Report on natural disasters in the Western Balkans

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Kosovo*: This designation is without prejudice to positions on status, and is in line with UNSCR 1244/99 and the ICJ Opinion on the Kosovo Declaration of Independence

1 Introduction

Information about natural disasters in Western Balkan region is indispensable for developing master curricula for risk management in these countries. According to work package 1.1 (WP 1.1) a partnership between BOKU and all partners from the Western Balkans is foreseen to close the knowledge gap about natural disasters. In the following chapters information about natural disasters, analysis of risk management aspects and survey of responsible institutes are documented for Western Balkan countries. In this report information of several reports was merged to get an overview about all natural disasters in the Western Balkans. Information in detail is given in the following reports, which can be found on the web page http://www.natrisk.ni.ac.rs/:

- WP1.1 UNI, UNID, KPA
- WP1.1 UNSA
- WP1.1 UPKM, TCASU
- WP1.1 VSUP

2 Identification of natural disasters

Natural disasters, which have occurred in Western Balkan countries, are qualitatively and/or quantitatively identified in the following chapters for all WB project partners. The following documentations are supported by photos of natural disasters and their consequences to improve the understanding of different process types.

2.1 Bosnia and Herzegovina

2.1.1 Types of extreme events

In Bosnia and Herzegovina occur a significant number of various kinds of natural disasters, with different frequency intensity. An overview of the major natural hazards like floods, landslides, earthquakes, wild fires, droughts as well as blizzard and snow drifts is given in the following chapters.

2.1.2 Landslides

The topography of the central part of Bosnia and Herzegovina (B&H) features mountainous terrains with peaks ranging from 500 to 2000 m above sea level. Approximately 2,400,000 ha (or 48%) of the total land area is forested and the remaining about 2,700,000 ha (52%) are covered by agricultural lands (CPDR 2007). Due to the topographic characteristics as well as other natural conditions such as torrential rainfall, landslides are continuous and well known hazards in B&H and represent complex and ever-increasing problems to communities and authorities at all levels.

According to Custovic, approximately 83% of overall B&H land is located in the hilly area (300 to 500m above sea level), hilly or Mediterranean mountainous areas (500 to 700m above sea level) or mountainous area (more than 700m above sea level). In these areas, the soil is often shallow and groundwater table is high. These topographic and hydrogeological characteristics are considered to be one of the primary reasons of the high change of landslides in B&H.

From the geological standpoint, many landslides in B&H appear to be related to the top soils and rarely to the failure of the underlying bedrocks. Areas consist of sandy clay, sandy silt soils and boulders are also affected by an increase of the pore water pressure (and subsequent reduction of the shear resistance). In many cases, these landslides in B&H are shallow and are observed on the relatively gentle slopes (typically less than 20 degrees) which often consist of thin layers of top soil and residual soils overlying weathered rocks. Many of these landslides can be classified into the "earth slide" or "earth flow" as per and "clayey soil slide".
In addition, "rotational slide" or "weathered rock slide" and "colluviums deposit slide" are also occasionally observed in B&H.
Other factors such as human factors can very often contribute tolandslide occurrence. The 1992 – 1995 war in the country also caused massive migration of people, linked with illegal construction of houses in the sloping areas or alongside riverbeds. In addition, lack of spatial planning documentation based on geological analysis leads to unsustainable territorial development and infrastructure investments, which in the long term also causes landslide hazards. Moreover, human activities relating to expansion on unsafe locations, unscientific mining, hazardous construction of roads, dams and ignoring natural features contribute to increased intensity of landslides.

In the year 2016 UNDP has developed hazard maps for landslides in B&H (Figure 1).

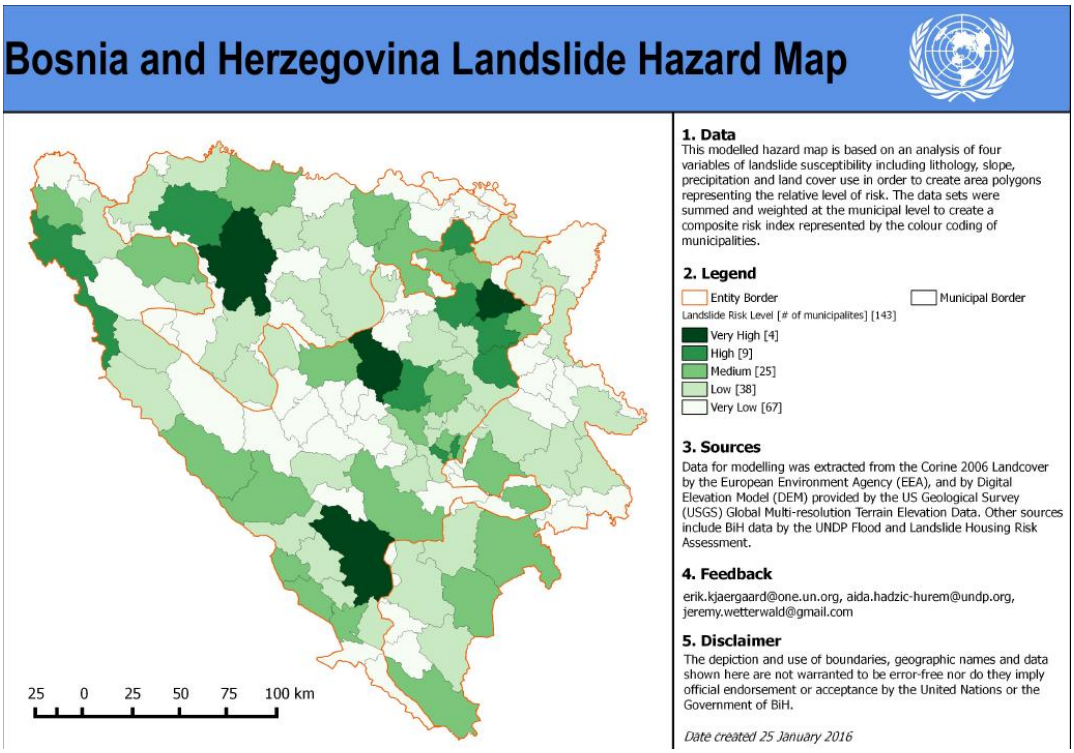


Figure 1: Landslide Hazard Map of Bosnia and Herzegovina (UNDP, 2016)

Landslides in 2014

Due to the floods, especially during the "floods in May", numerous landslides were activated and residential buildings were demolished (Figure 2). According to available data, in floods that occurred in May in Bosnia and Herzegovina, there was a total of 5,841 triggered landslides in affected areas of municipalities.

Figure 2: Typical "earth flow" recorded during heavy rainfall events in May 2014

2.1.3 Earthquakes

In the last decades several earthquakes occurred all over Bosnia and Herzegovina. Due to the fact that the Republic of Srpska was particularly affected a hydrometerorological Service was installed carring out observation, measuring and collection of data through the network of seismological stations.

In the year 2016 UNDP has developed hazard maps for earthquakes in B&H (Figure 3).

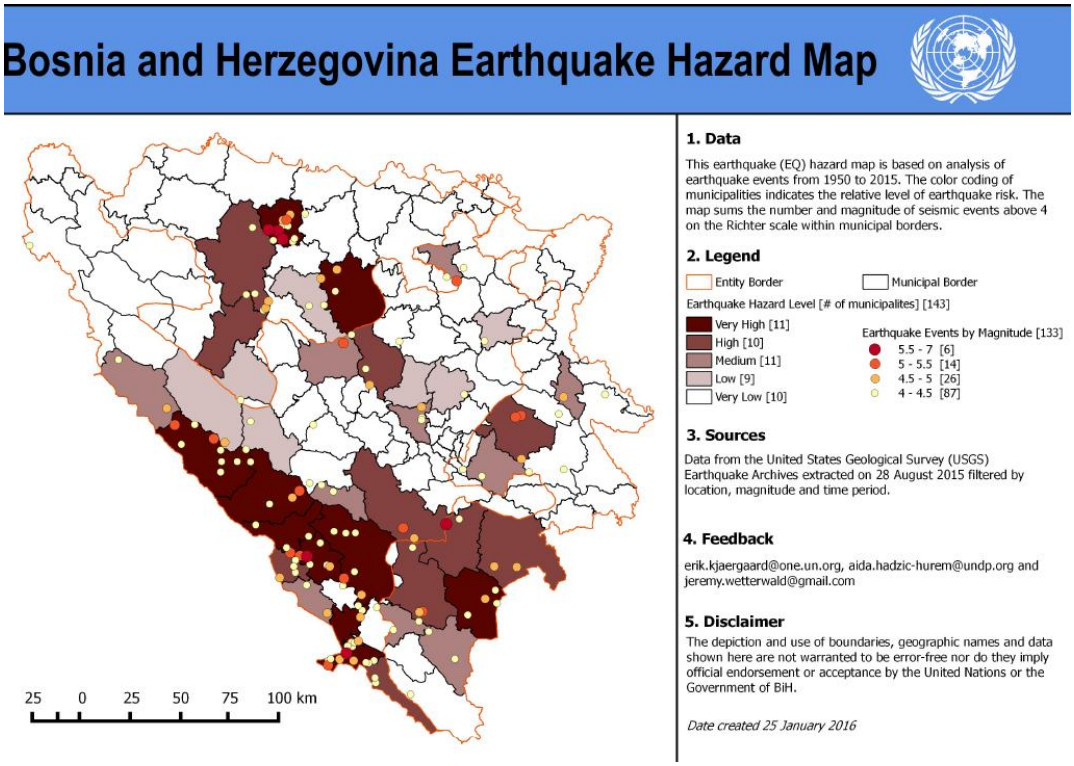


Figure 3: Earthquake Hazard Map of Bosnia and Herzegovina (UNDP, 2016)

A few selected earthquakes are described below.

Earthquake in 1888

The first series of earthquakes occurred in 1888 in the Banja Luka area, and the representative of the series was an earthquake that occurred 20th May 1888, M=5.7 Richter scale and intensity VI degree MCS (Mercalli-Cancani-Sieberg) scale.

Earthquake in 1969

On 26 and 27 October 1969 (Figure 4), 4 strong earthquakesoccurred and the main strike occurred on 27. 10. 1969 at 8.10 am, with a magnitude of M=6.6 Richter scale, followed by a sudden surge in the subsequent at 8.53 am, M=4.7 Richter scale. Earthquakes have left disastrous consequences in the area of 15 municipalitiesof Bosanska Krajina: Banja Luka, Čelinac, Laktaši, Gradiška, Prnjavor, Kotor Varoš, Kneževo, Srbac, Ključ, Jajce, Prijedor, Sanski Most, Kozarska Dubica and Novi Grad.

Figure 4: Earthquake in Banja Luka in October 1969

Earthquake in 2014

One of the largest earthquakes in previous years occurred on 29th of April 2014 in Banja Luka region with a magnitude of M=4.3 Richter.

2.1.4 Floods

Annually, the quantity of the rain in Bosnia and Herzegovina is about 1 250 l/m^{2}of rain or a total of 64 x 106 m^3 of precipitation. On the territory of Bosnia and Herzegovina, annual swell is 1,155 m^3/sec or about 57% of total precipitation and 62.3% goes through the Sava River basin to the Black Sea and 37.5% trough river basin to the Adriatic Sea. In general, according to total annual precipitation and runoff, Bosnia and Herzegovina is considered to be water rich area, and climatic, geographical and other relevant factors are adversely affecting the hydrological regime in all relations and on most watercourses, classifying it extremely uneven, not only in space but also in time (Deronja Suljic, 2015).

"In BiH, the key challenges are rehabilitation of water supply and water systems, flood control, water quality management and ecosystems, and the development of solid institutional framework" (Deronja Suljic, 2015).

It is already known that Bosnia and Herzegovina is exposed to a high risk of flooding. Flooding have, on several occasions, inflicted great damage to the economy, infrastructure facilities, the environment, the health of the population, induding the loss of human lives.

In the year 2016 UNDP has developed hazard maps for floods in B&H (Figure 5).

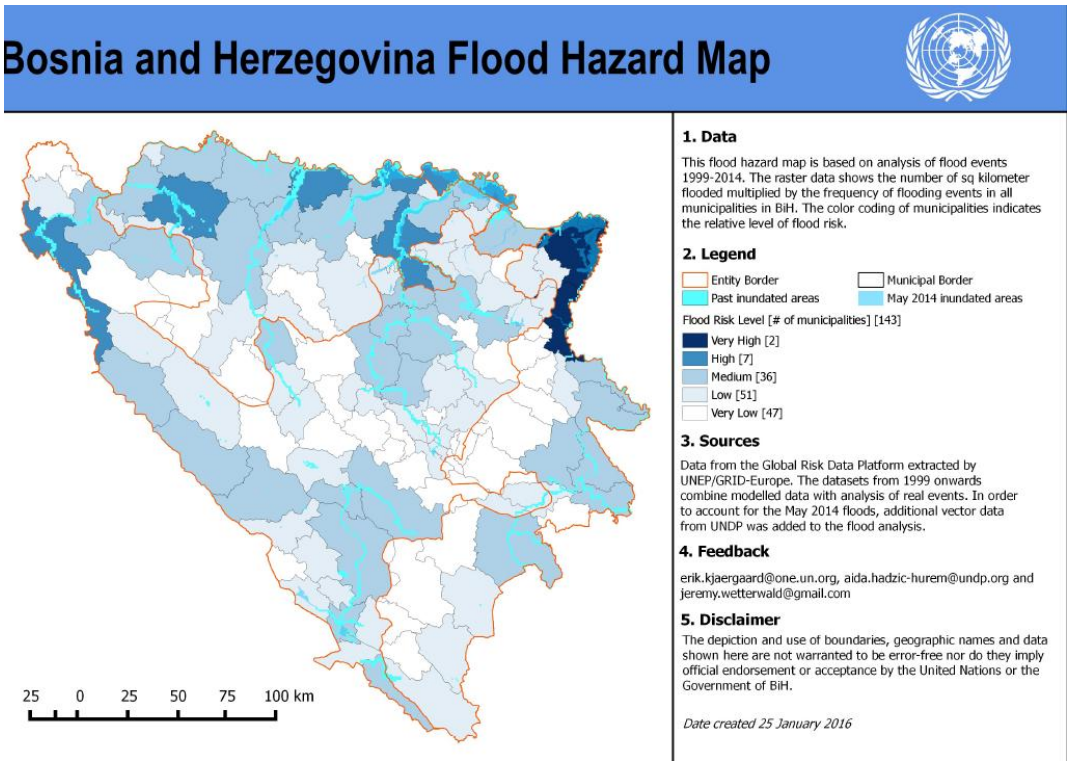


Figure 5: Flood Hazard Map of Bosnia and Herzegovina (UNDP, 2016)

Floods in 2001

Due to heavy rainfalls between 50 and 100 l/m² floods occured in April 2001 (Figure 6) causing enormous damage to agriculture, on buildings, roads, civil engineering structures and infrastructures in the municipalities Orašje, Zenica, Doboj, Tuzla and Travnik.

