Reference:

European Commission Directorate General Humanitarian Aid and Civil Protection ECHO

Grant Agreement for an action with multiple beneficiaries

Agreement Number – ECHO/SUB/2015/721166/PREP12

Raising Young People's Awareness on Preparedness and Self Protection – YAPS

Report on ACTION B.1

"Study regarding major natural and manmade risks in EU Member States"

Federal Office of Civil Protection and Disaster Assistance

AUSTRIAN RED CROSS

UNIVERSITATEA BABEŞ-BOLYAI

This project is funded by the European Union

http://yaps.online

Content

1. INTRODUCTION

Risk and hazard are common terms, defining complex and interconnected parameters and processes. Hazard is characterized by geographic localization, intensity (magnitude), frequency and occurrence probability. While the manifestation and the causes are well known, the moment and the place of occurrence are random (Mac, 2003). Tightly connected to hazard is risk. Often these two terms are confused. Hazard is a natural or anthropic phenomenon characterized by its potential to produce damages, thus representing the general source of future dangers. The risk is generated by the human society, or its valuable goods or the environment exposure to a specific hazard and is calculated through the product between probabilities and damages (Smith and Petley, 2009). Therefore, a hazard represents the potential threat of an event and not the event itself, and becomes a risk only if it affects to some extent a human community.

Risk exists only if its two components, hazard and vulnerability, are present (Glatron and Beck, 2008). The classic risk definition, as the product of an event occurrence probability and the negative consequences it might generate, associates two distinct elements, hazard and receptor (mostly human population):

$$\mathbf{R = P \times C},$$

where R – risk, P – probability of occurrence, C – consequences.

Conventionally, risk is expressed by the notation Risk = Hazard x Vulnerability. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability. Many times, the following relation is used:

R = hazard x vulnerability,

expressing the connection between an event and its consequences.

Within a region, the risk is relatively constant, while the community's vulnerability is conditioned by various factors such as reaction to danger, preparedness level etc. According to this relation, risk can be associated to high frequency hazard and low vulnerability, or to a low frequency hazard and high vulnerability.

The phenomenon evolution has three stages: the hazard stage, in which there is only the hazard, risk stage, in which the hazard affects human society and finally, the disaster occurrence (Alexander, 1993). To human society, there are two kinds of risks: an acceptable one, in which the damages and losses are tolerable for the population, and a severe one, the disaster, in which the damages cannot be overcome by the local community. The disaster is a result of the interaction between hazard and vulnerability, and it reflects the insufficient preparedness level of the community.

It must be mentioned that, regardless of the implemented prevention measures, absolute safety state can be achieved nowhere on Earth and in no situation for the human society, because there will always be a so called “residual risk” (Ozunu and Anghel, 2007).

Risk perception plays a very important role as it alters the population’s behavior. Perception is multi-dimensional and is influenced by a large variety of factors (e.g. past experiences, demographic profiles - age, gender, education level, income), which determine different ways of risk perception between communities and within the same community (Bradford et al., 2012). As a psychological process, the information received by a person from outside its community is altered by a combination of socio-cultural processes, economic factors and individual elements (personality, values, past experiences etc.) (Gavilanes-Ruiz et al., 2009). The perceived risk depends on risk communication, the psychological mechanism for processing uncertainty and the person’s past experiences regarding risks (Jaeger et al., 2002, cited by Renn, 2003).

The way children perceive risk is of great importance in their safety education. While many accidents occur in their homes and schools, they must be aware of self-protection measures. Usually, children under the age of 5 are under permanent supervision, either from a parent, or teacher of care givers. On the other hand, the rate of potential injuries is higher in older children, due to several reasons: they may encounter new situations where the hazards are new to them; they may not assess properly the potential negative consequences of a situation; they may not be able to cope with a certain situation, either physically or cognitively; they may consider that the benefits of their actions exceed the possible harmful consequences (McWhirter, 1997). All these elements must be taken into account when considering teaching preventive and/or response measures to children.

A study on approximately a thousand children aged 4 – 11 in Nootingham schools (McWhirter, 1997) revealed that at the age of 10, 50% of the children believe it’s somebody else’s responsibility to keep them safe. By the age of 11, the percent increased to 70% of the children recognizing that they are also responsible for keeping them safe. Also, around this age a limited understanding of accident prevention appears to develop. Furthermore, the terms “risk” and “risky” are not very clearly understood by small children. However, by the age of 9 their view is clearer. It is important to teach them how to remain safe in a practical way, by using practical examples from everyday life.

Technological hazards in Europe can results in human victims, economic losses and environmental degradation. However, their impacts change constantly in time, due to the continuous evolution of technology and the dynamics of society, in general (Hewitt, 1997). Additionally, information on technological hazards and their generated damages are much less comprehensive than in the case of natural disasters, due to the fact that estimates after the event are rarely undertaken.

Regarding the target group of this project, children aged 7 – 12, it is considered that they are less exposed to technological hazards. Several legislative instruments regulate the distances between industrial facilities, infrastructures and residential settlements in order to prevent and mitigate accidents and their consequences. These distances are expected to be appropriate to ensure the safety of the human population and the environment. Therefore, it is expected that buildings which feature increased vulnerability due to the large number of gathered people (schools, hospitals) are located in safer areas, away from the industrial areas.

In Europe, the knowledge and measures about self-protection in case of emergency is very poor in general. Within the population, the target group of this project (young people aged 7 – 12) requires a special approach, as their knowledge and behavior is different from adults. Their perception to accidents and disasters needs to be educated through an efficient teaching program. Therefore, the first objective of the present project was to assess the natural hazards of each EU member state, with a special focus on those hazards that can affect young people in their homes or schools. The partner countries of the project were subjected to an extended hazard assessment.

CHAPTER 1

2. MAJOR NATURAL RISKS IN EU MEMBER STATES

BELGIUM (Kingdom of Belgium)

Belgium is a small, yet densely populated country in Western Europe. Although the severe hazards that pose significant threats in other parts of the world, such as volcanoes and tsunamis, do not affect this region, there are many hazards regularly occurring. According to CRED EM-DAT 2015, the most frequent and damaging threat to national safety are storm surges and floods. Storms are also one of the most costly natural hazards in the coastal areas. For example, the storm Kyrill in 2007 caused 46 fatalities and insured losses of around EUR 4.5 billion (EUR 7.7 billion of overall losses) in Germany, Austria, the Czech Republic, the United Kingdom, France, Belgium, Poland, the Netherlands, Denmark, Switzerland and Slovenia (EEA, 2010). Other examples include Cilly, Desiree and Fanny, 1998; Jeanette, 2002 (38 fatalities, over 60 000 affected, EUR 2.6 billion overall losses (EUR 1.7 billion insured losses), thousands of trees uprooted and general disruption in power lines, roads, and railways.)

There are two major types of floods affecting Belgium: river flooding and coastal flooding. Flooding is the most important natural hazard in terms of economic losses. For example, the flood in 14-15 September 1998 affecting the Provinces of Brabant Wallon, Liege, Antwerp and Leuven in Belgium and The Netherlands (Haringvliet River and lowlands) caused economic losses of EUR 600 million (EEA, 2010). As to coastal flooding, data showed that the maximum high tide levels are recorded not at the river mouth, in the estuary of the Scheldt, but in the Antwerp-Dendermonde section, further inland (Heyse, 1997). This demonstrates why the greatest potential flood risk is in the alluvial plain of the lower Scheldt (Mys et al, 1983, cited by Heyse, 1997). However, the flooding risk was greatly reduced by building a system of dykes and overflow polders to store water during storm surges.

On the other hand, mortality is caused mainly by extreme temperatures. ESPON expects an increase between 3.0 and 3.5°C in the period 2071-2100 compared to the reference period 1961-1990. One major event of temperature event was the heat wave in Jul/Aug 2003 and Jun/Jul 2006, the latter affecting mostly Belgium, France and the Netherlands in terms of fatalities. July 2006 became the warmest month in Belgian history, with an all-time high mean temperature of 23.0 C (73.4°F).

In Belgium, seismic activity has been studied in detail since 1985 by the Royal Observatory of Belgium (Uccle, Brussels). There are identified four seismic areas: the Henegouwen basin, the Brabant-Flanders massif, the Liege region, and the Eifel region together with the Roer graben (Heyse, 1997). The maximum intensity is VIII, and the return period for epicentral intensities > VI, calculated for the last 350 years, is 16 years. Other studies demonstrated that one earthquake of magnitude M=6.2 occur in average each 475 years (Plumier et al., 2001).

The historic reports also indicated the occurrence of three large earthquakes with a magnitude greater than 6.0 since 1350 in the region.

Belgium is an important crossroad for gas flows from diverse sources and routes. However, the infrastructure system is robust, ensuring a secure and safe gas pipeline transport. Therefore, the number of accidents in the transport sector is small; one major accident worth mentioning is the Ghislenghien accident, occurring in 2004, which is also the biggest industrial disaster in Belgium since 1956. The explosion after gas leakage from a pipeline killed 24 people and injured 132, causing overall losses of about EUR 100 million (EEA, 2010).

Table 1.1. Natural risks profile of Belgium according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	31.6%	-	12.0%
Storm	50.0%	-	83.5%
Extreme temperature	15.8%	98%	-
Earthquake	2.6%	-	4.5%
Other	-	2.0%	

* Economic loss for 10 year average (2005-2014): 94,715.000 $

Source: http://www.preventionweb.net/countries/bel/data/

BULGARIA (Republic of Bulgaria)

Bulgaria is a country situated in the Balkan Peninsula, highly vulnerable to several natural hazards, such as floods, earthquakes, landslides, forest fires and storms. 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.

The most important hazard, in terms of frequency, economic losses and mortality are floods. As per EM-DAT, floods comprised 30% of the hazards in the country during the period 1974-2006. In Bulgaria, floods are mainly caused by heavy rains, intensive melting of snow mixed with rainfall during spring (tributaries of the Danube), flashfloods in the summer and dike breaking. In Bulgaria there are 40 large dams, some of which regularly overflow in case of severe rain or snow melting and become a threat to settlements near rivers. (Karagyozov et al., 2012) One of this dams which could cause enormous damages is the Iskar dam, with a capacity of 655 million cubic meters of water and a 60 meter high concrete wall. Furthermore, the floods in the summer of 2005 had the most severe consequences on the Bulgarian society and economy. These include: 31 deaths, 13,000 victims and more than 60,000 people were affected in some way. The economic losses were 274 million dollars in July and another 200 million dollars in August. All in all, approximately 70% of the entire country was affected (Karagyozov et al., 2012).

Bulgaria is characterized by intense seismic activity – approximately 95% of its territory is threatened by earthquakes, due to the set of active faults in this region. This assessment is based on the large number of weak and strong earthquakes which occurred in the recent past.

The most active part of Bulgaria is the South-Western area. The strongest earthquake recorded in the continental Europe occurred in this region, on April 4, 1904 and it is known as the Kroupnik earthquake, with a magnitude M = 7.2 (Zlateva et al., 2011).

In the last decades, the number of landslides in Bulgaria increased, due to major floods occurring in this region and to seismic activity, which trigger different types of land movement (Zlateva et al., 2011). The total number of landslides reaches 1,000, located in several distinct areas.

In Bulgaria, fires have also become a serious threat. Most of them are forest fires, causing significant economic losses. The main causes are human activities and natural phenomena. Data from EFFIS (European Forest Fire Information System) indicate a record number of 1,710 fires in 2000 and 1,479 in 2007. For the period 1988 – 2004, the average is 504 fires, with a total of 8,566, while the total burned area is 152,777 ha (EU and UNDP, 2013).

Technological hazards include industrial accidents and failures, severe road accidents, accidents with rail vehicles, aircraft crashes and other accidents. Five technological hazards were recorded during the period 2004 – 2006, while more deaths were caused by technological (transport accident) hazards.

Table 1.2. Natural risks profile of Bulgaria according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	47.4%	47.2%	96.2%
Storm	10.5%	-	-
Extreme temperature	21.1%	44.8%	-
Wildfire	10.5%	6.1%	3.8%
Earthquake	7.9%	-	-
Drought	2.6%	-	-
Other	-	1.8%	-

* Economic loss for 10 year average (2005-2014): 51,185.000 $

Source: http://www.preventionweb.net/countries/bgr/data/

CROATIA (Republic of Croatia)

Croatia is a developing economy, a EU member state since 2013, located across Central and South-Eastern Europe, at the crossroads of the Adriatic Sea, the Balkans and the Pannonian Plain.

In 2009, the Government of the Republic of Croatia adopted the Natural and Man-made Catastrophes and Major Disasters Vulnerability Assessment. According to this national assessment, the major hazards affecting Croatia are flooding, which includes river flooding and flash floods, earthquakes and forest fires. The other natural hazards affecting Croatia are: heavy rains, drought, heavy snow, icing on the roads, hailstorm, strong winds and heat waves (WMO, 2012). The costliest hazards in the last decades were drought and extreme temperatures.

Seismic hazard is high especially in Northern Croatia. The exposure to seismic hazard is increased by the presence of densely populated areas and economic active areas (industry, services). One may mention the 1906 earthquake close to Zagreb (Magnitude 6.1); the two 6.2 magnitude earthquakes which occurred in 1923 and 1942 in the border region with Bosnia and Herzegovina; the Ston-Slano earthquakes of 1996 (magnitude 6) which completely destroyed three villages and caused heavy damage in a number of southern Dalmatian cities (EU and UNDP, 2013).

Flooding, which is one of the most frequently occurring natural hazards, affects a major part of Croatia, this state being located within the Danube basin. With about 50% of the territory located below 200 m above sea level, round 15% of the country, containing 57 settlements and 87,000 residents, is prone to riverine floods. Between 1925 and 2000, 23 destructive floods occurred in seven major river basins, severely affecting 85 settlements (EU and UNDP, 2013). Approximately 700 km2 is exposed to flash-floods, occurring especially in mountain areas (Drava and Danube watershed, Dalmatian watersheds).

The ignition and spreading of forest fires is determined by several factors, mainly meteorological: drought, high temperatures and wind speed. These conditions are found in Croatia, therefore forest fires occur throughout the country, especially at the end of spring and during summer, les frequent in the North, the risk increasing toward the South. The main cause of wildfires is human actions/negligence (60% of registered cases, with 3.3% of natural origin, and the remainder unknown) (EU and UNDP, 2013). The vicinity of human settlements requires the involvement of fire fighters and the evacuation of population and tourists, in some cases. Furthermore, the damages are severe: 63,685 ha average annual area burned and $177.5 million economic loses during 2000. In 2007, drought periods in winter and spring, along with hot and windy periods in summer created the perfect conditions for fire ignition and propagation, resulting in the death of 12 people in Croatia.

Although drought has not been considered one of the major hazards affecting the country in the national risk assessment, it causes great economic losses, especially in the agriculture, energy and water sectors. Severe droughts generate highest damages in the Mediterranean region and East Croatia. In the last 20 years severe drought hit the country four times, resulting mainly in reduced crop yields (especially maize). Damage to agriculture caused by drought between 1980 and 2002 was estimated at around $3.23 billion. In 2003 Croatia experienced the most severe drought in 50 years, with water levels in some areas dropping to70% below normal, and reported damages of $330 million (mostly crop damage) (EU and UNDP, 2013).

Croatia also experiences extreme temperature phenomenon. For example, the heat wave which affected the Zagreb, Split, Osijek and Rijeka areas of Croatia in 2007, killed 40 persons and injured 200 persons. On the other hand, the icing episode in 2014 in the Gorksi kotar mountain region caused damages on power systems, forests and vegetation worth more than 300 million euros.

Table 1.3. Natural risks profile of Croatia according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	40.9%	-	11.6%
Storm	4.5%	-	-
Extreme temperature	22.7%	97.9%	34.9%
Wildfire	22.7%		5.5%
Earthquake	4.5%	-	-
Drought	4.5%		48.0%
Other	-	2.1%	-

* Economic loss for 10 year average (2005-2014): 8,000.000 $

Source: http://www.preventionweb.net/countries/hrv/data/

CYPRUS (Republic of Cyprus)

Cyprus is a large island in the Mediterranean Sea, the third largest after Sicily and Sardinia. The southern part of the country (approximately 57%) is controlled by the Republic of Cyprus, while the other part is occupied by the Republic of Turkey. According to CRED EM-DAT 2015, the most frequent hazards occurring in Cyprus are extreme temperature phenomena, drought and storms, the latter also having the most severe economic consequences. However, earthquake is the hazard with the most important contribution to the average annual loss.

