earlier, there was a steady increase in the number of events over the time between 1984 and 2003. The deaths recorded are highest during 1994-1998. The economic loss shows a decreasing trend during this period, though the number of victims increases, especially during the period 1999-2003. The rise in the number of victims in this period is due to the severe drought of 2000.

As per country-level statistics, nine severe droughts occurred in the country during the period 1990-2007. The droughts of 1990, 1992 and 2003 each lasted for the whole vegetation period of four to nine months. The 2000 drought was severe and crippled Moldovan agriculture in the spring and summer of the year. This affected about 2.6 million people. The proportion of overall agricultural losses in affected areas was between 70 per cent and 90 per cent (UNDP). In contrast to these observations, the economic losses reported by EM-DAT during 1999-2003 are relatively low. According to the United Nations Office for the Coordination of Humanitarian Affairs, the windstorm and frost of November 2000 caused an estimated damage of USD 20.8 million. The economic loss due to all the various hazards comes to about 2.13 per cent of the country's GDP, which is equivalent to an annual average loss of USD 61 million. Economic losses reported are mostly due to hydrometeorological hazards.

Figure 27

Distribution of different hazards in Moldova (1984-2006)

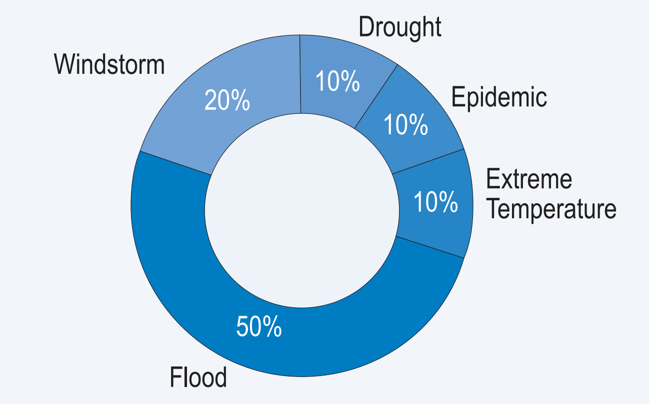
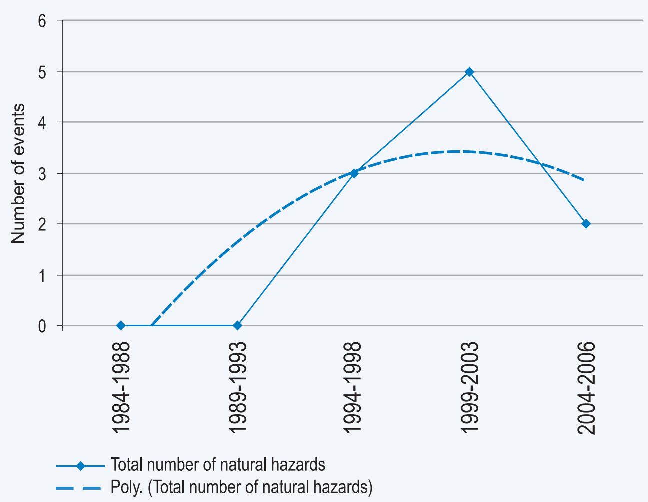


Figure 28

Trends in natural hazards in Moldova: 1984-2006

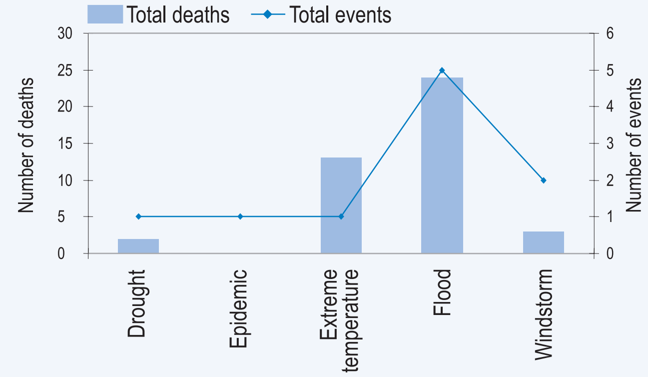


Historic earthquake records report a severe earthquake of magnitude 7.3 in Chisinau in 1940. Moldova is in close proximity to the Vrancea seismic zone in Romania. The United States Geological Survey has reported a recent earthquake of magnitude 2.9 in the Ukraine-Romania-Moldova border region on 15 February 2005. The earthquake on 17 August 1999 affected towns in both Moldova and Ukraine, including Kishinev, Simferopol and communities all around Black Sea coast of Crimea, with an intensity of 2-3 MSK, according to the Geophysical Survey, Russian Academy of Sciences.

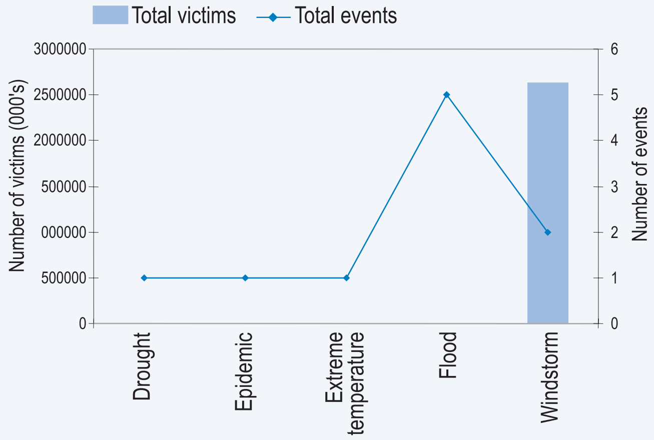
Figure 29

Moldova: Hazard incidence, human and economic impact of hazards (1984-2006)

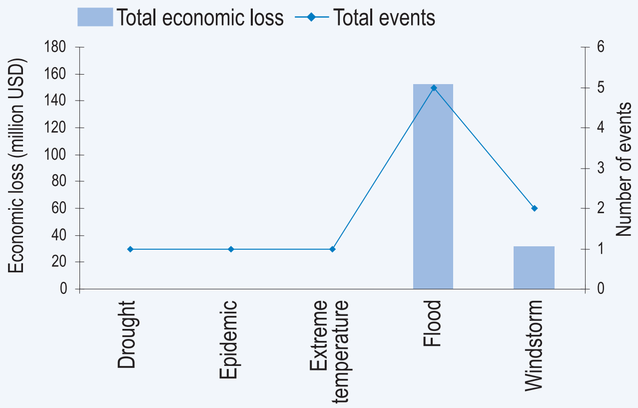
29a Hazard incidence and number of deaths due to each hazard in Moldova (1984-2006)



29b Hazard incidence and number of victims due to each hazard in Moldova (1984-2006)



29c Hazard incidence and economic losses reported due to each hazard in Moldova (1984-2006)

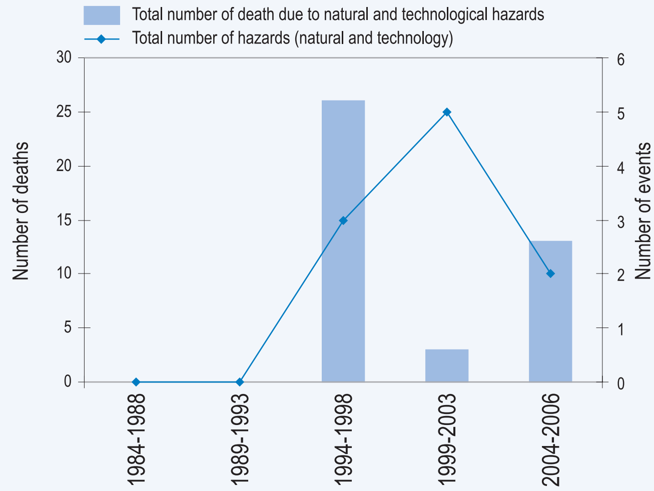


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

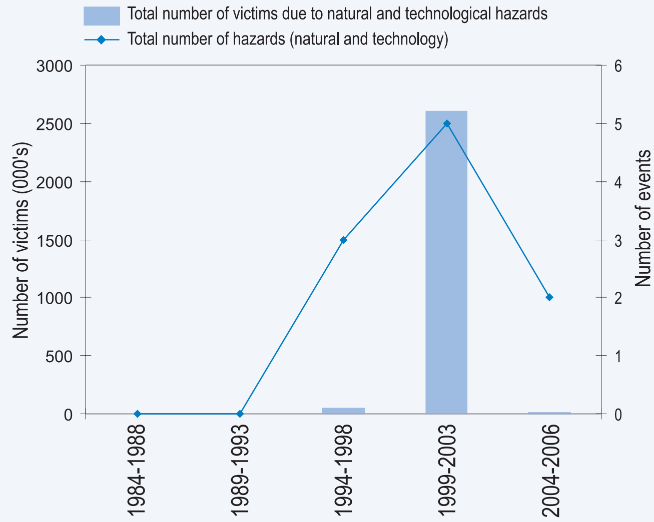
Figure 30

Moldova: Occurrence of hazards, their human and economic impacts (1984-2006)

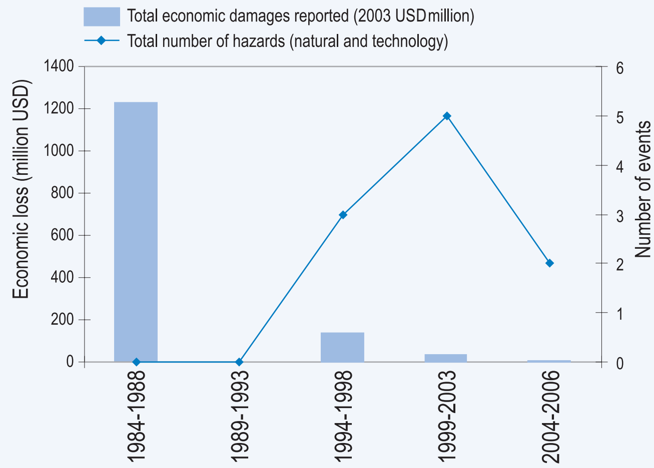
30c Total number of hazards and economic losses reported due to hazard in Moldova (1984-2006)



30b Total number of hazards and total population affected in Moldova (1984-2006)



30c Total number of hazards and economic losses reported due to hazard in Moldova (1984-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.6.3 Observations

Moldova is vulnerable to hydrometeorological hazards, particularly floods. Drought, frost and windstorms also affect the economy of the nation. Historic records of earthquake, and the country's location within the seismic zone of Vrancea zone, both indicate that the country is vulnerable to earthquake. There is a need to update and expand the seismic zone map of the country, as the existing map is more than twenty years old (Alkaz V. 2005). No detailed disaster risk assessment has been conducted for the country. There is a lack of a sound institutional framework and coordinated approaches between central and local governments for handling disaster preparedness and mitigation.

Considering the occurrence of hydrometeorological hazards in Moldova, the country requires establishment/consolidation of long-range forecasting for hydrometeorological information. A national hydrometeorological system with equipment; software; methodologies for data modeling, warning and prediction; and training; as well as facilitation of access to satellite information and information from the Euro-Asiatic meteorological infrastructure; is required. Financial constraints limit the country's implementation of systematic approaches to detailed risk assessment, mitigation measure preparation, and development of an early warning system. Consolidation of institutional and legal backgrounds, such as development of the national strategy for mitigation of hydrometeorological hazards risk, needs to be in place for the country as a proactive step towards disaster preparedness and mitigation. Considering the small size of the country, regional cooperation is very important for disaster preparedness and mitigation. The country has made an effort towards regional cooperation, associated with the activities of the Disaster Preparedness and Prevention Initiative and NATO (the North Atlantic Treaty Organization) towards disaster mitigation in the region.

3.7 Romania

3.7.1 Country profile

Romania borders Hungary and Serbia to the west, Ukraine and Moldova to the north-east, and Bulgaria to the south. Romania has a stretch of sea coast along the Black Sea, and the Carpathian Mountains run through its centre. Romania has a geographic area of 238,390 square kilometres; it is the second-largest country in SEE and the twelfth-largest in Europe. The Danube River flows along its border with Serbia and Bulgaria. The Tiza River shares the national boundary of Romania with Hungary. The Danube, joined by the Prut River, forms the border with the Republic of Moldova. The Danube flows into the Black Sea on Romanian territory, forming the Danube Delta, the largest delta in Europe. This delta is currently a biosphere reserve and World Heritage-listed site due to its rich biodiversity.

Romania has a population of 21,634,350 (World Bank 2005), with a population density of 91 people per square kilometre. Population density is high in the towns and in the plains. After late 1989, the country experienced a decade of economic instability and decline, led, in part, by an obsolete industrial base and a lack of structural reform. From 2000 onwards, however, the Romanian economy has transformed into one of relative macroeconomic stability, characterized by high growth, low unemployment and declining inflation. The economy is predominantly based on services, which account for 55 per cent of GDP, even though industry and agriculture make significant contributions, comprising 35 per cent and 10 per cent of country's GDP respectively. Additionally, 32 per cent of

Figure 31

Map of Romania

the Romanian population is employed in agriculture and primary production, one of the highest rates in Europe. With a higher GDP per capita in 2006, Romania is considered an upper-middle income economy, and has been a part of the European Union since 1 January 2007.

3.7.2 Risk assessment

Romania is highly vulnerable to earthquake and flood. It is also one of the most seismically active countries in Europe. In terms of the number of events, flood contributes to the highest percentage (41 per cent) of disasters. Occurrence of other hazards, both natural and technological, is also high in this country. Figure 32 details the proportional distribution of different hazards in the nation during the period 1974-2006.

Romania has recorded some devastating earthquakes and floods in its history, causing deaths and economic losses. Even though, as per EM-DAT, earthquakes comprised just 5 per cent of all hazards recorded in the country during 1974-2006, there have been some damaging and catastrophic earthquakes in Romania in the past. Historic records show that the earthquake of 1940 had 980 fatalities, while the 1977 earthquake had 1,641 fatalities and led to economic damages of USD 2 billion. Landslides have often occurred as associated hazards of earthquakes and floods in the country.

The EM-DAT data for the last 33 years (1974-2006) shows that natural hazards - particularly earthquake, flood and extreme temperature - have taken a toll of 1,940 lives. Analysing the time series data (figure 33), there is a steady increase in the incidence of disasters, due to both natural and technological hazards, after the 1980s in the country. In both natural and technological hazards, the last three year bin (2004-2006) shows a decline against the past trend.

Flood is the hazard that occurs most frequently; while, in terms of severity, earthquake has killed highest number of people, with a substantial economic loss generated as well (USD 2,756 million, as per the National Geophysical Data Center). Flood has affected the largest population, with the highest economic loss (of USD 3,269.3 million).

Hydrometeorological disasters have increased steadily, with mounting numbers of events and mounting numbers of victims (including killed and affected), particularly after 1993. The period 2004-2006 recorded 24 hydrometeorological hazards in the nation. As per EM-DAT, 1974-78 recorded the highest number of deaths, victims and economic losses during the last 33 years. This was due to a severe earthquake during 1977. There was substantial economic loss recorded during 2004-2006. There was a steady increase in number of events over the period. Deaths were recorded due to almost all hazards, except drought and epidemic. Eliminating the extreme event value of 1977, the economic losses reported for the rest of the period shows that losses have been

Figure 32

Distribution of different hazards in Romania (1974-2006)

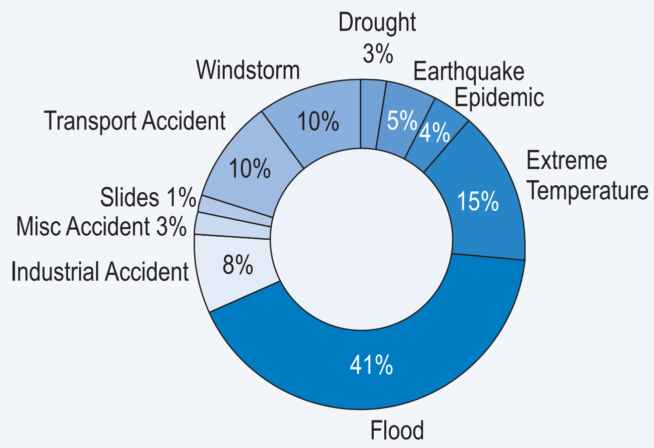
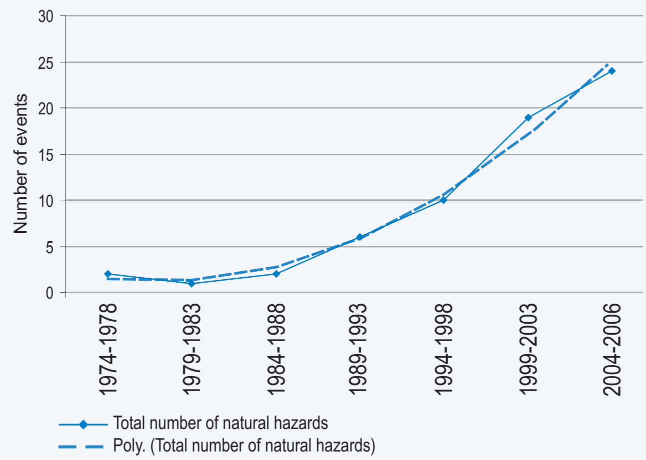


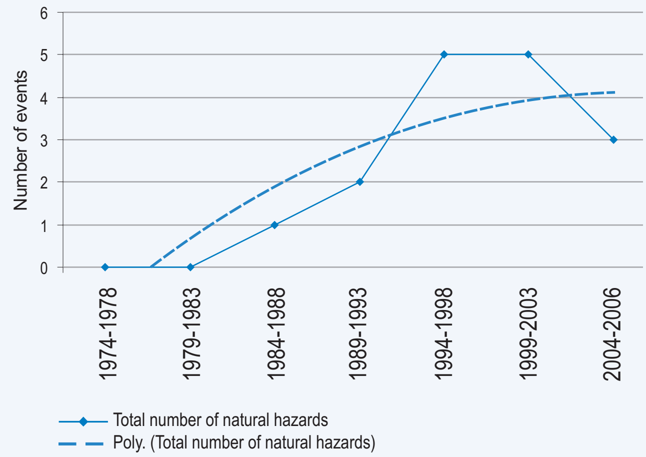
Figure 33

Trends in natural and technological hazards in Romania: 1974-2006

33a Trends in natural hazards in Romania: 1974-2006



33b Trends in technological hazards in Romania: 1974-2006



increasing steadily over time, along with the number of events. This shows the increased vulnerability of the country, along with its economic growth.

The south and south-west region of the nation is highly vulnerable to earthquakes due to its proximity to the Vrancea seismic zone. Even though Romania has not recorded any major earthquake in the last two decades, the vulnerability of the country to earthquake needs to be analysed, considering the longer return period probability. Even though the total affected population due to technological hazards is showing a dip in value, the number of technological events increased after the 1980s. Two major transport accidents happened in 1989 and 1995, affecting 190 and 114 people respectively. Occurrence of events and population affected by transport accidents are higher compared with industrial accidents. No fire events were recorded in EM-DAT, but Global Fire Monitoring Center data shows the country had 102 events between 1990 and1997, affecting 355 hectares of land.

3.7.3 Observations

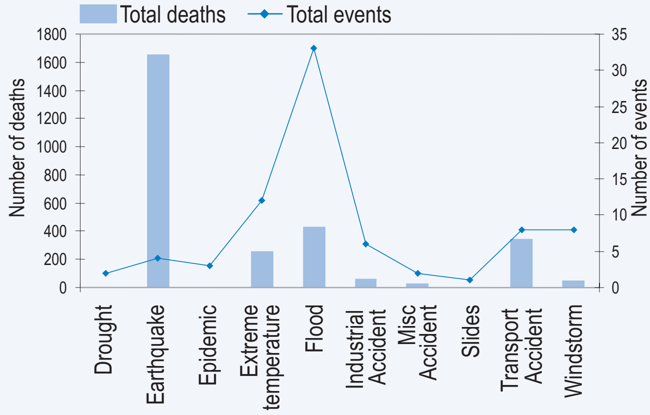
Romania is highly vulnerable to various hazards, particularly to earthquake and flood. Romania is in the process of developing and strengthening legislative and organizational frameworks for disaster mitigation and preparedness. The country has enlarged international cooperation in the field of earthquake prevention, particularly assistance and technical support from the World Bank and Japan, and is developing a national-level database in GIS as part of its surveillance of disasters triggered by natural hazards. The country has existing building codes, and is moving towards an earthquake catastrophic insurance system for buildings. A detailed vulnerability assessment on flood and earthquake for the entire country is being carried out by RMSI, with the financial support of the World Bank. There are different organizations involved in seismic monitoring with their own monitoring networks (the National Institute of Research Development for Earth Physics, and the National Institute for Building Research), but it would be more efficient to have coordinated activities with a central database.

The General Inspectorate for Emergency Situations (GIES) under the Ministry of Administration and Interior has set up the National Emergency Management System, which aims to prevent and manage emergency situations, to manage and coordinate emergency situations, and to manage and coordinate human, material and financial resources. GIES is working in close association with CMEPC and DPPI towards regional cooperation. GIES is also making an effort to coordinate with the World Health Organization and NATO on regional cooperation for prevention of natural or technological disasters and terrorist activities in the region. However, the coordination between the central ministry and the local bodies, and the involvement of other departments in disaster preparedness and prevention, all need to be strengthened.