Figure 6: Floods in the River Una in the year 2001

Floods in 2004

Around 13.500 ha of agricultural area has been affected by floods in March and April 2004 in the cantons Central Bosnia Canton, Una-Sana Canton and Herzegovina-Neretva Canton leading to overall lossess of around 13million Euros.

Floods in 2010

In January, June and December 2010 occured floods (Figure 7) in the cantons Tuzla Canton, Posavina Canton, Bosanian-Podrinje Canton, Zenica-Doboj Canton and Herzegovina-Neretva Canton causing overall losses of around 44 million Euros.

Figure 7: Floods in the River Bosna in the year 2010

Floods in 2014

The last occurred on May 2014, and were catastrophic (Figure 8). Flood damage could not be avoided, but it could have been reduced if all the steps were taken to build a functional and efficient system of flood protection.

Figure 8: Consequences of Floods in May 2014 (up) and comparison pictures in October 2014 (down)

In mid-May 2014, the territory of Bosnia and Herzegovina, Serbia and Croatia were caught by a storm accompanied by large amounts of rain, which caused an increase in water levels in all rivers and their tributaries, and flooding vast areas of land.After several days of rainfall in mid-May 2014that has overcome the record of the last 120 years there was a rapid increase in the river levels of Bosna, Sava and Drina rivers and their tributaries.At least 23 people died as a result of floods and thousands were temporarily or permanently evacuated from their homes.Also, in the flooded areas and areas affected (Figure 9) by landslides 14,415 residential buildings were damaged, while 1,030 residential buildings weredemolished. In addition, the total flooded surface was 30,478 ha of agricultural land.The final estimate of 3.98 billion BAM was done only with the help of international experts, because the entity teams (due to the different methodology used)have expressed doubts about the entity estimates the damage,disputing them (Evropska komisija, 2014).

Figure 9: Areas affected by floods in May 2014

2.1.5 Wild fires

Forest fires are uncontrolled movements of uncontrolled fire on the forest area, and differ according to the type, method and origin of the damage.

In the year 2016 UNDP has developed hazard maps for fires in B&H (Figure 5).

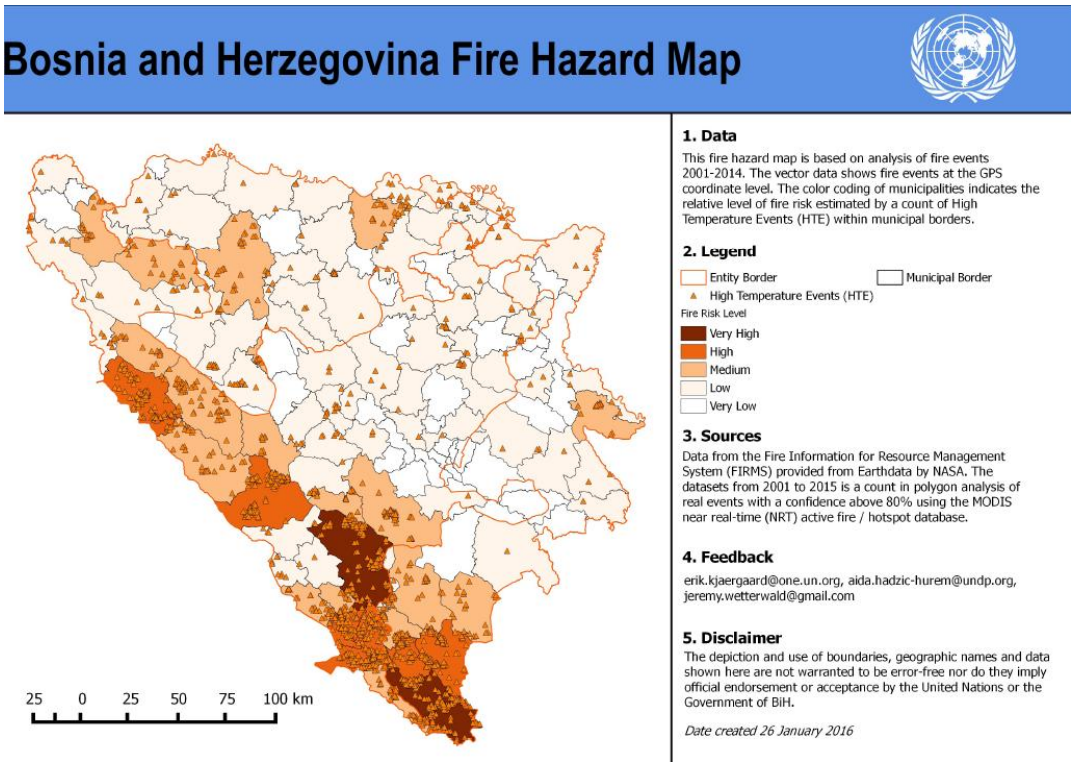


Figure 10: Fire Hazard Map of Bosnia and Herzegovina (UNDP, 2016)

Direct damages include loss of timber supplies, terrestrial vegetation and other forest products, and the cost of extinguishing the fire and rehabilitation.

Indirect damage includes a negative impact on beneficial functions of forests and is determined in a relative manner.

According to the Ministry of Agriculture, Water Management and Forestry of the Federation of B&H the data concerning wild fires as well as estimated damage in the period from 2007 to 2012 is as follows in Table 1:

Table 1: Wild fires as well as estimated damage in the period from 2007 to 2012

Year	No of fires	Fired area (ha)	Burned wood mass (m^3)	Burned number of seedlings (pieces)	Estimated damage (KM)	Note
2007.	932	13.742,00	40.017,00	32.644,00	4.787.131,50	
2008.	355	5.354,00	32.318,00	199533,00	1.897.047,0	
2009.	190	1.396,00	1.954,00	132576,00	560538,50	
2010.	116	116,00	1.268,00	15.807,00	217345,50	This is for 8 Cantons as HNC and WHC did not submit the data
2011.	682	6.609,91	6.893,94	23.778,00	2.523.579,50	This is for 9 Canton as HNC dod not submit the data
2012.	1082	43.317,20	831 488,00	710.990,00	23.876.550,50	Data from the Ministry of Agriculture, Water Management and Forestry of the Federation of B&H
2007. – 2012.	**3357**	**70.535,11**	**913.938,94**	**1.115.328,00**	**33.862.195,50**	

2008. – 2012.	2425	56.793,11	873.921,94	1.082.684,00	29.075.061,00	

The natural disaster in February 2017 in Trebevic (Sarajevo Canton) is exemplary shown in Figure 11 for wild fires in Bosnia and Herzegovina.

Figure 11: Fire in Trebevic (Sarajevo Canton) in February 2017

2.1.6 Droughts

In Bosnia and Herzegovina droughts cause great damages to agricultural and food production industry almost every year.

Drought can be displayed in two ways: via the quantity of water shortages in the soil in mm and through the relationship between actual and potential evapotranspiration (SET/PET) with the so-called coefficient of drought. The average annual water deficit in the soil in B&H is about 125 mm, with the largest in the southern parts (300 mm), considerably lower in northern (100 mm) and lowest in the central parts (50 mm). Agriculture must be protected not only from average droughts but also those that occur once a decade. Therefore, one must take into account the frequency of drought.

The greatest risk of drought in Bosnia and Herzegovina is in the northeast and southwest. Namely, in the last 50 years 7 extremely dry periods were noted.

It was found that the strongest droughts occur in the Mostar area. In that part of B&Hthe catastrophic drought with annual soil water deficiency of over 400 mm was recorded in 1952. Very mild drought has Bihać area, or they are not present at all. Other locations are between these two.

Descending order of drought that occurs once every ten years would be as follows: Mostar >Bijeljina>BosanskiBrod> Tuzla> Sarajevo>Livno> Banja Luka>Bihać (Table 2)

Table 2:Annual water deficit in the soil in mm

	The scale of intensity					
	Annual soil water deficiency in mm					
	0	1 -100	101 - 200	201 - 300	301 - 400	>
Location	No drought	Very mild drought	Mild droughts	Severe drought	Very severe drought	Catastrophic drought
Bihac	17	10	3	0	0	0
Banja Luka	12	12	4	2	0	0
BosanskiBrod	4	8	13	5	0	0
Bijeljina	3	6	13	7	1	0
Tuzla	12	13	2	3	0	0
Livno	6	17	5	2	0	0
Sarajevo	8	11	10	1	0	0
Mostar	0	8	9	10	2	1

Depending on the climatic characteristics of climate, drought can occur in different seasons, and with varying intensity. In the Mediterranean climate drought may last for 5-6 months a year, and in the northern parts of the country and karst fields 3 months (August-October).
In the flat part of the country drought is less pronounced than in Herzegovina, while at least expressed in the mountainous part of Bosnia.
During the last decades in Bosnia and Herzegovina there were several drought years (2000, 2003, 2007, 2011, 2012): In August 2000, Bosnia and Herzegovina suffered from the worst drought in 120 years; about 60% of agricultural production was affected which resulted extremly food deficiency.
In summer 2003. more communities in B&H was hit by fourmonth drought which caused arround 200 million euro damages in agriculture and affected 200.000 people ”
In summer 2007. Extreme hight temperatures and drought destroyed more than 40% agricultural production and caused forest fires which affected about 250 ha
Also in 2012 (Figure 12) we had prolonged drought period which caused damages from 1 bilion USD in agricultural production and 70% reduced grains and vegetable yealds. Reduced energy production from power plant for 25 %.

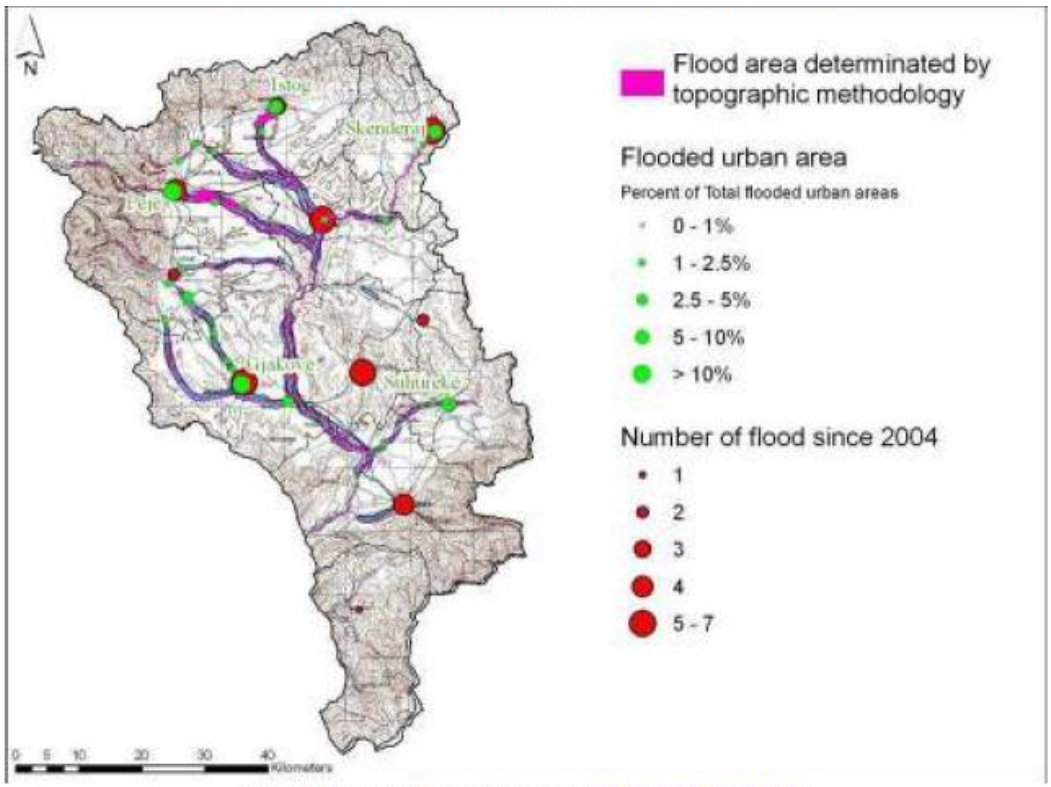
Figure 12: Drought in Bosnia and Herzegovina in the year 2012

2.1.7 Blizzard and snow drifts

Although Bosnia and Herzegovina haven't had long-term problems with blizzards and snow driftsin recent years, still certain problems appear in some parts especially of the Republic of Srpska and in particular periods in winter which are related to snow drifts on the roads that prevent the normal flow of traffic and economic activities of people that live in that area. This is typical for the area of Foča,especially for travel route trough Čemerno that connects the area of eastern Herzegovina with the area of Sarajevo-Romanija. In addition to this, occasional snow drifts that cause certain problems with the normal functioning of people were recorded in the area of Mrkonjić Grad, Birač and Pale.