The recorded data showed that the seismicity of Cyprus is highest in the South-West and Southern part of the island. During the last 100 years, at least 500 earthquakes with epicenters in the vicinity of the broader Cyprus area were felt in parts of the island. Out of these, 15 caused damage and some of them unfortunately caused victims (RoC, 2015). Recent studies demonstrate a number of 0.7 earthquakes with a magnitude higher than 7.0 with a return period of 153 years and a number of 50 earthquakes with a magnitude higher than 5.0 with a return period of 2 years.

In the last decades, the consequences of climate change, especially rising temperatures, heat weaves and dry winters facilitated the increase of drought periods in Europe. Cyprus is situated in an area likely to be affected by climate change and therefore, prone to droughts. For example, in 2008, after a period of 4 consecutive years of low rainfall, the drought situation reached a critical level, water being supplied by tankers from Greece (EEA, 2010).

Also, Cyprus has identified pandemics and/or epidemics as a main risk hazard. It must be mentioned that Member States tend to focus on an assessment of pandemics based on the greater severity and the geographical scope of this hazard (EC, 2014).

Table 1.4. Natural risks profile of Cyprus according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Storm	22.2%	-	69.7%
Extreme temperature	33.3%	96.8%	-
Wildfire	11.1%	-	-
Earthquake	11.1%	3.2%	30.3%

Drought	22.2%	-	-

Source: http://www.preventionweb.net/english/hyogo/gar/2015/en/home/data.php?iso=CYP

CZECH REPUBLIC

Floods are considered one of the two most frequent hazards reported for Czech Republic (EC, 2014), while the economic implications raised by flood risks are the highest (Tab. 1.5). In contrast to other countries which feature coastal areas, Czech Republic can be mainly affected by river flooding and flash flooding. Due to the geographical position of the country, the floods cannot be considered a consequence of direct climate change effects (KAMEDO 88, 2002), but rather a risk associated to under-investment in national flood defense strategies (RMS, 2003). However, when considering the impacts of global climate change, the flood risk of Czech Republic is associated with the storm risk. Storm hazard is generated by severe weather phenomena, where thunderstorms and gale-strong winds which often characterize the storm phenomenon are furthermore linked to hurricane hazards (EC, 2014).

Earthquakes have been reported to represent a low risk in Czech Republic, but they can cause dam breaks which further lead to flooding (Ranguelov et al., 2007). The combined consequences of earthquakes and flooding as a secondary effect of an earthquake can have a great impact on the Czech population, the vulnerability of the inhabitants being increased due to under-investment of prevention flood programs (KAMEDO 88, 2002).

Another hazard for the Czech population is represented by pandemics (EC, 2014). Many EU Member States have indicated the need to include pandemics in future disaster risk management strategies and suggested to prioritize pandemics among the main hazards. Even though pandemic forecasting is extremely hard, due to the lessons learnt from past disasters, pandemics can be associated with flood events. As Czech Republic and neighboring states present a high risk to floods, the possibility of pandemic events to occur is increased. A more localized viral impact can be generated by epidemics, which may feature an increased frequency then pandemics. The Czech authorities have reported also the risk of epizootics (EC, 2014) since the diseases generated by these epidemics can pose a threat to human health, even though the transmissibility rate is lower than in human-to-human cases as in pandemics.

Climate change may be one of the causes for epidemic outbreaks due to elevated temperatures which favor the development of fertile environments for various diseases. Taking in consideration that extreme temperatures have been identified as the deadliest risk for the Czech population (Tab. 1.5), the effects of climate change can exhibit a severe impact on Czech Republic.

Table 1.5. Natural risks profile of Czech Republic according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	56.5%	17.2%	96.3%
Storm	26.1%	1.7%	3.7%
Extreme temperature	17.4%	81.1%	-

* Economic loss for 10 year average (2005-2014): 152,611.000 $

Source: http://www.preventionweb.net/countries/cze/data/

DENMARK (Kingdom of Denmark)

Denmark is the smallest country in Scandinavia, a Northern region of Europe. It is a low risk area, natural and technological disasters occurring rarely and with modest consequences.

However, Denmark faces meteorological and hydrological hazards every year: flooding and extreme weather phenomenon in the coastal regions.

In the recent decades, heavy rains and cloudbursts are types of extreme weather which occurred with a higher frequency and with severe consequences. The Danish Meteorological Institute (DMI) defines heavy rain as rainfall exceeding 24 mm in six hours locally within the area, while cloudburst is a term for a brief powerful downpour and is defined as rainfall exceeding 15 mm in 30 minutes locally within a warning area (DEMA, 2013). For example, cloudburst of 2 July 2011 was the costliest natural incident in Denmark since the hurricane of 1999 and, according to a Swiss reinsurance company, the costliest single incident in Europe in 2011. The impact was mainly on infrastructure: power outages, no heating, disruption of train services, closing of motorways, breakdown of IT systems.

Winter storms also occur, bringing high winds and extensive flooding, especially along the coast. Hurricanes and storms that hit Denmark originate along the polar front, the conditions that produce them existing most often in autumn and winter. A hurricane is characterized by a wind speed of over 33 meters per second (m/s) and a storm is characterized by a wind speed between 25 and 33 m/s (DEMA, 2013). The Danish Meteorological Institute (DMI) has registered 76 storms and hurricanes in Denmark since 1950, most of these occurring during the winter months. Some of the most damaging storms affecting Denmark were Anatol, in December 1999 (27 fatalities, EUR 3 billion overall losses, EUR 2.4 billion insured losses, more than 160,000 homes without power, considerable damage to Scandinavian and Baltic forests); Lothar, Martin, in December 1999 (151 fatalities, about 3.5 million people affected in France, Switzerland, Germany, Denmark, Sweden, Poland, Lithuania, Austria and Spain, EUR 15.5 billion overall losses, EUR 8.4 billion insured losses, generalized damages to housing and transportation systems); Kyrill in January 2007 (46 fatalities, EUR 7.7 billion overall losses, EUR 4.5 billion insured losses in Germany, Austria, Czech Republic, the United Kingdom, France, Belgium, Poland, the Netherlands, Denmark, Switzerland, and Slovenia, hundreds of thousands of households in half a dozen countries affected by power cuts; forests heavily affected) (EEA, 2010).

A storm surge is a flood caused by an extremely high sea water level due to stormy weather. The Wadden Sea coast is the most exposed area, but other low-lying areas along the west coast of Jutland are also affected. The tidal range is only 2 m, but during storm surges, however, the water-surface set-up is very important (Moller, 1997). Under extreme conditions, wind in the North Sea is known to be able to increase the sea water level by up to 5-6 metres. In the Wadden Sea, heightened water level, in which the effect of wind accounts for 2-2.5 metres, occurs a few times every year (DEMA, 2013).

Other identified hazards in the National Risk Profile were: pandemic influenza, animal diseases and zoonoses, transport accidents, accidents with dangerous substances on land, marine pollution accidents, nuclear accidents, terrorist acts and cyber-attacks. Out of these, pandemic influenza has critical overall consequences, while animal diseases and zoonoses have serious consequences. Among man-made incidents, nuclear accidents have critical consequences, and the other three types of accidents (transport accidents, accidents with dangerous substances on land and marine pollution accidents) have serious consequences.

In Denmark, influenza is a common contagious disease occurring every year between November and April, affecting 5-10% of the entire population. Every 2-3 years on average, an outright flu epidemic occurs, normally lasting 4-6 weeks and typically with around 20% of the population infected. The infected population usually recovers after a few days in bed, but there are several cases of complications, ending in death. Pandemic flu occurs a few times every century and can spread globally, regardless of seasons. In Denmark, the last pandemic flu was the A (H1N1) flu, in 2009. There were 4,642 confirmed cases and 30 laboratory confirmed deaths, a mortality rate lower than any annual seasonal flu epidemics (DEMA, 2013).

Table 1.6. Natural risks profile of Denmark according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Storm	90.9%	100%	84.8%
Drought	9.1%	-	15.2%

* Economic loss for 10 year average (2005-2014): 140,000.000 $

Source: http://www.preventionweb.net/countries/dnk/data/

ESTONIA (Republic of Estonia)

Estonia is situated in Northern European, in the Baltic region. The main hazards identified are extreme temperatures and storms, their occurrence generating human victims, as well as economic losses.

Severe weather is one hazard considered major in Estonia (EC, 2014). The national risk assessment also identifies storms as particularly high risk hazards. For example, the storm Anatol, in December 1999 affected Germany, Sweden, Lithuania, Poland, Latvia and Estonia: 27 fatalities, EUR 3 billion overall losses, (EUR 2.4 billion insured losses), more than 160,000 homes without power, considerable damage to Scandinavian and Baltic forests. The storm Gudrun and Erwin, in January 2005, impacted Ireland, the United Kingdom, Denmark, Sweden, Norway, Finland, Germany, Estonia, Lithuania, Latvia, the Netherlands and Poland: 16 fatalities, EUR 4.5 billion overall losses, (EUR 2 billion insured losses) (EEA, 2010).

The risk of extreme hot temperatures and heat wave has a high probability occurrence, although its impact is considered limited.

The national risk assessment also identifies wildfires and forest fires as important threats, regardless of the season. One severe forest fires could have more damaging consequences than many small ones (EC, 2014).

Estonia also identified pandemics and/or epidemics as a main risk hazard, in the "very high-risk emergencies" category. Pandemics, although with a low occurrence probability have important human impacts on health and indirect socio-economic impacts, affecting the entire society and day-to-day life. Furthermore, it must be emphasized the cross-border dimension of this hazard.

Industrial/chemical accidents are also a risk considered in Estonia. Nuclear and/or radiological accidents are important, due to their severe consequences: land/water contamination, longer-term health complications due to exposure to radiation (cancers) or psychological stress and important economic costs due to losses in the agricultural sector, reduced tourism and affected industrial production (EC, 2014). One must also emphasize the transboundary dimension of this hazard, three nuclear power stations being closer to Estonia (Ignalina, Sosnovy Bor, Loviisa).

Table 1.7. Natural risks profile of Estonia according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues
Storm	33.3%	-	100%
Extreme temperature	66.7%	100%	-

Source: http://www.preventionweb.net/countries/est/data/

FINLAND (Republic of Finland)

Finland is a sovereign state in Northern Europe, one of the safest countries to live in from the geomorphological point of view: earthquakes are very rare, volcanism is unknown and the landslides generate minor damages. However, storms and flooding have a high occurrence probability and cause significant economic losses.

Storms are included in the extreme weather phenomenon, and they are one of the most intense events in Finland. They wind speed usually exceeds 20 – 21 m/s. It is a widespread phenomenon and its consequences can be significant, affecting the normal functioning of the society. Examples of such storms include Mauri, in Sept. 1982, Janika, in Nov. 2001, Gudrun and Erwin, in Jan. 2005 (16 fatalities, EUR 4.5 billion overall losses, EUR 2 billion insured losses in Ireland, the United Kingdom, Denmark, Sweden, Norway, Finland, Germany, Estonia, Lithuania, Latvia, the Netherlands and Poland) (EEA, 2010).

The main cause for flooding in Finland is snowmelt (given the long period of winter: 5 month in South and 8 months in Northern Finland). The second type of floods which pose a severe threat are those caused by summer and autumn rain (Koutaniemi, 1997). Floods can generate severe impacts on human health, environment, infrastructure and economic activity. In Finland, the average losses due to floods are less than one million euros per year. It is worth mentioning the storm water flood in Pori on 16 August 2007 generated approximately EUR

20 million worth of damage to buildings, personal belongings and vehicles. Flooding due to spring and autumn rainfalls peaked in 2012 at approximately EUR 10 million, and in 2013 the combined damage caused by spring flooding in the whole of Finland was approximately EUR 5 million (MoI Finland, 2016).

The likelihood of a new pandemic outbreak is considered high in Finland (MoI Finland, 2016). An influenza pandemic is a nee spreading epidemic circulating in the world, with a morbidity exceeding the normal seasonal influenza. The infection may cause serious illnesses in all age groups, and its direct impact affects not only the health care system, but the entire society.

From the technological point of view, Finland has a high risk of nuclear accidents. Two nuclear power plants are situated in Finland, and two other nuclear facilities are located in Russia and one in Sweden. A radiation hazard could be caused either by an accident in a Finnish nuclear power plant or in a nearby foreign facility.

Table 1.8. Natural risks profile of Finland according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues
Flood	33.3%	-	-
Storm	66.7%	-	100%

Source: http://www.preventionweb.net/countries/fin/data/

FRANCE (French Republic)

France is one of the largest countries in the Europe, with a great variety of landscapes. Therefore, there are numerous types of hazards affecting the environment and the population. In the period 1998 – 2009, France was affected by 56 disasters, summing a total of more than 20,000 fatalities (EEA, 2010).

The river system in France displays a diverse set of conditions reflecting differences of hydrology and response to meteorological events. In recent years, flooding was the most important natural hazard affecting France, in terms of economic losses: the winter storms and flooding in December 2003 causing over EURO 1,6 billion in losses and 7 people killed. It must be also mentioned the flood in September 2002, with 23 people killed and economic losses of EUR 1,5 billion and the flood in November 1999, with 33 people killed and economic losses of EUR 570 million. Also, there was recorded an increase in the frequency and magnitude of extreme flood events: most flash-floods took place since the beginning of the 20th Century, in the North-western European Alps (www.climatechangepost.com).

The heat waves that affected France in 2003 and 2006 had enormous social, economic and environmental negative effects. The heat wave in 2003 began in June and continued until mid-August. It was estimated that this was the hottest summer since at least 1500 (Luterbacher et al., 2004), the temperatures being 20 – 30% higher than the season average in Celsius degrees. In France temperatures reached 40 °C and remained unusually high for two weeks (UNEP, 2004). The number of recorded casualties in France was 14,802, using a method from the National Institute of Health and Medical Research (INSERM, France). The hot temperatures were accompanied also by dry weather, with significant water deficit. This resulted in lowered crop yields: potatoes, tobacco, wine production, green fodder. The heat wave also affected the nuclear reactors, which are usually cooled down by river water and the energy sector. The demand for electricity by the population increased. In this situation, France had to reduce its energy exports by more than half. The heat wave in 2006 persisted from the end of June until the end of July. In terms of fatalities, Belgium, France and the Netherlands were the most affected.

The danger posed by avalanches increased with the development of winter tourism. Avalanches are natural phenomenon and their occurrences are usually not noticed. However, in the past years, the fatalities occurred in connection with snow sports, and not in relation to natural catastrophic avalanches. In France, most snow avalanches occur in the Alps but there are subsidiary areas at risk in the Pyrenees, the Massif Central and the Jura (Joly et al., 1997).. Many fatalities were caused by avalanches in secured areas or in sports area: Les Orres (1998, 11 fatalities), Montroc (1999, 12 fatalities), Mont Blanc (2008, eight fatalities).

In the summer of 2010, France was affected by wildfires, which broke out to the extended drought period and whose spreading was facilitated by strong winds. In the period 2000 – 2009, there were recorded a number of 31 fatalities (EEA, 2010).

According to CRED EM-DAT 2015, the majority of economic losses in France were generated by storms. The most important such events in terms of economic losses were the storms Lothar and Martin in late December 1999 and Kyrill in January 2007. The former two storms affected about 3.5 million people in France, Switzerland, Germany, Denmark, Sweden, Poland, Lithuania, Austria and Spain, caused 151 fatalities and insured losses of EUR 8.4 billion (overall losses amounted to EUR 15.5 billion). France's forestry sector was especially damaged. The latter caused 46 fatalities and insured losses of around EUR 4.5 billion (EUR 7.7 billion of overall losses) in Germany, Austria, the Czech Republic, the United Kingdom, France, Belgium, Poland, the Netherlands, Denmark, Switzerland and Slovenia (EEA, 2010).

Table 1.9. Natural risks profile of France according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	34.0%	-	17.7%
Storm	43.0%	-	67.3%
Extreme temperature	13.0%	97.5%	14.8%
Wildfire	5.0%	-	-
Drought	2.0%	-	-
Landslide	3.0%		
Other	-	2.5%	-

* Economic loss for 10 year average (2005-2014): 992,500.000 $

Source: http://www.preventionweb.net/countries/fra/data/

GREECE (Hellenic Republic)

Greece is a country in South - Eastern Europe and it is bordered to the East by Turkey and the Aegean Sea, to the North by Albania, Republic of Macedonia and Bulgaria, to the West by Ionian Sea and to the South by the Mediterranean Sea.