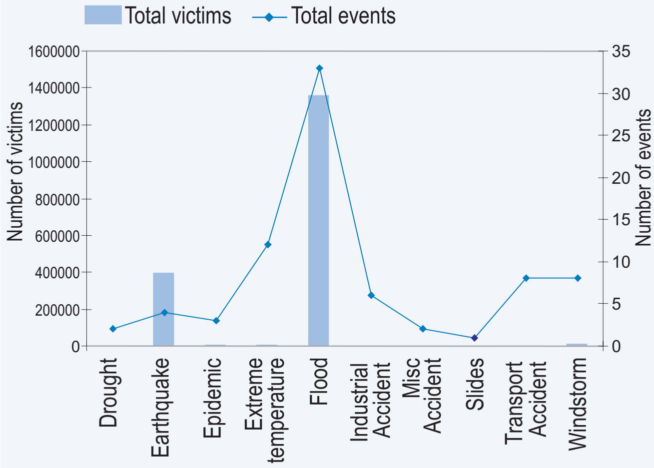
Figure 34

Romania: Hazard incidence, human and economic impact of hazards (1974-2006)

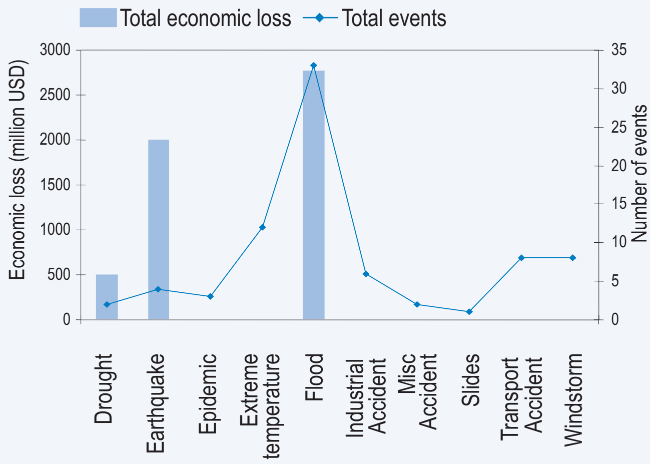
34a Hazard incidence and number of deaths due to each hazard in Moldova (1984-2006)



34b Hazard incidence and number of victims due to each hazard in Moldova (1984-2006)



34c Hazard incidence and economic losses reported due to each hazard in Moldova (1984-2006)

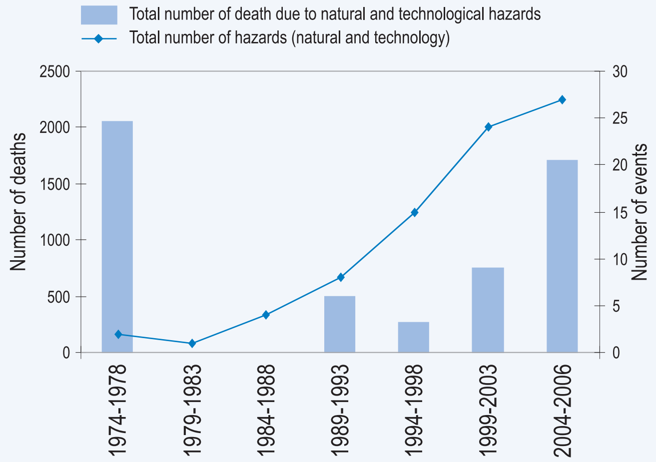


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

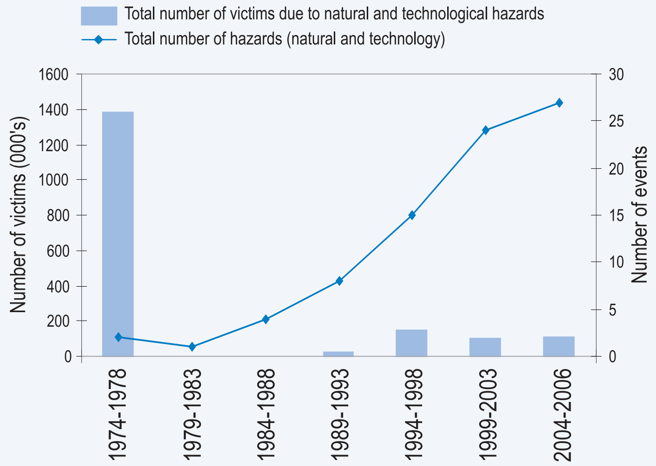
Figure 35

Romania: Occurrence of hazards, their human and economic impacts (1974-2006)

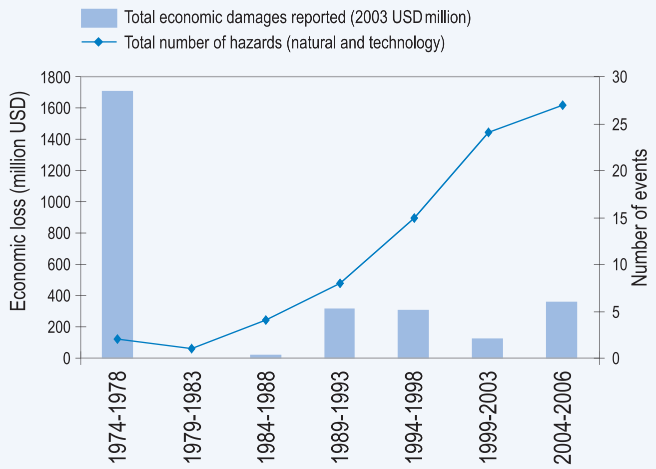
35a Total number of hazards and total number of people killed in Romania (1974-2006)



35b Total number of hazards and total population affected in Romania (1974-2006)



35c Total number of hazards and economic losses reported due to hazard in Romania (1974-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.8 Serbia

3.8.1 Country profile

The Republic of Serbia is a landlocked country in the SEE region. It is bordered by Hungary on the north; Romania and Bulgaria on the east; Albania and Macedonia on the south; and Montenegro, Croatia and Bosnia and Herzegovina on the west. The country mainly comprises plains and low hills (except in the mountainous region of Kosovo and Metohija). The Danube, the Sava and the Drina are the main rivers flowing in the country. The Danube flows through Belgrade (the capital) and the main cities in the country.

Serbia has gone through a number of political changes ever since its first formation as an independent kingdom in 1217. The last was Serbia becoming independent from the state union of Serbia and Montenegro in 2006. Kosovo and Metohija are two autonomous provinces in the country. The estimated population (2005) of Serbia is 9,396,411, including Kosovo and Metohija. The population density of the country is 105 people per square kilometre, with Kosovo having the highest density of 146 people per square kilometre. The estimated GDP (2006) of Serbia is USD 50.688 billion, with a growth rate of 5.8 per cent, compared to growth of 6.3 per cent in 2005.

Figure 36

Map of Serbia

3.8.2 Risk assessment

As Serbia just became independent in 2006, there is lack of retrospective, country-specific, secondary risk-related data available in the EM-DAT database. So EM-DAT's combined data for Serbia and Montenegro is presented here to provide an understanding of risk in the region. Some additional information from secondary sources is also presented.

EM-DAT data for Serbia and Montenegro is available only from 1989, and is analysed to understand the hazard and vulnerability status of the country. The number of events that occurred during the period 1989-2006 shows that occurrence of technology- and flood-related hazards is the highest (38 per cent and 34 per cent respectively) among all hazards. Other hazards reported during this period and their percentage share are shown in figure 37.

The number of disasters due to natural hazards has increased over the time, while disasters due to technological hazards show a decreasing trend. But compared to many other SEE countries, Serbia and Montenegro have reported more technological disasters, with an annual incidence rate of 0.56, meaning an average of one event every two years.

The number of victims is highest due to flood (125,412), which has affected about two per cent of the country's total population, and the number of deaths is highest due to technological hazards (159).

Severe earthquakes occurred during 1979, 1980 and 1998 in the country. The 1998 event has caused an economic loss of more than USD 400 million (Pusch 2004). There is no economic loss data recorded for Serbia and Montenegro during this period in EM-DAT.

The National Geophysical Data Center reports an economic loss of USD 2,705 million due to earthquake during the last 33 years. This is equivalent to an annual average of USD 82 million, or 1.66 per cent of country's GDP. UNDP statistics shows there are 321,934 people exposed to flood. The incidence rate of flood and technological hazards is 0.5. The annual average number of deaths for all hazards is 10, while the annual average number of victims is 7,028.

In addition to the combined data on Serbia and Montenegro presented above, there are some country-specific observations available. According to a national report on disaster reduction progress (Anonymous 2004), the biggest hazards that have affected the population and property of Serbia are flood, fire, earthquake and technological hazard. The valleys of larger watercourses, in which the largest settlements and the best farmland, infrastructure, and industry are located, are highly prone to floods. Vojvodina has the highest risk of floods. The floods are mostly along the river courses of Sava,

Figure 37

Distribution of different hazards in Serbia and Montenegro (1989-2006)

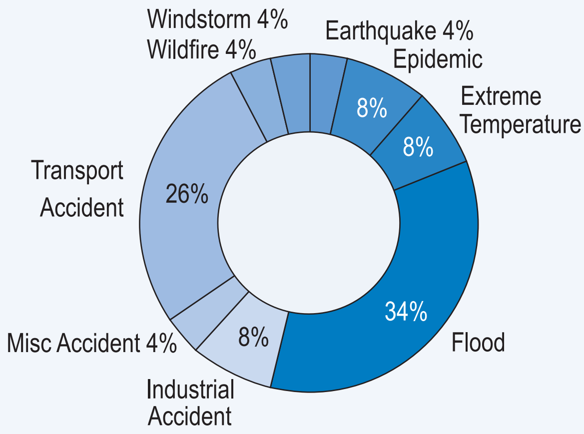
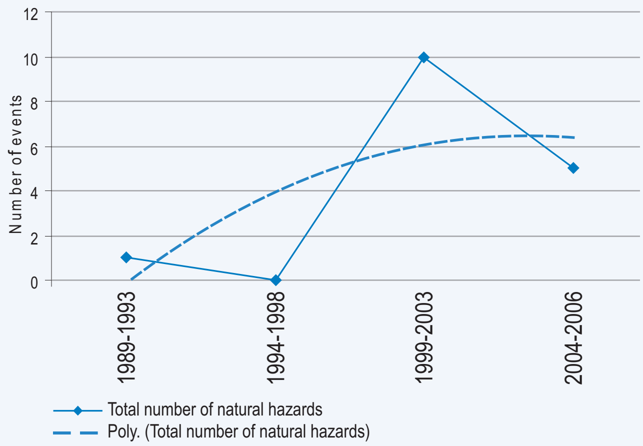


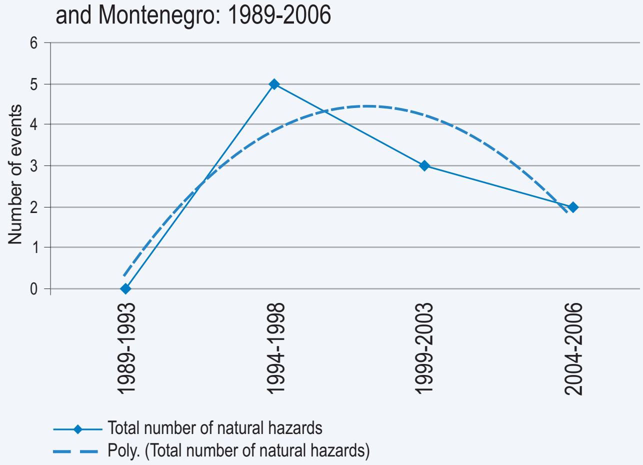
Figure 38

Trends in natural and technological hazards in Serbia and Montenegro: 1989-2006

38a Total number of natural hazards in Serbia and Montenegro: 1989-2006



38b Total number of technological hazards in Serbia and Montenegro: 1989-2006



Drina, Velika Morava, Juzna Morava and Zapadna Morava. Human activity has accelerated soil erosion, increasing the landslide risk in both republics.

As per the national report, seismic activity in Serbia is strong and frequent (magnitudes from 7 to 9); over 50 per cent of Serbia is vulnerable to earthquakes of magnitude 7, and around 20 per cent of the territory is vulnerable to magnitude 8 earthquakes. The most risk-prone area of Serbia is around Kopaonik, in south-eastern Serbia. There is high risk for larger cities due to high population density.

There is not much threat due to wildfire reported in the country, but vulnerability to technological hazard is very high. Accidents occurring during transportation of toxic and hazardous materials have been reported in the country. The political situation and conflicts of the recent past in the country have had lingering impacts on people and the environment, resulting in the release of toxic materials into the environment. These releases have affected water and sediment quality, especially in the Danube, Velika Morava and Lepenica rivers.

5.8.3 Observations

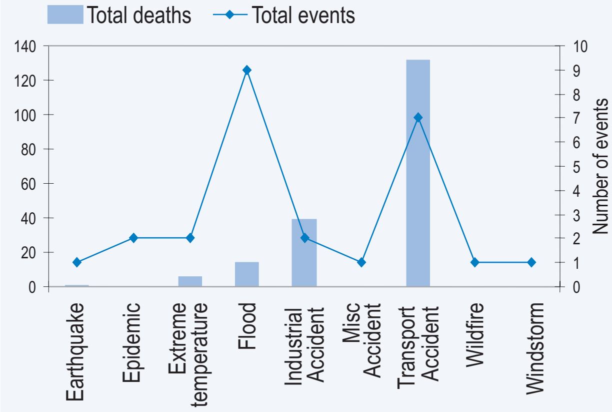
Following the series of political changes the country has undergone, it is now in the process of building a constructive framework for national security and disaster risk management. This is occurring with the support of the Stability Pact SEE disaster preparedness and prevention initiative. Currently the laws in the country are outdated, not in agreement with international conventions and European Union standards, and the constitution needs reconstruction. There is no disaster management plan in place and no efficient early warning system. At present, international cooperation is mainly focused on protection and rescue of citizens and assets. As a next step, the country should strive to integrate disaster management into development activity, so that mitigation and prevention will achieve due priority in the near future. International cooperation in this regard is very important. During the previous regime of the state union between Serbia and Montenegro, the Ministry of Public Administration and local self-government, in cooperation with the International Federation of Red Cross and Red Crescent Societies and the national Red Cross organization, initiated risk assessments in 30 municipalities in Serbia. The assessments need to be evaluated and, if required, re-initiated.

Awareness and interest need to be generated among non-governmental organizations and other private organizations, such as universities, to get them involved in disaster management activities. There is lack of awareness and training among the public, and insufficient funds for awareness activities.

Figure 39

Serbia and Montenegro: Hazard incidence, human impact of hazards (1989-2006)

39a Hazard incidence and number of deaths due to each hazard in Serbia and Montenegro (1989-2006)



39b Hazard incidence and number of victims due to each hazard in Serbia and Montenegro (1989-2006)

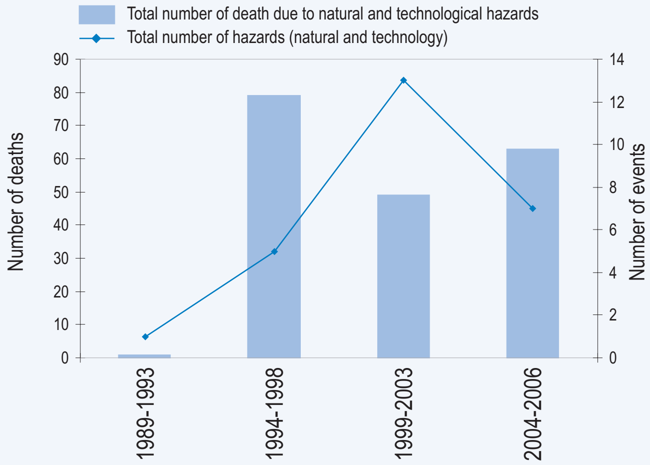
ata Source: EM-DAT: The OFDA/CRED
ternational Disaster Database

Land-use legislation and flood and landslide vulnerability mapping need urgent attention, as the country is highly prone to flood and landslide. Technological hazards due to chemical industries and to past events need environmental epidemiological research in the country for the long-term health of the citizens.

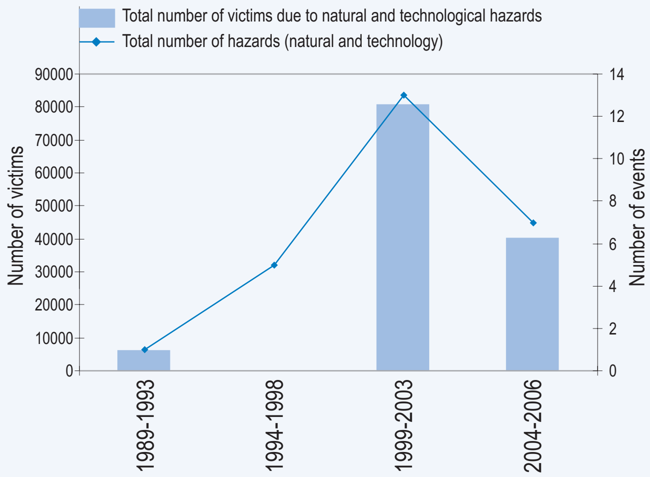
Figure 40

Serbia and Montenegro: Occurrence of hazards, their human impacts (1989-2006)

40a Total number of hazards and total number of people killed in Serbia and Montenegro (1989-2006)



40b Total number of hazards and total population affected in Serbia and Montenegro (1989-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.9 Montenegro

3.9.1 Country profile

The Republic of Montenegro achieved independence in 2006 and is located in the eastern part of SEE. The country is bordered by Adriatic Sea to the south and Croatia on the west; Bosnia and Herzegovina on the north-west; Serbia in the north-east; and Albania in the south-east. Montenegro has faced political and economic transitions, regional conflict, economic sanctions and NATO interventions. The political transition has impacted the economy and development of the country due to an influx of refugees and a "brain drain" from the country. Montenegro has embarked on an ambitious programme of reform, driven by the European Union accession process and independence. Market reforms have yielded moderate success, with control over inflation and a reduction in unemployment.

Montenegro is mostly mountainous, with a segment of karst topography and a narrow coastal plain. Due the mountainous topography of the country, economic activities are concentrated in the small narrow plains. The karst topography is generally at an elevation of 1,000 meters above sea level. The geographic area of the country is 13,812 square kilometres, relatively small in size. Scadar Lake, located in the south of the country, extends across the boundary into the territory of Albania. The estimated population of the country is 684,736 (2007) with a density of 45 people per square kilometre. The country's GDP is USD 11.458 billion (2005 estimate).

Figure 41

Map of Montenegro

3.9.2 Risk assessment

There is little retrospective country-specific disaster data available. Based on the combined data for Serbia and Montenegro available in EM-DAT, risk assessment has been attempted in section 3.8.2, above. However, some additional information available solely for Montenegro from various sources is presented here.

Montenegro is vulnerable to earthquake, flood and fire (forest fire and industrial fire). There are also threats due to technological hazards related to mining and other industrial activities in the country. The best and most fertile land in Montenegro is regularly flooded. The Pazicko polje is vulnerable to flooding, and flood events were reported there in 1980 and 2001. The valley of River Lim at the estuary of the River Moraca, and the Zeta plain are also susceptible to flood. Flooding occurs irregularly in other areas due to the karstic structure.

Montenegro is exposed to low- and medium-intensity earthquakes, and occasionally to devastating earthquakes of large magnitude. Modern research has confirmed the lasting existence of a high level of seismic activity and earthquake hazard in this part of the lithosphere, practically the entire region of Montenegro. The coastal area, the Zeta-Skadar depression and the Berane basin should be highlighted as significant seismically active areas of the country. The earthquake of 15 April 1979 at the coast and wider area of Skadar Lake had a devastating effect. There is a high probability of intensive manifestations of destructive geological phenomena during the strong earthquakes: liquefaction, activation of large slides and huge rock slides in the region. The populated coastal plains of the country are in the high seismic zone of VIII and IX degree EMS98 scale (Anonymous 2006).

3.9.3 Observations

The country has developed a broad framework under the Ministry of Interior for handling emergency situations and civil security. The national spatial plan of Montenegro (Anonymous 2006) is a comprehensive document highlighting some of the major hazards in the country and recommending a spatial plan for designing mitigation measures. The report has integrated risk mitigation measures to a good extent into the spatial development plan, even though vulnerability due to different hazards is not worked out. In line with this report, developing a country-level GIS database can not only leverage the spatial planning activities, but also help in preparing a disaster management plan for the country. The country requires legislation on land-use planning and building codes, and an improved firefighting system, particularly in the populated part of the country.

UNDP is active in the country, and is assisting in strengthening the national capacities for efficient management of external assistance. Considering the size of the country and its geological setting, transboundary initiatives play a crucial role in disaster mitigation and preparedness.

3.10 Slovenia

3.10.1 Country profile

Slovenia has a surface area of 20,270 square kilometres, bordering Italy on the west, the Adriatic Sea on the southwest, Croatia on the south and east, Hungary on the northeast, and Austria on the north. Slovenia has four major geographic regions: the Alps, the Dinaric-Karst, the Pannonian plain and the Mediterranean. Karst covers around 44 per cent of the total area of the country.

Slovenia has a population of 2,000,500, with a population density of 99 people per kilometre. (World Bank 2005). Slovenia has a high-income developed economy which enjoys the highest GDP per capita of the newly joined European Union countries, at around 86 per cent of the European Union average. The country's relatively high rate of inflation declined to 2.3 per cent by 2006 and is now comparable to the average in the European Union. Slovenia's economy has started to grow more strongly in the last few years (5.2 per cent in 2006, 4.0 per cent in 2005, 4.4 per cent in 2004, 4.8 per cent 2007 forecast), after relatively slow growth in 2003 (2.7 per cent). Overall, the country is on a sound economic footing.

Figure 42

Map of Slovenia

3.10.2 Risk assessment

Slovenia is more vulnerable to earthquake than to any other hazard. Hazard data for Slovenia is available only from 1995 onwards in the EM-DAT database. During the last 11 years, five disaster events were recorded in the country. Out of this, two events (40 per cent) were earthquake and one was a flood event, while one event involved extreme temperature and one was technological (an industrial accident).

The incidence of natural hazards showed an increasing trend during this period. There is insufficient data for trend analysis of technological hazard.

The number of events and deaths, and the affected population, are highest for earthquakes, while economic loss is high due to extreme temperature. Economic loss due to extreme temperature is USD 80 million.

Slovenia is vulnerable to earthquakes, summer storms, heavy floods, frost, landslides and other natural hazards. The loss is estimated to equal more than 2 per cent of the country's GDP. The 1990 flood has caused damages of over one-fifth of GDP (Pusch 2004).