2.2 Kosovo*

Kosovo* is exposed to frequent floods, heavy snowfall, drought, and other meteorological hazards. Most of Kosovo* is exposed to flooding (Figure 13). Flash floods are common in mountain areas (where average annual precipitation is as much as 1750 mm per year), while river floods occur in plains and lowlands. Floods also trigger occasional mudflows in mountain areas. Outburst floods are a threat to Pristina, Mitrovica, Podujevo and Dakovica, due to the structural vulnerability of dams. In some highly exposed rivers basins (such as the Drim in the western part) floods occur every 2-3 years. Urosevac city was struck by a severe flood that affected the southern part of the city in 1973. Between November of 2007 and June of 2008 three floods displaced 3,500 people and damaged homes and agricultural land, which necessitated humanitarian assistance from the international community.



Source: Kosovo Water Project, www.kosovo-water.eu

Figure 13: Flood Hazard Map of Drini River Basin

Kosovo* is regularly exposed to both meteorological and hydrological drought. Due to seasonal fluctuations in precipitation, agricultural production in regions with no irrigation is often affected. Water scarcity mainly affects low lying areas in the central as eastern portions of the country. This is due to seasonality of natural river flows and groundwater recharge, as well as poor management of resources. Kosovo* has been struck by drought several times in the last two decades (1993, 2000, 2007, and 2008).
In 2000 moderate to severe metrological drought covered most of the territory of Kosovo*, as shown in Figure 14 below. Since 2004 80% of Kosovo* municipalities have suffered from water shortages due to hydrological drought and the misuse of water resources.

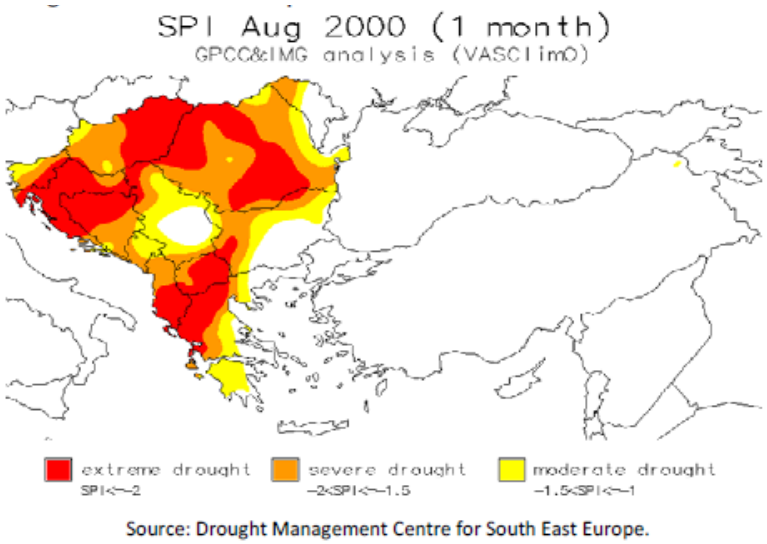


Figure 14: Standard Precipitation Index for Western Balkans in the year 2000 (DMCSEE, www.dmcsee.org, 2017)

Forests comprise 43% of the territory of Kosovo*. They are especially prone to catch fire at the end of spring and during dry summers. Since 2000 there have been an increasing number of forest fires. Fire brigades and other relevant operational teams have carried out between 2,000 and 3,000 interventions for each subsequent year.
Exposure to hazards such as droughts, floods, and wildfires will become greater with climate change. Climate variability has already increased in the Western Balkans. The past few decades have witnessed a rising intensity of precipitation extremes like heavy rain events, as well as more severe drought, particularly since 1980s. Climate change owing to global warming is expected to accelerate this trend. According to the available projections, higher temperatures will make heat waves and forest fires more likely to occur. Extreme rainfall events and increased variability of river flows will make flooding more frequent and severe. Increased temperatures, more uncertain rainfall, and reduced runoff will heighten exposure to drought.

Kosovo* is located in a seismically active zone, making it susceptible to earthquakes. As shown in Figure 15 below, most of the country is located in a moderate to high hazard zone. Significant earthquakes occurred in Kosovo* in 1921 in Urosevac (intensity of IX on the MSK-64 scale and a magnitude of 6.1), in 1980 in Kopaonik region (intensity of VIII degrees and a magnitude 5.9), in 2002 in the Gnjilane municipality (intensity of VIII-IX and a magnitude of 5.7). The latter event resulted in significant structural damage and evacuation of people in the affected villages. The most recent significant earthquake in Kosovo* occurred in 2010 in the eastern part of the

country and measured 5.2 magnitude according to the Seismological Institute in Pristina. Kosovo* has suffered severe levels of destruction on several occasions due to earthquakes that have occurred in the neighboring countries, such as Albania, Montenegro, Macedonia, and Serbia.

Kosovo* is also exposed to landslides, particularly in the areas of Mitrovica, Pristina, Pec, and Strpce. At least one-quarter of communities are vulnerable to landslides/rockfalls with an incidence rate probability of 1% (10% over 10 years).

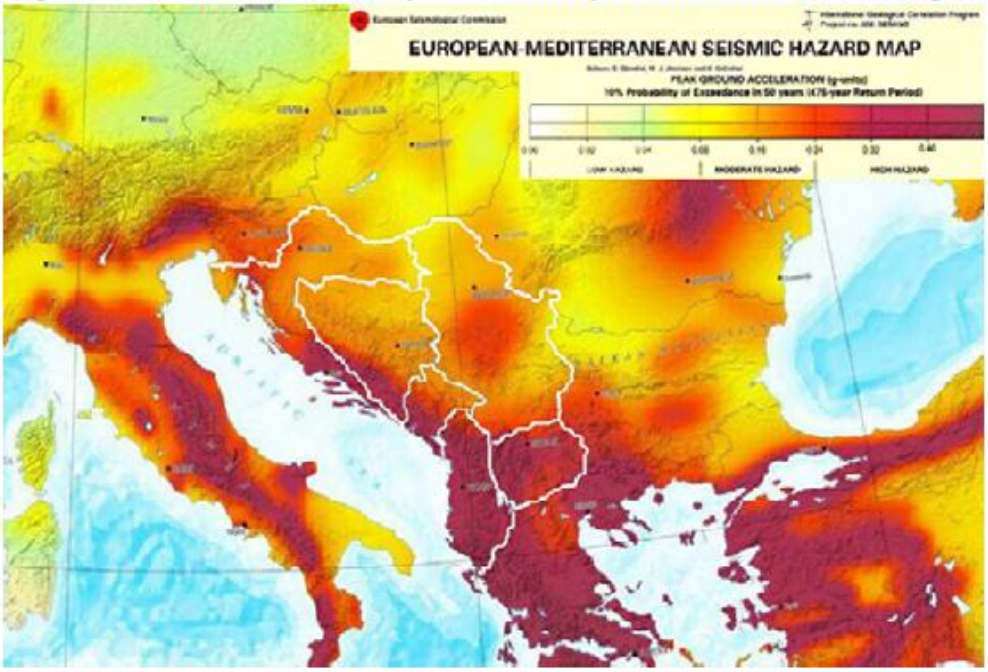


Figure 15: Seismic Hazard Map of the European-Mediterranean Region

2.2.1 Types of extreme events

In January and February 2012, due to extremely low temperatures and windstorms followed by heavy snowfall, several municipalities in Kosovo* have been heavily affected, with many villages being cut off from road traffic and supply of goods. The majority of the affected villages are situated in the rural and poorer areas of Kosovo*, and the emergency situation represents an additional hardship in their already difficult situation. Several municipalities across Kosovo* were forced to declare states of emergency.

Snowfall and storms caused an avalanche that resulted in ten fatalities in the village of Restelica, Dragash municipality. There were shortages of food and other essential goods, as the population was not prepared for such a harsh winter with extreme weather.

Since the end of the conflict in 1999, Kosovo* has been experiencing an unprecedented construction boom and urbanization, which is not adequately controlled by the authorities. Structural vulnerability to earthquakes and floods is increased by illegal construction in hazard zones and failure to adhere to building codes (the majority of buildings are out of compliance). Lack of maintenance and destruction during wartime further aggravate this vulnerability. Moreover, inadequate design of drainage and sewage systems in urban areas makes it more likely that floods will form here and that subsequently drinking water supplies will be unprotected.

Inadequate land use and municipal planning places many populations in the way of hazards. This was a significant factor in damages caused by a severe flood that affected Urosevac city in 1973. Moreover, according to a study by the OSCE in Kosovo*, illegal construction and informal settlements have exploded, informal and illegal transactions continue unabated, illegal occupation of property remains rampant, and the cadastre system and property rights register are incomplete and inaccurate.

The most recent events on the North of Kosovo* were floods in 2014.

Heavy rainfalls in April 2014 (Figure 16) have caused floods leading to significant infrastructure damage to several communities in Kosovo*.

Figure 16: Floods in Kosovo in the year 2014; Damaged Dam in Leposavic (left); Flooded agricultural land in April 2014 (right)*

The damage was mainly caused by overflowing of the rivers from their riverbeds and flooding of fields, gardens, orchards, meadows as well as construction objects on them. In several cases rainfalls caused landslides blocking roads and damaging property. Due to effects of torrent rains, some parts of the roads were washed away, which resulted in creation of gullies. Water also hollowed out road bases so that some sections of road surface collapsed. Five out of seven bridges over the Ibar River were, to bigger or smaller extent, affected by floods in April 2014. It is also necessary to mention that Kutinje bridge in Leposavić town was destroyed by floods in spring 2013 (Figure 17). The character and reasons of the bridge collapse are similar to those of this year damages. In Zvečan municipality private agricultural lands were damaged in Srbovac, Žitkovac, Valać, Grabovac, Lozište and Rudare villages. Altogether ca 150 ha of arable land was under the water. According to the municipal damage evaluation commission report, plots of at least 109 land owners were flooded, although the number could be bigger, because not all of them reported to the municipality. In Banjska village water destroyed 50 m long sustaining wall, which prevented banks from erosion and overflowing. Also surface of many local roads was covered by water. It affected local traffic and contributed to further worsening of the road surface. The main damage in Zubin Potok was caused by a landslide, which buried 80 m of the paved road passing through the rural areas between VeljiBreg village and Zubin Potok old town. The road became fully impassable and is closed for traffic.

Figure 17: Floods in Kosovo in the year 2013; Broken bridge in Kutnje (left); Damaged road (right)*

According to the municipalities damage evaluation commission, the public and private sectors suffered following damage from floods (Table 3):

Table 3: Assessed damage from floods in the Northern municipalities

Process type	Date	Municipality	Overall losses (€)	Additional information
Floods	April 2014	Northern municipalities	115.141	Agricultural facilities (incl. crops and plants)
Floods	April 2014	Northern municipalities	206.617	Repair of road infrastructure
Floods	April 2014	Northern municipalities	132.942	Repair of bridges
		Total	**454.700**	

In the area of Northern Kosovo* there are several mines for lead and zinc exploitation. Lead and zinc ore processing waste deposit is situated on the right bank of the river Ibar (Figure 18) and it is located on the distance of 1200 m from the location of mineral processing plant.

*Figure 18: Industrial waste landfill with erosion faults on the river Ibar bank in Kosovo**

The tailing waste deposit occupies 30 ha of mainly agricultural land and so far there were deposited 3,340,000 t of waste. For its specific content of heavy metals and non metals, toxic components and other polluting substances originated from flotation process, these deposits are sources of the air, soil surface and ground waters pollution. Floatation waste deposit has been exploited since 1980. The major part of the landfill is bordering with the Ibar River, i.e.

approximately 1km and has natural limits by the hill on the eastern side. Landfill is characterized by the relatively steep dam slopes on the northern and western sides with surface partly covered by sand and the rest is covered by oxidized pulp with deep erosion canals drills. Landfill remedy has not been done so there are no plants or grass on the surface. As a result, during the windy events the dust from the landfill is spread around and presents potential risk for the town of Leposavić and surrounding villages. When polluted water overflows the banks, it is spread on the fields and leaves pollutants (heavy metals in this case) into the soil. This is how a natural disaster multiplies hazardous impact from environmental pollution and, respectively, mitigation of flood risk will decrease pollutants' impact on people's health and environment.

2.3 Serbia

Serbia is a landlocked country situated in southeastern Europe, in the centre of the Balkan Peninsula, between 41°53′ and 46°11′ latitude North and 18°49′ and 23°00′ longitude East on an area of 88,509 km^2. Because Serbia covers part of the Pannonian Plain in the north, the country also belongs to Central Europe, while due to its southern region, in terms of geography and climate, Serbia is also considered as Mediterranean country.

The climate of Serbia is moderately continental, with localised variations and a gradual change between the seasons. Nearby geographical regions like the Alps, the Mediterranean Sea, the Bay of Genoa, the Pannonian Basin and the Morava Valley, the Carpathian and Rhodope Mountains, as well as Serbia's hilly and mountainous region, with its valleys and plateaus, significantly influence the weather and climate in Serbia. The dominant position of river valleys from the south towards the hilly areas in the north of the country allows the deep penetration of polar air masses in southern regions. The vast majority of Serbian territory lies in a temperate climate zone, but the southwestern regions border the subtropical and continental climate zones.