Greece is the most seismically active region in Europe due to its location: the African plate is subdued under the Eurasian plate and runs through the Mediterranean Sea (EEA, 2010). According to CRED EM-DAT 2015, earthquakes occupy the first place in terms of mortality and economic losses, as it can be seen in the table below (Tab. 1.10). It must be mentioned the earthquake event from September 1999, which had a moment magnitude of Mw 5.8 and caused more than 140 deaths and left 70,000 people homeless, damaged partly or totally more than 30,000 buildings and caused economic losses of about EUR 4 billion (EEA, 2010).

Moreover, due to the tectonic plates, Greece is also exposed to the risk of tsunamis in the Aegean Sea region. For example, the earthquake from 1956 in the South-Central area of the Aegean Sea, with a magnitude of 7.8, generated local tsunamis which caused more damage (Dominey-Howes, 2002; Okal et. al, 2009). According to Galanopoulos (1960) the highest waves (20-25 m) were recorded in the North coast of Astypalaea and in the South coast of Amorgos. This event caused 53 deaths, 100 injuries and severe economic losses in Greece (Okal et. al, 2009).

Due to its geographic position (Southern-Eastern Europe), Greece is also exposed to drought, strong winds and hot temperature which increase wildfire probability (EC, 2014). According to Sarris et. al. (2014) in the summer of 2007, 280.000 ha of Greece surface burnt, causing more than 60 fatalities and thousands of people were left homeless (Sarris et al, 2014). Every year, Greece along with Italy, Portugal, Spain and France account approximately 85% of the total burnt area in Europe (EC, 2014; EEA, 2010). According to CRED EM-DAT 2015, wildfire is the second hazard in terms of economic losses and mortality in Greece, after earthquakes.

On the other hand, the most frequent natural hazard in Greece is flooding. In Greece, floods are mainly caused by intense rainstorms. The areas that are particularly exposed to floods are: closed hydrological basins in karst areas, river floodplains and urban areas (Mimikou and Koustoyannis, 1995). According to EEA (2010) the worst flooding event in Greece in the last 50 years, occurred in 2006 March 13 and caused economic issues of EUR 410 million.

Table 1.10. Natural risks profile of Greece according to CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Earthquake	28.3%	50.9%	52.6%
Extreme temperature	7.5%	13.4%	-
Flood	37.7%	10.8%	11.5%
Storm	9.4%	2.0%	3.2%
Wildfire	15.1%	22.9%	23.1%
Drought	-	-	9.5%
Other	1.9%	-	0.1%

* Economic loss for 10 year average (2005-2014): 220,566.000 $

Source: http://www.preventionweb.net/countries/grc/data/

HUNGARY

The main risks evaluated for Hungary are listed in table 1.11. Flood is the most frequent hazard that can affect Hungary and its economic implications are the greatest in case of disaster propagation. Hungary has mostly experienced river flooding, while floods from other sources were less common (EC, 2015). Nearly one quarter of the country is assessed as prone to flooding events and the future flood risk is expected to increase due to larger precipitation volumes which are forecasted (HMEV, 2009). Due to the Hungarian topography, plains and flat lands are most exposed to this hazard when the precipitation water exceeds the infiltration capacity in the soil, while restricted areas are prone to local heavy rainfall which leads to flash flooding (Farago et al., 2010).

In Hungary, like in most EU Member States, the hazards which generate a great impact on human population in terms of loss of life are the ones associated with extreme temperatures. Climate scenarios indicate an increase of the average temperatures especially during the summer season, and increased rainfalls in the summer and winter seasons. The regions characterized by flat topography experience the highest temperatures and have the lowest annual precipitation (Mezösi et al., 2013), so the inhabitants of these areas are the most exposed to heat waves. Storms have been evaluated to have a similar frequency with extreme temperature events (Tab. 1.11), but its impact on Hungarian population is considerably reduced compared to previous phenomena.

In a large part of Hungary which is characterized by flat topography, the increased temperatures combined with reduced precipitations are leading to drought hazard. Hungary is known for experiencing long periods of drought, but the severity of these phenomena has increased in the last years (Somlyódy and Simonffy, 2004). The greatest impact is directly generated on the agriculture crops, determining considerably high economic losses, and secondly, the consequences are extended to the food supply of the population. Based on climate change scenarios (Mezösi et al., 2013), it is estimated that the severity of drought periods will increase and droughts will become a serious problem for Hungary until the end of the 21st century.

Medium seismic risk has been appointed to Hungary, but some high populated regions (Budapest-Kecskemét) were identified with high seismic activity, so the vulnerability to earthquakes may be increased in urban communities (EC, 2014).

Table 1.11. Natural risks profile of Hungary according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	53.6%	-	64.1%
Extreme temperature	17.9%	90.9%	-
Storm	17.9%	7.7%	-

Drought	7.1%	-	35.2%
Earthquake	3.6	-	-

* Economic loss for 10 year average (2005-2014): 49,800.000 $

Source: http://www.preventionweb.net/countries/hun/data/

IRELAND (Republic of Ireland)

Ireland is an island in the North Atlantic and it is the third-largest island in Europe. Due to its geographical position, Ireland is a country which is less exposed to natural disasters (OEP, 2012). Natural risks in Ireland are rather associated with extreme weather conditions such as floods and storms (Bruen and Gebre, 2011). According to CRED EM-DAT 2015, storms present a higher percent in terms of frequency, mortality and economic losses than floods, as it can be seen in the table below (Tab. 1.12.). Generally, Ireland experiences storms of low impact in West and Northwest parts of the country few times a year and storms with a moderate impact every two or three decades (OEP, 2012). An example of such a storm event in Ireland is the one from January 2005, when it caused 16 fatalities, EUR 4.5 billion economic losses in Ireland, Denmark, Sweden, Norway, Finland, Germany, Estonia, Lithuania, Latvia, the Netherlands, the United Kingdom and Poland (EEA, 2010). In recent years, Ireland also experienced significant floods, mainly fluvial floods due to the heavy rainfall periods. For example, the rainfall from October/November 2009 caused a severe flooding. Due to the flooding, more people were evacuated and some buildings and houses were damaged (OEP, 2012).

Other natural risks correlated with severe weather phenomenon in Ireland are extreme low temperature and droughts/heat waves which can increase the risks of forest fires and can have a severe impact on the agriculture sector.

Table 1.12. Natural risks profile of Ireland according to CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues
Flood	23.5%	23.8%	53.5%
Storm	76.5%	76.2%	46.5%

Source: http://www.preventionweb.net/countries/irl/data/

Regarding pandemics and epidemics, these are considered main risk hazard in Ireland (EC, 2014).

ITALY (Italian Republic)

Italy is a country in Southern Europe and it is located in the Mediterranean Sea and borders France, Switzerland, Austria and Slovenia to the North.

According to CRED EM-DAT 2015, Italy is vulnerable to many natural hazards, as it can be seen in the table below (Tab. 1.13). Moreover, the risks of earthquakes, landslides and volcanic eruption can increase the probability and consequences of transport accidents and loss of critical infrastructure (EC, 2014).

Table 1.13. Natural risks profile of Italy according to CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Earthquake	15.5%		44.5%
Extreme temperature	11.3%	96%	8.0%
Flood	36.6%		37.5%
Storm	12.7%		3.4%
Wildfire	8.5%		3%
Drought	4.2%		3.5%
Landslide	8.5%		
Volcano	2.8%		
Other		4.0%	0.1%

* Economic loss for 10 year average (2005-2014): 2,249,760.000 $
Source: http://www.preventionweb.net/countries/ita/data/

Ones of the highest risk hazards in Italy are floods and flash floods, which according to CRED EM-DAT 2015 are very important due to the economic losses. Floods, along with landslides are spread in Italy and cause injuries every year. For example, the storm from November 1994 (Po valley) caused 42 fatalities due to the landslides and 55 deaths and 85 injured people due to the floods from several provinces (Guzzetti et al., 2005).

Another frequent natural hazard in Italy is earthquake, which is also the most important hazard in terms of economic losses. For example, the L'Aquila earthquake from April 2009 which occurred in the town of L'Aquila and in the surroundings in Central Italy killed 308 people. It had an Mw 6.3 main shock and it is considered to be the most damaging earthquake in Italy since the earthquake from 1980 which had a Mw 6.9 (Cultera et al., 2011).

The volcanic activity also represents a very high risk in several locations of the country, due to the three main active volcanoes: Mount Vesuvius, Mount Etna and Mount Stromboli. Mount Etna is located on the Eastern coast of Sicily and it is characterized by continuous eruptive activity. It is well known that Mount Etna is the largest stratovolcano in Europe, the most active volcano in the world and the most important due to the emission of thousands of tons of gases and particles into the troposphere (Calabrese et al., 2016).

LATVIA (Republic of Latvia)

Latvia is a country in the North of Europe and it is bordered to North by Estonia, to South by Lithuania and to East by Russia and to the West to the Baltic Sea.

Due to the geographical location and climate, Latvia is a country exposed to extreme temperatures, storms and floods. Extreme temperatures are the most frequent, have the most severe mortality and economic losses in Latvia, as it can be seen in the table below (Tab. 1.14). According to EEA (2010), the cold spell from 2001 October-December caused 431 fatalities in Latvia, Lithuania, Poland, Hungary, Romania and Turkey.

According to CRED EM-DAT 2015, storm is the second natural disaster in Latvia, in terms of frequency and mortality. For example, the winter storm Gudrun, from 2005 January which hit Denmark, Ireland, Estonia, Finland, Germany, Estonia, Latvia, Lithuania, Poland, Norway, Sweden and United Kingdom, caused 16 fatalities and EUR 4.5 billion economic losses (EEA, 2010). In Latvia, the wind gusts recorded were up to 40 m/s and it was considered the worst storm which hit Latvia in the last 40 years. The storm caused over 7 million m^3 of forest damage, affected about 40% of the total shore line, damaged 54.000 km of distribution lines and caused total economic losses estimated to EUR 195 million (Hellenberg and Visuri, 2014; www.climatechangepost.com; www.latvianhistory.com).

Table 1.14. Natural risks profile of Latvia according to after CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues
Extreme temperature	57.1%	93.5%	100%
Storm	42.9%	6.5%	-

Source: http://www.preventionweb.net/countries/lva/data/

Apart from natural disasters, Latvia is susceptible to chemical, biological, radiological and nuclear accidents (e.g. the chemical accident from 2009 in Riga; the oil spill in the Daugava River from 2007; the diphtheria epidemic from 2000 which affected 102 people; etc.) (Hellenberg and Visuri, 2014).

LITHUANIA (Republic of Lithuania)

Lithuania is a country in the Northern Europe and it is bordered to the North by Latvia, to the East by Belarus, to the South by Poland and to the West by Baltic Sea.

During the last two decades, Lithuania didn't experience any large scale natural or technological disasters. Although natural disasters are rare due to the geological and climate conditions, floods, storms and forest fires are the most frequent natural hazards in this country (Hellenberg and Visuri, 2013) while earthquakes and landslide are considered to be the rarest ones (Lithuania report, 2005). Regarding floods, the sudden melting of snow or ice plugs seems to be two of the five main causes for flood disasters. The increasing risk for forest fires is also the result of severe weather events (heat waves, droughts) (EC, 2014).

In Lithuania, extreme temperatures are the most frequent natural disaster causing high mortality rates. Extreme temperatures in Lithuania include heat waves, drought and cold spill (EC, 2014). An example of such event is the heat wave from Jun 1999, which caused 32 fatalities in Lithuania (EEA, 2010).

Storm is the second natural disaster in terms of frequency and mortality in Lithuania. An example of such disaster is the winter storm Gudrun, from 2005 January. It caused 16 fatalities and economic losses of 4.5 billion EUR in Lithuania, Denmark, Ireland, Estonia, Finland, Germany, Estonia, Latvia, Poland, Norway, Sweden and United Kingdom (EEA, 2010).

Table 1.15. Natural risks profile of Lithuania according to CRED EM-DAT, (Feb. 2015)

Natural Hazard	Frequency	Mortality	Economic issues*
Extreme temperature	36.4%	87.1%	-
Storm	27.3%	8.6%	11.2%
Drought	18.2%	-	88.8%
Flood	18.2%	4.3%	-

* Economic loss for 10 year average (2005-2014): 25,557.000 $

Source: http://www.preventionweb.net/countries/ltu/data/

Pandemics and epidemics are considered a main risk hazard in Lithuania. Regarding technological/man-made risks, Lithuania is exposed to nuclear, chemical and transport accidents risks, as well as the risk of contamination and environmental pollutions (EC, 2014).

LUXEMBOURG (Grand Duchy of Luxembourg)

Luxembourg is a country with 2.590 square kilometers in Western Europe and it is bordered to the East by Germany, to the West and North by Belgium and to the South by France.

In the table 1.16 below, one can distinguish the frequency, mortality and economic issues concerning natural disasters in Luxembourg between 1990 and 2014, according to the CRED EM-DAT 2015.

Regarding natural disasters, Luxembourg is a country exposed to extreme temperatures, floods and storms. According to CRED EM-DAT 2015, extreme temperatures have a mortality rate of 100% as you can see in the table below. An example of extreme temperature event is the one from July/August 2003, when heat waves caused 70,000 fatalities in Luxembourg, Austria, Belgium, Czech Republic, France, Germany, Italy, the Netherlands, Portugal, Slovakia, Slovenia, Spain, Switzerland and United Kingdom (EEA, 2010).

Table 1.16. Natural risks profile of Luxembourg, 1990-2014 (after CRED EM-DAT)

Hazard	Frequency	Mortality	Economic issues
Extreme temperature	10.0%	100%	
Flood	10.0%		2.4%
Storm	80.0%		97.6%

Source: http://www.preventionweb.net/countries/lux/data/

MALTA (Republic of Malta)

Malta is an island country in Southern Europe. According to the World Risk Index 2015, Malta is one of the countries less vulnerable to natural disasters, being the second safest place in the world after Qatar (UNU-EHS, 2015). Nevertheless, Malta is exposed to landslides along the North-Western coast. Due to the existence of extensional faults and due to the different geomechanical properties of the rock masses, Malta is exposed to the lateral spreading/rock spreading phenomena.

Malta has a Mediterranean climate, with an average annual temperature of 18 °C. The highest temperatures are in July and August, which presents rare precipitations. On the other hand, winters are rarely cold and from October till January are about 70% of the average annual precipitations (550 mm), which are generally related to thunderstorms. Sometimes precipitations can generate floods in lowland areas (Mantovani et al., 2013).

NETHERLANDS (Kingdom of Netherlands)

Netherland's assessment of coastal and inland floods has indicated coastal flooding as the worst credible risk scenario (EC, 2014). However, the flood protection system in the Netherlands has the highest safety standards in the world, reason for which it can be considered a model for flood risk management to other countries (Ten Brinke et al., 2010). This is the reason for which floods are not recorded among the most frequent risks in Netherlands (Tab. 1.17), even though almost two thirds of Netherlands is prone to flooding according to national authorities.

The most severe risks are associated to weather hazards, storms being identified as particularly high risk hazards for Netherlands. The frequency and intensity of severe storms is expected to increase until the end of the 21st century as a consequence of elevated CO_2 emissions (Dorland et al., 1999). If no reduction measurements will be undertaken for CO_2 emissions, the number of severe storms is anticipated to rise by 20-30%, which is the equivalent of nearly 10 more storms over the period 2071-2100; also the top wind speeds may increase by 2-16%. The speed of the wind is a determining factor in the damaging effects of severe storms, being anticipated that a 2% increase in storm wind speed could increase the average annual damage to 80%, while 6% could generate an increase even to 500% (Dorland et al., 1999).

Other risks associated to weather hazards are the extreme temperature events characterized by hot temperatures and heat waves or low temperatures associated with snow and ice that can be prone to sudden melting. Netherlands reports both risks, indicating these hazards as high likelihood events (EC, 2014). Even though the implied economic issues are among the lowest (Tab. 1.17), extreme temperatures generate a great impact on the human population, determining the highest mortality rate. The impact on the population is expected to increase due to other hazards that can be associated to extreme temperature (e.g. flooding due to unexpected snow/ice melt, wildfires during hot summer periods).