As per EM-DAT, between 1994 and 2006, two earthquakes were recorded. These events killed one person and affected 1,306, with an economic loss of USD 10 million. As per the country report, the Gorenjska-Ljubljana and Dolenjska-Notranjska-Bela Krajina regions are the active earthquake zone areas of the country. Over 650,770 citizens, 33.1 per cent of country's population, lives in areas where earthquakes of VIII and IX levels on the MCS scale could occur. Each year, Slovenia experiences ten weak-to-moderate shocks. In the past, several destructive earthquakes have taken place, with epicenters either within the territory of present-day Slovenia or in its vicinity.

No deaths or victims were reported due to flood, but an economic loss of USD 5 million is recorded in EM-DAT. The economic loss due to earthquake is USD 10 million during the last 33 years, and 321,934 people were exposed to earthquake, showing the vulnerability of the country to earthquake. Drought-related hazards have caused USD 80 million in losses during this period. With the country's strong GDP, the loss percentage to GDP is relatively low. As per the national report, 14.8 per cent of the total area of the country is under the threat of flood, with 132,000 people (7 per cent of the total population) exposed to flood risk; 30,984 people are exposed to earthquake. About 7,000 square kilometres of the country is affected due to landslides. The country is prone to risk due to avalanches also.

Figure 43

Distribution of different hazards in Slovenia (1994-2006)

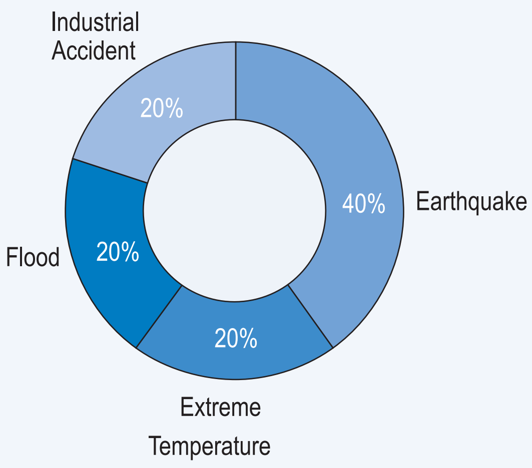
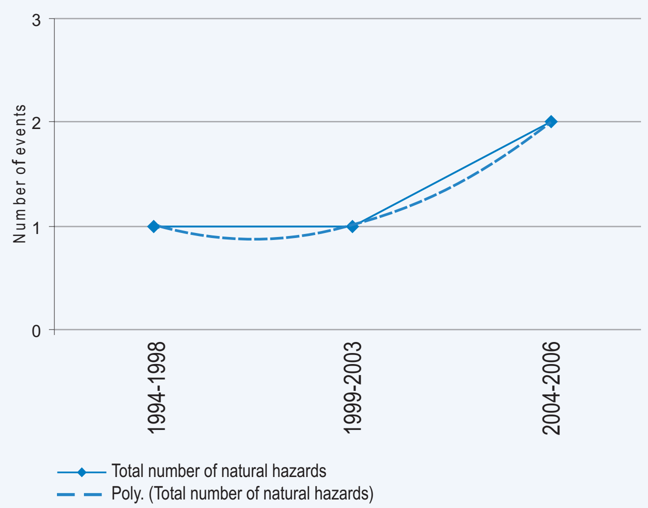


Figure 44

Trends in natural hazards in Slovenia: 1994-2006 (data not available prior to 1994)

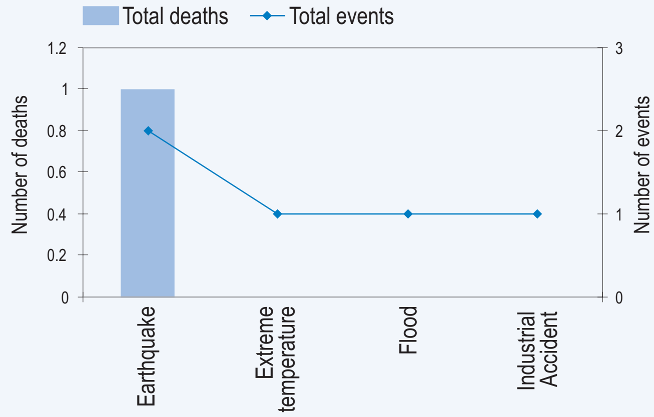


As per the country-level report, the karst and coastal region, and the Notranjska region have the risk of fire; fire is reported as one of the most frequent hazards in Slovenia. Between 1987 and 1997 there were an average of 2,712 fires per year in Slovenia, of which 1,080 occurred outdoors, 1,337 in buildings and 295 on means of transport. According to the Global Fire Monitoring Center, there were 89 fire events affecting an area of 643 hectares during 1991-1999.

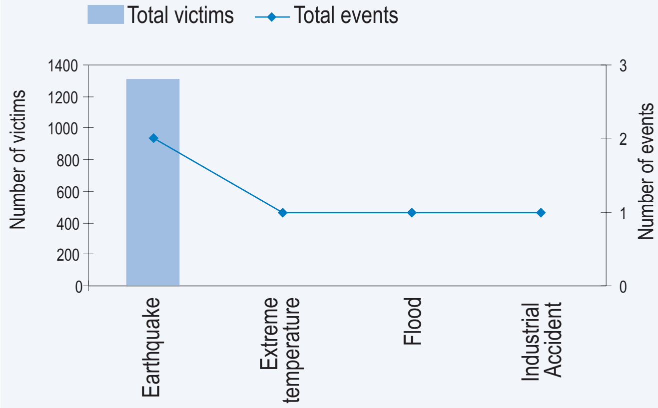
Figure 45

Slovenia: Hazard incidence, human and economic impact of hazards (1994-2006)

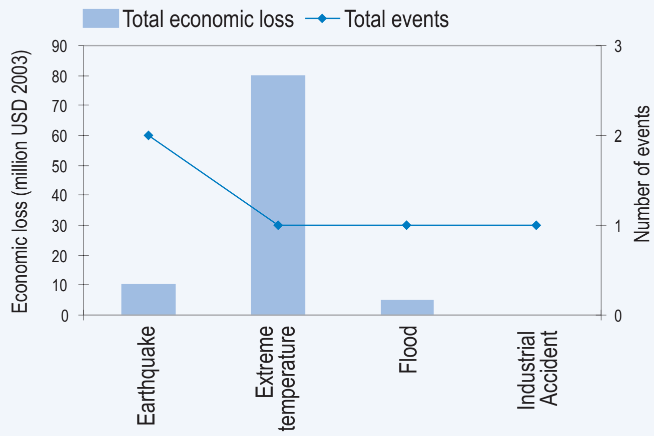
45a Hazard incidence and number of deaths due to each hazard in Slovenia (1994-2006)



45b Hazard incidence and number of victims due to each hazard in Slovenia (1994-2006)



45c Hazard incidence and economic losses reported due to each hazard in Slovenia (1994-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

3.10.3 Observations

The country is less vulnerable than other SEE countries to both natural and technological disasters. Considering its geographic position in the Balkans and the drainage characteristics of the country, Slovenia needs to be involved in regional cooperation for disaster preparedness and prevention. Slovenia is a member country of the Sava River Basin initiative.

The country has an emergency response plan in the event of earthquakes, nuclear accidents, floods, aircraft accidents, railway accidents, accidents in the sea and terrorist attack. Based on the national security strategy of Slovenia, the National Programme of Protection against natural and other disasters was adopted, and different hazards are addressed according to the priorities in the country's five-year plans. While it is looking at disaster management from a proactive perspective, including preparedness and mitigation, the country warrants a comprehensive national level disaster management plan. Non-governmental organizations are active in protection, rescue and relief tasks in the country. Building codes are being used in the country, but they need to be followed strictly, considering the earthquake vulnerability of the region. The existing institutional framework has the capacity to handle disasters and emergency situations. There is a need for urgent attention to development of a detailed biophysical and socio-economic GIS database, which would be a planning tool for disaster mitigation and preparedness.

3.11 Turkey

3.11.1 Country profile

Turkey in the Balkan region is bordered by eight countries: Bulgaria to the north-west; Greece to the west; Georgia to the north-east; Armenia, Azerbaijan, and Iran to the east; and Iraq and Syria to the south-east. The country is bordered by the Mediterranean Sea to the south, the Aegean Sea to the west, and the Black Sea to the north. Turkey also borders the Sea of Marmara, which, as it is used by geographers to mark the border between Europe and Asia, makes Turkey transcontinental.

Turkey's area, inclusive of lakes, occupies 779,452 square kilometres with a population of 72,065,000 and a population density of 92 people per kilometre (World Bank 2005). Turkey has an area bigger than all the rest of the SEE countries put together, and has a population larger than the aggregate population of all the other SEE countries.

Since the economic crisis of 2001, inflation has fallen to single-digit numbers, investor confidence and foreign investments have soared, and unemployment has fallen. Turkey has gradually opened up its markets through economic reforms by reducing government controls on foreign trade and investment. Privatization of publicly-owned industries and liberalization of many sectors to private and

Figure 46

Map of Turkey

foreign participation has continued, amid political debate. The GDP growth rate for 2005 was 7.4 per cent, making Turkey one of the fastest-growing economies in the world. Turkey's GDP ranks seventeenth in the world and Turkey is a member of "G20", which brings together the 20 largest economies of the globe. Turkey's economy is no longer dominated by traditional agricultural activities in the rural areas, but more so by a highly dynamic industrial complex in the major cities, mostly concentrated in the western provinces of the country, along with a developed services sector. The agricultural sector accounts for 11.9 per cent of GDP, whereas industrial and service sectors make up 23.7 per cent and 64.5 per cent, respectively.

3.11.2 Risk assessment

Turkey is highly vulnerable to earthquakes and technological hazards. Technological hazards contribute to about 54 per cent and earthquakes 19 per cent of the hazards recorded during the last 33 years in the EM-DAT database. As per EM-DAT, the country has recorded almost all kinds of hazards: earthquake, extreme temperature, flood, landslide, epidemic, windstorm, wildfire and technological hazards.

The incidence of hazards during the period 1974-2006 shows that there has been a steady increase in the number of events; in both natural and technological hazards. The annual incidence of both natural and technological hazards shows a steady rise over the period. Almost all years have recorded at least one event, and in 2004, 10 natural hazards events and 10 technological hazard events took place in the country. Eleven technological hazard events were recorded in 2003.

The disaster impact indicator shows that the country is highly vulnerable to earthquakes. Turkey probably has highest figures recorded in entire SEE region in the numbers for deaths (31,065), victims (8,091) and economic losses (USD 18,499 million) due to both natural and man-made disasters, as per EM-DAT. Turkey lies in one of the most active seismogenic and volcanic regions in the world. There are three different major fault systems in Anatolia from east to west; about 70 per cent of the country's population and 75 per cent of industrial facilities are vulnerable to earthquake, and 66 per cent of the country is located in the active fault zone. It is estimated that 64 per cent of Turkey's total disaster losses in the last century are due to earthquakes.

Rapid and uncontrolled urbanization has increased the level of vulnerability to earthquakes. There have been approximately 70 major earthquakes in the last century, collectively causing the deaths of 100,000 people and destroying 500,000 homes. In 1999, two major earthquakes hit the Marmara region, killing 17,225 people and destroying 38,240 buildings. Viewed within the context of loss of life and injury, earthquakes account for about 90 percent of losses.

Figure 47

Distribution of different hazards in Turkey (1974-2006)

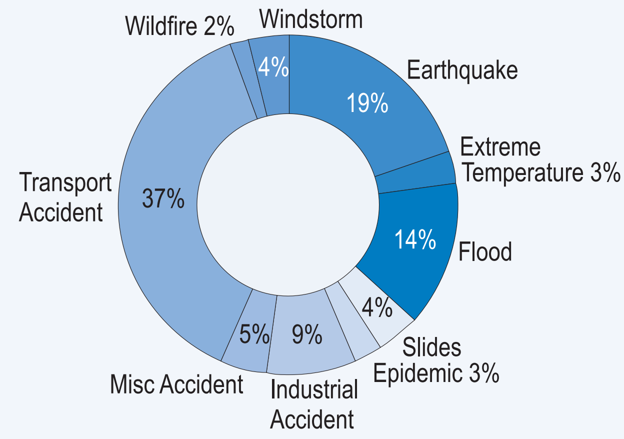
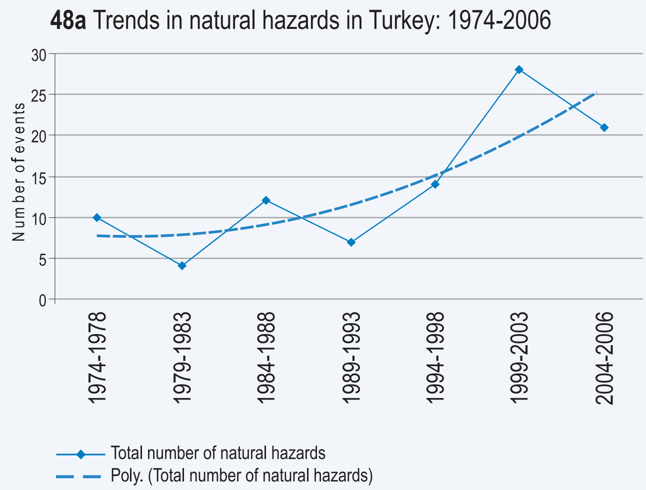


Figure 48

Trends in natural and technological hazards in Turkey: 1974-2006



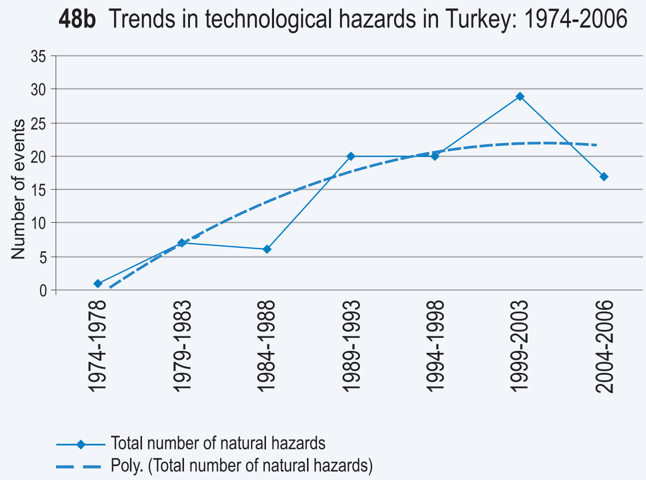
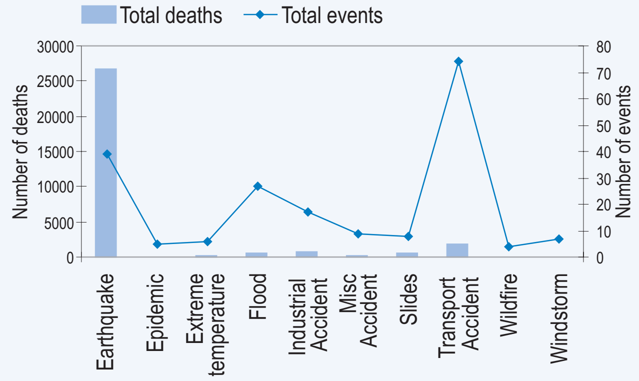


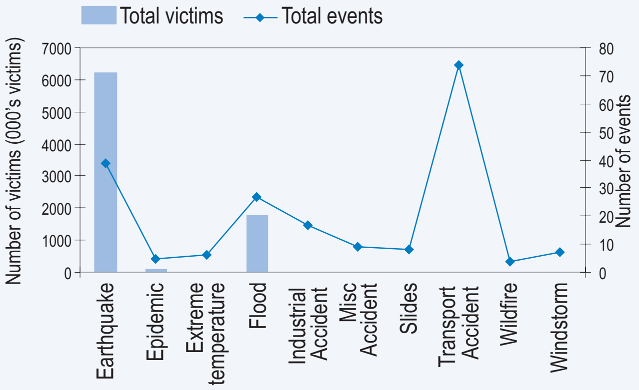
Figure 49

Turkey: Hazard incidence, human and economic impact of hazards (1974-2006)

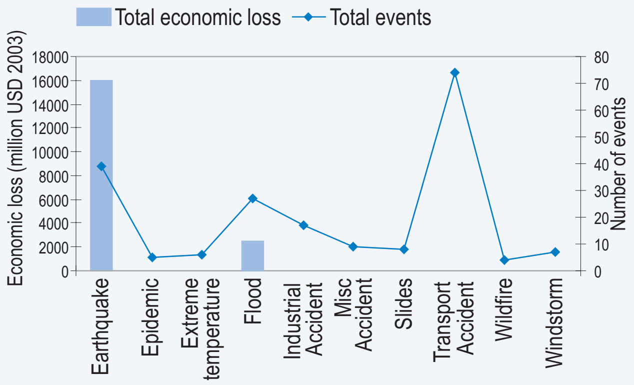
49a Hazard incidence and number of deaths due to each hazard in Turkey (1974-2006)



49b Hazard incidence and number of victims due to each hazard in Turkey (1974-2006)



49c Hazard incidence and economic losses reported due to each hazard in Turkey (1974-2006)

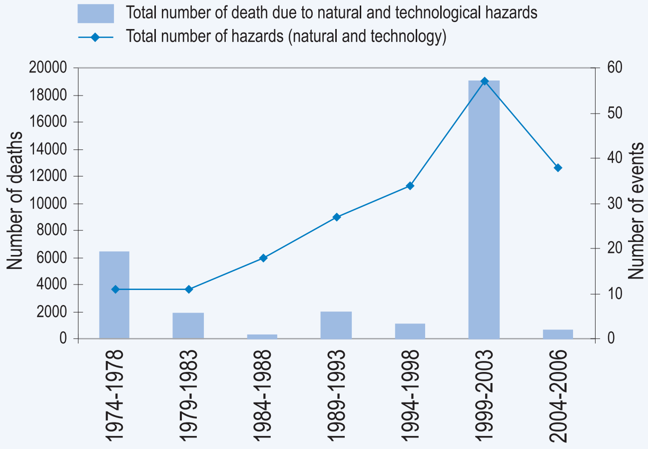


Data Source: EM-DAT: The OFDA/CRED International Disaster Database

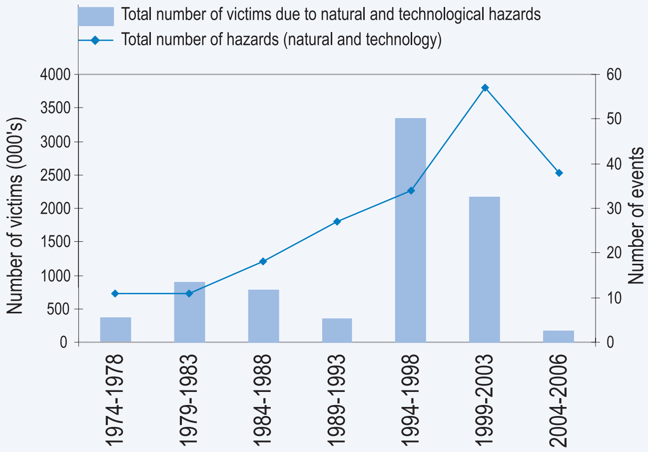
Figure 50

Turkey: Occurrence of hazards, their human and economic impacts (1974-2006)

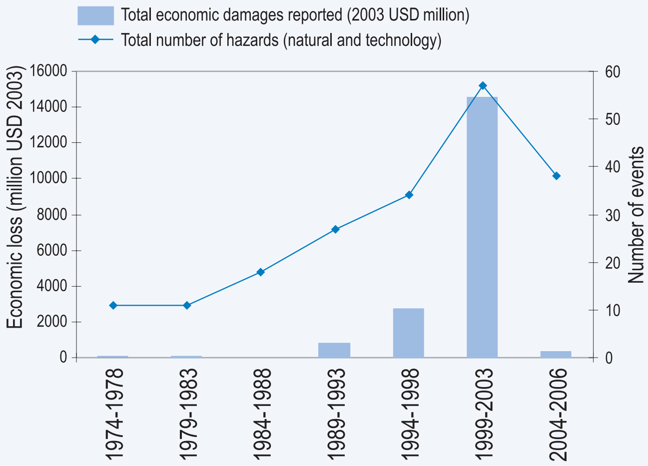
50a Total number of hazards and total number of people killed in Turkey (1974-2006)



50b Total number of hazards and total population affected in Turkey (1974-2006)



50c Total number of hazards and economic losses reported due to hazard in Turkey (1974-2006)



Data Source: EM-DAT: The OFDA/CRED International Disaster Database

Average annual direct economic losses due to earthquake exceeded USD 1 billion in the last decade. About 950 people per year are killed due to earthquake in the country, giving it third position in the world in terms of death risk due to earthquakes. The physical exposure per year is 2.75 million people, and stands eighth in the world. The Erzincan earthquake of 1992, the Adana-Ceyhan earthquake of 1998 and the Marmara earthquake of 1999 are the worst earthquakes of the decade in the country.

In terms of disaster impact, flood stands next to earthquake with highest number of deaths, victims and economic loss. Coastal regions are at greatest risk from floods. The Black Sea region of the country is highly prone to landslides. About 25 per cent of the country is exposed to landslide hazard, and 11 per cent of the total population and 16 per cent of the total disaster losses are due to landslides.

Analysing the incidence of events and their impact over time shows that the highest number of events and the highest levels of economic loss were recorded during 1999-2003. Analysis of death and affected population during 1974-2003 shows that all the five-year groups recorded death, affected populations and economic losses. EM-DAT shows that risks due to all hazards are higher in Turkey than in any other country in the region.

3.11.3 Observations

Turkey has faced some of the most devastating natural hazards during the last decade in Europe. There has been a paradigm shift in the disaster management approach of the country, which has moved towards emphasizing a proactive and ex ante approach to reducing the impact of hazards. The country has started emphasizing mitigation and preparedness, rather than its former approach of focusing on rehabilitation and recovery. The country has set up a national catastrophic insurance program, making insurance compulsory for residences, in order to minimize the financial gap and to transfer the risk from individuals and the state budget to the private sector. Turkey developed seismic micro-zonation maps for all municipalities, which became obligatory for municipalities in the Marmara earthquake region. Studies show the probability of earthquake in Istanbul is 20 per cent in the next 10 years. Studies show that there a steady westward progression of large magnitude earthquakes, and the probability of a major earthquake event in Istanbul is very high in the near future.