The mean annual air temperature for areas 300 m above sea-level is 10.9°C and for regions at an altitude of 300 m to 500 m it is around 10°C. In mountainous regions above 1000 m the air temperature is around 6°C, while in regions above 1500 m it is around 3°C. Autumn is warmer than spring. The coldest month is January with the mean monthly temperature ranging from -6°C in mountainous regions to around 0°C in the country's flat regions. The warmest month is July with the mean monthly temperature ranging from 11°C to 22°C.

The annual rainfall in low-lying areas ranges from 540 to 820 mm. Regions which are 1000 m above sea-level have between 700 and 1000 mm of rainfall annually, while some mountain peaks in southwestern Serbia have up to 1500 mm of rainfall a year. The majority of Serbia has continental rainfall patterns, with larger volumes in the warmer half of the year, apart from southwestern areas, which have the most rainfall in autumn. June is the rainiest month, with an average of 12 to 13% of the total annual rainfall that month. February and October are the least rainy months. The normal annual volume of rainfall for the entire country is 896 mm.

The northern part of Serbia, Vojvodina, located in the Pannonian Plain, is predominately flat. There are also plains in Macva, Posavina, Pomoravlje and Stig, as well as in Negotin Krajina in eastern Serbia. 55% of Serbia's land is arable, the large part of which is located in Vojvodina, the country's main agricultural region. The central part of Serbia and the hilly Sumadija region are located south of the Sava and Danube rivers. Further, south, the hills gradually give way to mountains.

The mountain landscape of Serbia is rich in canyons, gorges and caves, as well as preserved forests, which are home to a multitude of endemic species. Serbia's mountains belong to the Rhodopes range, which runs along the right and left sides of the South and Great Morava rivers and to the Carpathians and Balkan Mountains, which are located in the eastern part of Serbia, south of the Danube river.
Serbia has total population of 7,243,007 and is home to many different ethnic groups. According to the 2011 census, Serbs are the largest ethnic group in the country and constitute 83.3% of population. Hungarians are the largest ethnic minority in Serbia, concentrated predominately in northern Vojvodina and representing 3.5% of the country's population (13% in Vojvodina).

2.3.1 Types of extreme events

Occurence of significant number of various kinds of natural disasters, of different frequency and intensity is specific for the territory of Serbia. With an average of 100 disasters in ten years from the beginning of the 19th century, number of the natural disasters by the end of the 20th century reached the number of even 2.800 disasters in ten years (Table 4).

Table 4: Number of natural disasters by periods. Source: National strategy of protection and rescue in emergencies, Official Gazette of the Republic of Serbia, No. 86/2011

1900-1940	1960-1970	1980-1990	1990-2000
100	650	2.000	2.800

In most cases occurrence, scope and duration of natural disasters cannot be predicted in advance, but there are some phenomena for which, based on experience, statistics and methods of modeling as well as the place where they usually occur, it is possible to expect that they could occur. An assessment of vulnerability of the territory of the Republic of Serbia to floods and landslides has been done and, based on the available statistics, the map of natural disasters risk (forest fires, floods, landslides and earthquakes) has been made.

Table 5 shows the estimated area of the Republic of Serbia vulnerable to natural hazards and it covers total area of 57.33 % (Dragicevic et al., 2011).

Table 5: Areas vulnerable to natural hazards in the territory of Serbia

Natural hazard	Area [km2]	Percentage of total Serbian area [%]
Seismic hazard VI II–IX MCS	16388.59	18.55
Seismic hazard IX–X MCS	1109.71	1.26
Excessive erosion areas	3320.80	3.76
Landslide hazard areas	13327.60	15.08
Areas vulnerable to drought	18306.93	20.72
Potential floodable areas	15198.07	17.20
Highest risk of forest fires	3154.95	3.57
Vulnerable areas in Serbia	50659.87	57.33

A map of natural disaster risk is shown in Figure 19 (Dragicevic et al., 2011).

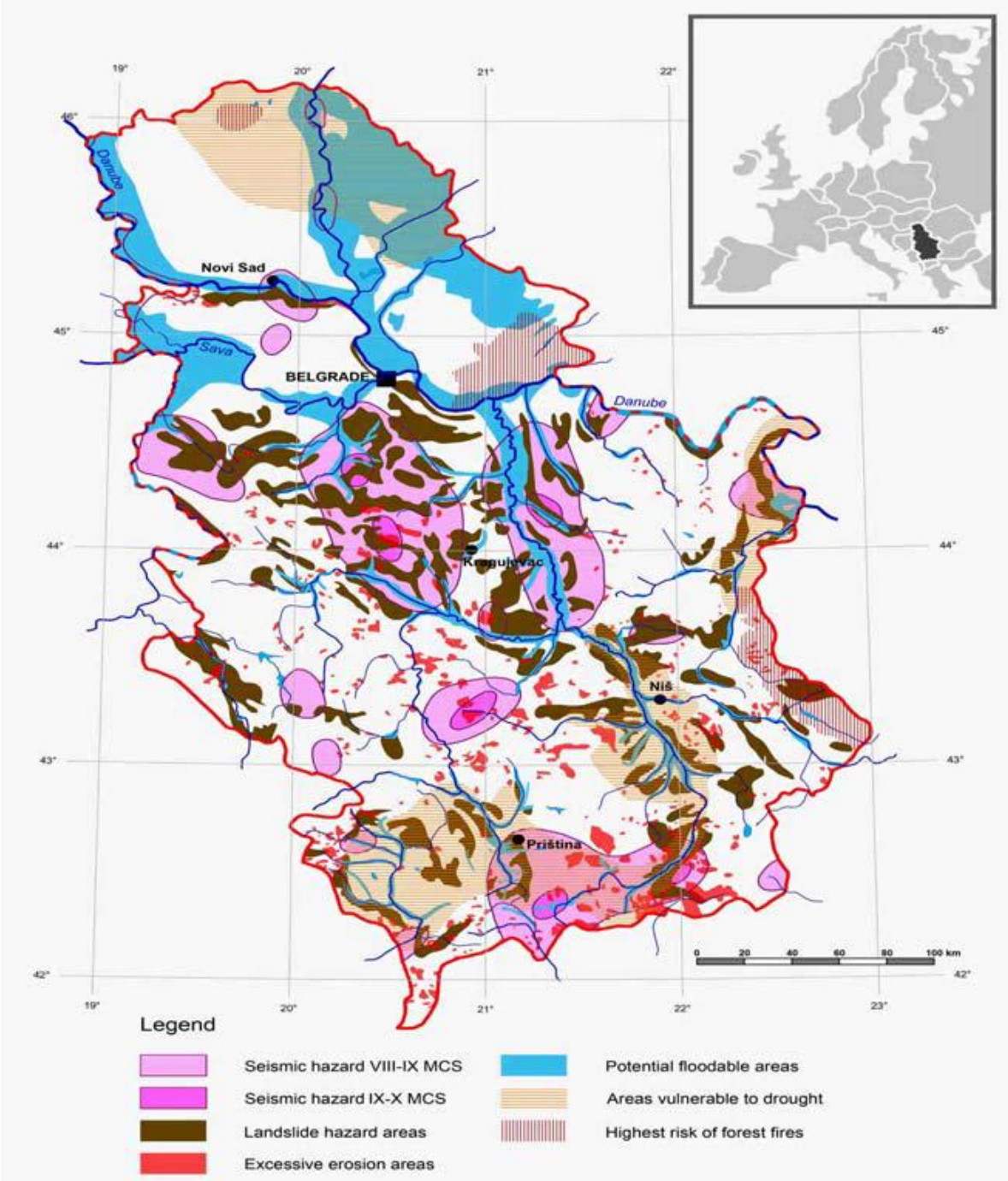


Figure 19: Integral vulnerability map of the natural hazards on the territory of Serbia. Source: Natural Hazard Assessment for Land-use Planning in Serbia (Dragicevic et al., 2011)

Most experts agree that the dimate changes will cause more frequent extreme climate consequences such as floods, landslides and fires (Sekulic, et al., 2012). Positive trend of number of catastrophic and unfavourable natural events especially reflects with the events depending on the meteorological conditions.

Table 6 contains the data relating the natural disasters registered in the last ~20 years on the territory of The Republic of Serbia, as well as the data relating epidemic of contagious diseases in the last 100 years.

Table 6: Identification of extreme events

Process type	Date	Catchment area/ Region	Municipality	Fatalities	Overall losses (€)	Additional information
Earthquake	May 1980	Kopaonik				measuring 5,8 on Richter scale
	September 1998		Mionica			measuring 5,7 on Richter scale
	November 2010		Kraljevo	2 killed, 180 injured		measuring 5,4 on Richter scale
Flood	1999	The river Velika Morava	Sumadija	8		30 bridges damaged
	2005	The river Tamis	Secanj, Zitiste, Plandiste			85.000 ha ad 150 houses flooded, 1000 people evacuated
	2005	The river Juzna Morava	Nis, Jablanica, Rasina, Toplica			
	2014	Serbia	24 municipalities	51	1,800,000,000	31879 people evacuated
Landslides and escarpments	2006	Bogdanje	Trstenik			130 houses destroyed
	2014	Umka-Duboko	Belgrade		54,000,000	Area of 1.8 km², about 14,000,000 m³
	2014	Krupanj	Krupanj		4,680,000	389 facilities either damaged or destroyed
	2014	Kladovo	Kladovo			30 landslided
Blizzards and snowdrifts	February 2014	Vojvodina, Eastern Serbia	Feketic, Majdanpek, Knjazevac			snowdrifts 5m high
	January 2017		13 municipalities in Serbia	Several people	60,000 per day	Regular ice defence along part of the Danube, Sava and the entire flow of the Tisa
Hail	May 2015	Central Serbia	Arilje, Kragujevac		10,000,000	50 % of raspberry growing areas
	June 2016	Banat	Pancevo			Damaged facilities, vehicles, crops
Drought	2000	Vojvodina and Central Serbia			657,000,000	Extreme drought, 37-61 tropic days
	2003	Vojvodinanad Central Serbia			940,000,000	Extreme drought
	2007	Serbia			564,000,000	Caused 258 forest fires
	2011	Eastern, South-eastern and Central Serbia			470,000,000	Extreme drought
	2012	Vojvodina and Central Serbia			1,900,000,000	5 to 8 heat waves
Epidemic of contagious diseases	1914-1918	Serbia		150,000 - 200,000		Typhus
	March 1972	Serbia- total number of 174 persons	124 Kosovo*, 1 Vojvodina,	175 ill, 35 died		Variola
	1998, 2010, 2014	Sokobanja, Pcinja, Gadzin Han		– 16 30		Tlaremia
Large-scale fires	2007	Staraplanina, Rtanj,	Pirot, Kraljevo, Vranje	Several injured	40,000,000	22.000 ha of forest, 258 forest fires
	August 2012	Tara, Zlatibor	Bajinabasta	2 killed, 22 injured	more than 30,000,000	11.000 ha of forest, 20 large-scale fires

The World Bank (2005) identified the weather dependent economic sectors in the Republic of Serbia, participation of these sectors in gross national income (without VAT), registered and assessed damage. Participation of the weather dependent sectors in gross national income of the Republic of Serbia without the autonomous Province Kosovo* and Metohia, at constant prices without VAT from the year 2002 for the period from 2000 to 2004 varied from 42% to 43.8%. Already in 2005 participation of the weather dependent sectors in gross national income of the Republic of Serbia was 47.18%. The World Bank's Study comprised only 49% of the weather dependent sectors and it did not take in consideration the damage caused by forest fires. However, 258 forest fires were registered during 2007. The area of 33.000 hectares of overgrowth was burnt an out of that area, 16.000 hectares were forest area. The forest fires caused the damage of about 40 million Euros. 24 million Euros was the amount necessary only for recovery. Indirect damage was not estimated.

Table 7 shows the estimated damage in the weather dependent sectors in the Republic of Serbia. There is no doubt that Serbian economy suffers enormous losses in material goods, but it is also obvious that the atmospheric disasters on the territory of the Republic of Serbia cause losses in human lives.

Table 7: Estimated damage in the weather dependent sectors in the Republic of Serbia

Sector/unfavorable weather events	**Estimation of losses in sectors**	
	Average annual losses in millions of dinars	**Average annual losses in human lives**
Agriculture/floods	from 3.100 to 8.500	Several to tenths
Waterpower engineering/floods	About 1.960	----------
Agriculture/hail, heavy rainfalls, strong wind	About 7.316	Several to tenths killed by thunder stroke
Agriculture/ drought, frost	About 4.000	No losses
Production of energy (heat)/ extremely low air temperature	About 716	Several to tenths
Maintenance of roads/snow, ice, icing	About 3.500	----------
Losses in human lives on highways, regional and local roads caused by bad weather conditions vary from 105 to 131 per year		
Commercial air traffic	From 54 to 72	----------
TOTAL	**From 16.648 to 48.572**	**From several to 160**

2.3.2 Earthquakes

Seismic activity is present on the territory of Serbia (Figure 20) where 50% of the territory is potentially threatened by the earthquakes magnitude of which is 7 and 20 % by the earthquakes magnitude of which is 8 (UN, 2008).