Particularly to Netherlands are the earthquakes generated by gas extraction, where the prolonged period of activity in Groningen has led to frequent earthquakes of increasing magnitude (van der Sar, 2014). However, measurements are being taken to limit the impact on population, so that no significant threat to be exhibit to human safety.

Table 1.17. Natural risks profile of Netherlands after CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Storm	66.6%	-	84.3%
Extreme temperatures	18.5%	98.2%	2.2%
Flood	11.1%	-	13.5%

Earthquake	3.7%	-	-

* Economic loss for 10 year average (2005-2014): 68,800.000 $

Source: http://www.preventionweb.net/countries/nld/data/

POLAND (Republic of Poland)

Poland is a country in Central Europe, which is bordered to the North by Lithuania, to the North-West by the Baltic Sea, to the North-East by Russia, to the West by Germany, to the South by Slovakia and Czech Republic and to the East by Ukraine and Belarus.

Due to its geographic location and due to its relief, Poland is highly vulnerable to extreme temperatures, which are the main hazards in terms of frequency and mortality. Along with heat waves, droughts and cold spills, extreme temperatures also include sporadic events such as: freezers, rime, glaze and hailstorms, which commonly produce fewer losses (Ustrnul et al., 2015; EC, 2014). An example of extreme temperature event in Poland is the cold spell from October 2002, which caused 183 fatalities (EEA, 2010).

According to CRED EM-DAT 2015 (Tab. 1.18) are second hazards in terms of frequency and have a mortality rate of 2.4% from the total mortality rate due to natural disasters in Poland between 1990 and 2014. Nevertheless, the storm from December 1999 caused 151 fatalities, 3.5 million affected people and economical losses of about EUR 15.5 billion, in Poland, France, Germany, Switzerland, Sweden, Denmark, Lithuania, Austria and Spain.

On the other hand, floods are the most important hazards in Poland in terms of economic losses. For example, the floods from 2001 July 25, generated by torrential rains and dyke failure of the Wisla River, caused economic losses of about EUR 810 million and 25 fatalities (EEA, 2010).

Table 1.18. Natural risks profile of Poland according to CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Extreme temperature	39.5%	89.9%	
Flood	23.7%	5.8%	97.1%
Storm	34.2%	2.4%	2.9%
Wildfire	2.6%		
Other		1.8%	

* Economic loss for 10 year average (2005-2014): 333,590.000 $

Source: http://www.preventionweb.net/countries/pol/data/

Regarding epidemics and pandemics, according to European Commission (2014) pandemics are seen as the second highest risk hazard in Poland.

PORTUGAL (Portuguese Republic)

The main natural risks reported for Portugal are listed in table 1.19. Floods are considered the most frequent risk for the population, and they can be divided in fluvial floods and coastal floods. Even though about 60% of the population inhabits the coastal zone, rising to 80% in the touristic periods, coastal floods have been reported as an ancillary type of flood by the Portuguese authorities (PT FHRM Report, 2015). Fluvial floods are distinguished between large river floods which are caused by heavy rains that may persist for long periods (e.g. weeks), and flash floods which are caused by heavy and concentrated rainfall. Flash floods are considered to have more devastating consequences than large river floods by affecting the drainage basins and due to their reduced time of prediction the prevention measurements are limited (PEA, 2009). Since Portugal has an increased risk of storms, the frequency of floods is directly influenced, thus increasing the negative consequences by the accumulation of these two risks.

Wildfires are another highly predominant hazard for Portugal, and the economic losses are the greatest for this type of risk. Portugal was mentioned among the main five countries affected by wildfires (EC, 2014), and which represent approximately 85% of the total burnt area at European level. High temperatures, drought and strong winds are the main conditions which determine fire ignition. All these conditions have been reported to represent natural risks by their own (Tab. 1.19), therefore wildfires are considered to generate a high impact on Portugal especially during the summer season. The main negative effects are represented by the destruction of natural landscape, which furthermore affects the local ecosystems and generates a decrease of the biodiversity in the area.

The most deadly risk for the Portuguese population is represented by the extreme temperatures. In contrast to wildfire, which has reduced mortality, but high economic implications, extreme temperatures have the largest impact in terms of loss of live, while the economic costs remain minimal. For Portugal, extreme temperatures mainly include phenomena such as heat waves, which are defined as a prolonged period with extremely hot and/or humid weather patterns for a specific area (EC, 2014). The Portuguese authorities have reported an increase of temperatures with 3-7°C during the summer season in the last years. This change of air temperature increases the frequency and intensity of heat waves, whose consequences affect the vulnerable populations.

Table 1.19. Natural risks profile of Portugal according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	29.6%	2.2%	21.3%
Storm	25.9%	-	4.6%
Wildfire	22.2%	-	52.9%
Extreme temperature	11.8%	95.1%	-
Drought	7.4	-	21.1%
Other	3.1%	2.7%	0.1%

* Economic loss for 10 year average (2005-2014): 327,000.000 $

Source: http://www.preventionweb.net/countries/prt/data/

SLOVAKIA (Slovak Republic)

The primary hazards which can pose a significant impact to Slovakia are listed in table 1.20. Flood risk has been evaluated as the most frequent disaster that can affect the population and due to the continental features of the country, river floods and flash floods are the main types of flooding that can occur. Severe weather events such as heavy rainfalls and/or sudden snowmelt due to unexpected temperature rises are the causes of flooding and due to their imprecise forecasting they can determine an extensive impact on the civil society. Based on recent reports (Jeneiova et al., 2014; Mediero et al., 2015), decreasing trends were detected in annual maximum flood series for the period 1950-2010 in the Central and East part of the country. Still, the human and economic losses generated by flood risks are among the greatest impacts to which Slovakia can be exposed and their consequences are hard to overcome.

The greatest impact on Slovakian population is generated by extreme temperatures, which are a consequence of climate change. Besides casualties due to heat waves as reported in some EU Member States, Slovakia is exposed to avalanches. The consequences of avalanches are extended to damages on infrastructure which increase the economic losses, thus leading to a higher and more spread impact on the inhabitants exposed to avalanche disaster.

Particularly to Slovakia are strong winds, which cause massive loss of forest wood. Reports on two strong winds disasters which occurred in Slovakia in the recent years (1996 and 2005) indicate that 1 million m^3, respectively 5 million m^3 timber were smitten to the ground as o consequence of violent winds which feature this phenomenon (Pavlík and Pavlík, 2003; Martin et al., 2015). Even though the impact is mainly focused on timber losses, this type of hazard can pose a risk to local inhabitants and even to any group of population which is found in a tree area at the moment of wind propagation.

Another risk to which the Slovakian forests are exposed is represented by wildfires. The meteorological conditions are the main causes that determine the occurrence of this hazard, but also human activity was associated to fire ignition. Due to strong wind hazard, the impact of wildfires can be more spread and more sever in Slovakia, thus leading to greater risk for the population.

Table 1.20. Natural risks profile of Slovakia according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	63.2%	32.3%	32.1%
Extreme temperature	26.3%	63.7%	19.1%
Storm	5.3%	-	48.8%
Wildfire	5.2%	3.0%	-

* Economic loss for 10 year average (2005-2014): 2,500.000 $

Source: http://www.preventionweb.net/countries/svk/data/

SLOVENIA (Republic of Slovenia)

The assessment of natural risks in Slovenia has assigned flood hazard with a particularly high level of risk (Tab. 1.21), indicating rivers, groundwater and coastal waters as the main sources of flooding (EC, 2015). Since Slovenia shares two international river basins with neighboring countries, river floods are considered the most common hazard, while coastal and groundwater flooding have been record only seldom. Future flood events are envisaged in the frame of climate change. Based on assessment scenarios, water flows of mountain rivers would increase by 30%, while increased temperatures are expected to rise the risk of flood in the Alpine region due to snow melting events (MESP, 2002). The authorities anticipate warmer and wetter winters, and hotter and drier summer, consequences of climate change which can generate changes in precipitation patterns, and thus increasing the uncertainty of flood disaster forecasting (MESPE, 2002).

Another severe impact on Slovenian population can be generated by storm events. Additionally to flood, storm risk generates the highest economic losses for Slovenia (Tab. 1.21). An explanation for the high economic impact may the damages to critical infrastructure (e.g. electricity networks, telecommunication); being the cause or contributing to flooding events, greater implication is attributed to the overall impact of storm phenomenon.

Extreme temperatures have been reported to have the greatest impact on population, determining the highest mortality rate associated to natural risks in Slovenia (Tab. 1.21). Based on national reports (MESP, 2006), Slovenia is expected to record an increase by 1 to 4ºC of the air temperature in the first half on the 21st century, therefore leading to heat waves during the summer season in coastal regions. The impact of elevated temperatures is anticipated to increase by the end of 21st century due to the warming trend of all seasons: summer with 3.5-8ºC, winter with 3.5-7 ºC, spring with 2.5-6 ºC and autumn with 2.5-5 ºC (MESP, 2010).

Slovenia has also identified earthquakes as a national risk (EC, 2014). Due to topography and geomorphology of the country, landslides or flooding events can be associated to earthquake consequences. The most severe impact is generated on infrastructure and human population, whose vulnerability is increased along the coastal regions.

Table 1.21. Natural risks profile of Slovenia according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	33.3%	-	35.9%
Earthquake	22.2%	-	-
Extreme temperature	22.2%	97%	10.6%
Storm	22.2%	2.0%	52.1%

* Economic loss for 10 year average (2005-2014): 66,200.000 $

Source: http://www.preventionweb.net/countries/svn/data/

SPAIN (Kingdom of Spain)

Based on the EC 2015 final report, Spain has reported the largest number of historic flood events (6165) at European level, thus flood representing the main natural risk for this country. Rivers and surface water are considered the most significant sources of floods, followed by coastal flooding, ground water and artificial structures containing water. Also flooding caused by sewage systems can be listed among flood hazards. Since Spain shares six international river basins with Portugal and France, the frequency of floods is directly influenced also by meteorological phenomena (e.g. heavy rainfall, storms) in the neighboring countries, and a cross-border impact can be generated. The flood consequences are complex and difficult to overcome, including severe effects on human health which may last prolonged periods of time after the flood event (e.g. depression, anxiety).

As in the case of Portugal, the highest impact on population regarding casualties is not registered by the most frequent hazards, but for extreme temperatures which is below the average incidence. Even though the economic issues are kept among the lowest, the mortality is the greatest (Tab. 1.22). Heat waves pose a severe risk especially for urban population during the summer season, and their frequency and impact is expected to rise in the future due the climate changes. Spanish authorities have reported an increase of the average temperature in the last 100 years with 1°C, the highest compared with 0.9°C in the rest of the EU (CCPCC, 2007).

Based on climate change scenarios, the number of floods is expected to decrease in the future, while the phenomena associated with extreme temperatures are estimated to become more frequent. Indirectly, these modifications contribute to drought phenomenon which generates the highest economic issues for Spain, although is reported to have a low frequency (Tab. 1.22). The effects of drought can be classified in three categories based on the generated water stresses: meteorological droughts characterized by a lack of rainfalls along a period of time, hydrological droughts when there are river flows or groundwater deficiencies, and agricultural droughts when soil water is restricted during the growing season (Eisenreich, 2005). Even though this hazard does not pose a threat for the water supply of the population, the impact on the Spanish society is experienced through high economic losses.

Table 1.22. Natural risks profile of Spain according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	29.4%	-	9.4%
Storm	27.5%	-	14.8%
Wildfire	21.6%	-	16.8%
Extreme temperature	11.8%	98.0%	10.4%
Drought	3.9%	-	47.0%
Earthquake	3.8%	-	-
Other	2.0%	2.0%	1.6%

* Economic loss for 10 year average (2005-2014): 594,400.000 $

Source: http://www.preventionweb.net/countries/esp/data/

SWEDEN (Kingdom of Sweden)

Sweden is one of the richest countries in the world and the high level of development allows the existence of a good crisis and security management to possible hazards. Due to well defined prevention strategies, the main risks for Sweden are caused by extreme weather events which are difficult to be forecasted and/or trigger secondary effects that exceed the anticipated consequences. Storm is one of these extreme weather events which is considered the main hazard for Sweden (Tab. 1,23). Powerful storms have been reported to cause uprooting of trees (MES, 2009) and determine a great impact on forest which implies high economic issues for Sweden. An example was Gudrun storm in 2005, when the storm fell was estimated at 75 million m^3 trees which is equivalent of the normal annual harvest of the country (Haanpää et al., 2007). Storms determine also the highest impact on Swedish population, the highest mortality rate being associated to direct consequences of storm disaster, but can also cover the generated consequences from secondary weather events (e.g. flooding).

Sweden shares eight international river basins with Finland and Norway and river flooding is considered one of the hazards that can pose a real risk to the population. Due to the global rise of the sea level, the average water level is expected to rise by 80 cm in the southern SE, 50 cm in the central region and 20 cm in the northern region until the end of the 21st century (SCCV, 2007).

Due to heavy precipitation, Sweden is also exposed to landslides. Beside environmental components as water shores or land surfaces, buildings and local infrastructure are the main factors exposed to landslide damages, so negative impacts can be directly determined on the inhabitants of the risk area. The occurrence of landslide events is increased during the wetter season and clay-rich areas are considered to present an increased risk to landslides.

Regarding extreme weather phenomena, Sweden indicates heat waves a potential hazard that can pose severe impact on human health especially in the coastal regions (EC, 2014).

Table 1.23. Natural risks profile of Sweden according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Storm	85.7%	100%	100%
Extreme temperature	14.3%	-	-

Source: http://www.preventionweb.net/countries/swe/data/

UNITED KINGDOM (United Kingdom of Great Britain and Northern Ireland)

The main natural hazards that can pose significant risks for the United Kingdom are listed in table 1.24. The UK authorities have indicated river flows as the primary sources for flood risk, followed by coastal waves which have the most widespread impact and heavy rainfall which often lead to flash flooding, a dangerous type of risk (EC, 2015). Under the influences of climate change, which generates rising of the sea level and more intense periods of heavy rainfall (DECC, 2009), UK is expected to experience more frequent flooding episodes. Since flood and storm risks have a high frequency in UK, the prevention strategies require proper sustainable measurements in order to ensure the population safety and to minimize the economic issues. The complex consequences generated by these phenomena may even require the temporary evacuation and housing of the affected population.

Another phenomenon associated to climate change effects is represented by extreme temperatures, UK experiencing both high and low temperatures. The risk of snow and ice was indicated as a sever hazard by the UK authorities (EC, 2014), and combined with unexpected periods of heating can increase the risks of other hazards (e.g. flood). Through their various effects (e.g. freezing, overheating), extreme temperatures can have a severe impact on infrastructure by generating various damages (e.g. accidents, disruption) on transport and/or energy networks (EEA, 2012). These consequences may be further experienced in various sectors of the country (e.g. agriculture, industry), thus increasing the economic losses. Among all anticipated hazards (Tab. 1.24), extreme temperatures generate the highest mortality rate among the UK population.

Regarding the impact on population, the UK authorities have assessed various pandemic scenarios because of their severe threats to human health and stated that influenza pandemic represents the highest overall risk of all hazards envisaged (EU, 2014). A big limitation in coping with pandemics is represented by the impossibility to predict its timing and the nature of the impact (CO, 2015).

Table 1.24. Natural risks profile of United Kingdom according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	42.6%	3.8%	63.1%
Storm	42.6%	18.8%	36.8%
Extreme temperature	11.8%	77.4%	-
Earthquake	2.9%	-	-
Other	0.1%	-	0.1%

* Economic loss for 10 year average (2005-2014): 1,544,150.000 $

Source: http://www.preventionweb.net/countries/gbr/data/

CHAPTER 2

3. MAJOR NATURAL RISKS IN PARTNER COUNTRIES

AUSTRIA (Republic of Austria)

Austria is situated in Central Europe, almost 70% of its territory being mountain areas. This mountainous topography, along with the climatic conditions, limits the living areas, therefore only 38% of the national territory is suitable for permanent human habitation (RoA, NCDPM, 2014). Furthermore, these two geographical features determine the occurrence of several natural hazards, with negative threats to the human society and the environment: floods, avalanches, landslides, storms and so on.