The law on disaster management in Turkey is a broad-based one, addressing all forms of disasters. There is a lack of coordination, even after the formation of the Turkey Emergency Management General Directorate (TEMAD) for multi-sectoral coordination and collaboration on disaster risk reduction in the country. The disaster management system is essentially the responsibility of the central government, with no local authorities, which is paradoxical considering the large size of the country. There is a need for micro-level land-use maps, and for implementation of building codes outside the municipal boundaries in the country. Most of the major natural hazard events in the country were followed by loans, basically designed to rebuild the affected area. But there are fewer efforts and financial requirements towards prevention and preparedness. The Disaster Emergency Management Information System (AFAYBIS), developed at a pilot level, needs to be assessed in detail, to explore the possibility of developing a national spatial data infrastructure, with the potential to be scaled up to the regional level.

3.12 South Eastern Europe regional analysis

3.12.1 Regional setting

A regional risk assessment of SEE needs to be examined against the background of the existing, transboundary nature of the region's physical and social contiguity. The transboundary rivers, the regional climatic conditions, the geological contiguity, the socio-economic and cultural settings, and the past political situation are important factors contributing to the complexity of the region. The small size of the countries also contributes to the region's homogeneous physiographic and climatic characterization, and leads to common and shared hazards. The relatively small size of the countries often makes it difficult to respond to hazards at a country level.

In addition to the geophysical, social and political settings of the region, other reasons exist for the aggravated transboundary disaster risk. They include: the transition from centrally planned to market economics; historic national and regional conflicts; the creation of new nations; political tensions and war; rapid and unplanned land-use changes; and also, due to regional climate change, an increase in extreme drought, extreme temperature and flood due to snow thaw.

Figure 51

South Eastern European countries

3.12.2 Risk assessment

Aggregate country-level data from EM-DAT was used for the regional analysis. First, the occurrence of different hazards in each country was examined (see table 1, below). This gives an understanding of the common risks in the region. The disaster and disaster impact indicators were ranked and a cumulative ranking computed, to understand the relative vulnerability of countries in the region. Ranking will help to assess regional risk in the SEE.

The country-wise hazard matrix shows that flood is a common hazard in all the countries in the region. Except for Moldova and Slovenia, all the countries in the region have recorded seven or more hazards.

It should be noted that various other sources besides EM-DAT show different scenarios, in which all hazards are present in all the countries. For instance, EM-DAT didn't record earthquake events in Bosnia and Herzegovina, but there are severe earthquake events recorded in Bosnia and Herzegovina's history. In Albania, the Global Fire Monitoring Center has reported 667 fire events affecting an area of 21,456 hectares during the period 1980-2000, but in EM-DAT, no events were recorded. See Table 1

Table 1 Country-wise hazard matrix

Country	Hazards								
	Earth-quake	Flood	Land slides	Drought	Extreme tempe-rature	Windstorm	Wildfire	Epi-demic	Techno-logical
Albania	x	x	x	x	x	x		x	x
Bosnia and Herzegovina		x	x	x		x	x	x	x
Bulgaria	x	x		x	x	x	x		x
Croatia	x	x		x	x	x	x		x
Republic of Macedonia		x		x	x	x	x	x	x
Moldova		x		x	x	x		x	
Romania	x	x	x	x	x	x		x	x
Serbia	x	x			x	x	x	x	x
Montenegro	x	x			x	x	x	x	x
Slovenia	x	x			x				x
Turkey	x	x	x		x	x	x	x	x

This matrix doesn't capture the severity of events in each country. For this, both annual average disaster events and the annual average of disaster impact variables (number of deaths, number of victims and economic loss) were calculated. To assess the relative vulnerability and risks in the region, these variables were ranked, and a cumulative ranking was used to assess the vulnerability levels of the countries. For disaster ranking, hazards were grouped into earthquake, flood-related, drought-related (see definitions in section 2.5 B), windstorm and technological hazards.

Turkey has the highest risk, both in terms of hazards and vulnerability, and Romania is in the second position. In geographic area, Turkey is almost as large as all the other countries put together. The large size of the nation contributes to the fact that Turkey had the highest number of hazards.

Table 2 Disaster and disaster impact ranking

Country	Disaster ranking	Disaster impact ranking	Cumulative rank
Albania	10	5	9
Bosnia and Herzegovina	3	6	5
Bulgaria	5	8	7
Croatia	9	5	8
Republic of Macedonia	4	4	4
Moldova	8	3	6
Romania	2	2	2
Serbia	7	5	3
Montenegro	7	5	3
Slovenia	6	7	10
Turkey	1	1	1

Annual average events show that almost one earthquake event occurs every year in Turkey, and one event occurs every eight years in Romania and Bulgaria. An average of one flood and related hazard occurs every year in Romania, while in Turkey, Serbia and Montenegro, one flood occurs every two years. Except Slovenia, all the countries experience a flood almost every six years. Highest economic losses are reported in Turkey and Albania. Average annual economic losses from all disasters in Romania are USD 150 million (Pusch 2004). Further economic loss and vulnerability is analysed in the forthcoming section 3.12.3

Earthquake

The SEE region is one of the major seismically active zones in Europe. Both the Mediterranean-Transasian seismic belt in the Balkan region and the Vrancea seismic belt extend beyond any one single country.

Turkey is one of the most seismically active regions in the world, suffering from frequent and devastating earthquakes, such as the 1999 Marmara earthquake. Seventy percent of the country's population lives in areas that are highly vulnerable to earthquake. Bucharest, Romania is one of the world's 10 most vulnerable cities to earthquakes (Pusch 2004). Descriptions of some of the major damaging earthquake events recorded in the region are provided in Table 3.

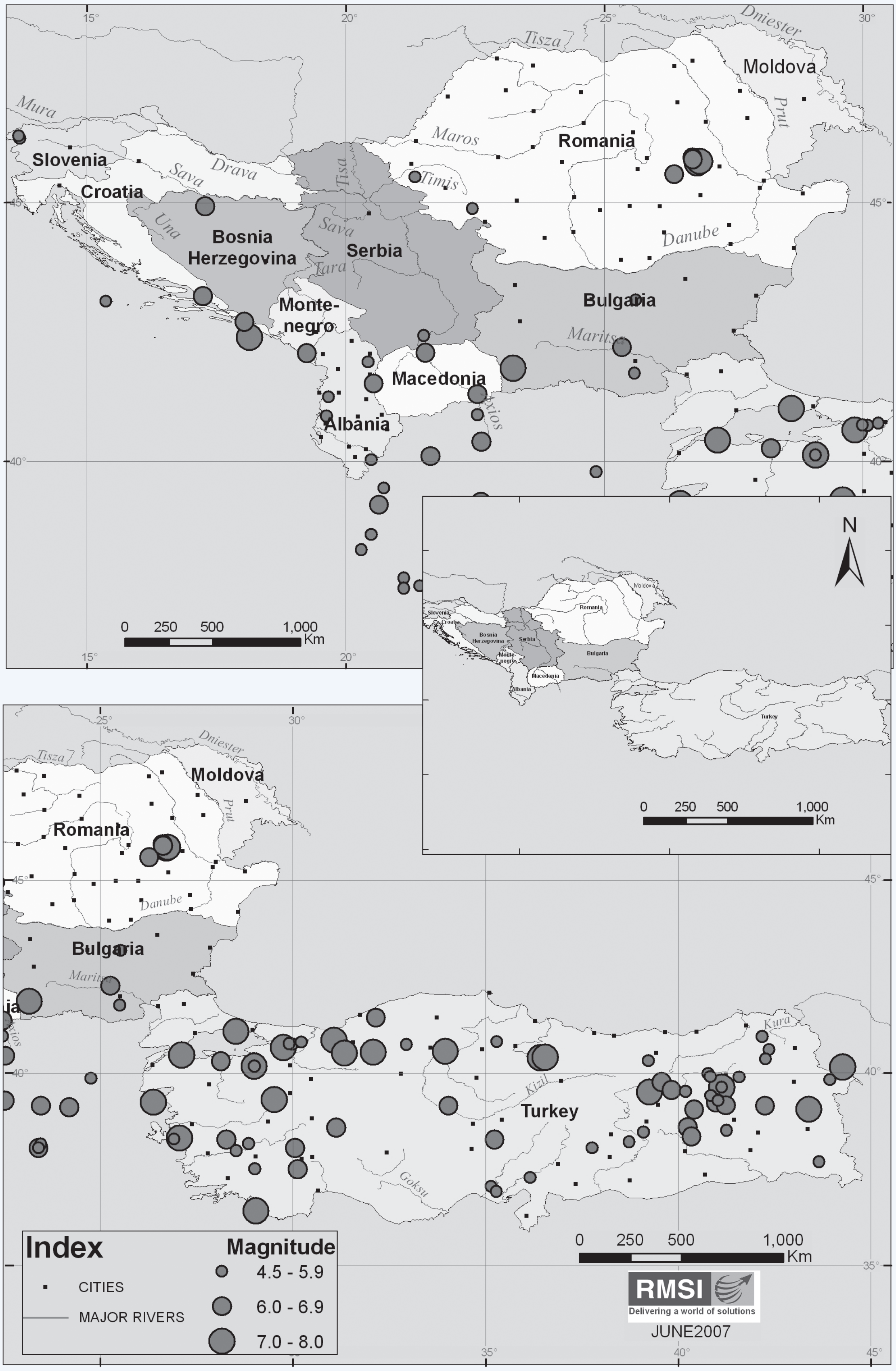
Table 3 Some major damaging earthquakes in SEE countries

Country	Date	Magnitude	Number of deaths	Number of victims	Economic loss (in millions of USD)
Albania	Nov. 30,1967	6.0	11	134	na
Albania	Nov. 16,1982	5.2	1	5,005	na
Albania	Jan. 09, 1988	5.5	na	690	na
Albania	Sept. 30, 1988	5.0	na	2100	na
Bosnia & Herzegovina	Oct. 27,1969	6.6	15	1,132	na
Bulgaria	Apr. 14,1928	6.8	107		na
Bulgaria	Mar. 04,1977	7.2	20	185	na
Bulgaria	Dec. 06,1986	5.7	3	3,060	50
Bulgaria	May 30,1990	6.7	1	na	na
Croatia	Sept. 05,1996	6.0	na	2,000	na
Croatia	Oct .08,1909	6.0	na	na	na
Croatia	Jan. 11,1962	6.1	na	na	na
Croatia	Apr. 06,1667	7.3	5000	na	na
Croatia	Mar. 29, 2003	5.5	na	na	na
Macedonia	July 26,1963	6.1	1,070	4,400	300
Macedonia	Apr. 04,1904	7.8	na	na	na
Macedonia	Mar. 08,1931	6.7	na	na	na
Moldova	Nov. 10, 1940	7.4	78	1,078	na
Moldova	Mar. 04,1977	7.2	na	na	na
Moldova	Aug. 30, 1986	7.0	2	15,020	680
Montenegro	Apr. 15, 1979	6.9	35	100,418	na
Montenegro	Nov. 10, 1940	7.4	2,000	na	10
Romania	Mar. 04,1977	7.2	1,578	12,699	2,050
Romania	Aug. 30, 1986	7.0	2	560	na
Romania	May 31, 1990	6.7	8	304	24
Romania	Oct. 27, 2004	5.8	na	na	1
Serbia	Apr. 24, 2002	5.4	1	100	na
Slovenia	Jul. 12, 2004	5.0	1	605	10
Slovenia	Apr. 12,1998	5.5	0	700	na
Turkey	Apr. 29,1903	6.3	6,000	na	na
Turkey	Aug. 09,1912	7.8	923	1,575	na
Turkey	Dec. 26,1939	8.0	32,962	na	20
Turkey	Nov. 26,1942	7.6	4,000	na	na
Turkey	Dec. 20,1942	7.3	3,000	na	na
Turkey	Nov. 26,1943	7.6	2,824	5,000	na
Turkey	Aug. 19,1966	6.9	2,394	109,500	20
Turkey	Mar. 28,1970	7.2	1,086	83,448	55.6
Turkey	May 22,1971	6.8	878	88,665	5
Turkey	Sept. 06,1975	6.6	2,385	53,372	17
Turkey	Nov. 24,1976	7.6	3,840	216,000	60
Turkey	Oct. 30,1983	7.1	1,346	834,137	25
Turkey	Mar. 13,1992	6.8	653	348,850	750
Turkey	Oct. 01,1995	6.1	94	160,240	100
Turkey	Jun. 28,1998	6.3	145	1,589,600	500
Turkey	Aug. 17,1999	7.4	17,127	1,358,953	8,500
Turkey	Oct. 05,1999	5.2	0	103	4,776
Turkey	Nov. 12,1999	7.2	845	224,948	1,000
Turkey	Feb. 03,2002	6.2	42	252,327	95
Turkey	May 01,2003	6.4	177	290,520	135
Turkey	Jul. 02, 2004	5.4	18	356	na

Na - mentioned in number of death, total affected and economic loss columns; denotes data not available.
Source: EM-DAT, National Geophysical Data Centre and other regional published research papers.

Figure 52

Some major damaging earthquakes reported in SEE region (1667-2006)



Source: EM-DAT, National Geophysical Data Center and other regional published research papers.

Flood and related hazards

Ninety percent of the area of SEE countries falls within transboundary river basins, including the Danube, Drin, Martisa/Evros, Neretva, Nestos, Sava, Struma/Strimon, Vardar/Axios and other river basins. These transboundary rivers flow into the Adriatic, the Aegean, the Ionian and the Black Seas. More than half of the transboundary basins are shared by three or more riparian states. Shared lake basins include Doiran, Ohrid, Prespa and Shkoder. The SEE region is also characterized by a large number of transboundary groundwater aquifers that are often karstic in their nature.

The Mediterranean-Transasian fault zone passes through the Balkans, and the mountainous terrain, poor land-use and river basin management practices, and deteriorating infrastructure have all increased vulnerability to floods and landslides (Pusch 2004).

All countries except Slovenia face high risk due to flood. Flood has severely impacted Romania, Moldova, Bulgaria, Serbia and Montenegro. Romania is one of the most flood-prone countries in the region. In Bosnia and Herzegovina, the flood protection structures were destroyed during the war. The country used to have sufficient flood protection structure to protect 50 per cent of its flood prone area.

According to Pusch (2004), in Croatia, floods endanger more than 15 percent of the national inland territory. Flood protection systems are extremely complex and comprise a large number of structures that regulate and protect water.

Table 4 Some major floods in SEE countries

Country/countries	Date	Number of deaths	Number of victims	Economic loss (in millions of USD)
Albania	17-Nov-1992	11	35,000	7
	20-Sep-1995	4		
	20-Dec-1997		8,000	
	4-Dec-2004		2,500	0.1
	21-Sep-2002		66,884	17.5
	30-Nov-2005	3		
Bosnia and Herzegovina	6-Apr-2004		275,000	
	Jun-2001		9,000	
	6-Dec-2005		3,100	
	23-Mar-2004		3,000	
Bulgaria	2-Jul-2005	17		247
	4-Aug-2005	7	12,000	3.23
Romania	1926	1,000		
	11-May-1970	215	238,755	500
	4-Mar-1977		1,000,000	
	29-Jul-1991	68	15,000	500
	Jul-1975	60		1,000
	30-Jun-2006	30		
	5-Apr-2000		60,431	100
	21-Sep-2005		30,800	
	13-Mar-2006		16,477	
Serbia and Montenegro	Jul-1999	11	70,678	
	28-Nov-1992	1	6,000	
	28-Dec-2000		2,000	
	11-Jun-2002		2,400	
	20-Apr-2005	2	3,790	
	21-Feb-2006		1,200	
Turkey	20-May-1998		1,240,047	1,000
	4-Nov-1995		306,617	1,000

Source: EM-DAT

The only city adequately defended from flooding is Zagreb, estimated to be safe from a 1,000-year flood event (Pusch 2004).

Albania, Bosnia and Herzegovina, and Montenegro are highly vulnerable to landslide. Landslide events have considerably increased in these countries lately due to unplanned land use, forest and mineral resource exploitation, heavy rains, and change of water and land regimes. In countries like Albania and Romania, landslides are often reported as associated hazards of flood and earthquake.

Drought and related hazards

Drought and drought-related hazards are severe in many countries in SEE. Drought events are most frequent in Bosnia and Herzegovina. No deaths have been recorded due to drought in EM-DAT. But economic loss due to drought has been recorded in Albania, Bosnia and Herzegovina, Croatia, Macedonia and Romania (See table 5).

Albania, Croatia, Moldova and Serbia and Montenegro are highly vulnerable to extreme temperature. The number of deaths reported in these countries is relatively higher. Almost all countries in the region are prone to fire-related hazards, even though fire-related hazards are not recorded in EM-DAT in Albania and Slovenia. The Global Fire Monitoring Center has reported fire events in almost all the countries in the region.

Windstorm

Albania, Bosnia and Herzegovina, Bulgaria, Croatia and Moldova are highly vulnerable to windstorm. The 2000 windstorm in Croatia incurred a loss of USD 177.5 million, and the 2003 event caused a loss of USD 20 million. The November 2000 windstorm and frost in Moldova caused an economic loss of USD 20.8 million.

Technological hazards

Technological hazards are highest among Serbia, Montenegro, Slovenia and Turkey. Turkey experiences the highest number, with an average of three events every year. Technological hazards, including industrial accidents and transport accidents, are common in many countries in the region. With rapid industrial and economic expansion, many countries have experienced fast growth in industry and infrastructure development, contributing to an increase in technological hazards in the region. The region is vulnerable to risk from hazards related to handling hazardous materials and to chemical and nuclear plants. The distribution of nuclear power plants and nuclear research facilities in and around the SEE region is shown in figure 53. Deaths due to technological hazards have been recorded in Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Romania, Serbia, Montenegro and Turkey. Transport-related hazards are in general higher than industrial accidents in these countries. Among all the countries, Romania has recorded the highest number of deaths. Even though the number of events is high in Turkey, the number of deaths recorded is relatively lower.

3.12.3 Vulnerability assessment

The vulnerability assessment of the SEE countries is based on the incidence rate of hazards, the annual average number of deaths and the exposed population. There is a dearth of data for hazard-specific exposed populations in all the countries, due to the unavailability of sub-national level data in organized formats. Some countries have statistics departments with sub-national level data, but it could not be accessed during this study. Therefore, regional vulnerability is analysed using data from the EM-DAT database, the National Geophysical Data Center website, and hazard/country-specific research papers.

Table 5 Some major droughts in SEE countries

Country	Date	Number of deaths	Number of victims (people)	Economic loss (in millions of USD)
Albania	1989-1991	0	3.2 million	24.67
Bosnia and Herzegovina	2003	0	62575	250
Bosnia and Herzegovina	2003	0	0	158
Croatia	2003	Ndr	ndr	330
Macedonia	1993	0	0	10
Moldova	2000		2.6	
Romania	2000	Ndr	ndr	500

ndr – no data recorded
Source: EM-DAT

Figure 53

Distribution of nuclear power plants and nuclear research facilities in SEE region

Table 6 below shows that, on average, one flood strikes Romania and Turkey every year; and the combined data on Serbia and Montenegro shows that one flood event occurs every two years in those two countries. Substantially large populations are exposed to earthquake in Albania, Croatia, Macedonia, Romania, Slovenia and Turkey; while in most countries, a large population is exposed to flood. Data on the population exposed to drought is available for a few countries like Bosnia and Herzegovina, Bulgaria, Moldova and Romania, which display substantially high levels of exposure. The exposed population data shows the countries' high vulnerability towards particular hazards; it is imperative that preparedness and prevention measures should be a high priority. Drought, earthquake and flood in the region are transboundary in nature, a fact that emphasizes the need for transboundary cooperation and policy approaches.

Economic loss data available from different sources shows the countries' economic vulnerability to these hazards. The economic loss data is compared with the country's GDP to understand the impact of the loss on the country's economy. In Turkey, the annual average economic loss is to the tune of 12 per cent of the country's GDP, while for Romania it is 5 per cent. Other countries like Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Serbia and Montenegro also had substantial losses. The economic loss data complied from various sources, even though it is not complete, still shows an intense picture of loss in the region, with adverse impacts on the economy and on development of the countries.

3.12.4 Observations

The SEE region is highly vulnerable to flood, earthquake, landslide, forest fire and technological hazards. Poor land-use management, lack of land-use planning codes and river basin management practices, and deteriorating flood regulation infrastructure have all increased vulnerability to floods and landslides. A lack of early warning systems has also increased vulnerability to floods. The transboundary nature of some of the major rivers in this region, which cause recurring floods, calls attention to the need to develop both a regional hydrometeorological early warning system, and regional cooperation on flood management at the river basin level. River basin planning, with involvement of countries within the basin region, can reduce the vulnerability to flood as well as to drought. The Mediterranean-Transasian fault zone that passes through the Balkans, the Vrancea seismic zone, and the mountainous terrain all cause the high occurrence of earthquake in the region. The lack of both building codes and building code enforcement, along with high population densities in urban areas, causes high earthquake vulnerability in the region.

Infrastructure for flood regulation and seismic monitoring in many countries has deteriorated or been destroyed during the war period. Macedonia has the best-developed system for seismic monitoring and emergency management, which was developed to serve the former Yugoslavia. There is much scope for updating the system and supporting transboundary cooperation.