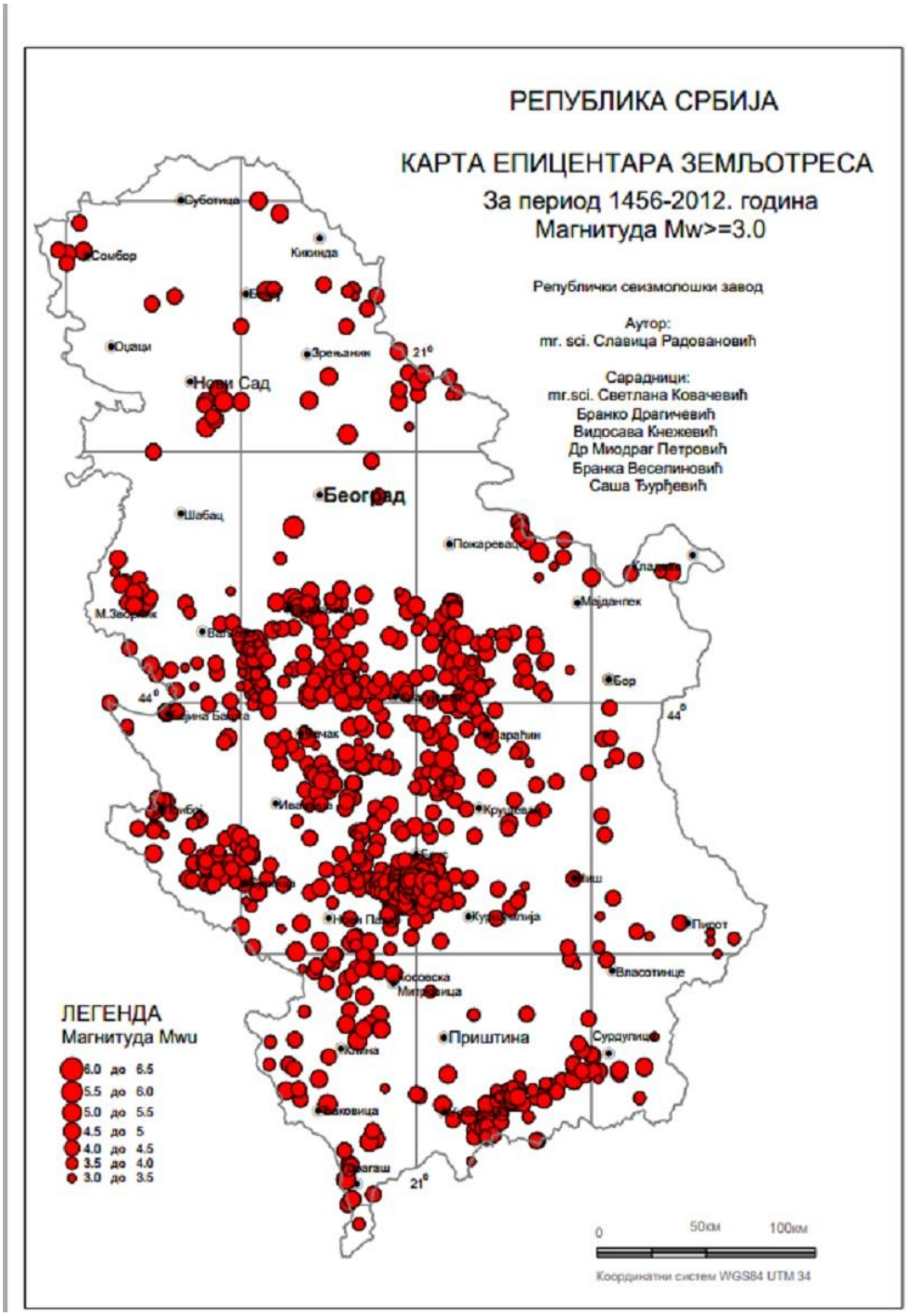


Figure 20: Map of epicenter of the earthquakes in Serbia in the period 1456-2012 (Seismological survey of Serbia, 2012 www.seismo.gov.rs)

Majority of the earthquakes take place in Central Serbia and the areas around Kopaonik, Mionica, Rudnik, Trstenik (Radovanovic, 2008)and South Serbia.

Serbia is situated in seismically active area, on the edge of so-called Mediterrenean transitional seismic zone or, to be more precise, Mediterranean belt. Thanks to its position on the very edge of the plate, the earthquakes in Serbia cannot measure more than 6,2 to 6,3 on the Richter scale.

The strength of the earthquake which occurred on Kopaonik on 18 May 1980 was 55,8 on the Richter scale. Based on the first catalogues issued by the Seismic Bureau, constant weak to moderate seismic activity was registered in the area of Kopaonik in the period from 1900 to 1980. 32 earthquakes were located from the beginning of 2009 to 11 February 2009, and the last stronger earthquake was registered on 10 April 1998 and its magnitude was 4,5 on the Richter scale.

Epicentre of the earthquake in the area of Mionica was in several villages in that municipality and the municipality of Ljig, the mountain chain from Suvobor to Maljen. According to the data provided by the Commission for making of the damage list, about 12000 objects and 6500 houses were damaged only on the territory of Mionica.

On Wednesday, 3 November 2010 at 01:56 an earthquake with magnitude of 5,4 degrees in Richter occurred in the region of Kraljevo (Figure 21). Intensity of the earthquake was estimated to 7,5 degrees in MCS. The epicentre was about 10km north-west of Kraljevo, in the valley of the Gružariver in the villages Vitanovac, Vitkovac and Stubal by the road Kraljevo-Kragujevac.

Figure 21: Earthquake consequences in Kraljevo, November 2010

The earthquakes of the abovementioned intensity are considered as moderate earthquakes which can cause damages on poorly-built buildings, older buildings and structure facilities, i.e. the facilities without seismic protection. The earthquake was felt in other towns in Serbia as well, and the Republic Seismic Bureau published the data saying that these quakes were of lower intensity, about 3 degrees in Richter.

The earthquake caused the most serious damage to a suburb of Kraljevo – the settlement Grdica where a married couple died because of collapse of the house they lived in. There were also 180 injured people but none of them were life-threatened.

Damage caused by the earthquake was visible on many houses. There were about 16,000 damaged facilities out of which more than thousand and a half were out of use, while about 10,000 of them were to be repaired(Ministry of Interior, 2010). Some parts of the town of Kraljevo were without electricity supply as well as without water. As for public institutions, the Health Centre was damaged as well as the Public Health Institute. Military facilities also suffered damage.

2.3.3 Floods

Floods affect large number of people and cause enormous material damage. Floods on big rivers and torrential floods are most frequent natural disasters in the Republic of Serbia and that is because of the position and relief of Serbia.

The rivers in Serbia belong to the watersheds of the Black (81,261 km^2 or 92% of the Serbia territory), Adriatic (4,500 km^2 or 5% of the Serbia territory) and Aegean (2,650 km^2 or 3% of the Serbia territory) seas. On more than 90% of the Serbian territories, there are rivers that join the Danube, thus going to the Black Sea. The rivers in the Aegean one are the Lepenac, Pcinja and few others in the southern Serbia, along the border with Macedonia and Bulgaria. The longest river in Serbia is the Danube. More than one fourth of this river's bed stretched through Serbia, and all 588 km are navigable. Also among the navigable rivers are the Sava and Tisa, as well as part of the Morava, which is the largest Serbian river. The Morava flows through the most fertile area of the central Serbia, and the most populated, called Pomoravlje.

In Serbia, 12.4% of its territory (10,968 km^2) is potentially endangered by flooding. According to Gavrilovic (1981), the largest flood areas are in the basins of rivers Tisa (2800 km^2), Sava (2,243 km^2), Velika Morava (2,240 km^2) and Danube (2,070 km^2). The main causes of floods in the Tisa river basin are small stream slope, geological composition and broad alluvial plains. In the river basins of Danube and Sava, floods are caused by precipitation and by coincidental flood waves of their tributaries. The main problems in the Velika Morava River basin are flash floods.

According to Dragicevic et al. (2013), the potentially flooded area in Serbia with a 100-year return period is 15,198.07 km^2 (17.2% of total area). Serbia is mostly threatened by the floods of small to medium-size torrential rivers mostly in late spring (from May to the end of June), a period characterised by intensive rainfalls of a few-hour duration (Kovacevic-Majkic et al. 2014) found that floods threaten 18 % of Serbia's territory along large rivers (1.6 million ha), as well as 512 large settlements, a great number of industrial facilities, 4,000 km of roads and 680 km of railroads.

Floods in 1930 and 1937

One of the great registered floods occurred in Obrenovac in 1930. Level of water was 40 cm above street level. Also, flood occured 7 years later (1937), when embankment was breached at Breska settlement in Obrenovac.

Floods in 1948

The flood in the Juzna Morava basin was in 1948. It was caused by rains which tired of land with water and flash floods brought a lot of sediment in river basin. As a result of flood, the Juzna Morava River destroyed all bridges.

Floods in 1965

One of the longest and the largest flood was in the Danube river basin from March to July 1965. The main cause was snow melt in Czechoslovakia. 43 municipalities were affected with flood only on the territory of Vojvodina. Also, flood destroyed 1800 houses and 23,000 people and 60,000 livestock were evacuated. 300,000 people had to be vaccinated of infectious diseases. Many companies, roads (214 km), railways (80 km) were damaged. 50,000 people worked daily on the rescue and it was built 177 km of embankment. In addition, flood occurred in the Velika Morava basin (May 1965) and in the Zapadna Morava basin (May 1965). Flood covered area of 17,000 ha in the Velika Morava basin. The main reason for flood in the Zapadna Morava basin was precipitation (more than 100 mm) in Čačak, Kraljevo and Kruševac, and flood affected all municipalities this basin.

Floods in 1970

Overflow of river Tisa caused flood in 1970. The main reason for this disaster was rain and snow melt in Hungary and in Romania. Government was taken the comprehensive measures against flood, for the first time in Serbia.

Floods in 1981

Many embankments (for 50 years return period) were built after II world war in Obrenovac, but disastrous flood occurred in 1981.

Floods in 1999

In the river basins of major tributaries of the Velika Morava great flash floods occurred in July 1999. As result of floods 8 people lost their lives, dozens of thousands of houses and hundreds of commerce buildings were damaged and 30 bridges in basins of the Velika Morava, the Jasenica, the Kubršnica and the Lepenica were destroyed(Milanovic and Milijasevic, 2008).

Floods in 2000

Flood occurred on the Tisa and the Tamiš in 2000. Main reason for flood was sudden melting of snow and intensive rainfall from the slopes of Carpathian Mountains.

Floods in 2005

In the flood on the Tamiš in 2005, the most of damage were in municipality Sečanj, Žitište (approximately 50,000 ha of area with 20,000 people) and Plandište (35,000 ha with 14,000 people) (Milanovic and Milijasevic, 2008)..

Flooding in April 2005 caused serious damage to private property, agriculture and public infrastructure. For example, the total damages in the three most flood prone municipalities in Banat caused by the flooding was estimated at EUR 12.6 million. According to VodeVojvodine the total costs of rescue operations and protection works, excluding of reconstruction works, amounted to EUR 3 million.

Floods in 2007

In November 2007, flood occurred in the Vlasina river basin, due to saturation of soil with water and high elevation of ground water, caused by snow melting (Milanovic et al, 2010).

Floods in 2010

In 2010, the flood in the Pcinja River Basin and in the Kolubara River Basin affected 670 ha of land and 257 buildings were flooded with the total damage at 370,000 €.

Floods in 2014

Catastrophic floods registered in Serbia in May 2014 caused enormous damages (Figure 22). During the third week of May 2014 Serbia was affected by heavy rains and the rains were caused by the field of low air pressure ("Yvette") formed above the Adriatic Sea. Record amount of rainfall was registered then: more than 200mm of rain fell in Western Serbia during only one week which equals the amount of rainfall for a three-month-period under standard conditions.

Figure 22: Floods in May 2014 in Obrenovac

Enormous amount of rain caused fast and significant increasing of big rivers level in Western, South-western, Central and Eastern Serbia on the Sava, Tamnava, Kolubara, Jadar, Zapadna Morava, Velika Morava, Mlava and Pek rivers. Enormous amount of rain and increasing of the water level had three immediate effects:

- High intensity sudden floods which caused total demolition of the houses, bridges and

parts of the roads (in Krupanj and in vicinity of Šabac);

- Increased level of water caused big floods in urban parts (especially in Obrenovac) and in rural parts (around Šabac) and
- Increased flow of underground waters caused occurrence of numerous landslides (around Krupanj and BajinaBašta).

As a result of these events, total number of 1,6 million people in whole country were either directly or indirectly affected by the disaster. Floods and landslides caused death of 51 people out of which 23 people drowned. Besides, another 31,879 persons were temporarily evacuated from their flooded and destroyed homes; 24,000 of them were from Obrenovac. Most of the evacuated persons found their shelter with their relatives, but 5,000 were placed in temporary accommodation organized by the Red Cross of Serbia and RS Government. This doubled number of internally displaced people which had made majority of the displaced people even before the floods.

Total value of the destroyed goods in 24 affected municipalities covered by Damage assessment was 885 million Euros, and value of the losses was 640 million Euros, so total amount was 1,525 million Euros as shown in the Table 8. This amount of money makes 3 % of total gross domestic product in the whole country providing evidence of the seriousness of the catastrophy caused by the floods and landslides.