Table 2.1. Top Natural Disasters in Austria for the period 1900 to 2013 sorted by economic damage costs, according to EM-DAT CRED database

Top Natural Disasters in Austria for the period 1900 to 2013 sorted by economic damage costs:		
Disaster	**Date**	**Total damage ('000 US$)**
Flood	12 Aug 2002	2,400,000
Flood	2 June 2013	1,000,000
Flood	21 Aug 2005	700,000
Storm	29 Feb 2008	500,000
Storm	23 Jul 2009	500,000
Storm	17 Jan 2007	400,000
Extreme temperature	July 2003	280,000
Flood	22 Jun 2009	200,000
Flood	8 Jul 1997	175,000
Storm	25 Feb 1990	120,000

The steep landscape determines the development of human settlements in low flood-plains: over 93 people per square kilometer live within the Austrian territory drained by the Danube (Ward and Paulus, 2013). The natural exposure is aggravated by inadequate spatial planning, which results in 12% of all buildings to be potentially exposed to flooding and almost 9% to be considered at an extreme risk (Url and Sinabell, 2008).

There are two major types of flooding, the differences consisting in causes, danger and prevention measures. In the mountain area, the floods are accompanied by heavy sediment transport and debris flow, taking the form of torrents (Embleton-Hamann, 1997). The middle and lower altitude high-waters take the form of familiar floods.

River flooding is especially generated by heavy rainfall and a combination of rainfall and snowmelt. There are two areas of highest daily average precipitation, delimitated by the barrier effect of the mountains: the northern side of the Alps and the South of the country. From the hydrological point of view, almost the entire Austrian territory belongs to the Danube river basin, with a small portion belonging to the Rhine river basin. The north of the main Alpine ridge drains directly to the Danube across the country. Because of this unity two-thirds of the country experience approximately simultaneous flood danger from relief rainfall on the north side of the Alps (Embleton-Hamann, 1997).

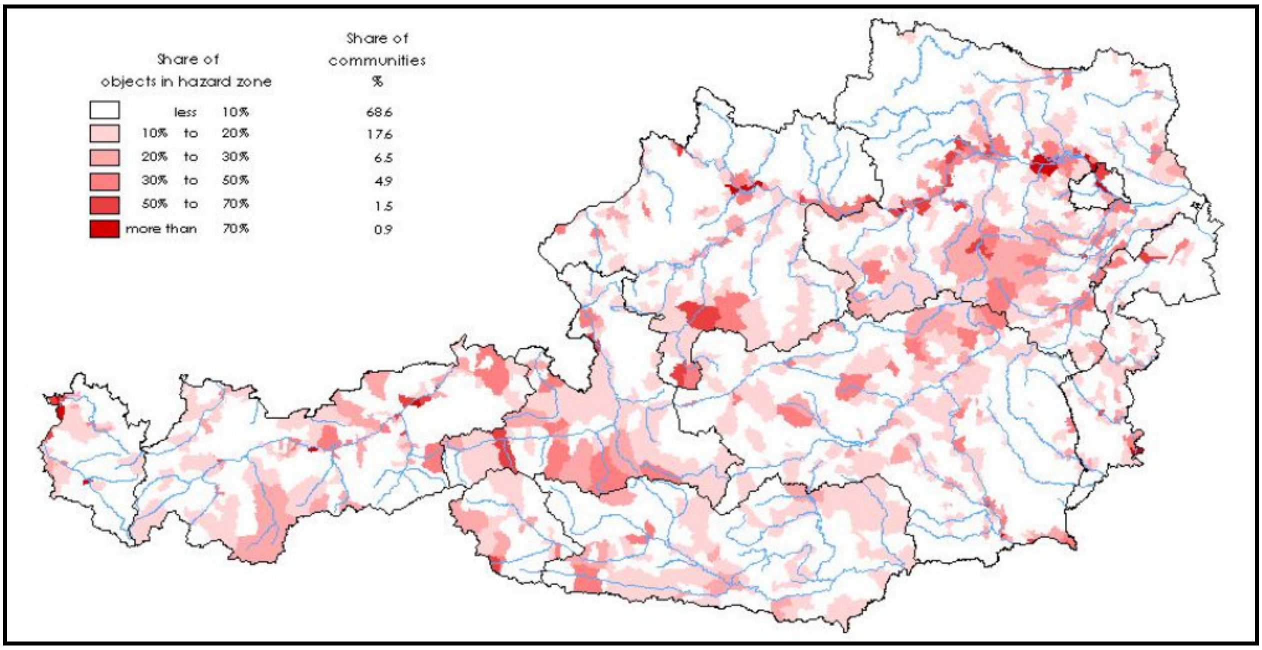

Figure 2.1. Exposure of public, commercial and private properties to flood risks in Austria in 2005 (Land-, Forts- und wasserwirtschafttliches Rechenzentrum GmbH (2006), cited by Url and Sinabell, 2008)

Although flooding is one the most widespread hazards in Austria, the flood in 2002 represented a crucial moment for the country, and for the entire flood risk management in Central Europe (EC, 2002). The 1 – 18 August 2002 flood affected Germany (Elbe River, State of Saxony, Dresden); Czech Republic (Moldau, Vltava and Elbe –Labe- Rivers, Prague); Austria (Salzburg and other areas). The flooding was caused by intense long-lasting period of rain over large areas: > 125 mm rain on August 6–7, and > 320 mm on 11–13. There were 47 fatalities and Austria recorder losses of Eur 3.7 billion (EEA, 2010). Another flood event worth mentioning is the 21 – 26 August 2005 event, which impacted Switzerland, Austria (Voralberg, Tyrol, Styria, Carinthia) and Germany (Bavaria State). There were heavy regional rains, which killed 11 people and produced 620 million Euros losses in Austria (EEA, 2010).

The Federal Ministry of Agriculture, Forestry, Environment and Water Management funded the HORA (Austrian flood risk zones, “HOchwasserRisikoflächen Austria“), published in

2006. The aim of this information system is to better determine the exposure degree to flood risk to individual objects in the country (Url and Sinabell, 2008).

Austria is also exposed to earthquakes: an average of 40 events per year is perceived by the population (RoA, NCDPM, 2014). The seismic activity is generated by the Mediterranean-trans-Asian earthquake belt, near to the border between the African and Eurasian plates, which is occupied by the eastern Alps. Over the past decade occurred most perceptible earthquake in Tyrol, followed by Lower Austria, Carinthia, Styria, Vorarlberg, Upper Austria, Salzburg and Burgenland. On average, Austria has to expect an earthquake of epicentral intensity VIII or more every 46.3 years; earthquakes of epicentral intensity >VII occur every 8.5 years, and >VI every 1.6 years (Embleton-Hamann, 1997).

Table 2.2. List of Austrian earthquakes that have caused damage to buildings since 1972 ($I_0 \geq 6$ °)

Date	Hour	M	I_0	Epicentru	State
05. Jan 1972	05:58	4,1	6	Wr. Neustadt	Niederösterreich
16. Apr 1972	11:10	5,3	7-8	Seebenstein	Niederösterreich
16. Apr 1972	12:05	4,0	6-7	Seebenstein	Niederösterreich
17. Jun 1972	10:03	3,6	6-7	Pregarten	Oberösterreich
12. Jun 1973	22:03	4,0	6	Krieglach	Steiermark
12. Dec 1973	01:03	4,5	6	Murau	Steiermark
26. Dec 1976	10:00	2,7	6	Feldkirch	Vorarlberg
12. May 1979	22:34	4,0	6	Frohnleiten	Steiermark
31. Jan 1981	13:49	3,7	6	Judenburg	Steiermark
15. Jun 1981	12:17	4,4	6	Obdacher Sattel	Steiermark
14. Apr 1983	16:52	5,0	6-7	Weichselboden	Steiermark
15. Apr 1984	12:57	4,9	6-7	Maria Schutz	Niederösterreich
24. May 1984	21:56	4,6	6	Gloggnitz	Niederösterreich
08. May 1992	09:51	4,3	6-7	Feldkirch	Vorarlberg
10. Nov 1995	01:32	4,2	6	Fohnsdorf	Steiermark
09. Jan 1996	02:07	4,1	6	Baden	Niederösterreich
11. Jul 2000	04:49	4,8	6	Ebreichsdorf	Niederösterreich
21. Jul 2003	15:15	4,4	6	Murau	Steiermark
29. Oct 2003	08:15	3,9	6	Kundl	Tirol
01. Oct 2004	12:01	3,8	6	Niklasdorf	Steiermark
07. May 2009	23:27	4,3	6	Mürzzuschlag	Steiermark
02. Feb 2013	14:35	4,4	6	Bad Eisenkappel	Kärnten

Source: RoA, NCDPM, 2014

Avalanches are caused by heavy snowfalls, sudden temperature increase and strong winds, which determine the rapid snow drifting. Since 1967, the Federal Office for Forests (BFW) recorder 5500 avalanches, out of which 4350 were harmful (RoA, NCDPM, 2014). The most threatened area in Austria is the high Alpine Mountains, where the slopes favor the drifting of the snow. Within the Alps, there are three areas with a high avalanche risk: the Arlberg region, the inner valleys of the western Tyrol and the inner valleys of Eastern Tyrol (Embleton-Hamann, 1997).

Major avalanches usually occur naturally, while smaller events are mainly caused by skiers. Although the number of winter sports and the accidents triggered by these is constantly increasing, the number of fatalities remained constant, due to the implementation of improved warning systems. The direct damage losses generated by avalanches are quite small; however, the indirect losses are significant. Tourism is an important economic activity for the Alpine regions and therefore its interruption or any decrease in the number of tourism caused by avalanches may be disastrous for the local economy (EEA, 2010).

The main consequences of avalanches in Austria are listed below (excerpt from Schadlawinen-Datenbank (harmful Avalanche Database) for the period 1967/1968 – 2003/2004 – NRP GE):

- over 950 dead,
- more than 750 buildings destroyed,
- more than 200,000 linear meters of roads destroyed,
- more than 300 vehicles destroyed,
- more than 320,000 cubic meters of damaged wood,
- more than 2,000 hectares of forest and crop damaged,
- destroyed over 30,000 linear meters of connection lines.

According to EM-DAT CRED, storms are the hazard with the highest occurrence frequency. In Austria, there are three main types of storms usually occurring: winter storms, Foehn storms and mesoscale convective systems (RoA, NCDPM, 2014). The highest wind speeds occur in the high mountains and on the plains in the North and East of the country. Storms affect mainly the vegetation, buildings and infrastructure. They cause some of the costliest natural hazards in Europe, in terms of insured losses.

Winter storms occur during autumn and winter months. Examples of this type of storm are the Lothar (1999) and Kyrill (2007). When the storm Kyrill reached the North of the Alps, the wind speed was 120 km/h. This storm is considered among the most damaging events in Europe. It caused 46 deaths and overall losses of almost EUR 8 billion. It damages infrastructure and communication networks and important economic sectors, especially forestry (EEA, 2010).

Landslides are natural mass movements that threaten human life, buildings, infrastructure and the environment. Their occurrence is facilitated by several factors, such as lithology, soil properties and land-use cover, and their triggering conditions may be earthquakes, snow melt, erosion, land-use changes, human activities and so on. These factors determine the occurrence of landslides mainly in hilly and mountain areas, the Alps being prone to this type of events (Embleton-Hamann, 1997).

One of the most destructive landslide occurred on 21 and 22 August 2005, when the heavy rainfall triggered 250 250 landslides in the two neighboring municipalities of Gasen and Haslau in state of Styria. The affected area covers more than 60 km² and is close to the western foothill of the Fischbacher Alps. The landslides moved debris flows and earth slides, with a total volume of 148,000 m³ covering an area of 183,000 m² (EEA, 2010). The losses were significant: two people were killed, 40 properties and 2,180 m of roads were damaged, 13 properties as well as 810 m of roads were destroyed, forest and agricultural areas were devastated; overall, the calculated economic losses were about EUR 65 million (EEA, 2010).

Table 2.3. Natural risks profile of Austria according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	35.3%	6.7%	69.4%
Storm	41.2%	2.2%	25.8%
Extreme temperature	14.7%	77.4%	4.2%
Earthquake	2.9%	-	-
Landslide	5.9%	13.7%	-
Other	-	-	0.6%

* Economic loss for 10 year average (2005-2014): 330,000.000 $
Source: http://www.preventionweb.net/countries/aut/data/

GERMANY (Federal Republic of Germany)

A general evaluation of the risks associated with natural hazards in Germany is presented in table 2.4. The national risk assessment of the German authorities has appointed three main natural hazards to which Germany is exposed: floods, forest fires and storm surge (BBDR, 2015).

Table 2.4. Natural risks profile of Germany according to CRED EM-DAT (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Flood	22.4%	-	49.1%
Storm	58.2%	2.2%	47%
Wildfire	-	-	-
Extreme temperature	13.4%	97.2%	3.6%
Earthquake	3.0%	-	-
Other	3.0%	0.7%	0.2%

* Economic loss for 10 year average (2005-2014): 2,776,000.000 $
Source: http://www.preventionweb.net/countries/deu/data/

Germany shares eight international river basins with other EU Member States, so river floods are considered the main type of flooding that can generate a disaster. Other relevant sources are coastal waters, surface waters or reservoirs, but flooding events associated to these sources were less reported (EC, 2015). Usually, floods in Germany have natural causes, such as heavy rainfall, persistent precipitation or snowmelt. Based on an assessment which comprised the catchments of Danube, Elbe, Ems, Odra, Rhine and Weser during the 1051-2002 period (Petrow and Merz, 2009), resulted that Germany features an upward trend in flooding events due to climatic conditions, especially in the west, the center and the south of the country. These meteorological and hydrological conditions enable dissociation between winter and summer floods, where winter floods seem to be more prone to climate influences than summer floods (Petrow and Merz, 2009).

The technological prevention (e.g. construction of weirs, surface sealing) on the natural river flows present also drawbacks, even though these actions aimed to improve the development of the society by creating the possibility of human residences to settle close to water sources, or to facilitate navigation, or to enhance the agricultural production. By reducing the river branching and strongly straightening the watercourse, the recent flood flows feature higher speeds with more powerful flood waves, together with larger volumes of water (BBDR, 2015). The soil infiltration capacity is highly affected by heavy machinery used on arable fields which causes soil compaction, thus favoring surface water accumulation (Eisenreich, 2005). All these consequences of anthropogenic intervention have led to greater damages associated to flood events. Residential buildings, industrial or agricultural sites found near floodplains are particularly exposed to flood risks. To prevent and limit the flood damages in vulnerable areas, the German authorities took technical protection measurements such as the construction of dikes, dams and/or reservoirs (BBDR, 2015). However, the anthropogenic interference is considered to have a greater influence on flood risks than climate change (Zebisch et al., 2005).

In the recent years in Germany occurred severe flood events on its main river courses. In 2002, continuous heavy rainfall generated the Elbe flood, which was considered one of the worst catastrophes in central Europe in the last decades, generating a cross-border disaster. In Germany, the Elbe river reached record highs (9,4 meters) and caused significant damages to the east part of the country, where thousands of people were evacuated, casualties were reported and the economic losses were estimated at around EUR 9 billion (GFRG, 2006). Another severe flooding occurred in the spring of 2013, when intense precipitations have led to the Danube flood which determined severe damages in the south part of Germany and neighboring countries. The economic costs were estimated at EUR 12 billion, and it was considered one of the greatest disasters in the last centuries (Blöschl et al., 2013).

Forest fires represent another hazard to which Germany is exposed to. Almost one third of the country surface is covered by forests, comprising a total of 11.4 million hectares. The present distribution and state of the German forests is the result of former deforestation measurements undertaken for the expansion of human settlements, and for the creation of arable land, while the harvested trees were used in wood industry (BBDR, 2015). Germany has identified forest fires as a possible risk, featuring a medium rate of recurrence during the summer season (EC, 2014).

The most severe forest fires experienced by Germany were in 1992 when 4908 hectares of forest were burned and generated economic losses of EUR 12.8 million, and in 2003 when the fire damaged 1315 hectares of forest. The 2003 forest fire occurred in the year which recorded a heat wave characterized by maximum air temperature of 39.1°C and presented a high precipitation deficiency (Anderson, 2007). The impact of this particular fire disaster generated a greater damage than the average across 1991-2002, determining with 25% more burned forest.