Table 6 Average annual incidence of major hazards and vulnerability of SEE countries

Country	Annual average incidence of major hazards					Annual average number of deaths due to all hazards	Exposed population		
	Drought	Earthquake	Flood related	Wind storm	Techno-logy related		Drought	Earthquake	Floods
Albania	0.12	0.09	0.24	0.06	0.06	7.82	NA	155,688	131,704
Bosnia and Herzegovina	0.17	X	0.28	0.11	0.17	3.72	71397	NA	NA
Bulgaria	0.21	0.15	0.27	0.15	0.15	6.64	325,406	NA	275,537
Croatia	0.28	0.06	0.22	0.06	0.17	8.61	NA	30,928	108,929
Macedonia	0.17	X	0.22	x	0.11	13.39	NA	NA	17,784
Moldova	0.09	0.09	0.22	0.09	x	1.83	279,603	18,909	193,262
Romania	0.45	0.12	1.03	0.24	0.48	82.42	347,229	1,007,506	1,174,894
Serbia and Montenegro	0.17	0.06	0.50	0.06	0.56	10.00	NA	NA	321,934
Slovenia	0.04	0.09	0.04	x	x	0.04	NA	30,984	NA
Turkey	0.30	0.97	1.06	0.21	3.00	941.36	NA	2,745,757	1,883,782

x - data not available for computation, NA – data not available in the website.
Source: Annual average incidence and death computed using EM-DAT, exposed population UNDP .

Table 7 Economic loss in comparison to GDP in SEE countries

Number of years taken for average	Country	GDP per capita [$/ inh.] 2005	Annual average economic loss due to all hazards (millions of USD)	Percent to GDP	Economic loss (in millions of USD)			
					Drought	Earthquake	Flood	Tropical cyclone
1974-2006	Albania	2755.3	68.67	2.49	2238	2 to 5	24.673	0
1989-2006	Bosnia and Herzegovina	2384.0	22.94	0.96	408	> 5*	0	0
1974-2006	Bulgaria	4733.9	14.76	0.31	0	5*	260.23	0
1989-2006	Croatia	6376.2	33.76	0.53	330	> 5*	0	0
1989-2006	Macedonia	4467.7	24.59	0.55	0	5*	353.6	0
1984-2006	Moldova	2876.1	61.40	2.13	0	0	152.584	31.6
1974-2006	Romania	5954.9	292.76	4.92	500	2756*	3269.3	0
1989-2006	Serbia and Montenegro	4936.0	82.0	1.66		2705	0	0
1984-2006	Slovenia	13611.4	7.31	0.05	0	10	5	0
1974-2006	Turkey	4680.8	560.56	11.98	0	15988	2511	0

Source: EM-DAT, * from National Geophysical Data Center website, GDP- the World Bank statistics.
Economic loss from other hazards is also included for calculating annual average economic loss.

Technological hazards such as transport and industrial accidents, and vulnerability to them, are on the rise in the region. The Chernobyl accident has impacted some of the countries in the region. There are eleven nuclear power plants and three nuclear research facilities operating within or immediately adjacent to the region. The distribution of these nuclear power plants and facilities are shown in figure 53.

Some of the countries in the region have prepared national disaster management plans; these need to be reviewed and, if required, updated on a priority basis. Albania has developed a disaster management plan with the support of UNDP, and the plan is considered to be a comprehensive one.

There is a lack of coordination between central and local-level authorities in disaster management activities in many countries. Even though there are premier institutes working on disaster-related activities in many countries in the region, there is a lack of institutional coordination among these countries between the government departments who are responsible for implementing disaster risk management. There is a lack of capacity and training in disaster risk management and policy implementation at the government level in many countries. Private sector participation in disaster reduction is also not adequate in the region.

4

Hazard Risk Management Framework – Status Of See Countries

International organizations like the World Bank are now promoting a proactive and strategic approach to managing hazard risk projects across the world. The approach is premised on the notion that disaster-prone countries should not be caught by surprise. Disasters happen, and technological, social, organizational and financial remedies exist. Targeted assistance should be provided in high-risk areas before disasters occur. The institutional, technical and financial capacity for risk mitigation and emergency preparedness should be upgraded gradually. In addition, hazard risk management needs to be mainstreamed into the national, regional and local economic development process.

An exercise is attempted here to assess the status of the SEE countries' position within the World Bank's hazard risk management framework. To assess this, the main documents referred to are the national reports on the current status of disaster reduction that were developed for the 2005 World Conference on Disaster Reduction in Kobe, Japan. Reports for Bulgaria and Moldova were not available. Other country-level documents and presentations prepared for CMEPC meetings and SP SEE DPPI regional meetings, as well as SP SEE DPPI Bucharest Declaration documents were also used. Variables in the framework were rated qualitatively into four categories: good, satisfactory, needs improvement/not available, and under construction. This is shown in figure 54. This will help readers to easily understand the level of preparedness for each country, and will help show the way forward for planning disaster risk reduction activities in the region.

Figure 54

Hazard risk management framework - status of SEE countries

Emergency preparedness
1. Emergency response planning
2. Exercises
3. Public awareness
4. Communication & information management systems
5. Technical emergency Response capacity

Country	1	2	3	4	5
Albania	S	N	S	N	N
BiH	N	N	N	N	S
Bulgaria	N	N	N	N	S
Croatia	S	S	N	N	S
Macedonia	N	N	N	N	N
Moldova	N	N	N	N	S
Romania	S	N	N	S	S
Serbia	N	N	N	N	U
Montenegro	N	N	N	N	U
Slovenia	N	S	S	S	S
Turkey	S	S	S	S	S

Institutional capacity building
1. Decentralized emergency management system
2. Community participation
3. Legislative framework
4. Training, education & knowledge sharing
5. International cooperation

Country	1	2	3	4	5
Albania	N	N	S	S	G
BiH	N	N	U	N	S
Bulgaria	N	N	S	N	S
Croatia	N	N	S	N	S
Macedonia	N	N	S	S	S
Moldova	N	N	N	N	S
Romania	N	N	S	S	G
Serbia	N	N	U	N	S
Montenegro	S	S	U	S	S
Slovenia	S	S	S	S	S
Turkey	N	S	S	S	G

Risk assessment

Risk mitigation investments
1. Warning and monitoring systems
2. Hazard mapping and land-use planning
3. Code refinement and enforcement
4. Hazard-specific risk mitigation

Country	1	2	3	4
Albania	N	N	N	S
BiH	N	N	N	N
Bulgaria	N	N	N	N
Croatia	S	N	N	N
FYR Macedonia	S	S	N	S
Moldova	S	N	N	N
Romania	S	S	N	S
Serbia	N	N	N	N
Montenegro	N	N	N	N
Slovenia	S	N	S	N
Turkey	S	S	S	S

Catastrophe risk financing
1. Ex-ante funding arrangements
2. Catastrophe insurance pool
3. Reserve funds
4. Contingent capital facility

Country	1	2	3	4
Albania	N	N	N	N
BiH	N	N	N	N
Bulgaria	N	N	N	N
Croatia	N	U	N	N
Macedonia	N	N	N	N
Moldova	N	N	N	N
Romania	N	U	N	N
Serbia	N	N	N	N
Montenegro	N	N	N	N
Slovenia	N	N	S	N
Turkey	G	G	N	N

G Good
S Satisfactory
N Needs improvement/not available
U Under construction

5

Regional Initiatives And International Cooperation

5.1 Regional initiatives

Even though transboundary issues related to migration and political history in the region exist, there is coordination and cooperation among countries on disaster management activities. During the 1999 earthquake in Turkey, within a few hours of the event, the Bulgarian Red Cross had reached the site with equipment and sniffing dogs for support. Transboundary issues become complex with differences in socio-economic conditions, geography, laws and institutions among the countries in the region. Some of the major regional initiatives and cooperative international efforts in the region are described here.

Disaster Preparedness and Prevention Initiative for South Eastern Europe (DPPI SEE): On 16 March 2000, the Stability Pact for South Eastern Europe launched the Disaster Preparedness and Prevention Initiative (DPPI SEE), in an effort to contribute to the development of a cohesive regional strategy for disaster preparedness and prevention. DPPI SEE aims to pull together ongoing and future activities to identify and address unmet needs, in order to both improve the efficiency of national disaster management systems, and to endorse a framework for regional cooperation. DPPI SEE has been a primary example of regional ownership, with full involvement of regional countries cooperating under the Stability Pact for South Eastern Europe auspices, supported by interested countries and international organizations and agencies (such as the European Union, UNDP, the International Federation of Red Cross and Red Crescent Societies, NATO, the Swedish Rescue Services Agency and the Danish Emergency Management Agency).

One of the main tasks of DPPI SEE is to bring the participants' political strategies in line with one another, to coordinate existing and new initiatives in the region and, thereby, to help avoid unnecessary duplication of work. The objective of the DPPI SEE is to:

- Strengthen good neighborly relations and stability through the exchange of information, lessons learnt and best practices in the field of disaster management.
- Enhance cooperation among DPPI SEE partners in view of European Union enlargement and the process of Euro-Atlantic integration for SEE countries.
- Support and encourage countries in the region to develop, adopt and/or enforce state-of-the-art disaster emergency legislation, regulations and codes designed to prevent and mitigate disasters in line with guidelines and common practices accepted in the international community.

In July 2005, DPPI SEE was transferred to a regional office in Sarajevo. On 24 September 2007 in Zagreb, government representatives of Albania, Bulgaria, Croatia, Macedonia, Montenegro, Moldova, Romania and Slovenia signed a Memorandum of Understanding (MOU) on the institutional framework of DPPI SEE. Serbia signed the MOU in January 2008, and Bosnia and Herzegovina is committed to signing the MOU after completion of its internal decision-making procedures.

Since its formation, DPPI SEE's partners have initiated and developed various project proposals, strengthening regional cooperation through the utilization of coordinated action and using internationally accepted methodology. In the past six years, for example, more than 700 participants from the SEE region have participated in 53 training events conducted within framework of the DPPI SEE Disaster Management Training Program. Through the Joint Firefighting Unit Project (JFU), 72 firefighters from Bosnia and Herzegovina, Croatia and Montenegro have been equipped with identical firefighting and communication equipment, and have been trained using identical international standards. A new project, Joint Firefighting in SEE, seeks to build on this initial work by exploring establishment of a regional platform for education, training and coordination; refreshing training for JFU; training and equipping new and existing firefighting teams with standardized equipment; and initiating regular regional exchange of information regarding fire, forest fire and fire in open space. Another project, proposing the establishment of joint emergency response units in case of floods in the SEE region, aims to improve regional preparedness and response capacity for floods by equipping and jointly training eight emergency response units in eight countries of the SEE region.

DPPI SEE partners have also collaborated to harmonize seismic risk hazard maps in countries influenced by the Vrancea earthquakes, as well as in Moldova, Bulgaria, Romania and Turkey. This project expanded further in October 2007, when DPPI SEE, in collaboration with Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia, and supported by experts from Slovenia and Turkey, officially launched the Project for Harmonization of Seismic Hazard Maps for the Western Balkan Countries.

Civil Military Emergency Preparedness Council (CMEPC): The Civil Military Emergency Preparedness Council, previously known as the Civil Military Emergency Planning Council for South Eastern Europe (CMEPC SEE), was formalized in 2001, with the participation of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Slovenia, Romania and Turkey. Bosnia and Herzegovina is chairing the Council this year (2007); and Serbia and Montenegro are presently observers, and are likely to become members by the end of the year. The objective of the Council is to act as a consulting and coordinating body for regional cooperation in disaster management. The Council advocates for the development of common standards and procedures to be used by all the nations of the SEE region for planning and response to regional disasters and emergencies. Focusing on transboundary cooperation, the Council has drafted an agreement for facilitating border crossing procedures during emergency. The Council envisages developing and maintaining emergency, response and GIS databases for the region. The GIS database will include such elements as the roads, railways, gas pipelines and airports. The Council aims to open emergency operating centres in all the member countries, and to develop an emergency information network.

Regional initiatives based on river basin: Regional initiatives using a basin approach are not new to this region. Most of these initiatives primarily address natural resource and ecosystem management and conservation in the region. Disaster management is also integrated into these regional initiatives, though it is not yet given high priority.

Some of the main regional initiatives focusing on a basin approach are:

1. The Danube river basin initiatives
2. The Sava river basin initiative
3. Shared lake basin management

Danube river basin initiatives: The European Union is facilitating the process of Danube river basin and Tiza river basin management among the Danubian countries (Bulgaria, Croatia, Hungary, Romania, Slovakia and Moldova) and the Tiza countries (Hungary, Romania, Serbia and Montenegro, Slovakia and Ukraine). Two of the main objectives are (i) to develop river basin management plans, and (ii) to work towards flood management in the region. International organizations and academic institutions are also associating with many institutions within this region for river basin studies.

The United Nations Industrial Development Organization's (UNIDO) initiative in the Danube basin focuses in an integrated way on economic, social and environmental concerns for the development of the region. Under UNIDO, the Transfer of Environmentally Sustainable Technology (TEST) programme was designed and introduced in many parts of the world. This was also introduced in the industrial sites of Danube basin. UNIDO focuses on pollution and the transboundary issues related to pollution in the basin. In 1997, UNDP, with the financial support of the Global Environmental Facility and through the Pollution Reduction Programme for the Danube River Basin, identified 130 major manufacturing enterprises known as "hotspots". A significant number of these industries are contributing to transboundary pollution in the form of nutrients and/or persistent organic pollutants. In April 2001, UNIDO started implementating the TEST programme in five Danubian countries (Bulgaria, Croatia, Hungary, Romania and Slovakia). The objective of the programme is to assist industries in transition countries to comply with, and/or even go beyond, environmental standards while enhancing their productivity.

Sava river basin initiative: The Sava river basin initiative is an initiative of the Stability Pact, and is designed to establish and develop an internationally recognized partnership between its member countries (Albania, Bosnia-Herzegovina, Croatia, Montenegro, Slovenia and Serbia), and to support the countries' concerted effort to define, promote and organize the Sava Basin's water and related resources. The objective of this initiative is to rehabilitate and develop the navigation of the Sava basin, to protect the environment and biodiversity, and to promote the social and economic welfare of communities within the Sava basin. The European Union is committed to supporting this program, and the initiative envisages developing a pilot river basin management plan.

Shared lake basin management: Internationally Shared Surface Water Bodies in the Balkan Region is an initiative supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety; the Global Water Partnership-Mediterranean; and by UNESCO and the UNESCO Chair/International Network of Water-Environment Centres for the Balkans. The objectives are capacity-building, sharing of experience on integrated water resource management, and assisting in drafting and putting into action local integrated water resource management plans. The countries within the region are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro, Romania and Serbia. Lake Prespa, Lake Shkoder and Lake Ohrid are some of the major lakes in the region that share international boundaries.

5.2 International initiatives on regional cooperation

Council of Europe: The Council of Europe is a significant example of European cooperation relating to hazards and risk management. The Committee of Ministers of the Council of Europe set up the Open Partial Agreement in 1987, an intergovernmental agreement called the EUR-OPA Major Hazards Agreement. The objective of this agreement is to enhance multidisciplinary cooperation between member states to ensure better prevention, protection and relief in the event of major disasters due to natural or technological hazards. This agreement is conducted in collaboration with the European Union, other European institutions and several specialized United Nations agencies. In the scientific and technical domain, research and coordination efforts are encouraged through the European Network of Specialized Centres. This platform facilitates cooperation in the field of major disasters due to natural and technological hazards between Eastern Europe, the South of the Mediterranean, and Western Europe concerning knowledge, prevention, risk management, post-crisis analysis and rehabilitation.

The European Centres are mainly involved into the study of earthquake disasters, seismic risk management and training. The centres are listed below:

i. CRSTRA - Euro-Mediterranean Center on research in arid zones (Biskra, Algeria)
ii. ECTR - European Interregional Educational Centre for Training Rescuers (Yerevan, Armenia)
iii. ECMHT - European Centre on Training and Information of Local and Regional Authorities and Population in the Field of Natural and Technological Disasters (Baku, Azerbaijan)
iv. ISPU - Higher Institute of Emergency Planning (Florival, Belgium)
v. ECRP - European Centre for Risk Prevention (Sofia, Bulgaria)
vi. BE-SAFE-NET - European Centre for Disaster Awareness with the Use of the Internet (Nicosia, Cyprus)
vii. EMSC - European Mediterranean Seismological Centre (Bruyères-le-Châtel, France)
viii. CERG - European Centre for Seismic and Geomorphological Hazards (Strasbourg, France)
ix. CETICA - Euro-Mediterranean Centre for Technologies of Information and Communications Applied to Risk Management (Draguignan, France)
x. GHHD - European Centre on Geodynamical Risks of High Dams (Tbilisi, Georgia)
xi. ECPFE - European Centre on Prevention and Forecasting of Earthquakes (Athens, Greece)
xii. ECFF - European Centre on Forest Fires (Athens, Greece)
xiii. CUEBC - European University for Cultural Heritage (Ravello, Italy)
xiv. ECGS - European Centre for Geodynamics and Seismology (Walferdange, Luxembourg)
xv. ICoD - Euro-Mediterranean Centre on Insular Coastal Dynamics (Valletta, Malta)
xvi. ECILS - European Centre on the Vulnerability of Industrial and Lifeline Systems (Skopje, Former Yugoslav Republic of Macedonia)
xvii. ECMNR - European Centre for Mitigation of Natural Risks (Kishinev, Moldova)
xviii. CEPRIS - Euro-Mediterranean Centre for Evaluation and Prevention of Seismic Risk (Rabat, Morocco)
xix. CERU - European Centre on Urban Risk (Lisbon, Portugal)
xx. ECBR - European Centre for Rehabilitation of Buildings (Bucharest, Romania)
xxi. ECNTRM - European Centre of New Technologies for the Management of Natural and Technological Major Hazards (Moscow, Russian Federation)
xxii. CEMEC - European Centre for Disaster Medicine (San Marino)
xxiii. CEISE - Centro Europeo de Investigación Social de Situaciones de Emergencia (Madrid, Spain)
xxiv. AFEM - European Natural Disasters Training Centre (Ankara, Turkey)
xxv. TESEC - European Centre of Technological Safety (Kiev, Ukraine).

International Federation of Red Cross and Red Crescent Societies: The activities of the International Federation of Red Cross and Red Crescent Societies promote humanitarian principles and values, disaster response, disaster preparedness, and health and care in the community, with a particular emphasis on disaster response. The sharp increase in the number of natural hazards worldwide in recent years has prompted the Federation to devote more attention to disaster preparedness activities. Awareness of the risks societies face, how to reduce their vulnerability, and how to cope when disaster strikes are the focus areas in which the Federation is now working. The Federation has offices in all the SEE countries, which are very active and well-coordinated with government departments and civil societies in the region in disaster preparedness and prevention activities.

United Nations Development Programme (UNDP): UNDP is active in the SEE region and has offices in many of the SEE countries. UNDP is providing technical and financial support in many SEE countries for preparation of national disaster management plans and hazard-specific mitigation plans. UNDP is also involved in awareness and training activities, to develop strategic documents on disaster preparedness and prevention in the region.

The UN/ISDR secretariat and the World Bank: The UN/ISDR secretariat, in partnership with the World Bank, is striving to mainstream disaster risk reduction in poverty reduction and relevant sectoral development strategies in the region, especially in countries where risks are high. In September 2006, The World Bank Board launched a new partnership to support this work, the Global Facility for Disaster Reduction and Recovery. The UN/ISDR secretariat is the key partner in this initiative.

The Global Facility is designed to help meet the global demand for increased investment in disaster prevention and mitigation. It seeks to expand national, regional and global capacities to reduce disaster risk, particularly in low- and middle-income countries facing high risk of disasters. The Global Facility is also supporting the ISDR system to promote global and regional partnerships towards achieving some of the specific deliverables of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters *(UN/ISDR and World Bank).*

As part of this program, the UN/ISDR secretariat and the World Bank are partnering with media, research institutes and universities; and with the private sector for private investment in reducing risk.

In addition, the World Bank and the UN/ISDR secretariat, in collaboration with the European Commission, the Council of Europe (EUR-OPA) and Council of Europe Development Bank, the World Meteorological Organization and other partners, are jointly supporting the initiative called, until recently, SEEDRMI, or the South Eastern Europe Disaster Risk Management Initiative. This effort has now changed its name to the South Eastern Europe Disaster Risk Mitigation and Adaptation Initiative (SEEDRMAI). SEEDRMAI aims at reducing the vulnerability of the countries of South Eastern Europe to the risks of disasters. This initiative will form the foundation for regional and country-specific investment priorities (projects) in the area of early warning, disaster risk reduction and financing, and thereby catalyze additional investments in risk mitigation by national governments, the Council of Europe Development Bank and by World Bank sectoral lending. SEEDRMAI focuses on: (i) hydrometeorological forecasting, data sharing and early warning; (ii) coordination of disaster mitigation, preparedness and response; and (iii) financing of disaster losses, reconstruction and recovery, and disaster risk transfer (disaster insurance). The initiative will build on the cooperation already existing in the region, and will complement and consolidate the activities promoted by the European Union, the Council of Europe, the United Nations, the Stability Pact, the Disaster Preparedness and Prevention Initiative, and CMEPC to promote more effective disaster mitigation, preparedness and response.

Office of the United Nations Disaster Relief Coordinator (UNDRO): UNDRO works closely with UNDP in disaster risk reduction activities. UNDRO, in cooperation with UNDP, established the Cooperative Project for Seismic Risk Reduction in the Mediterranean Region, under which a series of workshops were organized. The project aims at establishing procedures for the mitigation of earthquake disasters through the appropriate management of earthquake risk.

UN-HABITAT: Risk and Disaster Management Unit (RDMU): The Unit supports national governments, local authorities and communities in strengthening their capacity for managing disasters due to human-made and natural hazards. This applies both to the prevention and mitigation of disasters, as well as the rehabilitation of human settlements; awareness among decision makers and communities on mitigation and adequate rehabilitation of human settlements; and bridging the gap between relief and development by combining the technical expertise and on-the-ground know-how of the United Nations Human Settlement Programme (UN-HABITAT).

United Nations Office for Coordination of Humanitarian Affairs (OCHA): OCHA mobilizes and coordinates the collective efforts of the international community, in particular those of the United Nations system, to meet in a coherent and timely manner the needs of those exposed to human suffering and material destruction in disasters and emergencies. This involves reducing vulnerability, promoting solutions to root causes, and facilitating the smooth transition from relief to rehabilitation and development.