Table 8: Assessment of total damage and losses caused by the floods in the year 2014

	Effects of floods expressed in millions of Euros		
	Damage	**Losses**	**Total**
Social	**234,6**	**7,1**	**241,7**
Housing	227,3	3,7	230,9
Education	3,4	0,1	3,5
Health	3,0	2,7	5,7
Culture	1,0	0,6	1,6
Productive	**516,1**	**547,6**	**1.063,6**
Agriculture	107,9	120,1	228,0
Production	56,1	64,9	121,0
Trade	169,6	55,2	224,8
Tourism	0,6	1,6	2,2
Mining and energy	181,9	305,8	487,7
Infrastructure	**117,3**	**74,8**	**192,1**
Traffic	96,0	70,4	166,5
Communication lines	8,9	1,1	10,0
Water supply and hygiene	12,4	3,2	15,7
General problems	**17,2**	**10,6**	**27,9**
Environment	10,6	10,1	20,6
Management	6,7	0,6	7,2
Total	**885,2**	**640,1**	**1.525,3**

The damage from the flood in Kolubara mines is estimated to at 100 million EUR minimum. Water turned Kolubara mines into lakes. Each of the four mines is flooded, two of them completely. In the biggest OPM Tamnava – West Field, even 10 excavators are flooded and six of them are completely under water. Mining Basin Kolubara produces 70% of Serbia lignite

which is used in thermal power plants TENT producing more than 50% of Serbian electricity. At some places, water is as deep as 60 meters. In Obrenovac and the region, 22 power transformer stations were flooded and one cannot enter there.

When we take in consideration some municipalities which were not included by the Needs assessment in the process of renovation and which were affected by the disaster less than previously mentioned ones, the estimated value of the damages and losses should be increased from 1.7 to 1.8 million Euros (Government of the Republic of Serbia et al., 2014).

2.3.4 Landslides and escarpments on the slopes and inclinations

The area of Serbia is seriously exposed to risks from landslide.
Estimates show that the highest number of landslides in Europe is located on the territory of Serbia. About 25% of Serbia is potentially at risk for landslides and rock falls (Lazic and Bozovic, 1995). Furthermore, one of the largest landslides on the continent, Duboko, is in Serbia. About 70% of landslides in Serbia are known and researched (Figure 23).

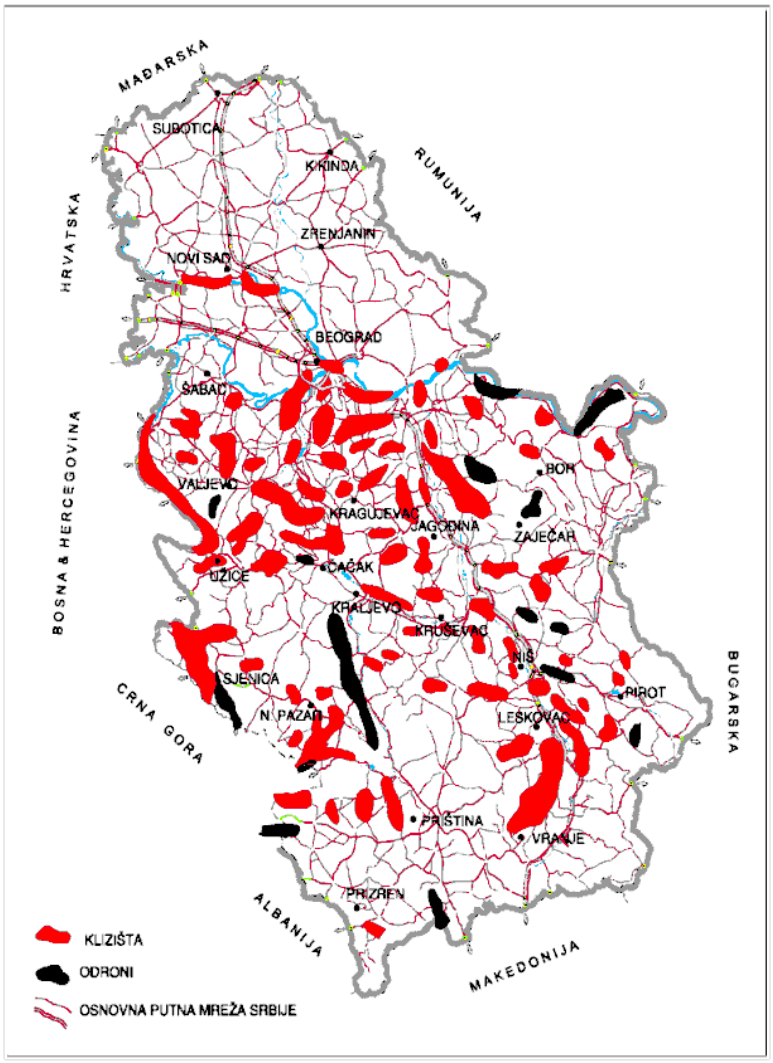


Figure 23: Map of rockfalls and landslides in Serbia (Abolmasov, 2014)

There are around 3,000 active and potentially active landslides in Serbia. Most of them cause the damage on local roads and highways and a few of them cause the damage on residential buildings. As far as Serbia is concerned, there are landslides in south-eastern part of Pannonian plain and in central parts. One of well-known landslides is on the right bank of the Sava and the Danube (Umka, Duboko, Vinča, Ritopek, Čortanovci, near Grocka, Karaburma, Smederevo and near Novi Sad). Main reason for landslides trigger is permanent erosion of the right riverbanks and intensive precipitation.

In Serbia, huge landslides that caused significant social-economic influence were registrated. Some of them are: Zavoj (1963), Jovac (1977) and Bogdanje (2006).

Landslides at the beginning of the 19th century

One of the oldest landslides is Umka-Duboko (first written documents about them are 200 years old), with maximum depth of 26 m. Total length of Umka is 1,700 m and its width is around 900 m. It is the shape of a wide fan with area of approximately 1.8 km^2 and volume of around 14,000,000 m^3. Umka directly depends on the precipitation and the levels of the Sava and it is slow moving landslide(Abolmasov et al., 2015). The total costs of remediation landslide Umka are estimated on 54 million euros(Mitrovic and Jelisavac, 2006).

Landslide in 1963

Landslide Zavoj was created after heavy rainfall and snow melting in spring 1963. Sunny side of StaraPlanina was affected and rushed into the valley of the Visočica River. This created a natural dam and created a lake behind the dam, flooding the village of Zavoj. Landslide was 1.3 km long and 160-220 m wide with mass of 240,000 m^2. Natural dam was later consolidated and surpassed by the construction of natural dam Zavoj.

Landslide in 1977

Landslide was activated in village Jovac, municipalities Vladičin Han, in February 1977. Landslide was 3 km long, 1 km wide with sliding surface of 500 m deep. Total horizontal movement was 500 m, for one month (total period of movement). Landslide closed the canyon of Jovačka River was in a distance of 200 m. The accumulation of water created a lake with the following dimensions 1,500 m long, 200 m width and 10 m depth. The total damage was estimated on 15 million euros. Especially, agricultural production was damaged with 63.32% of the overall damages (about 500 ha of forest, fields, pastures and orchards was destroyed). Village Jovac had the most of the damage with 118 householders destroyed, Ostrovica had 18 householders destroyed, Belovance 11 and Kunovo 7(Jevremovic and Kostic, 2011).

Landslides in 2006

Landslide Bogdanje was caused by heavy floods and uncontrolled deforestation in village Bogdanje near Trstenik. 200 people were evacuated and 130 houses were destroyed. In the same year, emergency state was proclaimed in Trstenik and Lucane. In Koceljevaoccured 95 landslides and they damaged 67 houses. Also, in Ljig municipality was 150 landslides.

Landslides in 2014

Landslides derived after floods in 2014 caused enormous losses to citizens and economy.
Heavy rains in our country in May 2014 and afterwards left a large amount of water that eroded and destroyed ground, moving huge amount of eroded material. Torrential streams destroyed fields, roads, railways, houses and other objects. Broad landslides occurred after the floods.

One of the municipalities most affected by landslide in 2014 was Krupanj (Figure 24). Total number of damaged and destroyed objects was 389. In Krupanj, total damage was estimated on 5 million Euros (Đokanovic, 2016a).

Figure 24: Consequences of landslides and floods in May 2014 in Krupanj

In municipality of Kladovo, 30 landslides were registrated after intensive rainfall and floods in September 2014(Figure 25) (Đokanovic, 2016b).

Figure 25: Consequences of landslides in September 2014 in Kladovo

2.3.5 Snowdrifts and low temperatures

Snowdrifts in 2014

In February 2014 east wind of hurricane strength made enormous snowdrifts in Vojvodina. The drifts were up to five meters high and a few hundred meters long. Firefighting, military and gendarmerie units were helping the local winter services in such a way that they used heavy machinery, primarily on the highway Subotica-Novi Sad near Feketić, as well as on the road between Bačka Topola and Mali Iđoš where the rescue teams took the frostbitten pasengers from their under snow vehides and transported them to the nearest villages. More than 700 snow-trapped people were evacuated and the military and police helicopters rescued 172 persons. All of 100 passengers were evacuated from two international trains which were blocked between Zmajevo and Vrbas because of strong snow drifts and wind.

In the beginning of 2014, due to natural disaster caused by snowfall and low temperatures in northern part of Serbia (Vojvodina), the Serbian Army Forces were involved in the tasks of reconnaissance from ground and air, the tasks of air and land evacuation of the snow-trapped citizens and passengers on the corridor 10 along the highway E-75 from Novi Sad toBačka

Topola (Figure 26). During the period of four days the Serbian Army members managed to evacuate 332 citizens (240 air-evacuated and 92 land-evacuated), the trapped ones were provided with about 1,000 l of tea, about 600 meals and 350 pieces of clothes and blankets for warming(Simovic, 2014).

Figure 26: Snowdrifts in the area of Zrenjanin in January 2014

Low temperatures in 2017

In January 2017, the emergency situation was declared in 13 municipalities in Serbia because of extremely low temperatures. 139 people were evacuated in Serbia from the beginning of the ice wave. Most of them were evacuated from Vranje and its surroundings, there were 300 rescuers and firefigters on the terrain and the army and police members were involved depending on the needs. There were even human casulties from freezing.

The roads: Trgovište – Donji Stajevac - Radovnica - Bosilegrad, Trgovište– state border with Macedonia (the border crossing Kalovo).

Regular ice protection was declared on a part of the Danube, Sava and along complete flow of the Tisa. Navigation was suspended on the Tisa – from the dam on the Tisa to the border with Hungary, on the Sava near Sremska Mitrovica and near Šabac, as well as on the Danube from Bezdan to Kladovo (Figure 27).

Suspension of navigation caused daily damage in the amount of 60,000 Euros, because the damage per ship was 1,000 Euros and 60 ships were anchored.

Figure 27: Ice on the Danube in January 2017

2.3.6 Hail

Hail in 2015

Hail which was falling on the territory of Central Serbia on 15 May 2015 around four o'clock devastated orchards and raspberry grounds. Hail the size of an egg was falling in the villages around Kragujevac, and the hailstorm cloud continued to move towards Paraćin affecting then the area of Ivanjica which is well known for production of fruits, especially raspberries. The hail destroyed 50% of the raspberry ground in the area of Ivanjica municipality, and an unofficial damage assessment is 10 million Euros (Blic online, 2015).

Hail in 2016

Nasty weather and hail the size of a fist which stroke Pančevo on 20 June 2016 around 7 PM inflicted enormous damage (Figure 28). The most numerous damages could be found on the roofs of the houses, residential buildings but on the cars as well. Several people who were either outside or were trying to rescue their property suffered minor injuries.The crop also suffered damage, both in the south of Banat and north of Banat where the hail totally destroyed the harvest on the area of around three thousand hectares in the area of the village Mokrin near Kikinda and serious damage was inflicted on another approximately two thousand hectares.

Figure 28: Hail and its damages in June 2016 in Pancevo

2.3.7 Drought

Territory of the Republic of Serbia is located in a region of the world considered vulnerable to climate change(IPCC, 2007). Droughts are most prevalent in the Vojvodina and Posavina (north of the country, where level of rainfall is low and where agricultural land is of the best quality) and in the eastern areas of Serbia. Droughts in Serbia usually occur every 3 to 5 years. They can reduce agricultural production from 20 to 80%. Droughts have been frequent since 1990 with increasing intensity and duration. They have had great impact on the production of food and energy, human health, biodiversity and water supply (IPCC, 2007). Droughts cause damages in Serbia, especially to agricultural production (500 million Euros per year).

Gocic and Trajkovic identified three distinct drought sub–regions: R1, R2 and R3 (Figure 29).

Region R1 includes the north and the northeast part of Serbia, region R2 includes the western part of Central Serbia and southwestern part of Serbia and region R3 includes central, east, south and southeast part of Serbia.

The R1 is characterized by the lowest amount of precipitations in the country and most intensive agriculture. The R2 is mostly forested with the average annual precipitations to 1000 mm, while the R3 is characterized by a moderate–precipitation regime with the average annual

precipitations to 650 mm. The R2 had the monthly precipitations values above average, while R1 and R3 had the precipitations values under average in Serbia.