Disturbances in the forest ecosystems have been related to climate change. The main effects are associated with increased temperatures along summer and winter season, changes in the precipitation patter which led to drier summers and wetter winters, and more frequent extreme weather events such as heavy rainfall, storms and droughts (BBDR, 2015). Climate warming combined with dryer summers are considered to present an increased risk for forest fires (Anderson, 2007). High temperatures (exceeding 30ºC), drought (precipitations under 300 mm) and strong winds are the main conditions which determine fire ignition. The northern and the northwestern forests of Germany were appointed to be more exposed to fires due to the coniferous forests that develop in sandy soils, conditions which increase the aridity of the ecosystems (Zebisch et al., 2005). Also soils with high thermal conductivity and low water storage capacity favor the humus drying process and increase the risk of forest fires. Pine forests are considered highly vulnerable to forest fires due to their wide spread on such soils, and their high caloric value ranks them as high flammable tree species (BBDR, 2015). The German authorities have estimated that the occurrence of forest fires will increase due to weather extremes associated to climate change.

Germany features around 3700 km coastal borders to the North and Baltic Seas which have been evaluated as prone to storm surge hazard. Several coastal flooding events were recorded as storm consequences in the last decades, out of which the storm surge of January 1994 led to the highest water level observed on the northern coasts (Sterr, 2008). The latest storm surge was recorded in November 2007, but its impact was relatively reduced due to flood protection measurements.

Usually, storm surge in North Sea are determined by a build-up of water masses along the coasts combined with heavy storms which feature wind speeds higher than 25 m/s from north-westerly directions, known as the wind-set up type. Storm surges can be determined also by a small intense low-pressure system which passes along the British Isles at high speed, known as the circulation type. While the wind-set up can be forecasted with in advance (e.g. 18 hours), the circulation type is much harder to be predicted, leaving only a few hours for the warning measurements. Beside the wind-set up type, storm surge in Baltic Sea can be determined by seiches that influence the water level be several decimeters in the western part of the sea (Jensen and Müller-Navarra, 2008).

Based on model studies, and excluding the sea level rise, it has been indicated that storm surge events are likely to increase along the German coastline due to climate change until the end of the 21st century (Gaslikova et al., 2013). The monitoring of sea level in Germany indicates that the average secular rise has increased by at least 10 cm for both North and Baltic Sea Coasts due to climate-related effects, taking in consideration also the regional subsidence. The sea level is expected to rise more fast in the following decades as a consequence of climate warming, determining an approximately 60 cm rise of the mean water level (Jensen and Müller-Navarra, 2008; Sterr, 2008).

Bremen has been evaluated as the most exposed state to coastal flooding risks, estimating that 92% of the population is prone the flood impact in case of sea level rise, followed by Schleswig-Holstein (23%), Niedersachsen (19%), Mecklenburg-Vorpommern (17%), and Hamburg (11%) (Sterr, 2008). The damages of storm surge can determine socio-economic imbalances for the affected areas. For example, the economic losses in the case of an extreme flood generated by 55 cm sea level are estimated at about 18.5 billion euro for the city of Bremen (Elsasser and Bürki, 2002). Due to the risks associated to storm surge, Hamburg undertook protection measurements for disaster scenarios which feature water level up to +7,30 m above mean sea level (BBDR, 2015). The total costs for the protection investment is estimated at 600 million euro, which are considerably reduce compared to the costs associated to possible flood damages (Walraven and Aerts, 2008). Considering also the predictions on rise of sea level, it can be concluded that the risk of storm surge to the German coastline may increase in the future as a consequence of climate change (BBDR, 2015).

ROMANIA (Republic of Romania)

Romania is a country located in Southeast Europe, bordered to the North-East by Ukraine, to the North-West by Hungary, to the North-East by Republic of Moldova, to the South by Bulgaria, to the South-West by Serbia and to the East by Black Sea. It has an area of 238,391 square kilometers, a temperate-continental climate of a transitional type and a rich natural diversity, that's why it is highly exposed to natural disasters such as earthquakes, landslides, floods, extreme temperature, etc. (tab. 2.5) which can have significant economic and social impact (Bălteanu et al., 2010).

Table 2.5. Natural risks profile of Romania according to CRED EM-DAT, (Feb. 2015)

Hazard	Frequency	Mortality	Economic issues*
Earthquake	4.1%		
Extreme temperature	25.7%	52.2%	
Flood	55.4%	42.6%	85.9%
Storm	12.2%	4.3%	
Drought			14.1%
Other	2.7%	0.9%	

* Economic loss for 10 year average (2005-2014): 243,543.000 $

Source: http://www.preventionweb.net/countries/rou/data/

Romania is a country known as one of the most vulnerable European countries regarding floods. In Romania, floods are the natural disasters with the highest frequency and economic losses, and the second one in fatalities number, after extreme temperature. The floods most commonly occur due to four causes: deforestation, the structure and the density of hydrographic network, the absence or failure of flood-protection dams and dykes and climate change and global warming (MoIA, GIES, 2015). An example of flood disaster in Romania is the one from June 2001, when three days of heavy rain generated massive floods. Hundreds of people were evacuated, 50.000 hectares of farmland were afloat and the economic losses were estimated to EUR 220 million. Another significant flood disaster in Romania was recorded in 2005, when due to the torrential rainfall 85 people died and the economic losses were estimated at EUR 1.2 billion (EEA, 2010).

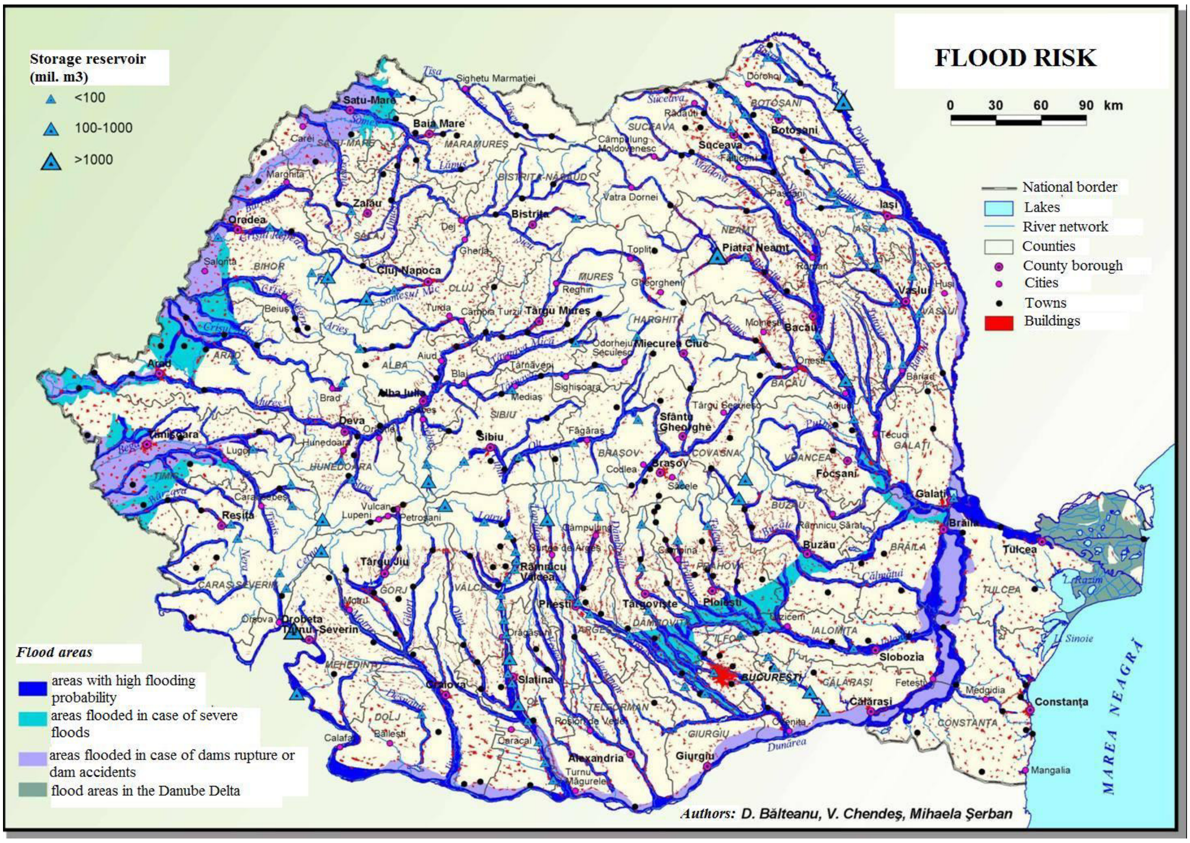

Figure 2.2. Flood risk map of Romania (Bălteanu et al., 2007)

Due to its geographical position and climate, extreme temperature is the second frequent hazard and the highest mortality in Romania, as it can be seen in the table above. According to EEA (2010) Romania was the most affected country in terms of extreme temperature events, between 2003 and 2009, from a total of 23 EEA member countries. For example, the heat waves from June and July in 2006 caused more than 2,400 fatalities in Romania, Spain, France, Germany, Belgium, Portugal and the Netherlands. On the other hand, extreme temperature such as cold spells and extreme winter conditions also affect Romania. For example, the cold spell from October and December 2001 caused about 430 fatalities in Romania, Poland, Latvia, Lithuania, Turkey and Hungary. Another example is the one from November 2005 – February 2006, when the extreme winter conditions and the cold spell caused 440 fatalities in Romania, Slovakia, Sweden, Spain, Switzerland, Turkey, United Kingdom, Poland, the Netherlands, Latvia, Italy, Hungary, Germany, France, Estonia, Czech Republic, Bulgaria, Belgium and Austria (EEA, 2010).

The seismicity of Romania (Fig. 2.3.) is generated by the seismic activity in the Vrancea region, which makes Bucharest the highest seismic vulnerable European capital. The Vrancea region is the most important seismic area in Romania due to its seismic complexity characterized by a continental convergence between the East-European plate and Intra-Alpine and Moesic subplates. This region presents a zone of crustal earthquakes with moderate activity and a zone of subcrustal earthquakes with a rare activity but strong one. This region is the source of more than 90% of the total seismic energy released in Romania (Ciucu and Fulga, 2008; Romania National Report, 2005). The worst recent earthquake in Romania was in March 1977. It had the epicenter in Vrancea at about 90 km depth and had a moment magnitude of M_w 7.4. It caused more than 1,500 fatalities (90% of the fatalities were in the capital, Bucharest), about 11,300 injured people, 660,500 damaged households (partly or totally) and total economic losses of about US $2.05 billion (70% in Bucharest) in 23 cities (Lang et al., 2012; Lungu et al., 2007; MoIA, GIES, 2015, 2015).

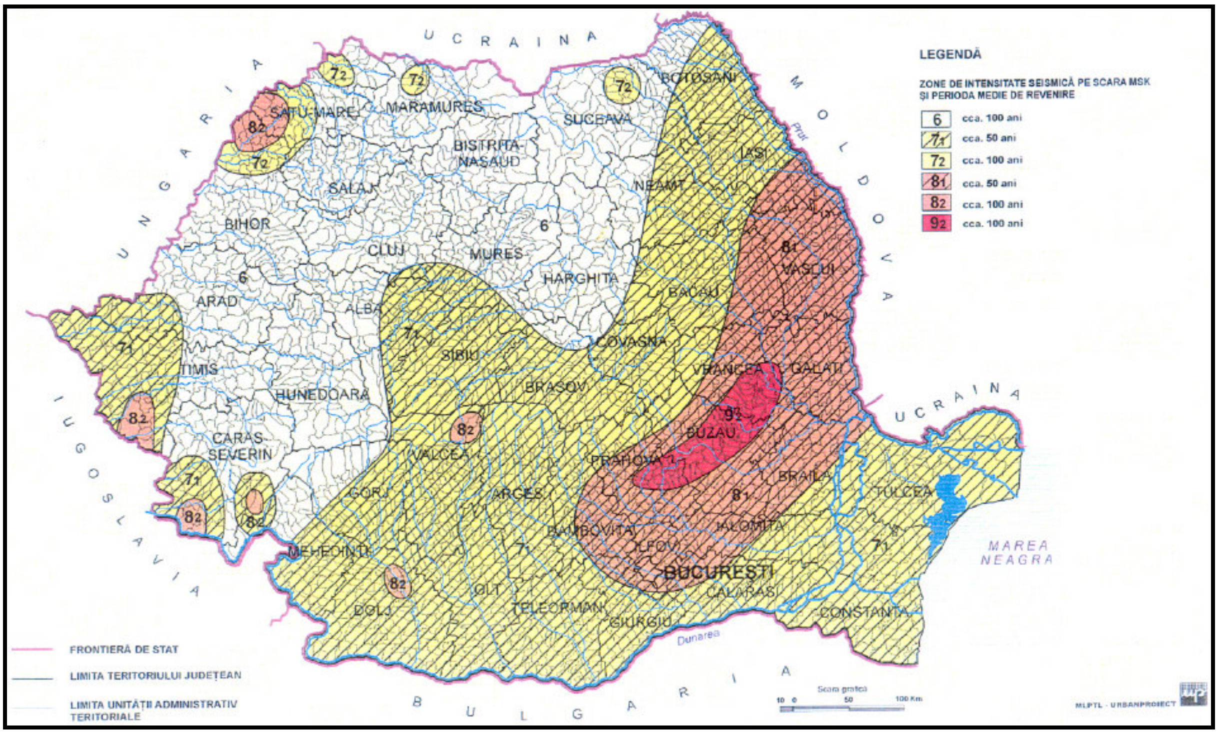

Figure 2.3. Seismic risk map of Romania (Law no. 575/2001)

Romania is a country particularly exposed to landslides (Fig. 2.4.), as a consequence of different factors caused by natural or man-made actions, such as: geographic diversity (mountains, hills and tablelands), climate conditions, massive deforestation, other natural disasters which can induce them (ex. floods, earthquakes) etc. (Bălteanu, 2010). A relevant example of such event is the one from March 1999 when 12 landslides destroyed more than 100 homes and damaged more railways and roads. Another example is the mudslide from November 2006 which caused seven fatalities (EEA, 2010).

Regarding epidemics and pandemics, according to European Commission (2014) pandemics are seen as the second highest risk hazard in Romania.

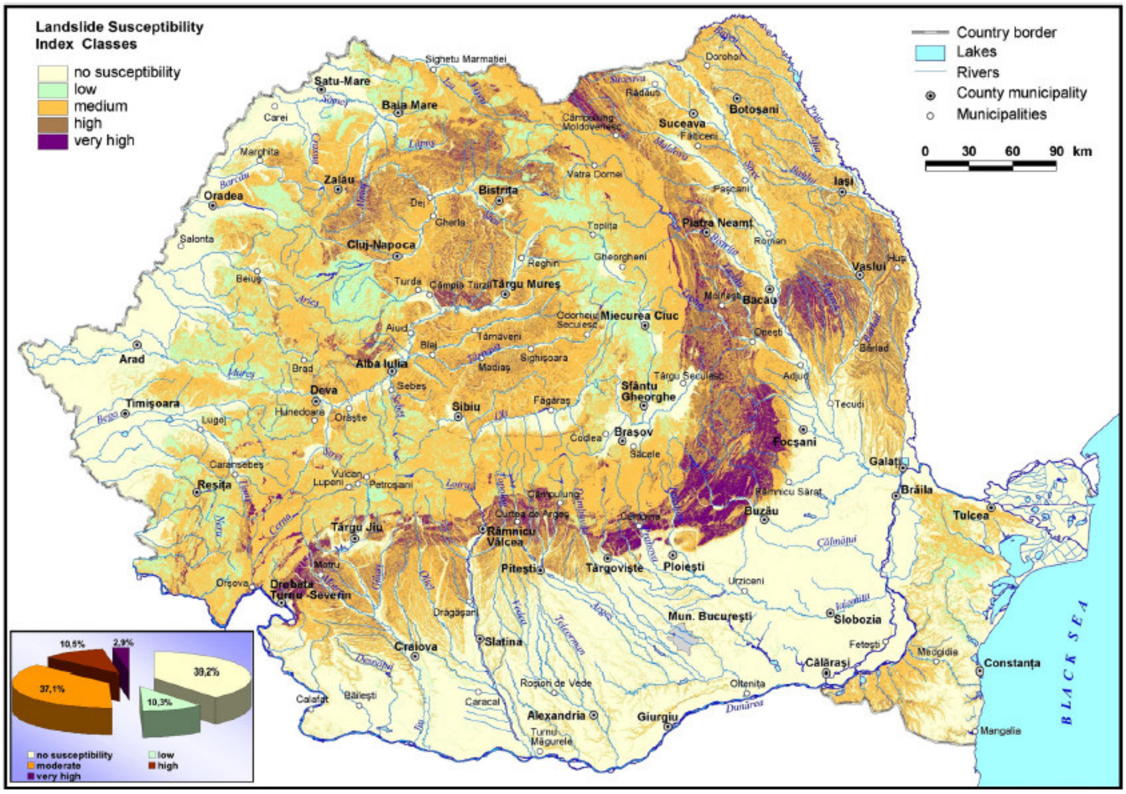

Figure 2.4. Landslide risk map of Romania (Bălteanu et al, 2010)

CHAPTER 3

4. OUTLOOK REPORT

The aim of this project is to strengthen the self-help competencies of people in recognizing and dealing with hazards. Therefore, at first, an evaluation of extraordinary events, natural and manmade risks must be developed, in order to identify those main threats in daily life situations. Also, it must be emphasized that within this report, a special attention was given to those risks young people may be exposed to in their everyday life.