International Search and Rescue Advisory Group (INSARAG): INSARAG is an inter-governmental network under the United Nations umbrella, which deals with urban search and rescue and related disaster response issues. Its purpose is to provide a platform for information exchange, to define standards for international urban search and rescue assistance, and to develop methodology for international cooperation and coordination in earthquake response. INSARAG includes earthquake-prone countries as well as traditional providers of international assistance.

United Nations Disaster Assessment and Coordination (UNDAC): The UNDAC team is a stand-by team of disaster management professionals who are nominated and funded by member governments, OCHA, UNDP and operational humanitarian United Nations Agencies such as the United Nations World Food Programme, UNICEF and the World Health Organization. Upon request by a disaster-stricken country, the UNDAC team can be deployed within hours to carry out rapid assessment of priority needs and to support national authorities and the United Nations resident coordinator to coordinate international relief on-site. Particularly after earthquakes, the UNDAC team is mobilized rapidly in order to effectively coordinate the search and rescue operation of international search and rescue teams, together with the national authorities of the affected country.

The United Nations Children's Fund (UNICEF):
UNICEF is instrumental in the region coordinating with other organizations in mine-related problems. UNICEF has had a major role to play in warning both local population and refugees about the risk of mines and unexploded ordnance in war-affected countries. The UNICEF multimedia mine awareness campaign included extensive publicity through posters and leaflets at transit points, in refugee camps, at returnee way stations and on the front lines, as well as through broadcasts of messages on radio and television. The awareness activities were also included in schools by incorporating awareness activities in all curriculum subjects. UNICEF has offices in almost all the countries in the region.

DG Environment / Civil Protection Unit / Monitoring and Information Centre (MIC): MIC acts as an information, communication and coordination centre on a 24/7 basis. It mobilizes experts and support from European Union member states and other participating states, in case of a disaster both within and outside the European Union. It receives alerts and requests for assistance directly from a disaster-stricken country, and immediately informs the national civil protection authorities. It may appoint coordination and assessment experts, who travel to the scene to identify the civil protection needs and help ensure the efficient delivery and distribution of assistance. MIC also plays a role in strengthening preparedness, including training courses and exercises.

In addition to these agreements, a proposal was submitted to the Global Fire Monitoring Center to promote cooperative transboundary wildland fire risk management and disaster prevention under the South Eastern European Fire Management Network (SEEFIRE). The Global Fire Monitoring Center was formed in 1998, with the objective to provide an international portal for wildland fire monitoring, early warning and a clearing house for worldwide wildland fire data and information sharing. Mandated by the UN/ISDR secretariat, the Global Fire Monitoring Center began to facilitate the establishment of the Global Wildland Fire Network, which is operating primarily through regional wildland fire networks and the UN/ISDR Wildland Fire Advisory Group. Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Macedonia, Romania, Serbia, Montenegro and Slovenia are envisaged to be part of SEEFIRE.

6

Detailed Case Studies: Turkey And Romania

6.1 Turkey case study: Development of an earthquake model for Turkey

RMSI developed an earthquake model of Turkey for one of the world's leading providers of products and services for catastrophe risk modeling. This model will integrate into the client's existing product, for use by the insurance/reinsurance companies in Turkey.

As part of this assignment, a comprehensive historical earthquake catalog was prepared and different seismic zones were delineated for the country. This, along with other physical variables, was used to develop an earthquake model using GIS and other statistical tools.

The model was developed using a probabilistic model framework at three resolution levels: sub-province, province and cresta. Detailed analyses were carried out using a varying resolution grid to capture the varying exposure levels in the country. Historical event reconstruction was carried out for more than 40 high-magnitude events that had occurred in the region during the last century. The model was validated by comparing historical losses against the modeled losses, particularly for recent events. The model includes both the area and fault line sources, and time dependency and time migration of earthquakes, including the cascading effect. As final output, exceedance probability curves and average annual loss for the entire country were prepared. The model analyses the attenuation of seismic energy in order to determine the level of ground shaking at a particular site. The attenuation relationship is calibrated using historic data before using the model. The model differentiates building vulnerability for large buildings, in urban areas, in high-seismicity areas like Istanbul. Vulnerability functions also considered construction type, occupancy class, year of construction and building height. The vulnerability model was validated and calibrated using insurance claims and damage data collected from experts and engineers in a reconnaissance survey following the 1999 Kocaeli and Duzce earthquakes. RiskLink® software is used for the analysis. This model also supports industrial facility vulnerability, which is calibrated based on historic events.

Figure 55

Sesimic sources used for earthquake modeling for Turkey

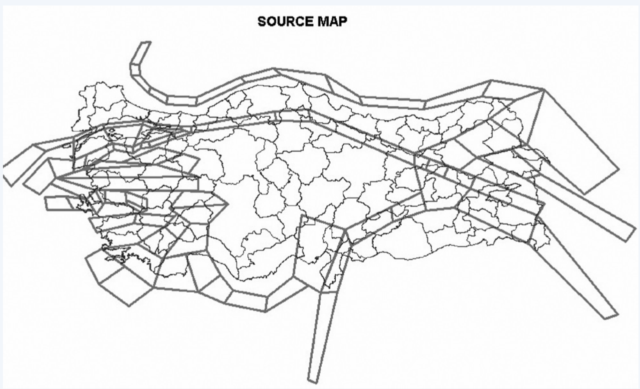
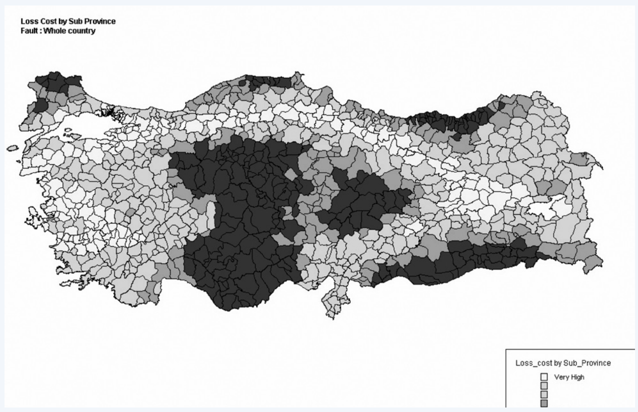


Figure 56

Modeled loss cost (sub-province) for Turkey



6.2 Romania case study: Development of Vrancea Earthquake Scenario

RMSI is executing a project to develop a Vrancea Earthquake Scenario for the Ministry of Interior and Administration Reform, Project Management Unit, Romania, with the financial support of the World Bank. The information provided in this case study is based on the tentative design report submitted to the client. The run-time feature of the model involving an import-of-shake map will be designed once the format of input data is finalized.

As part of this study, an earthquake damage computation model has been developed for the Vrancea earthquake source zone, including 16 identified counties and Bucharest city. The project aims at developing an up-to-date earthquake scenario that will model potential damages to the human and built environment from the maximum probable earthquake along the Vrancea subduction zone. The scenario will form the basis for updating emergency plans and procedures, as well as for developing and conducting training exercise programs for agencies and personnel to identify shortfalls and needs.

Methodology and data: High-resolution region-specific data and information on hazard and exposure characteristics were collected. Building- and asset-wise data were collected at the county level. Data on building and assets were not available in some counties. The model developed was calibrated and validated against loss/damage data available for recent historical earthquakes that have affected the region, especially the 1977 earthquake in the country.

The earthquake model consists of five standard modules comprising stochastic event, hazard, vulnerability, exposure and damage modules.

Earthquake stochastic module of scenario events: A composite and updated catalogue was compiled using catalogues from three different sources.

The catalogue was cleaned by removing duplicate events and accessory shocks (aftershocks and foreshocks). The average rate of occurrence of earthquakes has been estimated using an exponential distribution for earthquake magnitude, expressed as a relationship between the frequency and magnitude of earthquakes. The analysis of distribution of hypocentres of the Vrancea earthquake showed that the maximum number of earthquakes occurred at depths between 120 kilometres and 150 kilometres. Two reference scenario events of 475 years and 72 years average return period were generated. An additional 13 scenario events were generated to allow more flexibility in training personnel for disaster management.

Earthquake hazard module: The hazard module analyses the ground motion parameters at population-weighted centroids of each commune location using region-specific attenuation relationships. For each earthquake scenario, the intensity of ground shaking in terms of peak ground acceleration and spectral acceleration is generated for various discrete spectral periods/frequencies.

Macroseismic intensity attenuation was calculated and the model was calibrated using the intensity of recent events. Modeled intensities were mapped for the 1990, 1986, 1977

Figure 57

Earthquake catalogue of Romania complied from three different sources

and 1940 historical events. The epicenter and location of seismic networks records, which were used for developing source scaling and attenuation models, are shown in figure 58.

As local soil conditions can significantly impact earthquake ground motion and resulting structural damage, these conditions are classified in terms of their shear wave velocity, the stiffest soils having the highest shear wave velocity. To incorporate the effects of local soil conditions on building damage, soil classification was carried out by interpreting digitized and classified geologic maps.

Efforts have also been made to develop a regional collateral hazards model for collateral hazards like liquefaction, settlement, landslides, lateral spreading or surface fault rupture caused by rigorous ground shaking. In addition to the earthquake hazard assessment of subsequent emergencies that might occur in the event of earthquake, like fires and explosions, chemical accidents were also assessed and included in the model.

Exposure and vulnerability module: Vulnerability assessment was calculated for residential, commercial and industrial buildings; power grids and drinking water systems; communication networks, essential facilities and lifelines; and potential fatalities and casualties of people in the study area.

Outcome of the study: As part of this project, RMSI has developed a solution involving the design of a simple, user-friendly, GIS-based software system for effective use in day-to-day disaster management activities by users at the General Inspectorate for Emergency Situation (GIES), Romania, and other beneficiaries. The system was designed to allow viewing and updating of the risk databases and maps by authorized personnel, for incorporating new hazard and vulnerability information whenever required. It allows design and customization (wherever appropriate) of a model for damage computation, following an earthquake along the sub-crustal Vrancea zone, to compute the potential damages directly or indirectly caused by an earthquake. The model will be used for emergency response planning purposes.

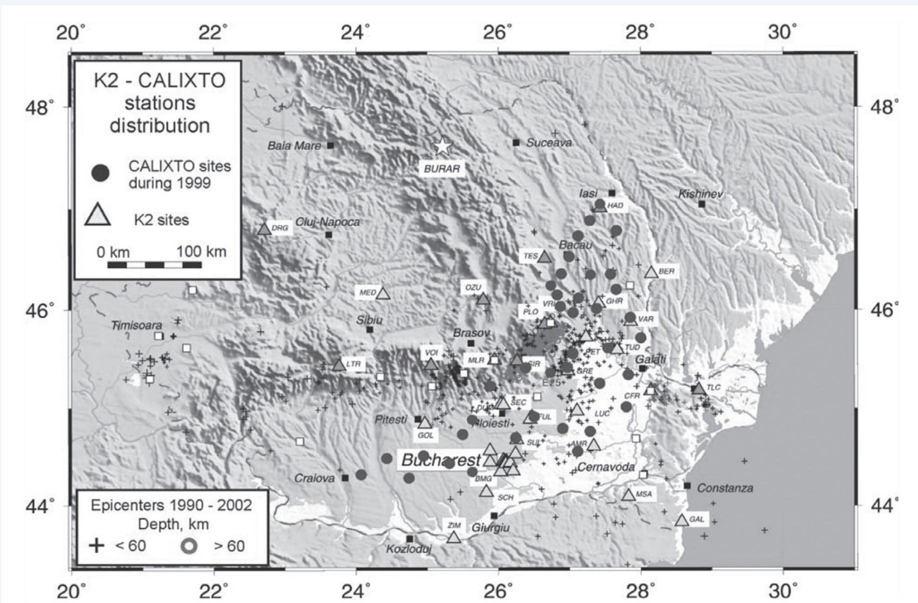
6.3 Romania case study: integrated disaster risk management study

RMSI is executing an integrated disaster risk management study for the Ministry of Interior and Administration Reform, Project Management Unit, Romania, with the financial support of the World Bank, in association with the Academy of Technical Sciences in Romania; IntelliGIS, Romania; and the Romanian Academy Institute of Geography.

The project aims to develop earthquake and flood models and to quantify the exposure and vulnerability of Romanian housing stock at risk from earthquakes and floods. In addition to this, an indicative assessment of landslides associated with flood and fire linked to earthquake was also modeled, in order to assist in the implementation of the proposed Romanian Catastrophe Insurance Scheme. As part of the project, earthquake and flood hazard maps were prepared in GIS for the entire country.

Figure 58

Epicentral map of the Vrancea earthquakes (circles, 1990-2002) and location of seismic networks



Methodology and data: Using the probabilistic model, stochastic event, hazard, vulnerability, exposure and damage were computed for earthquake and flood for the entire country. Figure 58 shows the 100-year return period intensity map for Romania.

Residential exposure at the county level, average annual loss, loss exceedance for various return periods, and frequency and intensity were calculated for earthquake, flood and landslide for the entire country. As part of the project, earthquake, flood and landslide hazard maps for various return periods were prepared in GIS. Average annual loss was calculated for public and private buildings, and the estimations were based on replacement cost or repair. The insured earthquake losses were computed by applying the insurance structure proposed in the Romanian Catastrophe Insurance Scheme to the total loss estimate. The total and insured average annual loss and return period losses for residential exposure in Romania due to earthquakes were computed, and losses by building category were also computed.

The stochastic events, generated using a probabilistic approach based on rainfall data, are employed for flood exposure and loss estimation. In the absence of rainfall data, in the current study, the probabilistic model uses peak discharge data to compute the return period of flood events. Further, flash floods were not modeled, owing to the lack of availability of rainfall data. A region-specific probabilistic model was developed, combining flooding and the spatial extent of floods for different severity (e.g. damage assessment).

The hazard module generates hazard intensities (in terms of flood depth) at population-weighted centroids of communes for each stochastic event. The digital elevation model, generated from data from the international Shuttle Radar Topography Mission in 2000, along with high-resolution river network data, is used for inundation analysis. Flood extent and flood depth maps have been generated by post-processing the simulated results of HEC-RAS in an Arcview environment with Hec-GeoRAS extension.[5] A flood extent map for different return periods was prepared.

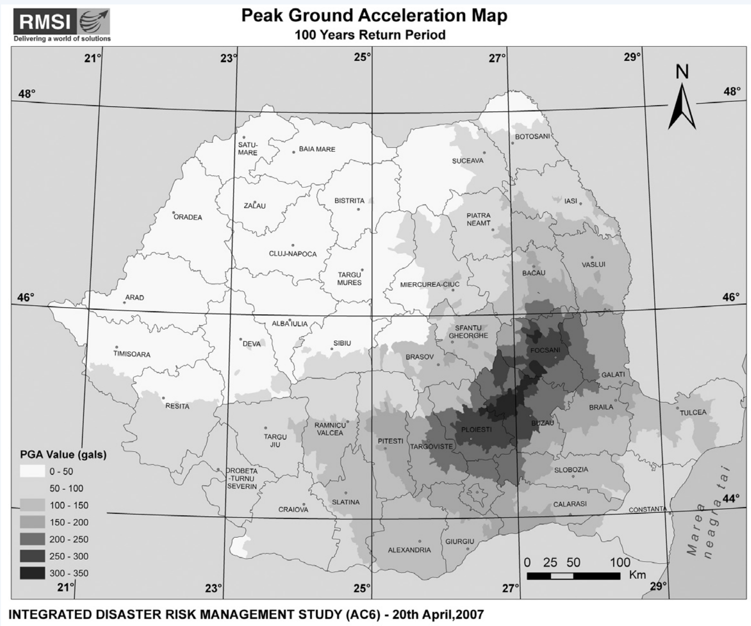
The flood vulnerability module relates flood depths to damage susceptibility of exposed residential assets. The value of residential buildings is estimated to be the same as in the case of earthquake exposure. Age-wise classification of buildings is ignored for flood exposure, and the buildings are classified based on materials used for construction and their height.

The exposure module computes an inventory of residential buildings at the commune level. The total residential exposure for floods in Romania is taken to be the same as its earthquake exposure, i.e. € 105.6 billion, and out of this total, the value in urban dwellings is approximately € 62 billion. The value of residential exposure in Bucharest is estimated to be € 12.2 billion (note: these figure are in the process of finalization).

5 HEC-RAS is a computer programme that models the hydraulics of water flow through rivers and other channels. Arcview is a geographic information system software product. HEC-GeoRAS is a set of procedures, tools, and utilities that allows to data be imported and exported from HEC-RAS.

Figure 59

Modeled 100-year return period intensity map for Romania



The loss module quantifies the losses caused to assets defined by the exposure module, in terms of both total replacement costs and insured losses. The model is calibrated and validated using observed historical data.

Outcome of the study: In line with the terms of the insurance structure proposed by the Romanian Catastrophe Insurance Scheme, earthquake losses and flood losses were computed. The total and insured average annual loss, and the return period losses, for residential exposure due to both earthquakes and flood were tabulated for the entire country. The report is in the review and finalization stage.

Figure 60

Average annual loss for earthquakes at commune level, Romania

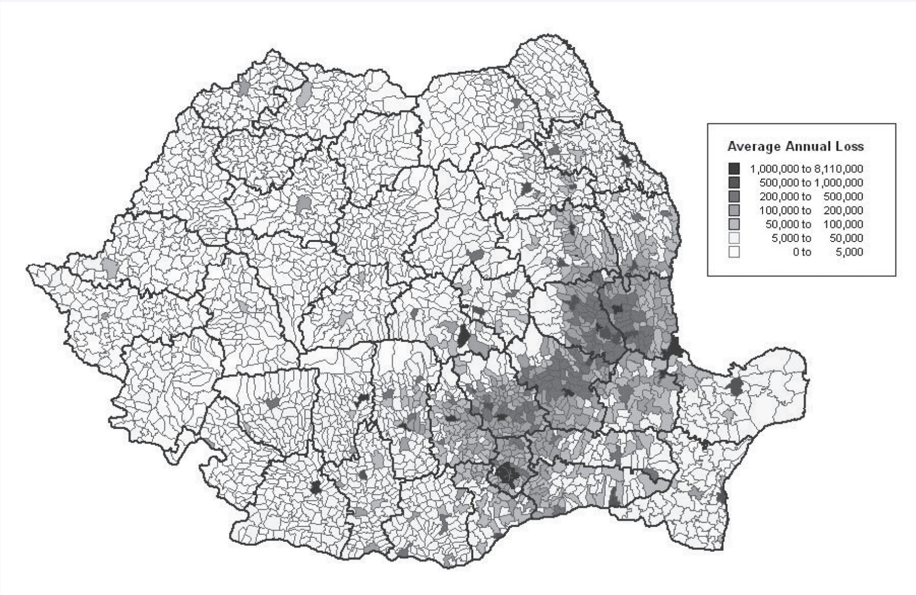


Figure 61

Map of average annual loss for floods at commune level, Romania

7

Conclusions and Recommendations

7.1 Conclusions

7.1.1 Disaster profile and risk assessment

Even though the SEE region is highly diverse in terms of geography, climate and people, the biophysical characteristics of certain stretches have homogeneity, leading to the occurrence of common and shared hazards.

Flood is the common hazard in the region. Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Moldova, Romania, Serbia and Montenegro are all highly vulnerable to flood. These countries show high frequencies of recorded flood events in the past. Landslides have often occurred as associate events in many of these countries. The region is also highly vulnerable to earthquake. Turkey, Romania, Macedonia, Bulgaria, Croatia and Albania have experienced the highest numbers of damaging earthquakes.

The frequency of and vulnerability to technological hazards are increasing in many countries in the region, particularly in Turkey, Serbia and Montenegro. The fast increase in growth in the industrial and service sector, which has boasted the growth of transport sector without enough corresponding infrastructural development, is one of the main causes.

It is apparent from historic data that prioritization of risk mitigation measures for various hazards is required. The seasonal hazards, which are predictable to a greater extent, need to be approached in different way than those hazards that have long average return period. Seasonal hazards like flood and fire need coordinated efforts for prevention and mitigation, while for earthquakes, code refinement and enforcement should be a priority. Risk transfer to the private sector could help, as most of these countries are gearing up for economic development.

7.1.2 National policy, legislation and strategies

National policies and legislation in most of the countries are focused on rescue and relief activities. There is a need to shift this to disaster preparedness and prevention, and to incorporate disaster management into the development plan of the country, giving ample scope for transboundary cooperation and activities for disaster risk management.

In many countries, even though much new legislation has been passed on disaster risk management-related issues, these laws are yet to be fully implemented and/or enforced. Many countries lack comprehensive disaster management plans, as well as clear definitions of roles and responsibilities for different departments.

7.1.3 Institutional structure and capacity

Governmental organization: Most of the countries in the region have gone through major political, social, economic and administrative changes, and this is reflected in the institutional aspects of disaster risk management. Presently, most of these countries are moving with rejuvenated energy towards development, and are in modes conducive to integrating disaster management into the development process. In some countries, there is a shift from military to civil administration in the disaster management structures. However, one can observe in many countries a lack of coordinated efforts among various departments, and a lack of coordination between centre and local administrative bodies, as well as a need to more clearly define such entities' roles and responsibilities in disaster mitigation and management. The benefit of decentralization in disaster management is widely recognized, due to the nature of hazard distribution in the region. But decentralization cannot be considered as a single rule for disaster management and preparedness, as there is a need for a centralized database, which should be accessible to all organizations that are involved in planning and formulating disaster management and mitigation activities within the country and the region.

In most of the countries, the data related to biophysical and socio-economic characteristics are either not available or are in discrete, not easily-used formats. This data should be aggregated and, where not available, should be generated, and organized in a usable format (ideally in GIS), which would provide a crucial tool for hazard prevention strategy planning. This is more significant in a situation where the issues are transboundary in nature. Vulnerability of different population cohorts would be crucial information to integrate into the development plan of the country. There should be policy for data-sharing with adjacent countries.