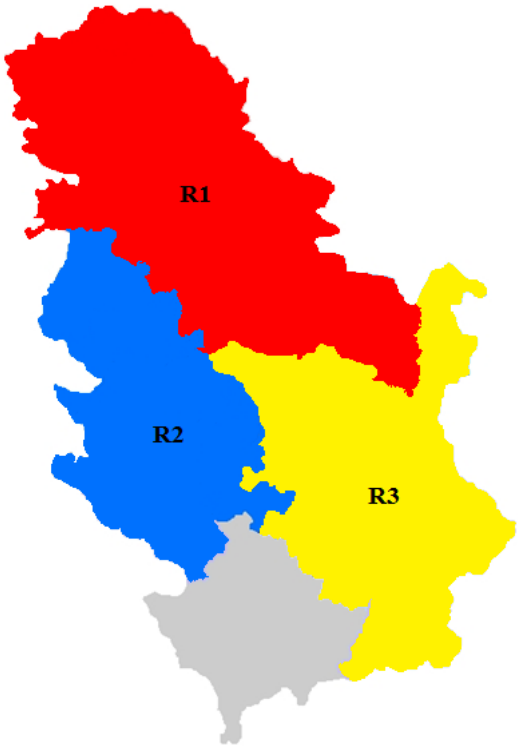


Figure 29: Drought–based regionalization in Serbia

Based on the SPI–12 (Standard Precipitation Index) values and defined categories of dry and wet conditions, the periods of drought were 1948–1953, 1958–1968, 1982–1985, 1988–1994, 2000–2003, and 2011–2012, whereas the periods with wet conditions were 1954–1957, 1969–1981, 1986–1987, 1995–1999, and 2004–2010(Gocic and Trajkovic, 2014).

Droughts that occurred in 2000 and 2003 had the same characteristics: lack of precipitations and high temperatures during growing season. According to SPI, these droughts fall under the category of extreme droughts(Ministry of Agriculture and Environmental Protection, 2015;Korak, 2012).

Drought in 2000

Drought in 2000 occurred in Vojvodina and in Central Serbia. Number of days with air temperatures above 30 ºC was from 37 to 61 days. Total damage was 650 million Euros(Korak, 2012).

Drought in 2003

One of the longest droughts occurred in 2003, and it started in March and ended in August. The main reason for this drought was high values of average monthly air temperatures during the growing season which caused a large number of tropic days. This drought influenced upon crops, especially upon corn, soybeans, sugar beets and sunflowers(Ministry of Agriculture and Environmental Protection, 2015). Damage from drought was estimated to the amount 940 million Euros.

Drought in 2007

There was a severe drought in April, July and August 2007. During these months air temperatures were extremely high (35 - 45 ºC), which caused 258 forest fires on the area of 33,000 ha and lower production of corn for 32.4 % than previous year. Only forest fires caused damage of 40 million Euros.

Drought in 2011

Drought occurred in 2011 caused serious damages in agricultural production. There were droughts in Eastern, South-eastern and in Central Serbia. According to SPI index, drought was a severe and extreme one. The drought was most intensive in August and September.

Drought in 2012

One of the driest years was 2012 (Figure 30), because there was very small amount of rainfall and maximum daily temperatures were over 35 ºC during the period between May and August. The most seriously affected areas were Vojvodina and Central Serbia. There were 5 heat waves (in some places there were 8 heat waves), with average duration of each wave from 6 to 10 days. Weak precipitations, high air and ground temperatures along with increased water consumption in August caused drought again at the end of the summer (Republic Hydrometeorological Service of Serbia, 2012).

Figure 30: Drought in Serbia in July 2012

According to the information provided by the Chamber of Commerce of Serbia and the Institute of Agricultural Economics in Belgrade, the damage caused by the drought in 2012 was more than 2 billion $, and in 2011 about 500 million $ (Dzeletovic et al.2013).

2.3.8 Epidemics of contagious diseases

Large outbreaks occurred in our geographic region in different historical periods: typhus, whichcaused great damage to Serbian Army and people during World War I, the epidemic of smallpox in Yugoslavia in 1972 and the epidemic of tularemia in the area the former Yugoslavia during the civil war and aggression on our country in the '90s of the last century (Ristanovic, 2015).

Typhus

The devastating typhus epidemic broke out in in Valjevo in December 1914, where the Austrians concentrated the 3000 diseased in the Valjevo hospital. Serbian troops liberated Valjevo and found many wounded and patients with typhus in the hospital. This typhus outbreak in Serbia was among the largest in the world. British Colonel, Dr. Hunter wrote: "The

1914/15 typhus epidemic in Serbia was the most sudden to emerge, the fastest to spread, the greatest in intensity, and the fastest-stopped epidemic in history." Dr Richard Strong, head of a US medical mission concluded that "the epidemic of typhus that took place in Serbia in 1915 was one of the scariest in the modern world" (Strong, 1920). During the First World War in Serbia the disease killed about 150,000 or even 200,000 people. All 595 Serbian doctors were ill and 122 of them died.

Epidemic of smallpox

Just in the period of intense campaign for eradication of smallpox the epidemic occurred in Yugoslavia in 1972, the largest post-war outbreak in Europe. An outbreak was detected on March 14, 1972. The epidemic affected a total of 175 persons (Figure 31), and 35 (20%) of them died. There were 99 (56.6%) male patients and 76 (43.4%) female patients. Most patients were registered in the Republic of Serbia (174 ill persons, 124 of them in the Province of Kosovo* and Metohia and 1 person in Vojvodina; 35 people died, 26 of them in the Province of Kosovo* and Metohia and 1 person in Vojvodina), while in Montenegro 1 person was ill.Out of 175 patients, 105 of them (60%) were previously vaccinated, 66 (37.7%) were unvaccinated, while for 4 of them (2.3%) vaccination status was unknown. It is necessary to emphasize big difference in the fatality rate among previously vaccinated (8%) and unvaccinated persons (35%). There were 52% or 91 people out of hospitals, while 84 patients (48%) were infected in hospitals.With all the problems that occurred in the work, some organizational, technical and other weaknesses, and lack of practical experience, it can be said that Yugoslav health service quickly and efficiently carried out the task of combating smallpox outbreak, which was large by number of cases (175) and geographical dispersion (25 foci) causing a severe disruption of life and economy in the country(Ristanovic et al., 2014).

Figure 31: Different clinical manifestations of smallpox in Yugoslavia A: early hemorhagicvariola with purpuric skin changes; B: ordinary form: variolapustulosaconfluens, 9th day of the illness; C: intrahospital infection; 4-months old baby died on the 14th day of the illness. (Šuvaković and Kecmanović, 1972)

Tularemia

Tularemia (rabbit fever, Francis disease, soldier's disease) has sporadically occurred in Serbia. The first outbreak was recorded in late 1998 in Sokobanja region.The epidemic spread and lasted during 1999 and 2000(Lako et al., 2001). Smaller outbreaks of tularemia occurred in Southern Serbia in 2010 when 16 persons were affectedinPčinja district, mostly preschool, elementary and high school children. An epidemic of tularemia with 30 peopleaffected occurred at the end of 2014 in the area of the municipality of Gadzin Han.According to Public Health Institute of Kosovo*, 1,469 cases of tularemia have been recorded since 1999. From 1 January to

10 February 2015 206 cases of tularemia were registered, and the epidemic was declared (Ristanovic, 2015). Consequences of Tularemia are depicted in Figure 32.

Figure 32: Consequences of Tularemia on arm and on lymph node

2.3.9 Large-scale fires

Forest fires are frequent and outspread on the territory of Serbia. They can occur in any time of time year, but there are three critical periods: March-April, July-August and September-October. 880 forest fires which affected area of 16.459,78 ha in the period 2000-2009, were registered on the territory of the state forests used by Public Company „Srbijasume". Territory distribution of the forest fires in Serbia is uneven. Largest number of the forest fires occurred on the territory of Vojvodina (60%), on the territory of Kosovo* and Metohia (10%) and on the territory of Central Serbia (30%)(Gajovic and Todorovic, 2013). Significant forest area was affected by the fires in the past decades (Table 9). The year 2007 particularly stands out because more than 22,000 hectares of the forest were destroyed then.

Table 9: Burnt forest area in the period 2004-2011 on the territory of Serbia. Source: http://webrzs.stat.gov.rs/"http://webrzs.stat.gov.rs, 2012

	2004	2005	2006	2007	2008	2009	2010	2011
Private forests	87	22	146	14.360	152	957	223	1.329
State forests	115	30	348	7.801	423	253	280	707
TOTAL	**202**	**52**	**494**	**22.161**	**575**	**1.210**	**503**	**2.036**

Forest fires are important threatening factors and they cause enormous damages. Total damage caused by forest fires in the state forests of the Republic of Serbia in the period 2000-2009 exceeds 36 billion dinars (Table 10) (Aleksic and Jancic, 2011).

Table 10: Damage inflicted to the state forests by forest fires in the period 2000-2009

	Dinars
Costs of fire suppression	44.498.395
Damage caused by fires	34.199.158.808
Costs of rehabilitation, growing and protection of forests	2.211.105.203
TOTAL	**36.454.762.406**

Forest fires manifest their consequences in a long period after the fire occurrence in the following ways: they influence upon biological diversity (the loss is irrecoverable); rare, endangered and vulnerable plant and animal species disappear (that influences upon reduction in species and genetic diversity); the scenery and beauty of the ambience changes (ambiental diversity); the terrain is affected (physical and chemical features as well as micro-biological composition of the terrain change); there are changes in the climate and micro-climate as well asin the water balance (rough disruption of hydrological regime, smaller supplies of water and floods) (Aleksic and Jancic, 2011).

Forest fires destroy agricultural crops, houses, infrastructure (bridges, lines etc.) and sometimes even people are killed. Forest fires influence upon losing of the organic matter from the ground and it causes return of carbon into atmosphere, intensified global warming as well as return of carbon dioxide into atmosphere. The following quantity of gases caused by forest forests was emitted in the period 1990-2004: 148.420 tons of CO2, 380 tons CH4, 3.500 tons of CO and 60 tons of NOX (Kadovic et al., 2007).

Landslides and various forms of intensive erosion occur at the fire sites.

The forest affected by forest fires, i.e. the damaged and physiologically weakened trees, becomes the source of excessive propagation of the harmful insects and plant diseases.

3 Analysis of risk management

Each country pursues its own strategies, how to deal with natural disasters and how to manage the related risks. Please provide any established practices for risk management (coping, rebuilding and prevention) including different tools, methods and procedures, if any information is available.

The objectives within this project include an assessment of the existing risk management in your country. Please outline advantages and disadvantages of the used strategies and point out any knowledge gaps.

3.1 Bosnia and Herzegovina

3.1.1 Established practices for risk management

Landslides

The prevention measures of landslide occurrence and risk mitigation may include but not limited to:

- Proper engineering is mandatory. There are a number of illegal constructions of houses in the landslide prone area. Construction activities without proper engineering assessment should be prohibited or restricted.
- Construction of earthworks for slopes should comply with the relevant standard or codes.
- Development of the landslide inventory system.
- The rating of the landslide risk could be developed as a function of the probability of the landslide occurrence and its consequences (finance, safety, environment, reputation, etc). This may be linked to the landslide inventory system to determine the urgency and the priority of the landslide remediation.
- The landslide inventory system could be also linked to other relevant legislations such

as those associated with the development application system, planning control, building regulation, deforestation, civil defense and emergency management, etc. so that the proposed activities within the landslide prone areas could be improved or restricted through proper engineering.

- Development of legislation such as "Landslide Prevention Law" which governs the landslide management and risk mitigations in B&H should be implemented.
- Many landslides in B&H are triggered by rainfalls. Monitoring of hourly rainfall should be undertaken. Warning systems based on rainfall data and/or ground displacement could be
- Utilized to minimize the landslide hazards. A statistical evaluation of rainfall and landslides could be utilized in establishing warning and evacuation control values.
- Excessive deforestation and inappropriate conversion of grass land to arable land should be restricted. Vegetation dries out the surface layers. Plant roots can also help stabilize slopes by anchoring a weak soil mass to fractures in bedrock, by crossing zones of weakness to more stable soil, and by providing long fibrous binders within a weak soil mass (Ziemer 1981).

Only few of listed prevention measures are included in local practices when considering risk management in B&H.

Earthquakes

The laws that are the basis for implementing the protection and rescue of people and property are:

- Law on protection and rescue of people and property in the event of natural or other disasters, "Official Gazette Federation of Bosnia and Herzegovina", no. 39/03, 22/06 and 43/10.
- Framework law on the protection and rescue of people and property in the event of natural or other disasters in Bosnia and Herzegovina (Official Gazette of Bosnia and Herzegovina 50/08)
- The methodology for the development of risk assessment of Bosnia and Herzegovina in the event of natural or other disasters (Official Gazette of Bosnia and Herzegovina 86/09)
- The law on jurisdiction of the authorities of the Sarajevo Canton in the field of protection and rescue of people and property in the event of natural or other disasters ("Official Gazette of the Sarajevo Canton 39/08")
- The Law on Amendments to the law on jurisdiction of the authorities of the Sarajevo Canton in the field of protection and rescue of people and property in the event of natural or other disasters ("Official Gazette of the Sarajevo Canton 19/11")
- Law amending the law on jurisdiction of the authorities of the Sarajevo Canton in the field of protection and rescue of people and property in the event of natural or other disasters ("Official Gazette of the Sarajevo Canton 45/15").

Assessment of natural disaster risk for B&H was done in 2012 and it represents the fundamental document which is used for development of the Protection plan and rescue of people and property in the event of natural or other disasters in Bosnia and Herzegovina and Programs for development of protection systems and rescue of institutions and authorities of B&H. This

document is not final, and it, as any other document, represents a material that needs to be updated dynamically. It is subject to changes, amendments, additions, upgrading (Bosna i Hercegovina Vijece Ministara, 2011).