The first chapter of this report assessed mainly the natural risks in European Union member states. The assessments comprised a short description of the hazards, their localization and manifestation type, past events and future trends. The second chapter deals with natural risks in partner countries: Austria, Germany and Romania. The same structure was used, but the analysis was more detailed. For both chapters, national risk assessments were used, where available, as well as other documented sources.

The results of the national assessment were summarized in the table below (table 3.1.). The table includes all European Union member states and the hazards that were identified within the previous analysis. Considering these results and keeping in mind that the target group of this project is young people aged 7 – 12, one may say that the natural hazards this age group is exposed to are storms, floods, extreme temperatures and earthquakes. These natural events may be extraordinary events, such as extreme temperatures (whether heat waves or cold waves), with high mortality rates; or daily hazards, such as storms or floods, with high frequency of occurrence. The other hazards: wildfire, drought, landslides, volcanos, avalanches, tsunami, even if affecting in some way the countries' population, impact the young population to a much lesser extent.

Table 3.1. The identified risks for EU Member States

No.	COUNTRY	NATURAL RISKS									
		Earthquake	**Extreme temperature**	**Flood**	**Storm**	**Wildfire**	**Drought**	**Landslide**	**Volcano**	**Avalanches**	**Tsunami**
1.	Austria	■	■	■	■			■		■	
2.	Belgium	■	■	■	■						
3.	Bulgaria	■	■	■	■	■	■	■			
4.	Croatia	■	■	■	■	■	■				
5.	Cyprus	■	■		■	■	■				
6.	Czech Republic	■	■	■	■						
7.	Denmark			■	■	■	■				
8.	Estonia		■		■						
9.	Finland			■	■						
10.	France		■	■	■	■	■	■		■	
11.	Germany	■	■	■	■	■					
12.	Greece	■	■	■	■	■	■				■
13.	Hungary	■	■	■	■		■				
14.	Ireland		■	■	■						
15.	Italy	■	■	■	■	■	■	■	■		
16.	Latvia		■	■	■						
17.	Lithuania	■	■	■	■	■	■	■			
18.	Luxembourg		■	■	■						
19.	Malta			■				■			
20.	Netherlands	■	■	■	■						
21.	Poland		■	■	■	■					
22.	Portugal		■	■	■	■	■				
23.	Romania	■	■	■	■		■				
24.	Slovakia		■	■	■	■				■	
25.	Slovenia	■	■	■	■						
26.	Spain	■	■	■	■	■	■				
27.	Sweden		■	■	■			■			
28.	United Kingdom	■	■	■	■						

Besides natural risks analyzed above, there are several other daily threats that could impact young people, so they are discussed below.

Fire is ubiquitous and can bring tremendous benefits to all humankind if used properly, but can also be destructive and undesirable, when out of control. In Europe, home fires kill over 4.000 people every year and injure tens of thousands more (EFRA, 2016). Approximately 12 people die in house fires every day in Europe, and 120 people are severely injured. Most exposed to risks associated with fire are young children and the elderly (ECSA, 2016).

Home fires are one of the major hazards in the world. At European level it is estimated that 3–4 % of the entire households can suffer damages produced by fires every year. However, estimations are difficult, due to the different counting and registering methods in EU member states. Therefore, there is no EU policy to collect these statistics or to address fire safety.

Within each household, there are significant volumes of flammable materials: furniture, textiles, curtains, carpets, foams, electronic equipment etc. All these materials may fuel a fire, once started. A survey in the USA shows that the bedroom was the most common area for the origin of fires caused by playing (39% of home fires), followed by the kitchen (8%) and living room (6%). As to home materials, mattress of bedding was the most common item first ignited in fires caused by playing (23%), followed by magazines, newspaper or paper (10%) and trash (9%) (Campbell, 2014).

The causes can also be diverse: candles, lighters, cigarettes, matches and so on. It is considered that the fires caused by cigarettes, lighters or matches result in more deaths and higher property damages than other fires (Miller et al., 2000). For example, in 2006 in the EU, cigarettes caused 12,900 fires which resulted in 650 deaths, 2,400 injuries, and 48 million euros in property damage (WHO, 2011). In the same study (Campbell, 2014) was mentioned that fires caused by playing were ignited by lighters (52%), then matches (18%) and candles (5%).

According to MacKay and Vincenten (2012), burns, scalds and fire represent the fourth leading cause of unintentional injury death for children and adolescents in the EU (aged 0 – 19). Furthermore, injuries related to fires, results in extended hospitals stays, multiple surgeries and long-life trauma. The highest rates for burns and scalds were recorder in Latvia, Estonia and Romania for males, and Bulgaria, Latvia and Estonia for females. Rates for females were either lower than males, or similar for all countries except Sweden, Lithuania and Bulgaria. As to age group, the highest rates occur in children under five years of age, because they cannot escape in the event that a house fire occurs.

The flammable materials that exist in a home reduce the available time for escape, in case of a home fire, to just 3 minutes. The best combination for fire prevention in a home is to implement active measures (smoke alarms) and passive measures (fire resistant products). The existence of smoke alarms in homes reduces the injury and death rate by 50% (ECSA, 2016). Smoke detectors are regulated differently in Europe: Finland, France, Iceland and Sweden require working smoke detectors in all public and private dwellings, while most other countries have legislation that requires smoke detectors for only new buildings or only public buildings, a situation that does not adequately protect children and families from lower socio-economic settings. Bulgaria, Croatia, Greece, Hungary and Israel have no legislation regarding smoke detectors (MacKay and Vincenten, 2012). Other legislative measures refer to the manufacture of reduced ignition propensity (RIP) cigarettes (prevent fire by quickly self-extinguishing when left unattended) (Gann et al., 2001). Finland was the first EU country to pass legislation requiring RIP cigarettes and in 2011, RIP cigarettes become mandatory in the entire EU. Furthermore, in 2006 EU adopted legislation only allowing child resistant lighters to be sold in Europe. However, in many European countries in spite of the existing legislation, this is not well enforced.

Therefore, it is important to communicate the risks, the prevention measures and the response actions for household fires to young children. An effective response can reduce the death or injury risk in case of home fires, saving lives and economic damages.

An **epidemic** represents the massive occurrence of a disease in a limited area or over a limited time, while a pandemic describes an epidemic that reaches major area of a country or of a continent (Catalogue of risks). Usually, these diseases are infectious diseases, spreading infections from viruses. The most common epidemics and pandemics are the viral infections in the respiratory tract, that is influenza, or flu, for short. Although a pandemic does not take into account the number of illnesses of deaths resulting from it, the number of infected cases is always greater: international reports estimate that approximately 25–35% of the population may be infected during a pandemic, compared to 5–10% in a seasonal influenza (MoI Finland, 2016).

Pandemic flu spreads like the normal flu, through close human contact. It spread at regional and global level, regardless of season. Another feature of influenza is the way it occurs, in two or three waves, while time of occurrence is very difficult to predict (DEMA, 2013).

In the human history there have been several diseases which reached the level of epidemic and/or pandemic. In the last hundred years there were four epidemics/pandemics: 1918–1919 Spanish flu (caused by the A (H1N1), 1957–1958 Asian flu (A (H2N2)), 1968–1969 Hong Kong flu (A (H3N2)) and in 2009–2010 New influenza A(H1N1). The Spanish flu was the most severe, occurring in three waves, the second being the worst. It is estimated that between 20 and 40 million people died (for example, in Germany between 225,000 and 300,000 people, or 0.5% of the population died) (Proske, 2008). Another consequence of this pandemic affected young people between 15 and 45 years, who died either of the virus infection, or due to associated diseases, such as pneumonia (DEMA, 2013). On the other hand, the Asian flu caused approximately 1 million fatalities, while the Hong Kong flu resulted in about 700,000 fatalities (Proske, 2008). The latest pandemic, in 2009, occurred in pigs and then spread to humans. The infection spread rapidly through the entire world, but the symptoms were not so severe. The pandemic affected mainly persons aged 5-24 (DEMA, 2013).

Flu pandemics can generate direct consequences on human life and health, or can indirectly affect the entire functioning of the society (e.g. the health care systems). For every society, the outbreak of a flu pandemic represents a significant risk: the infection spreads quickly, affecting more and more people, while the vaccine may not be readily available. Due to large number of staff absence, critical functions and processes of the society are interrupted for shorter or longer periods of time.

The latest major pandemics have broken out at 10–40 year intervals, and the likelihood of a new pandemic outbreak is high (MoI Finland, 2016). However, it is impossible to predict the time and place of occurrence, the virus type or the possible consequence of a flu outbreak. This uncertainty in predicting the consequences and likelihood make it an important hazard in many national risk assessments of EU member states. Epidemics/pandemics were considered a main risk hazard in 13 Member States: Cyprus, Czech Republic, Denmark, Estonia, Germany, Ireland, Lithuania, the Netherlands, Poland, Romania, Slovenia, Sweden and the United Kingdom (EC, 2014). According to their national assessments, the current situation is as follows: the United Kingdom assess influenza pandemics as posing the highest overall risk of all hazards addressed; Poland identifies pandemics as the second highest risk hazard; Estonia assesses this hazard in its top 'very high-risk emergencies' category; Denmark grants it a prominent place in countries' priority ranking of hazards; in Slovenia, while pandemics only rank as a medium overall risk, it is identified as one requiring considerable attention in future disaster risk management initiatives (EC, 2014).

To conclude, the assessment of national reports demonstrates that the risk level of epidemics/pandemics is considered high to very high in all relevant EU Member States.

5. Bibliography:

Alexander, D., 1993, *Natural Disasters*, Univ. College London

Anderson J. (ed.), 2007, *Climate change induced water stress and its impact on natural and managed ecosystems*. Report European Parliament IP/A/CLIM/ST/2007.06;

Bălteanu, D., Sima, M., Chendeş, V., 2007, *Natural and Technological Hazards related to Extreme Climatic Events in Romania*, Climate change in South-Eastern European countries. Causes, impacts, solutions, Graz, Austria 26-27th March.

Bălteanu, D., Chendeș, V., Sima, V., Enciu, P., 2010. *A country-wide spacial assessment of landslide susceptibility in Romania,* Geomorphology, 124, 102-112.

Blöschl G., Nester T., Komma J., Parajka J., Perdigão R.A.P., 2013, *The June 2013 flood in the Upper Danube Basin, and comparisons with the June 2002, 1954 and 1899 floods*, Hydrology and Earth System Sciences, 17, 5197-5212

Bradford, R. A., O'Sullivan, J. J., van der Craats, I. M., Krywkow, J., Rotko, P., Aaltonen, J., Bonaiuto, M., De Dominicis, S., Waylen, K., and Schelfaut, K., 2012, *Risk perception – issues for flood management in Europe,* Nat. Hazards Earth Syst. Sci., 12, 2299–2309, doi:10.5194/nhess-12-2299-2012

Bruen, M., Gebre, F., A., 2001, *Worldwide public perception of flood risk in urban area and it's consequences for hydrological design in Ireland*, National Hydrology Seminar, available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.461.1241&rep=rep1&type=pdf, accessed on March 2016

Calabrese, S., Randazzo, L., Daskalopoulou, K., Milazzo, S., Scaglione, S., Vizzini, S., Tramati, C., D., D'Alessandro, W., Brusca, L., Bellomo, S., Giuffrida, G., B., Pecoraino, G., Montana, G., Salerno, G., Giammanco, S., Caltabiano, T., Parello, F., 2016, *Mount Etna volcano (Italy) as a major "dust" point source in the Mediterranean area*, Arab J Geosci, 9:219.

Campbell, Richard, 2014, *Playing with fire*, National Fire Protection Association, available at: http://www.nfpa.org/research/reports-and-statistics/fire-causes/arson-and-juvenile-firesetting/children-playing-with-fire

Ciucu, C., Fulga, C., 2008, *Two case studies of post-sesimic regimes in the Vrancea Region, Romanian* Reports in Physics, Vol. 60, No. 1, 173-189.

Cultrera, G., Mucciarelli, M., Parolai, S., 2011, *The L'Aquila earthquake – Aview of site effects and building behavior from temporary networks*, Bull Earthquake Eng, 9, pp. 691-695.

Daominey-Howes, D., 2002, *Documentary and Geological Records of Tsunamis in the Aegean Sea Region of Greece and their Potential Value to Risk Assessment and Disaster Management*, Natural Hazards, 25:195-224.

Dorland C., Tol R.S.J., Palutikof J.P., 1999, *Vulnerability of the Netherlands and Northwest Europe to storm damage under climate change*, Climatic Change, 43, 513-535

Eisenreich, S.J., (editor), 2005, *Climate Change and the European Water Dimension. A report to the European Water Directors 2005*. EU Report No. 21553

Elsasser H., Bürki R., 2002, *Climate change as a threat to tourism in the Alps*, Climate Change, 20, 253-257

Embleton-Hamann, Christine, 1997, *Austria*, in Geomorphological Hazards of Europe, edited by Embleton, Clifford and Embleton-Hamann, Christine, Elsevier

Farago T., Lang I., Csete L., 2010, *Climate change and Hungary: mitigating the hazards and preparing for the impacts*. Report of the VAHAVA project

Galanopoulos A.G., 1960, *Tsunamis observed on the coasts of Greece from antiquity to present time*, Annali di Geofisica, 13, 369-386.

Gann, R, Steckler K, Ruitberg S, Guthrie, W.F., Levenson, M.S., 2001, *Relative Ignition Propensity of Test Market Cigarettes,* NIST Technical Note 1436. Gaithersburg, MD, National Institute of Standards and Technology, 2001

Gaslikova L., Grabemann I., Groll N., 2013, *Changes in North Sea storm surge conditions for four transient future climate realizations*, Natural Hazards, 66, 1501-1518

Gavilanes-Ruiz, J.C., Cuevas-Muñiz, A, Varley, N, Gwynne, G., Stevenson, J., Saucedo-Girón, R., Pérez-Pérez, A., Aboukhalil, M. and Cortés-Cortés, A., 2009, *Exploring the factors that influence the perception of risk: The case of Volcán de Colima, Mexico*, Journal of Volcanology and Geothermal Research 186 (2009) 238–252, 2009

Glatron, S. and Beck, E., 2008, *Evaluation of socio-spatial vulnerability of citydwellers and analysis of risk perception: industrial and seismic risks in Mulhouse*, Nat. Hazards Earth Syst. Sci., 8, 1029–1040, 2008

Guzzetti, F., Stark, C. P., Salvati P., 2005, *Population of Italy*, Environmental Management, vol. 36, no. 1, pp. 15-36

Haanpää S., Lehtonen S., Peltonen L., Talockaite E., 2007, *Impacts of winter storm Gudrun of 7th-9th January 2005 and measures taken in Baltic Sea Region*. Report ASTRA project (www.astra-project.org)

Hellenberg, T., Visuri, P., 2013, *ANVIL - Analysis of Civil Security Systems in Europe. Country Study: Lithuania*, available at *http://anvil-project.net/wp-content/uploads/2014/01/Lithuania_v1.0.pdf, accessed on April 2016*

Hellenberg, T., Visuri, P., 2014, *ANVIL - Analysis of Civil Security Systems in Europe. Country Study: Latvia,* available at http://anvil-project.net/wp-content/uploads/2014/02/Latvia_v1.1.pdf, accessed on April 2016

Hewitt, K., 1997. *Regions of Risk. A geographical introduction to disasters*, London, Longman, ISBN 0 582 21005 4.