Non Governmental Organizations: The International Federation of the Red Cross and Red Crescent Societies is active in almost all the countries in the region, and in some cases the Federation or its national society plays a leading role in disaster preparedness and response. These organizations in most of the countries are well coordinated with the relevant government departments. In Slovenia, non-governmental organizations are active in protection, rescue and relief activities, but many countries, particularly Serbia and Montenegro, need mobilization and training of people, organizations and private institutions to get them involved in disaster risk management activities.

7.1.4 Training and awareness

There are some premier academic institutions working in different countries in the region, particularly in the field of seismology. The resources of these institutions, both data and human, are not fully utilized for disaster management and preparedness activities. Regional cooperation between national hydrometeorological centres in individual countries needs to be strengthened for forecasting and early warning.

Scientific instruments in many of the countries for monitoring hazards have been damaged during war, or are technologically outdated and poorly maintained. Emphasis has been given to training and awareness during the past couple of years in most countries in the region. The training and awareness needs to be tailored to accommodate transboundary issues and cooperation in case of emergencies. Awareness should also reach the general public, and the efforts of organizations to impart training and awareness in schools should be encouraged. The use of media for dissimilating awareness programmes should be broadened and encouraged, so that the messages will reach a larger population.

7.1.5 Regional cooperation and international initiative

Initiatives on regional cooperation were strengthened with the adoption of Stability Pact for South Eastern Europe (SP SEE) 1999, a regional nodal body for regional cooperation and coordination.

Donor and humanitarian organizations working in this region play a crucial role in developing regional cooperation. There is increased association between international organizations since the 1990s in the SEE region on disaster management work. UNDP activities in almost all the countries occur in close association with the national governments. Association and levels of cooperation vary amongst the countries of the region.

The following are some of the prominent international organizations involved at different levels in many countries in this region in disaster management activities. The activities range from rescue and rehabilitation activities to technical cooperation for disaster mitigation and preparedness.

- United Nations International Strategy for Disaster Reduction (the UN/ISDR secretariat)
- United Nations Office for the Coordination of Humanitarian Affairs (OCHA)
- Office of the United Nations High Commissioner for Refugees (UNHCR)
- United Nations Children's Fund (UNICEF)
- United Nations Development Programme (UNDP)
- World Food Programme (WFP)
- World Health Organization (WHO)
- Food and Agriculture Organization of the United Nations (FAO)
- The World Bank
- International Atomic Energy Agency (IAEA)
- Nuclear Energy Agency of the Organization of Economic Cooperation and Development (NEA/OECD)
- World Meteorological Organization (WMO)
- International Federation of Red Cross and Red Crescent Societies (IFRC)
- International Committee of the Red Cross (ICRC)
- North Atlantic Treaty Organization (NATO)
- Japan International Cooperation Agency (JICA)
- Environment Directorate-General / Civil Protection Unit / Monitoring and Information Centre (MIC)
- Council of Europe Development Bank (CEB)

In addition to bilateral and multilateral links, some of the academic institutions enjoy intensive cooperation with scientific institutions in the United States and Western Europe. This often mobilizes resources to undertake studies and generate useful information for disaster management.

However, it is observed that there are more regional bodies/committees constituted than there are effective coordinated activities in the region for disaster risk management. Future activities should be focused more on reviving/strengthening the existing bodies/committees than establishing new ones.

7.2 Recommendations

The recommendations provided in this report are deduced based on the reports reviewed and on available country-level historic data on hazards and their impacts. Both reports and data have limitations. Some of the recommendations are generic for model disaster management activity, but most are specific to the region, taking into account the sites and situation factors of the countries in the region.

7.2.1 Regional cooperation

- Considering the common and shared hazards, the increasing vulnerability across political boundaries, and a demographic structure of an ageing population, it is important to develop a framework for regional cooperation. An organization (such as DPPI SEE) having capacity and resources should coordinate all related organizations working in disaster management, such as the national ministries of SEE countries, international donor agencies, non-governmental organizations and private organizations. This coordinating organization should promote partnerships between countries that share hazards and transboundary issues. The organization should be equipped with well-trained staff and adequate resources, and should be supported by appropriate legislation and authority for decision-making and implementation.

- The coordinating organization should also act as a technical clearinghouse and information dissemination centre. It should disseminate best practices and exercises; maintain databases and a web portal; and promote the exchange of technical, research and development information for disaster risk management.
- At the country level, a single ministry should handle disaster management activities within the country. There should be active association and coordination between national and local government, emergency managers, non-governmental organizations, World Meteorological Organization representatives and media in each country.
- The roles and responsibilities of the regional and country-level organizations handling disaster management should be clearly defined. The regional organization should have representatives from all member countries, and its activities should be well publicized to the member countries. The regional organization can be treated as the gateway for international organizations for developing new activities in the region related to disaster risk management: either country-specific or transboundary ones.
- Institutional capacity-building for both central and local governments on decentralized disaster management activities needs to be addressed. Emphasis on handling transboundary issues and transboundary cooperation should be included in the capacity-building activities.
- The region should develop mechanisms for information sharing and networking among all the countries in the region. An early warning system, through media such as radio and television, should be developed.

7.2.2 National policies, legislation and enforcement

- As a proactive measure, disaster risk management should be integrated into the development plans for the countries.
- Economic growth in this region is already underway; before it achieves an accelerated pace, it is important to enact and enforce legislative norms, like building codes and land-use planning, in the region.
- Financial instruments for society and government, like the Turkish Catastrophic Insurance Pool, are required for highly vulnerable countries in the region, particularly against earthquake and flood.
- Enforcement of legislation is crucial for successful policy implementation. Country-level and regional-level legislation, particularly on unified regional land-use norms, building codes and industrial safety measures, are to be enforced.

7.2.3 Links between policy and operations

- SEE countries must ensure a very close working relationship between the policy formulating body, the committee within the ministry responsible for national disaster management, and the operational agency/s that implement the decisions.
- Policies should envisage the transboundary issues that can evolve because of major hazards in the country (for instance, immigration of refugees).
- There should be good coordination between the central department (mostly the policymaking body), local government and other departments for smooth operations.

7.2.4 Links from the center to local government

- Links are critical between national, regional, district and community levels to facilitate implementation and ensure effective vertical communication: for example, information flowing up and resources flowing down. There should be a slow transition in budget allocation from prioritizing rescue and relief to prevention, preparedness and mitigation.
- Close working linkages are needed between bodies responsible for relief and mitigation activities. The roles and responsibilities of departments and organizations involved in rescue activities should be defined to ensure that risk measures activities reach all the needed, avoiding duplication in one place and omission in another during crisis situations.

7.2.5 Approach towards disaster risk management

- Disaster risk management should be proactive, emphasizing preparedness and mitigation, even though rescue and relief activities are important in the event of a disaster.
- Disaster preparedness and mitigation approaches should be based on the nature of hazards: the nature of origin, frequency and severity. Hydrometeorological hazards (such as flood, drought and extreme temperature), which are seasonal in nature, and associated hazards (such as certain epidemics due to water contamination during floods, and landslide associated with flood) need river basin approaches. Countries within a river basin should develop broad guidelines and regional unified land-use management norms within the watershed, practicing these for the common good. A river basin management plan should

be developed, which would be a key tool towards flood and drought risk management planning.

- The activities upstream of transboundary rivers can impact countries downstream. Thus a river basin approach is very important for regional water resource management, pollution control and hydrometeorological hazards management.
- Mitigation strategy measures need to be adopted for coping with hazards like earthquake, which have longer return periods, less predictability and are geologically controlled. For this, identifying vulnerable zones, implementing strict building codes and building public awareness are vital. To obtain information for seismic hazard assessments, optimized preparedness and response planning, it is necessary to upgrade and/or install seismographic networks in the region. The existing institutions involved in seismological activities need to be part of the network and to develop a common database.

7.2.6 Political consensus

- There should be political consensus within the country as well as in the region for preparedness and mitigation of disasters in the region. Formulating legislation and implementing it successfully needs political will, and should be taken with good spirit for common well-being and development.

7.2.7 Non-governmental organizations

- Non-governmental organizations should be well integrated within the disaster risk management framework in order to improve non-governmental organization/government cooperation and to establish a comprehensive, integrated pattern of response. Best practices of non-governmental organization activities in the region should be showcased, and organizations should be identified as champions, as part of encouragement.

7.2.8 The national disaster management plan

- There is an urgent need to establish or update national disaster preparedness plans, which incorporate linkages to international systems of disaster response, and have clearly defined and agreed roles and responsibilities for the national independent disaster response organizations. Disaster management plans should be proactive, giving emphasis to preparedness and mitigation.
- Harmonized disaster management plans and procedures in the region will help in the identification and prioritization required in the region.
- Flood protection systems are very complex, and the transboundary nature of the rivers has accentuated this situation. Regional cooperation and river basin planning is essential for flood management.
- Focus on hazard mitigation and regional cooperation is essential. Financial instruments supporting risk mitigation should also be approached with regional perspective for maximum utilization and efficient management of resources. The flood, earthquake, forest fire and technological hazards need to be considered as high priority, even though there would be varying intensities of different hazards in individual countries.

7.2.9 Disaster risk management database and risk modeling

- One of the main gaps identified during this study is the availability of reliable sub-national data, which is crucial for vulnerability assessment. A centralized database on variables required for vulnerability and risk assessments, risk modeling and preparing management plans at country and regional levels need to be generated. Some countries already have data available in GIS format, which needs to be brought into the common database. Data design should be developed and stored in a versatile format for easy retrieval, analysis and updating. Those countries that require training in data development should include this in the data development program. The data will help identification of vulnerable zones, formulation of land-use planning strategies, and development of regional plans for disaster mitigation and preparedness.
- Hazard forecasting and early warning systems at national and regional levels should be developed. The CMEPC should continue pursuing the development of a GIS-based portal for the region for disaster management and preparedness. For hazard forecasting, risk modeling for major hazards of the region, like flood and earthquake, should be taken up on a priority basis.
- There should be provision for sharing data that is required for handling transboundary hazards. If this requires legislative measures at the country level, the nodal organization should work as an ambassador between countries to help facilitate this.

References

1. Albania (2003). National Information on Disaster Risk Reduction: Albania, http://www.unisdr.org/eng/mdgs-drr/national-reports/Albania-report.pdf
2. Alkaz V. (2005). Seismic Hazard And Risk Studies In Republic Of Moldova, Science and Technology for Safe Development of Lifeline Systems, October 24-25, 2005, Bratislava, Slovak Republic.
3. Annual report (2005). Stability Pact for South Eastern Europe Annual Report 2005.
4. Anonymous (2006). Physical Plan of the Republic of Montenegro until 2020 (Draft), GTZ German Technical Cooperation.
5. Anonymous (2005). Study of historical floods in Central and Eastern Europe from an integrated flood management viewpoint, WMO/GWP Associated Programme on Flood Management, July 2005.
6. Anonymous (2004). Serbia and Montenegro National Disaster Reduction Progress Report Based on the Yokohama Strategy and Plan of Action Prepared for the Hyogo Conference, Kobe Japan 2005.
7. Anonymous (2001). Bosnia and Herzegovina National Report for the Stability Pact Disaster Preparedness Prevention Initiative for SEE.
8. Arsovski M., Gojcic N., Mitrev T. And Hadzijevski D. (1968). Seismo-Geological Investigations in Skopje valley. Earthquake of Skopje July 26, 1963 (Summary). Union of Yugoslav Laboratories, Beograd, Chapter 2, pp 93-97.
9. Bosnia and Herzegovina National Report for the Stability Pact Disaster Preparedness Prevention Initiative for South Eastern Europe, http://www.unisdr.org/eng/mdgs-drr/national-reports/Bosnia-and-herzegovina-report.pdf
10. EM-DAT Emergency Disaster Database http://www.em-dat.net/glossary.htm.
11. Federal Institute for Geosciences and Natural Resources and the Institute of Physics of the Earth. BRG Europe catalogue.
12. Goldammer G.J (2002). Forest Fire Problems in South East Europe and Adjoining Regions: Challenges and Solutions in the 21st Century. Paper presented at the International Scientific Conference “Fire and Emergency Safety” 31 October - 1 November 2002, Sofia, Bulgaria.
13. Guha-Sapir, D., Hargitt, P. H. (2004). Thirty Years of Natural Disasters, 1974-2003: The Numbers, Centre for Research on the Epidemiology of Disasters, Brussels.
14. IFRC (2005). Bulgaria: Floods Minor Emergency, International Federation of Red Cross and Red Crescent Societies, no. 05ME047, Nov. 21, 2005. http://www.reliefweb.int/rw/rwb.nsf/db900SID/RMOI-6JD2LC?OpenDocument
15. Information about disaster reduction based on the Yokohama strategy and action plan, Croatia, http://www.unisdr.org/eng/mdgs-drr/national-reports/Croatia-report.pdf
16. Inter-American Development Bank (2005). Indicators of Disaster Risk and Risk Management, Summary Report for World Conference on Disaster Reduction, Colombia.
17. Kapllani, B. (2006). Civil Emergency Services in Albania, South East Europe Disaster Preparedness, 21-23 March, 2006, Dubrovnik.
18. Mulutinovic, Z. (1998). Seismic Hazard and Counter Measures in the city of Skopje, Institute of Earthquake Engineering & Engineering Seismology, University “St. Cyrie and Methodius”, Skopje.
19. National Geophysical Data Centre web site, http://www.ngdc.noaa.gov/nndc/struts/form?t=101650&s=1&d=1
20. National Reporting and Information on Disaster Reduction, Republic of Macedonia document prepared for the World Conference on Disaster Reduction Kobe-Hyogo, Japan. http://www.unisdr.org/eng/mdgs-drr/national-reports/Macedonia-report.pdf
21. Natural Disaster Hotspots, http://geohotspots.worldbank.org
22. Oncescu, M.C., Marza, V.I, Rizescu, M., Popa, M. (1999). The Romanian Earthquake Catalogue between 984-1997, in Vrancea Earthquakes: Tectonics, Hazard and Risk Mitigation, F. Wenzel, D. Lungu (eds.) & O. Novak (co-ed), pp. 43-47, Kluwer Academic Publishers, Dordrecht, Netherlands.
23. Ozcebe, G. Zaicenco, A., Lungu, D., Paskaleva, I. (2004). Harmonisation of Seismic Hazard and Risk Reduction in the Countries Influenced by Vrancea Earthquakes, A Science for Peace Project Plan, submitted to NATO.
24. ProVention Consortium (2006). Risk Reduction Indicators, Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS) working paper.

25. Pusch, C. (2004). Preventable Losses, Saving Lives and Property through Hazard Risk Assessment, A Comprehensive Risk Management Framework for Central Europe and Central Asia, Disaster Risk Management Working paper series 9, The World Bank.
26. Regional Report of the DPPI Operational Team, "The Gorizia Document", Stability Pact for South Eastern Europe.
27. Relief Website, www.reliefweb.int
28. Report on Readiness and Prevention of All Kinds of Disasters in Bosnia and Herzegovina, http://www.unisdr.org/eng/mdgs-drr/national-reports/Bosnia-and-herzegovina-report.pdf
29. Republic of Slovenia, National Report and Information on Disaster Reduction, http://www.unisdr.org/eng/mdgs-drr/national-reports/Slovenia-report.pdf
30. Romania, National Report Regarding the Disasters Prevention in Romania, http://www.unisdr.org/eng/mdgs-drr/national-reports/Romania-report.pdf
31. Serbia and Montenegro, National Disaster Reduction Progress Report Based on the Yokohama Strategy and Plan of Action, http://www.unisdr.org/eng/mdgs-drr/national-reports/Serbia%20and%20Montenegro-report.pdf
32. Turkey, Information Report on Disaster Reduction by the Republic of Turkey, http://www.unisdr.org/eng/mdgs-drr/national-reports/Turkey-report.pdf
33. UNDP (2004). A Global Report on Reducing Disaster Risk: A Challenge For Development, United Nations Development Programme, Bureau for Crisis Prevention and Recovery www.undp.org/bcpr
34. UNDP (2004). Local Level Risk Management: A Case Study from Albania, Disaster Reduction Unit, UNDP.
35. http://www.undp.org/bcpr/disred/documents/publications/casestudy/albania.pdf,
36. UNDP (2004). Local Vulnerability and Capacity Assessment in Albania, UNDP.
37. UNDP, Turkey Local Capacity-Building for Disaster Prevention, UNDP.
38. UNDP, Turkey National Programme for Disaster Prevention, UNDP.
39. UNDP, Turkey Strengthening of Coping Capacities for Earthquakes, UNDP.
40. United Nations Development Programme website, http://gridca.grid.unep.ch/undp/
41. UN/ISDR (2004). Living with Risk: A Global Review of Disaster Reduction Initiatives, Inter-Agency Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), United Nations, 2004, vols. I, II, and Annex.
42. UN/ISDR (2004b). Terminology: Basic Terms of Disaster Risk Reduction. http://www.unisdr.org/eng/library/lib-terminology-eng-p.htm
43. UN/ISDR and the World Bank. Progress Report (1), Global Facility for Disaster Reduction and Recovery, UN/ISDR and the World Bank.
44. USGS PDE catalogue (2007). Catalogue of earthquakes from 1973 to present, data downloadable from USGS website.
45. World Bank (2006). Hazards of Nature, Risks to Development An IEG Evaluation of World Bank Assistance for Natural Disasters, the World Bank.
46. World Bank (2005). http://www.worldbank.org

Annexes

Annex 1:
About EM-DAT and data criteria

Introduction

Since 1988, the World Health Organization Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has been maintaining an Emergency Events Database called EM-DAT. EM-DAT was created with the initial support of the World Health Organization and the Belgian Government.

The main objective of the database is to serve the purposes of humanitarian action at national and international levels. It is an initiative that aims to rationalize decision making for disaster preparedness, as well as providing an objective base for vulnerability assessment and priority setting. For example, it allows one to decide whether floods in a given country are more significant in terms of human impact than earthquakes, or whether a country is more vulnerable than another.

EMDAT contains essential core data on the occurrence and effects of over 12,800 mass disasters in the world from 1900 to present. The database is compiled from various sources, including United Nations agencies, non-governmental organizations, insurance companies, research institutes and press agencies.

Context and basic principles of the database

The growing number of disasters requiring external assistance has prompted new interest in collaborative ventures, better donor coordination and a more rational approach to response. Increasingly, the emphasis is on preparedness and "pro-active" response, in place of the ad hoc reactive approach of the past. Facilitating the exchange of information, both during disasters and in preparation for disasters, is critical to the success of the international partnership, and has been one of the goals of recent international workshops.

At a very fundamental level, knowledge of the vulnerability of developing countries to different types of disasters is necessary for the most effective relief and preparedness planning. The usefulness of a disaster events database as a tool in this planning has become increasingly evident to many government and international agencies engaged in disaster relief, as well as in mitigation and prevention programmes.

In response to the need for better data on disaster occurrence, a number of databases have been established around the world, with different criteria, formats and purpose. These databases, while individually useful, have been generally limited in scope and have not been compatible with other existing databases. Inconsistencies, data gaps and ambiguity of terminology make comparisons and use of the different data sets difficult. This had led to a fair amount of confusion in the perception and evaluation of a disaster situation, and poses a severe obstacle for planning and fund-raising.

On the other hand, establishing a central database on all disaster events occurring in the world is an effort, which requires, first of all, the data items to be included in the register. To be workable, these definitions have to be kept simple and concrete to allow easy collection of these data by field assessment teams. Standard procedures for the collection and reporting of these data also have to be worked out between all participants to this effort. In order to remain a manageable enterprise, the scope of this central database has to be limited only to essential data, and agency-specific information may be maintained as supplement to this core database.

EM-DAT criteria and definition

For a disaster to be entered into the database at least one of the following criteria must be fulfilled:

- 10 or more people reported killed
- 100 people reported affected
- Declaration of a state of emergency
- Call for international assistance

EM-DAT data includes the following main information:

Disaster number:	A unique disaster number for each event (8 digits: 4 digits for the year and 4 digits for the disaster number - i.e.: 19950324).
Country:	Country(ies) in which the disaster has occurred.
Disaster group:	Three groups of disasters are distinguished in EM-DAT: natural disasters, technological disasters and complex emergencies.
Disaster type:	Description of the disaster according to a pre-defined classification.
Date:	When the disaster occurred. The date is entered as follow: Month/Day/Year.
Killed:	Persons confirmed as dead and people missing and presumed dead (official figures when available).
Injured:	People suffering from physical injuries, trauma or an illness requiring medical treatment as a direct result of a disaster.
Homeless:	People needing immediate assistance for shelter.
Affected:	People requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people.
Total affected:	Sum of injured, homeless, and affected.
Estimated damage:	Several institutions have developed methodologies to quantify these losses in their specific domain. However, there is no standard procedure to determine a global figure for economic impact. Estimated damage are given in USD and/or Euros.

Annex 2:
Data used

Albania

Hazard incidence, human and economic impact (1974-2006)

Hazard indicators	Period						
	1974-78	1979-83	1984-88	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	ndr	2	3	1	5	3	4
Total number of technological hazards	ndr	ndr	ndr	2	ndr	ndr	1
Total number of hazards (natural and technological)	ndr	2	3	3	5	3	5
Total number of deaths due to natural hazards	ndr	36	125	11	11	7	16
Total number of deaths due to technological related hazards	ndr	ndr	ndr	60	ndr	ndr	7
Total number of deaths due to natural and technological hazards	ndr	36	125	71	11	7	23
Total number of victims (people killed and affected) of natural hazards	ndr	ndr	7801	3235000	13666	192110	403000
Total number of victims (people killed and affected) of technological hazards	ndr	ndr	ndr	ndr	ndr	ndr	25
Total number of victims due to natural and technological hazards	ndr	ndr	7801	3235000	13666	192110	403025
Total economic damages reported (2003 USD million)	ndr	10	na	7	ndr	17.5	0.173

ndr – No data recorded, na – not available.

Total number of disasters (due to natural and technological hazards) during 1974-2006

Disaster Type	Number	Simple %
Drought	1	4.76
Earthquake	4	19.05
Epidemic	2	9.52
Extreme Temperature	2	9.52
Flood	7	33.33
Industrial Accident	1	4.76
Slides	1	4.76
Transport Accident	1	4.76
Windstorm	2	9.52
Total	21	100

Hazard impact (1974-2006)

Disaster	Total deaths	Total victims (000's person)	Economic loss (million USD)	Total events
Drought	0	3200	0	1
Earth quake	36	2.79	0	4
Epidemic	7	0.29	0	2
Extreme temperature	71	122.13	0	2
Flood	19	0	24.67	7
Landslide	57	0	0	1
Windstorm	8	525	0	2
Technological (industrial transport)	75	0	0	2
Total	273	3850.21	24.67	21

Bosnia and Herzegovina

Hazard incidence, human and economic impact (1989-2006)

Hazard indicators	Period			
	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	ndr	ndr	7	4
Total number of technological hazards	ndr	1	1	ndr
Total number of hazards (natural and technological)	ndr	1	8	4
Total number of deaths due to natural hazards	0	0	6	5
Total number of deaths due to technological hazards	ndr	12	44	4
Total number of deaths due to natural and technological hazards	0	12	50	Ndr
Total number of victims (people killed and affected) of natural hazards	ndr	ndr	73479	281100
Total number of victims due to natural and technological hazards	ndr	ndr	73479	ndr
Total economic damages reported (2003 USD million)	ndr	ndr	408	0

ndr – No data recorded, na – not available.

Total number of disasters (both natural and technological) during 1989-2006

Disaster Type	Number	Simple %
Drought	2	15.38
Epidemic	1	7.69
Flood	4	30.77
Slides	1	7.69
Transport Accident	2	15.38
Wildfires	1	7.69
Windstorm	2	15.38
Total	13	100.00

Hazard impact during 1989-2006

Disaster	Total death	Total victims	Total economic loss (million USD)	Total events
Drought	0	62575	408	2
Epidemic	0	400	0	1
Flood	0	290100	0	4
Slides	6	409	0	1
Transport Accident	56	67	0	2
Wildfires	0	0	0	1
Windstorm	4	1094	0	2
Total	66	354645	408	13

Bulgaria

Hazard incidence, human and economic impact (1974-2006)

Hazard indicators	Period						
	1974-78	1979-83	1984-88	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	1	2	1	2	2	8	10
Total number of technological hazards	ndr	ndr	2	2	1	ndr	ndr
Total number of hazards (natural and technological)	1	2	3	4	3	8	10
Total number of deaths due to natural hazards	ndr	0	0	1	3	18	57
Total number of deaths due to technological hazards	ndr	ndr	25	42	ndr	ndr	ndr
Total number of deaths due to hazards (natural and technological)	20	0	25	43	3	18	57
Total number of victims (people killed and affected) of natural hazards	ndr	na	ndr	5001	523	1017	12747
Total number of victims (people killed and affected) of technological hazard	ndr	ndr	ndr	119	200	ndr	ndr
Total number of victims due to natural and technological hazard	ndr	na	ndr	5119	723	1017	12747
Total economic damages reported (2003 USDmillion)	na	na	8	na	na	20.83	457

Total number of disasters (both natural and technological) during 1974-2006

Disaster Type	Number	Simple %
Drought	2	6.45
Earthquake	4	12.90
Extreme Temperature	4	12.90
Flood	9	29.03
Industrial Accident	1	3.23
Transport Accident	4	12.90
Wildfires	2	6.45
Windstorm	5	16.13
Total	31	100.00

Hazard impact (1974-2006)

Hazards	Total deaths	Total victims	Economic loss	Total events
Drought	0	0	0	2
Earthquake	24	3776	0	4
Extreme Temperature	29	372	0	4
Flood	40	12440	460.23	9
Industrial Accident	0	200	0	1
Transport Accident	117	236	0	4
Wildfires	7	174	17.6	2
Windstorm	2	5852	0	5
Total	219	23050	477.83	31

Croatia

Hazard incidence, human and economic impact (1974-2006)

Hazard indicators	Period			
	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	ndr	2	6	4
Total number of technological hazards	1	1	1	0
Total number of hazards (natural and technological)	1	3	7	4
Total number of deaths due to natural hazards	0	0	41	7
Total number of deaths due to technological hazards	61	35	11	0
Total number of deaths due to hazards (natural and technological)	61	35	52	7
Total number of victims (people killed and affected) of natural hazards	ndr	2000	1200	257
Total number of victims due to natural and technological hazard	25	0	ndr	7
Total number of victims due to natural and technological hazard	25	2000	1200	250
Total economic damages reported (2003 USDmillion)	86	2035	1452	264

Total number of disasters (due to natural and technological hazards) during 1974-2006

Disaster Type	Number	Simple %
Drought	1	6.67
Earthquake	1	6.67
Extreme Temperature	2	13.33
Flood	4	26.67
Transport Accident	3	20.00
Wildfires	3	20.00
Windstorm	1	6.67
TOTAL	15	100.00

Hazard impact (1974-2006)

Hazards	Total deaths	Total victims	Economic loss	Total events
Drought	0	0	330	1
Earthquake	0	2000	0	1
Extreme Temperature	45	245	240	2
Flood	0	2050	0	4
Transport Accident	107	132	0	3
Wildfires	1	1	37.75	3
Windstorm	2	2	0	1
Total	155	4430	607.75	15

Macedonia

Hazard incidence, human and economic impact (1989-2006)

Hazard indicators	Period			
	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	1	1	6	5
Total number of technological hazards	2	ndr	1	0
Total number of hazards (natural and technological)	3	1	7	5
Total number of deaths due to natural hazards	0	0	17	16
Total number of deaths due to technological hazards	198	0	10	0
Total number of deaths due to natural and technological hazards	198	0	27	16
Total number of victims (people killed and affected) of natural hazards	10000	1500	6600	103503
Total number of victims (people killed and affected) of technological hazards	15	0	6	0
Total number of victims due to natural and technological hazards	10015	1500	6606	103503
Total economic damages reported (2003 USDmillion)	na	350	13.56	3.6

Total number of disasters (due to natural and technological related hazards) during 1989-2006

Disaster Type	Number	Simple %
Drought	1	6.25
Epidemic	1	6.25
Extreme Temperature	2	12.5
Flood	7	43.75
Transport Accident	3	18.75
Wildfires	1	6.25
Windstorm	1	6.25
TOTAL	16	100

Hazard impact

Hazards	Total deaths	Total victims	Economic loss	Total events
Drought	0	10000	0	1
Epidemic	0	200	0	1
Extreme Temperature	30	30	0	2
Flood	2	111402	353.6	7
Transport Accident	208	229	0	3
Wildfires	0	0	13.563	1
Windstorm	1	4	0	1
Total	241	121865	367.163	16

Moldova

Hazard incidence, human and economic impact (1984-2006)

Hazard indicators	Period				
	1984-88	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	ndr	Ndr	3	5	2
Total number of technological hazards	ndr	ndr	ndr	ndr	ndr
Total number of hazards (natural and technological)	ndr	ndr	3	5	2
Total number of deaths due to natural hazards	ndr	ndr	26	3	13
Total number of deaths due to technological hazards	ndr	ndr	ndr	ndr	ndr
Total number of deaths due to due to hazards (natural and technological)	ndr	ndr	26	3	13
Total number of victims (people killed and affected) of natural hazards	ndr	ndr	42959	2603860	6500
Total number of victims (people killed and affected) of technological hazards	ndr	ndr	ndr	ndr	ndr
Total number of victims due to natural and technological hazards	225559	4	42959	2603860	6500
Total economic damages reported (2003 USDmillion)	1228	na	140	36.43	7.75

Total number of disasters (due to natural and technological related hazards) during 1984-2006

Disaster Type	Number	Simple %
Drought	1	10
Epidemic	1	10
Extreme Temperature	1	10
Flood	5	50
Windstorm	2	20
Total	10	100

Hazard impact (1984-2006)

Hazards	Total deaths	Total victims	Economic loss	Total events
Drought	2	2	0	1
Epidemic	0	1647	0	1
Extreme Temperature	13	13	0	1
Flood	24	26116	152.584	5
Windstorm	3	2625583	31.6	2
Total	42	2653361	184.184	10

Romania

Hazard incidence, human and economic impact (1974-2006)

Hazard indicators	Period						
	1974-78	1979-83	1984-88	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	2	1	2	6	10	19	24
Total number of technological hazards	0	0	1	2	5	5	3
Total number of hazards (natural and technological)	2	1	4	8	15	24	27
Total number of deaths due to natural hazards	1701	0	0	120	151	102	308
Total number of deaths due to technological hazards	0	0	17	190	155	24	45
Total number of deaths due to natural and technological hazards	1701	0	17	310	306	126	353
Total number of victims (people killed and affected) of natural hazards	1386300	na	2000	21750	147215	102042	109997
Total number of victims (people killed and affected) of technological hazards	0	0	0	0	0	102	30
Total number of victims due to natural and technological hazards	1386300	na	2000	21750	147215	102144	110027
Total economic damages reported (2003 USDmillion)	2050	na	0	500	263.4	746.89	1709

Total number of disasters (due to natural and technological related hazards) during 1974-2006

Disaster Type	Number	Simple %
Drought	2	3
Earthquake	4	5
Epidemic	3	4
Extreme Temperature	12	15
Flood	33	42
Industrial Accident	6	8
Misc Accident	2	3
Slides	1	1
Transport Accident	8	10
Windstorm	8	10
Total	79	100

Hazard impact (1974-2006)

Hazards	Total deaths	Total victims	Economic loss	Total events
Drought	0	0	500.00	2
Earthquake	1650	394500	2000.00	4
Epidemic	0	5271	0	3
Extreme Temperature	256	2956	0	12
Flood	432	1360217	2769.29	33
Industrial Accident	60	162	0	6
Misc Accident	29	31	0	2
Slides	0	330	0	1
Transport Accident	342	372	0	8
Windstorm	44	8410	0	8
Total	2813	1772249	5269.29	79

Serbia and Montenegro

Hazard incidence, human and economic impact (1989-2006)

Hazard indicators	Period			
	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	1	0	10	5
Total number of technological hazards	0	5	3	2
Total number of hazards (natural and technological)	1	5	13	7
Total number of deaths due to natural hazards	1	0	15	5
Total number of deaths due to technological hazards	0	79	34	58
Total number of deaths due to hazards (natural+ technological)	1	79	49	63
Total number of victims (people killed and affected) of natural hazards	6000	ndr	80459	39990
Total number of victims (people killed and affected) of technological hazards	0	95	338	272
Total number of victims due to natural and technological hazards	6000	95	80797	40262
Total economic damages reported (2003 USDmillion)	ndr	ndr	ndr	ndr

Total number of disasters (due to natural and technological related hazards) during 1989-2006

Disaster Type	Number	Simple %
Earthquake	1	3.85
Epidemic	2	7.69
Extreme Temperature	2	7.69
Flood	9	34.62
Industrial Accident	2	7.69
Misc Accident	1	3.85
Transport Accident	7	26.92
Wildfires	1	3.85
Windstorm	1	3.85
Total	26	100

Hazard impact (1989-2006)

Hazards	Total number of death	Total number of victims	Economic loss	Total number of events
Earthquake	1	101	0	1
Epidemic	0	869	0	2
Extreme Temperature	6	76	0	2
Flood	14	125412	0	9
Industrial Accident	39	69	0	2
Misc Accident	0	307	0	1
Transport Accident	132	500	0	7
Wildfires	0	12	0	1
Windstorm	0	0	0	1
Total	192	127346	0	26

Slovenia

Hazard incidence, human and economic impact (1994-2006)

Hazard indicators	Period		
	1994-98	1999-03	2004-06
Total number of natural hazards	1	1	2
Total number of technological hazards	1	0	0
Total number of hazards (natural and technological)	2	1	2
Total number of deaths due to natural hazards	ndr	ndr	1
Total number of deaths due to technological hazards	0	0	0
Total number of deaths due to natural and technological hazards	ndr	ndr	1
Total number of victims (people killed and affected) of natural hazards	700	ndr	605
Total number of victims (people killed and affected) of technological hazards	0	0	0
Total number of victims due to natural and technological hazards	700	ndr	605
Total economic damages reported (2003 USDmillion)	0	80	15

Total number of disasters (due to natural and technological related hazards) during 1994-2006

Disaster Type	Number	Simple %
Earthquake	2	40
Extreme Temperature	1	20
Flood	1	20
Industrial Accident	1	20
Total	5	100

Hazard impact (1994-2006)

Hazards	Total number of death	Total number of victims	Economic loss	Total number of events
Earthquake	1	1306	10	2
Extreme Temperature	0	0	80	1
Flood	0	0	5	1
Industrial Accident	0	0	0	1
Total	1	1306	95	5

Turkey

Hazard incidence, human and economic impact (1974-2006)

Hazard indicators	Period						
	1974-78	1979-83	1984-88	1989-93	1994-98	1999-03	2004-06
Total number of natural hazards	10	4	12	7	14	28	21
Total number of technological hazards	1	7	6	20	20	29	17
Total number of hazards (natural and technological)	11	11	18	27	34	57	38
Total number of deaths due to natural hazards	6361	1471	152	1143	500	18328	598
Total number of deaths due to technological hazards	32	399	122	781	524	654	393
Total number of deaths due to all hazards (natural + technological)	6393	1870	274	1924	1024	18982	598
Total number of victims (people killed and affected) of natural hazards	369406	894137	774380	354422	3345963	2160512	158092
Total number of victims (people killed and affected) of technological hazards	100	514	0	254	715	626	405
Total number of victims due to natural and technological hazards	369506	894651	774390	354676	3346678	2161138	158497
Total economic damages reported (2003 USDmillion)	77	40	0	775	2718.5	14571	317

Total number of disasters (due to natural and technological related hazards) during 1974-2006

Disaster Type	Number	Simple %
Earthquake	39	19.9
Extreme Temperature	6	3.06
Flood	27	13.78
Slides	8	4.08
Epidemic	5	2.55
Industrial Accident	17	8.67
Misc. Accident	9	4.59
Transport Accident	74	37.76
Wildfires	4	2.04
Windstorm	7	3.57
Total	196	100

Hazard impact (1974-2006)

Hazards	Total death	Total victims	Economic loss (million USD)	Total events
Earthquake	26756	6221.3	15988	39
Epidemic	31	100.4	0	5
Extreme Temperature	101	8.6	0	6
Flood	598	1749.3	2511	27
Industrial Accident	809	1.3	0	17
Misc. Accident	214	0.8	0	9
Slides	591	2.9	0	8
Transport Accident	1882	3.4	0	74
Wildfires	13	0.9	0	4
Windstorm	70	1.7	0	7
Total	31065	8090.6	18499	196

SEE disaster incidence

Number of years taken for average	Country	Disasters (annual average events)									
		Drought-related		Earthquake		Flood and related		Windstorm		Technology related	
		Rank	Events	Rank	Events	Rank	Events	Rank	Events	Rank	Events
1974-2006	Albania	6	0.12	4	0.09	6	0.24	6	0.06	7	0.06
1989-2006	Bosnia and Herzegovina	5	0.17		x	4	0.28	4	0.11	4	0.17
1974-2006	Bulgaria	4	0.21	2	0.15	5	0.27	3	0.15	5	0.15
1989-2006	Croatia	3	0.28	5	0.06	7	0.22	6	0.06	4	0.17
1989-2006	Macedonia	5	0.17		x	7	0.22		x	6	0.11
1984-2006	Moldova	7	0.09	4	0.09	7	0.22	5	0.09		x
1974-2006	Romania	1	0.45	3	0.12	2	1.03	1	0.24	3	0.48
1989-2006	Serbia and Montenegro	5	0.17	5	0.06	3	0.50	6	0.06	2	0.56
1984-2006	Slovenia	8	0.04	4	0.09	8	0.04		x		x
1974-2006	Turkey	2	0.30	1	0.97	1	1.06	2	0.21	1	3.00

SEE disaster impacts (annual average events)

Number of years taken for average	Country	[redacted]	Annual average number of deaths due to all hazards	[redacted]	Annual average number of victims due to all hazards	[redacted]	Annual average economic loss due to all hazards (Million USD)
1974-2006	Albania	[redacted]	7.82	[redacted]	117267.91	[redacted]	1.19
1989-2006	Bosnia and Herzegovina	[redacted]	3.72	[redacted]	19680.61	[redacted]	22.67
1974-2006	Bulgaria	[redacted]	6.64	[redacted]	697.15	[redacted]	14.76
1989-2006	Croatia	[redacted]	8.61	[redacted]	213.17	[redacted]	33.76
1989-2006	Macedonia	[redacted]	13.39	[redacted]	6760.11	[redacted]	24.59
1984-2006	Moldova	[redacted]	1.83	[redacted]	125529.26	[redacted]	61.40
1974-2006	Romania	[redacted]	82.42	[redacted]	53515.82	[redacted]	292.76
1989-2006	Serbia and Montenegro	[redacted]	10.00	[redacted]	7028.11	[redacted]	x
1984-2006	Slovenia	[redacted]	0.04	[redacted]	56.78	[redacted]	4.13
1974-2006	Turkey	[redacted]	941.36	[redacted]	244317.45	[redacted]	560.56

SEE Vulnerability variables

Number of years taken for average	Country	[redacted]	Population	[redacted]	Population density	[redacted]	Population density in flooded area(person/ sq.km)	[redacted]	Urban population growth rate [% per year]	[redacted]	Arable land [% of land area]	[redacted]	(HDI)	[redacted]	GDP per capita [$/popu laton]
1974-2006	Albania	[redacted]	3062619	[redacted]	109	[redacted]	109.6	[redacted]	2.2	[redacted]	25.7	[redacted]	0.70	[redacted]	2755.3
1989-2006	Bosnia and Herzegovina	[redacted]	3911570	[redacted]	76	[redacted]	x	[redacted]	1.7	[redacted]	17.1	[redacted]	x	[redacted]	x
1974-2006	Bulgaria	[redacted]	8645446	[redacted]	70	[redacted]	82.9	[redacted]	0.5	[redacted]	38.6	[redacted]	0.78	[redacted]	4733.9
1989-2006	Croatia	[redacted]	4649560	[redacted]	79	[redacted]	61.4	[redacted]	1.4	[redacted]	24.6	[redacted]	0.79	[redacted]	6376.2
1989-2006	Macedonia	[redacted]	1963490	[redacted]	79	[redacted]	77.5	[redacted]	1.6	[redacted]	27.3	[redacted]	0.77	[redacted]	4467.7
1984-2006	Moldova	[redacted]	4316649	[redacted]	124	[redacted]	136.0	[redacted]	1.4	[redacted]	67.7	[redacted]	0.72	[redacted]	2876.1
1974-2006	Romania	[redacted]	22676156	[redacted]	91	[redacted]	90.6	[redacted]	1.0	[redacted]	44.3	[redacted]	0.78	[redacted]	5954.9
1989-2006	Serbia and Montenegro	[redacted]	10078052	[redacted]	79	[redacted]	100.3	[redacted]	1.6	[redacted]	41.8	[redacted]	x	[redacted]	x
1984-2006	Slovenia	[redacted]		[redacted]	99	[redacted]		[redacted]		[redacted]		[redacted]		[redacted]	
1974-2006	Turkey	[redacted]	59060003	[redacted]	92	[redacted]	97.0	[redacted]	4.9	[redacted]	35.9	[redacted]	0.68	[redacted]	4680.8

SEE Risk ranking

Country	Disaster ranking		Disaster impact ranking	
	Cumulative rank	Reduce to unit	Cumulative rank	Reduce to unit
Albania	29	10	19	5
Bosnia and Herzegovina	17	3	20	6
Bulgaria	19	5	23	8
Croatia	25	9	19	5
Macedonia	18	4	16	4
Moldova	23	8	15	3
Romania	10	2	9	2
Serbia and Montenegro	21	7	10	5
Slovenia	20	6	29	7
Turkey	7	1	4	1

SEE Economic loss in comparison with GDP

Number of years taken for average	Country	GDP per capita [$/inh.] 2005	Annual average economic loss due to all hazards (million USD)	Per cent to GDP	Economic loss (in million USD)			
					Drought	Earthquake	Flood	Tropical cyclone
1974-2006	Albania	2755.3	68.67	2.49	2238	2 to 5	24.673	0
1989-2006	Bosnia and Herzegovina	2384.0	22.94	0.96	408	> 5*	0	0
1974-2006	Bulgaria	4733.9	14.76	0.31	0	5*	260.23	0
1989-2006	Croatia	6376.2	33.76	0.53	330	> 5*	0	0
1989-2006	Macedonia	4467.7	24.59	0.55	0	5*	353.6	0
1984-2006	Moldova	2876.1	61.40	2.13	0	0	152.584	31.6
1974-2006	Romania	5954.9	292.76	4.92	500	2000	2420.29	0
1989-2006	Serbia and Montenegro	4936.0	82.0	1.66		2705	0	0
1984-2006	Slovenia	13611.4	7.31	0.05	0	10	5	0
1974-2006	Turkey	4680.8	560.56	11.98	0	15988	2511	0

Source: EM-DAT, * from National Geophysical Data Centre website

Economic loss of other hazards is also included for calculating annual average economic loss.

United Nations
International Strategy for Disaster Reduction

Secretariat Geneva
Tel. :+41 22 917 8908/8907
Fax : +41 22 917 8964
isdr@un.org
www.unisdr.org

International Environment House II
7-9 Chemin de Balexert
CH 1219 Châtelaine
Geneva, Switzerland

Postal Address:
Palais des Nations, CH-1211
Geneva, Switzerland

Secretariat Africa, Nairobi
isdr-africa@unep.org
www.unisdr.org/africa

Secretariat Asia and the Pacific, Bangkok
isdr-bkk@un.org
www.unisdr.org/asiapacific

Secretariat the Americas, Panama
eird@eird.org
www.eird.org

Secretariat Europe, Geneva
albrito@un.org
www.unisdr.org/europe

Secretariat, West Asia and North Africa, Cairo
info@unisdr-wana.org
www.unisdr.org/wana

UN/ISDR-13-2008-Geneva