Heyse, Irenee, 1997, *Belgium*, in Geomorphological Hazards of Europe, edited by Embleton, Clifford and Embleton-Hamann, Christine, Elsevier

Jeneiova K., Sabo M., Kohnova S., 2014, *Trend detection in long term maximum annual discharge series in catchments of Slovakia*, Acta Hydrologica Slovaca, 15, 161-170

Jensen J., Müller-Navarra, 2008, *Storm Surges on the German Coast*, Die Küste, 74, 92-124

Joly, F., Bocquet, G., Bravard, J-P., Chardon, M., Kieffer, G., Paskof, R., Vogt, J., 1997, *France*, in Geomorphological Hazards of Europe, edited by Embleton, Clifford and Embleton-Hamann, Christine, Elsevier

Karagyozov, Kiril, Razmov, Todor, Todorova, Mirena, Varadinova, Julia, Dzhaleva-Chonkova, Anna, 2012, *Impact of Natural Disasters on Transport Systems – Case Studies from Bulgaria,* Report from the International Panel of the WEATHER project funded by the European Commission's 7th framework programme, Sofia, April 2012

Koutaniemi, Leo, 1997, *Finland*, in Geomorphological Hazards of Europe, edited by Embleton, Clifford and Embleton-Hamann, Christine, Elsevier

Lang, D., Molina-Palacios, S., Lindholm, C., Banal, S., 2012, *Deterministic earthquake damage and loss assessment fot the city of Bucharest, Romania*, J Seismol, 16:67-88.

Lungu, D., Arion, C., Aldea, A., Vacareanu, R., 2007, *Seismic hazard, vulnerability and risk for Vrancea events*, International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, Oct. 4-6, Bucharest, Romania, available at http://digbib.ubka.uni-karlsruhe.de/volltexte/beilagen/1/proceedings/pdf/45_Symposium_Bucharest_07_064_Lungu.pdf, accessed on March 2016

Luterbacher, J., Dietrich, D., Xoplaki, E., Grosjean, M., Wanner, H., 2004, *European seasonal and annual temperature variability, trends, and extremes since 1500*, ScienceA, 303, 1 499–1 503.

Mac, I., 2003, *Environmental science*, Europontic Publishing House, Cluj-Napoca (in Romanian)

MacKay M, Vincenten J., 2012, *Child Safety Report Card 2012: Europe Summary for 31 Countries*. Birmingham:

Mantovani, M., Devoto, S., Forte, E., Mocnik, A., Pasuto, A., Piacentini, D., Soldati, M., 2013, *A multidisciplinary approach for rock spreading and block sliding investigation in the north-western coast of Malta*, Landslides, 10:611-622.

Martin Z., Galla S., Majlingova A., 2015, *Disaster risk management in Slovakia*, Disaster Management 2015

McWhirter J., 1997, *Spiralling into control*, The Royal Society for the Prevention of Accidents contributing to safe policy development, available at http://www.rospa.com/rospaweb/docs/advice-services/school-college-safety/spiral-into-control.pdf

Mediero L., Kjeldsen T.R., Macdonald N., Kohnova S., Merz B., Vorogushyn S., Wilson D., Alburquerque T., Blöschl G., Bogdanowicz E., Castellarin A., Hall J., Kobold M., Kriauciuniene J., Lang M., Madsen H., Onuşluel Gül G., Perdigão R.A.P., Roald L.A., Salinas J.L., Toumazis A.D., Veijalainen N., Òðinn Þórarinsson, 2015, *Identification of coherent flood regions across Europe by using the longest streamflow records*, Journal of Hydrology, 528, 341-360;

Mezösi G., Meyer B.C., Loibl W., Aubrecht C., Csorba P., Bata T., 2013, *Assessment of regional climate change impacts on Hungarian landscapes*. Regional Environmental Change, 13, 797-811

Miller T, Romano E, Spicer R., 2000, *The cost of childhood unintentional injuries and the value of prevention*. The Future of Children: 2000 Spring/Summer; 10(1): 137-63

Mimikou, M., Koustoyannis, D., 1995, *Extreme floods in Greece: The case of 1994*, U.S. - ITALY Research Workshop on the Hydrometeorology, Impacts, and Management of Extreme Floods, Perugia, Italy, 13-17 November

Moller, Jens Tyge, 1997, *Denmark*, in Geomorphological Hazards of Europe, edited by Embleton, Clifford and Embleton-Hamann, Christine, Elsevier

Okal, E., A., Synolakis, C., E., Uslu, B., Kalligeris, N., Voukouvalas, E., 2009, *The 1956 earthquake and tsunami in Amorgos, Greece*, Geophys. J. Int., 178, 1533-1554

Ozunu, A., Anghel, C., 2007, *Technologic risk assessment and environmental safety*, Accent Publishing House, Cluj-Napoca (in Romanian)

Pavlík M., Pavlík Š., 2003, *Gale disaster in Slovakia: consequences and management implications*, proceedings of International Conference "Wind Effects on Trees", University of Karlsruhe, Germany

Petrow T., Merz B., 2009, *Trends in flood magnitude, frequency and seasonality in Germany in the period 1051-2002*. Journal of Hydrology, 371, 129-141;

Plumier, André, Doneux, Catherine, Camelbeeck, Thierry, Van Rompaey, Gilles, Jongmans, Denis, Wathelet, Marc, Teerlynck, Herve, Nguyen, Frederic, 2001, *Seismic Risk Assessment and Mitigation for Belgium in the Frame of Eurocode 8*, Final Report, SSTC Project

Proske, D., 2008, *Catalogue of Risks, Natural, Technical, Social and Health Risks*, Springer-Verlag Berlin Heidelberg

Ranguelov B., Jelínek R., Wood M., Hervás J., 2007, *Risk Mapping of Earthquakes in New Member States*, European Commission, Joint Research Centre - EUR 22901 EN

Renn, O., 2003, *Perception of risks*, Toxicology Letters, vol 149, p. 405-41, 2003

Smith, K, Petley, D.N., 2009, *Environmental Hazards: Assessing Risk and Reducing Disaster*, Fifth Edition, Taylor & Francis e-Library
Sarris, D., Christopoulou, A., Angelonidi, E., Koutsias, N., Fulé, P., Z., Arianoutsou, M., 2014, *Increasing extremes of heat and drought associated with recent severe wildfires in southern Greece*, Reg Environ Change, 14:1257-1268
Somlyódy L, Simonffy Z., 2004, *Water in Hungary: with Tradition and Unique Problems to EU*. Begegnungen, Schriftenreihe des Europa Institutes Budapest, Band 25, 127-145;
Sterr H., 2008, *Assessment of vulnerability and adaptation to sea level rise for the coastal zone of Germany*, Journal of Coastal Research, 24, 380-393;
Ten Brike W.B.M., Kolen B., Dollee A., Van Waveren H., Wouters K., 2010, *Contingency planning for large-scale floods in the Netherlands*, Journal on Contingencies and Crisis management, 18, 55-69
Url, T., Sinabell, F., 2008, *Flood risk exposure in Austria – options for bearing risk efficiently*, Schmollers Jahrbuch (Journal of Applied Social Science Studies), SJ 128 (2008), 593–614.
Ustrnul, Z., Wypych, A., Henek, E., Maciejewski, M., Bochenek, B., 2015, *Climatologically based warning system against meteorological hazards and weather extremes: the example for Poland*, Nat Hazards, 77:1711-1729
Van der Sar N.M., 2014, Risk Assessment 2014, available at: https://zoek.officielebekendmakingen.nl/blg-346093, accessed on April 2016
Walraven A., Aerts J., 2008, *Connecting Delta Cities. Sea level rise and major coastal cities*. Report Free University Amsterdam, the Netherlands
Ward, S. M., Paulus, G., 2013, *Augmenting Austrian flood management practices through geospatial predictive analytics: a study in Carinthia,* Nat. Hazards Earth Syst. Sci., 13, 1445–1455, 2013, doi:10.5194/nhess-13-1445-2013
Zebisch M., Grothmann T., Schroeter D., Hasse C., Fritsch U., Cramer W., 2005, *Climate Change in Germany. Vulnerability and Adaptation on Climate Sensitive Sectors*. Federal Environmental Agency (Umweltbundesamt), Dessau
Zlateva, P., Pashova, L., Stoyanov, K., Velev, D., 2011, *Social Risk Assessment from Natural Hazards Using Fuzzy Logic,* International Journal of Social Science and Humanity, Vol. 1, No. 3, September 2011

BBDR, 2015, Bericht der Bundesrepublik Deutschland zu Risikobewertung gemäß Artikel 6 EU des Beschlusses Nr. 131/2013/EU über ein Katastrophenschutzverfaren der Union
Cabinet Office, 2015, *National Risk Register of Civil Emergencies*, 2015 edition, London, UK;
CCPCC, 2007, Comisíon de Coordinación de Políticas de Cambio Climático, 2007. *El cambio climático en España. Estado de situación*. Documento resumen Noviembro de 2007;
CRED EM-DAT (Feb. 2015) – The OFDA/CRED – International Disaster Database www.emdat.be Université catholique de Louvain Brussels – Belgium;
Department of Energy and Climate Change of the United Kingdom, 2009, *The UK's Fifth National Communication under the United Nations Framework Convention on Climate Change*;
EFRA, 2016, Home fire safety, http://www.homefiresafety.eu/
European Child Safety Alliance, 2016, *Fires in the Home,* available at http://www.childsafetyeurope.org/publications/info/factsheets/fires-in-the-home.pdf, accessed on April 2016

European Commission, 2002, *Communication From the Commission to the European Parliament and the Council, The European Community Response to the Flooding in Austria, Germany and Several Applicant Countries – A Solidarity-Based Initiative*, COM(2002) 481 Brussels, Belgium, available at: http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52002DC0481, accessed on April 2016
European Commission, 2014, Commission staff working document, *Overview of natural and man-made disaster risks in the EU*, Brussels, 8.4.2014
European Commission, 2015, Commission staff working document, *Report on the progress in implementation of the Floods Directive,* Brussels, 9.3.2015
European Environment Agency, 2010, *Mapping the impacts of natural hazards and technological accidents in Europe. An overview of the last decade*, EEA Technical report No 13/2010, ISSN 1725-2237
European Environment Agency, 2012, *Climate change, impacts and vulnerability in Europe*, Technical Report No. 12/2012, 210-206
EU and UNDP, 2013, *Natural Disaster Risks and Risk Assessment in South East Europe*, available at:ww.gripweb.org/gripweb/sites/default/files/disaster_risk_profiles/SEE%20DRR%20Risk%20Assessment%20Report-Final.pdf, accessed on February 2016
Hungarian Ministry of Environment and Water, 2009. *5th National Communication to the UNFCCC,* available at: http://unfccc.int/resource/docs/natc/hun_nc5.pdf, accessed on March 2016
Government of Federal Republic of Germany, 2006, *4th National Communication Report under the Kyoto Protocol to the United Nations Framework Convention on Climate Change*
KAMEDO Report No. 88, 2002, *Floods in the Czech Republic and Southeastern Germany*, 2002, Ulla Näsman, Birgit Zetterberg-Randén, Helge Brändström (ed.), KAMEDO = Swedish Disaster Medicine Study Organization;
Ministry of the Environment, Spatial Planning and Energy, Republic of Slovenia, 2002. *Slovenia's First National Communication under the UN Framework Convention on Climate Change*; available at: http://unfccc.int/resource/docs/natc/sloenc1.pdf, accessed on March 2016
Ministry of the Environment and Spatial Planning, Republic of Slovenia, 2006, *Slovenia's Fourth National Communication under the United Nations Framework Convention on Climate Change*; available at: http://unfccc.int/resource/docs/natc/svnnc4.pdf, accessed on March 2016
Ministry of the Environment and Spatial Planning, Republic of Slovenia, 2010, *Slovenia's Fifth National Communication under the United Nations Framework Convention on Climate Change,* available at: http://unfccc.int/resource/docs/natc/svn_nc5.pdf, accessed on March 2016
Ministry of the Environment of Sweden, 2009. *Sweden's Fifth National Report under the United Nation's Framework Convention on Climate Change*, available at: http://unfccc.int/resource/docs/natc/swe_nc5.pdf, accessed on April 2016
Ministry of the Interior Finland, 2016, *National Risk Assessment 2015*, Helsinki 2016, available at: https://www.intermin.fi/download/65647_julkaisu_042016.pdf?24174829b537d388, accessed on March 2016
Ministry of Internal Affairs, General Inspectorate for Emergency Situations, 2015, National Risk Assessment 2015 – Summary – Romania.
Office of Emergency Planning, 2012, A National Risk Assessment for Ireland, available at https://emergencyplanning.ie/media/docs/A%20National%20Risk%20Assessment%20for%20Ireland%20Published.pdf

Portuguese Environment Agency with the cooperation of Ecoprogresso – Environment and Development Consultants SA, 2009, *Fifth National Communication to the United Nations Framework Convention on Climate Change. Second National Communication in the context of Kyoto Protocol*, 248 pp, available at: http://unfccc.int/resource/docs/natc/prt_nc5_resubmission_2.pdf, accessed on April 2016

PT FHRM Report, 2015, *Portugal Assessment of Flood Hazard and Flood Risks Maps* (http://ec.europa.eu/environment/water/flood_risk/pdf/fhrm_reports/PT%20FHRM%20Report.pdf)

Republic of Austria, National Crisis and Disaster Protection Management, 2014, *Gemeinschaftskonzept zur Verhütung von Naturkatastrophen und von Menschen Verursachten Katastrophen*, Version 4 Stand 16/09/2014, in German

Republic of Cyprus, Cyprus Civil Defence Department, Ministry of Interior, 2015, *1st Report on the National Risk Assessment Program of the Republic of Cyprus*, available at: http://www.moi.gov.cy/moi/CD/cd.nsf/all/0C74FEE8301614EAC2257F16002D8656/$file/RISK%20ASSESSMENT%20REPORT_CYPRUS_DEC%202015.pdf?openelement, accessed on March 2016

Risk Management Solutions Inc., 2003, *Central Europe Flooding*, August 2002, event report, 21 pp, available at: http://forms2.rms.com/rs/729-DJX-565/images/fl_2002_central_europe_flooding.pdf, accessed on March 2016

Swedish Commission on Climate and Vulnerability, 2007, *Sweden facing climate change - threats and opportunities*. Final report of the Swedish Commission on Climate and Vulnerability. Swedish Government Official Reports SOU 2007

The Danish Emergency Management Agency (DEMA), 2013, *National Risk Profile*, available at: http://brs.dk/viden/publikationer/Documents/National_Risk_Profile_(NRP)_-_English-language_version.pdf, accessed on April 2016

United Nations Environmental Programme/Dewa/Grid-Europe, 2004, *Impacts of summer 2003 heat wave in Europe,* Environment Alert Bulletin no. 2

UNU-EHS, 2015, World Risk Report, available at http://www.worldriskreport.org/fileadmin/PDF/2015/WRR_2015_engl_online.pdf, accessed on March 2016

World Health Organisation, 2011, *Burns Preventions: Success Stories from Lessons Learned*, Geneva, 2011, available at: http://www.who.int/violence_injury_prevention/publications/other_injury/burn_success_stories/en/, accessed on March 2016

World Meteorological Organization, 2012, *Strengthening Multi-Hazard Early Warning Systems and Risk Assessment in the Western Balkans and Turkey: Assessment of Capacities, Gaps and Needs, (Chapter 4 - Croatia)*, Regional Programme on Disaster Risk Reduction in South East Europe Activity 2 (WMO): Regional Cooperation in South Eastern Europe for Meteorological, Hydrological and Climate Data Management and Exchange to Support Disaster Risk Reduction (IPA/2009/199-922)

*** Lithuania report for national reporting and information on disaster reduction for the World Conference on Disaster Reduction, 2005, available at http://www.unisdr.org/2005/mdgs-drr/national-reports/Lithuania-report.pdf

*** Romania National report regarding the disasters prevention in Romania, elaborated for the Disaster World Conference (Kobe-Hyogo, Japan, 18-22 January 2005), available at http://www.unisdr.org/2005/mdgs-drr/national-reports/Romania-report.pdf

- http://www.climatechangepost.com/latvia/storms/
- https://latvianhistory.com/2013/12/06/natural-disasters-in-latvia/

- http://www.timesofmalta.com/articles/view/20100527/local/malta-has-least-risk-of-natural-disaster-report.309099