The plan of protection and rescue of people and property in the event of natural or other disasters of the institutes and bodies of B&H represents a framework for action regarding preparation, organization and implementation of protection and rescuing of people and property of institutes and bodies of B&H in the case of natural or other disasters. In the plan for protection and rescue the organization as well as the measures and means of conducting these protection and rescue measures are determined as well as tasks for institutes and bodies of B&H in the protection and rescue as well as forces and financial means required for fulfilling the tasks that are coming from the Framework Law ("Official Gazette" 50/08), Law on ministries and other administrative bodies of B&H ("Official Gazette"32/02, 5/03, 42/03, 26/04, 42/04, 45/06, 88/07, 35/09, 59/09 and 103/09), and other regulations that are dealing with the role and tasks of the institutes and bodies in the field of protection and rescue, as well as professional materials, international documents and practice. This plan gives guidelines for formation of protection plans and rescue at the entity level and Brcko District. The plan also aims to improve preparedness to natural or other disasters and to clarify the division of authority and responsibility in order to effectively protect people and property in the optimal use of resources. This plan actually is a practical information data and tool for coordination of risk reduction from natural or other disasters.

Assessment of risk was done for three cities Banja Luka, Grahovo and Ljubinje (Report done by Council of Ministers B&H in March 2011).

Floods

- Water Law (FB&H Official Gazette No. 70/06)
- Law on rescue of people and material goods from natural and other disasters (FB&H Official Gazette No. 39/03, 29/06)
- Regulation on flood defense plans (FB&H Official Gazette No. 3/02)
- Regulation of the Federal headquarters of civil protection (FB&H Official Gazette No. 54/03)
- Regulation on the organization, content and implementation of measures for protection and rescue of people and material goods (FB&H Official Gazette No. 27/98)
- Regulation on types and contents of plans for protection from harmful effects of water
- The decision on the master plan of operational measures of flood control in 2007. (FB&H Official Gazette No. 18/07)
- • Federal operational plan of flood control (FB&H Official Gazette No. 07/11)

Droughts

Drought monitoring in Bosnia and Herzegovina are carried out by two Hydrometeorological Servises in two entities: Federal Hydrometeorological Institute in Sarajevo (FHMI) and Republic of Srpska Hydrometeorological Institute in Banja Luka (RSHMI). Roles and responsibilities of the NHMSs in Bosnia and Herzegovina related to drought includes systematic observation and monitoring of hydrometeorological parameters; providing and publishing information, forecasts, products and services related to the weather, climate and water, provision of quality-assured historical and real-time hazard data; the derivation of drought-relevant parameters, indices and indicators routinely collected data, and their comparison with past and expected

values. Currently FHMI and RSHMI have their own separate meteorological and hydrological measurements, with the objective to monitor on entity level only (Figure down) Data (precipitation and temperature) are collected from the entities hydro-meteorological network that belong to Hydrometeorological services in Bosnia and Herzegovina and from another network of stations that belong to the Water Agencies. Regarding droughts, HMS's analyzes extreme weather conditions and produces drought maps, depending on user requirements, or for specific projects. Drought maps is based on calculations of SPI (Standardized Precipitation Index) on monthly basis. Also PDSI index should become operational in the near future.

Wild fires

In accordance with Article 26, item 3) of the Law on protection and rescue of people and material goods from natural and other disasters ("Official Gazette of the Federation B&H", Nos. 39/03, 22/06 and 43/10, hereinafter: Law on protection and Rescue) and article 13, item 2) of the Law on fire protection and fire service ("Official Gazette of B&H", No. 64/09, hereinafter: the Law on fire protection), and the Conclusion V. No. 1958 / 2014 from 06.11.2014 the Government of the Federation of Bosnia and Herzegovina, Federal Civil Protection Administration is in charge to speed up the drafting of the Development Programfor the next period, and submit it to the Government of the Federation of Bosnia and Herzegovina for acceptance.
Accordingly, the Federal Administration of Civil Protection at the end of 2015, took activities on the implementation of these conclusions, and in cooperation and with the participation of federal ministries and other organs of the Federation of Bosnia and Herzegovina, in accordance with Article 25, paragraph 1, item 2) Law on protection and rescue of people, produced a preliminary draft and draft development Program.

Law on fire protection and fire fighting
(http://www.civilnazastita.com.ba/propis/Zakon_pozar_vatrogastvo.pdf)
Extinguishing forest fires in Bosnia
(http://msb.gov.ba/PDF/STUDIJA_O_GASENJU_sPOZARA_U_BiH.pdf)
Law on forests
(http://fmpvs.gov.ba/upload_files/1444657237-ZOPrednacrt.pdf)

In Article 4, among other things, it states: Forest protection is a set of measures and activities that are required to take by the owners and users that manage forests for the protection of forests against fire, other natural disasters, pests, diseases and harmful anthropogenic impacts; in Article 94 , among other things, a creation of Rules is foreseen which is to regulate the content of plans for fire protection, data collection, keeping the register of forest fires, the conditions of using the data and the form in which the reports on forest fires referred to in Artide 35, paragraph 9 of this Law;)

3.1.2 Assessment of risk management aspects

Landslides

There is no landslide risk matrix or risk rating system in B&H. The priority for remediation is given to landslides near infrastructure and facilities. In the case that landslide occurs, Civil protection usually performed some of the temporary remediation measures given Figure 33.

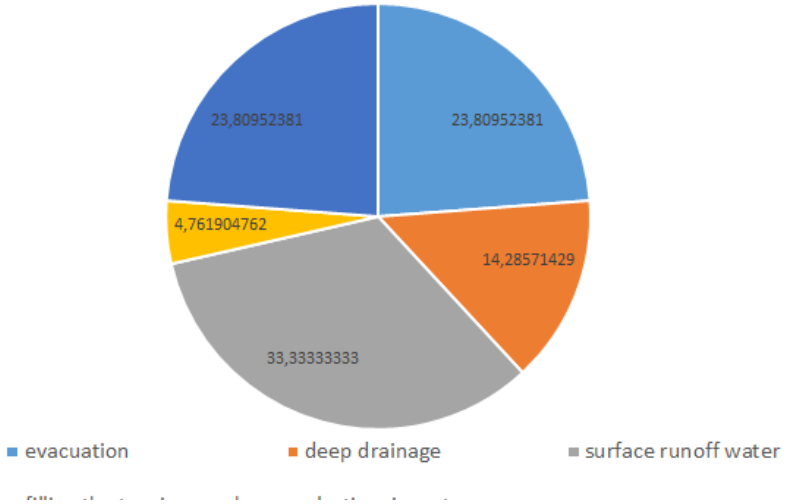


Figure 33: Temporary remediation measures in case of landslides

It is interesting to note that the relation between number of landslides where only Emergency measures were done, to number of remediated landslides is 7:1 (UNDP, 2015)

Earthquakes

The civil protection was fully equipped with material and technical means as well as with the equipment needed for operation and action in the event of natural and other disasters until 1992. After the 1992 most of the material was stolen, destroyed or obsolete. Currently, civil protection, and organized and rescue forces **have negligible tangible assets and equipment in the form of hand tools and light handheld machines and appliances which are insufficient for the civil protection facilities to operate effectively in the protection and rescue actions in the resultant natural and other disasters**.

In the coming period it is necessary to plan adequate financial resources for purchasing and equipping the civil protection units **as well as training the personnel for protection and rescue** in accordance with the Law on Protection and Rescue.

The protection services are **not fully equipped and are lacking professional personnel**.

During the war activities (1992 - 1995), in the wider area of Bosnia and Herzegovina seismic stations were destroyed, and the installed instruments in the seismological center in Banja Luka, due to lack of maintenance, scarcity of spare parts and old equipment (30 years) are no longer feasible for quality use.

In order to reduce the consequences from earthquakes for people and property, it is necessary to take preventive measures that are to be implemented through regional and town planning of cantons and municipalities. In addition, it is necessary to apply the appropriate laws and regulations on the method of construction of residential, commercial, industrial and infrastructure facilities (roads, railways, water and sewage networks, etc.).

Taking into account the specific conditions of seismic areas, locations where structures are constructed and applying the fundamental principles of earthquake engineering in design can have a large impact on the reduction on the consequences due to the earthquake. Based on the existing situation it can easily be concluded that the existing composition of the housing stock and the concentration of buildings in certain areas does not provide the possibility for effective protection against earthquakes, except for buildings which were built according to modern-

resistant structural systems in major cities: Sarajevo, Banja Luka, Tuzla, Mostar, Zenica, Doboj and etc.

Given the high seismicity of the territory of Bosnia and Herzegovina, and insufficient number of existing seismic stations and outdated seismic instruments, **it is necessary to modernize the network of seismic stations**, in order to conduct systemic registration, collection, analysis and study of seismic and seismic-tectonic events (natural and induced earthquakes, explosions and rock bursts), the study of seismicity, seismic activity and the frequency of earthquakes, as well as the definition of the seismic action effects of near source and far source earthquakes in the studied area and forecasting their impact on soil, water, water courses and facilities.

For the purpose of preventive measures to protect people and property from these kinds of natural disasters, it is necessary to draw up maps (earthquakes epicenters, seismic risk, maximum intensity), seismic, seismic-tectonic and other maps, necessary for spatial planning and seismic design and construction.

To evaluate the effects on people and property in the event of an earthquake on the territory of Bosnia and Herzegovina, it is necessary to have data regarding the structure of the housing stock and the entire infrastructure. So, in that respect it is necessary to make a database of all types of structures built in Bosnia and Herzegovina and conduct their risk assessment in order to qualify and quantify possible risks due to earthquake actions.

In order to increase the public awareness and public education for disaster risk reduction it is necessary to form a guide. As well create awareness among policy makers about the consequence of earthquake which is crucial for appropriate planning and prompt implementation. It is necessary to conduct talk programs, seminars, workshops and conferences in different levels in cooperation with Government of B&H and other stakeholders. It is necessary to share experiences among the professionals, developing national/international linkages with similar agencies, improve coordination mechanism among the stakeholders and keeping update with the recent global achievements in the field of earthquake risk reduction.

Incorporating Disaster Risk Reduction aspects in the higher educational curriculum, developing and examining the National Emergency Operation Centre (NEOC) and assisting the local Government for developing response and recovery plans, risk sensitive land use plans, bylaws, guidelines, which has ultimately helped the government stepping ahead for earthquake risk reduction and preparedness in the country.

A development program for protection and rescue from natural and other disasters in the **Federation of Bosnia and Herzegovina for the period of seven years was developed in September 2016.**

On the basis of the assessment it was concluded that the existing building stock and concentration of the buildings in certain regions, illegal construction and landslides, due not offer a good possibility for effective protection against earthquakes, except for the structures that are built using modern design codes and regulations.

Measures and activities that are to reduce the earthquake list are stated. It is clearly stated that all Cantons (from 1 to 10) are subject to earthquake risk and dangers in all urban areas.

Floods

By entity laws of the Water (2006) have established two inter fully independent system of water management in B&H.

At the very beginning consideration of the situation in this complicated situation, it is important to give a general remark that water laws and related strategic plans, when the flood concerned,

predominantly related to flood prevention. The laws on the protection of accidents and related strategic documents and plans are directed to the prevention, rescue phase and elimination of consequences of accidents, and therefore also flood.

When we talk about strategic and planning documents, it is important to note that for the implementation of measures for prevention of floods responsible entity ministries and agencies for water, while planning for the implementation of measures under the program plans to protect rescue people and property in simplified terms, competent: Sector protection and rescue Directorate at the Ministry of security, the entity, cantonal and municipal civil protection.

Flooding with catastrophic outcomes, especially from May 2014 indicate that the flood protection system is still incomplete and dysfunctional, and that in future all necessary strategic and planning documents in B&H make timely coordinated, concerted, and most importantly, all to achieve an integrated national and regional flood protection system, which guarantees to citizens greater security of life and property.

Unfortunately, new strategies, the analysis of the functionality of water management in B&H, on the analysis of the existing concept of civil protection in B&H, the analysis of all the problems that came to light in May 2014 on the issue of coordination in the rescue of people and goods during natural disasters in B&H (the development of new risk maps with marked zones of risk of natural disasters, the analysis allowed for the construction of residential buildings in places that are in the red zone past floods, the penalties for careless public institutions and individuals, etc.), the parliaments and governments of all levels of government in Bosnia and Herzegovina are still talking insufficiently, and the information and reports on these topics go unnoticed.

Wild fires

Assessment of fire risk in their area, in the context of the Canton's risk assessment of natural and other disasters, was done by only three cantons (Una-Sana, Tuzla and Sarajevo Canton), while the fire safety plan for their area was done only by one canton (Tuzla canton). It is clear that this is still an open issue and something that has not been completed for the entire region of the Federation of B&H.

Going to a lower level, level of municipalities, assessment of fire risk in their area as part of risk assessment/municipality of natural and other disasters, from a total of 79 municipalities/towns in the Federation of Bosnia and Herzegovina, was done by only 25 municipalities(Bosanska Krupa, Domaljevac- Samac, Gracanica, Tuzla, Lancaster, Doboj Istok, Gradačac, Kalesija, Kladanj, Lukavac, Sapna, Srebrenik, Vares, Zavidovici, Zenica, Maglaj, Tesanj, Kakanj, Gorazde, Travnik, Travnik, Jablanica, Konjic, Hadzic, Stari Grad), while 12 municipalities (Bosanska Krupa, Gracanica, Tuzla, Gradacac, Kalesija, Vares, Zenica, Tešanj, Goražde, Jablanica, Stari Grad and Hadzici) issued a fire safety plan for their area.

In the last decade it has been almost impossible to carry out a good-quality analysis, mainly because statistical data on fires and burned areas are not collected in the same way in FB&H, RS and BD. Data submitted on fires in FB&H cover the fire seasons from2008 to 2012. However, there is no precise information on the distribution of fires on the territoryof FB&H, thus the data cannot be used to analyze the occurrence of fires.

There are no valid and official data for the main causes of forest fires in BiH, although unofficially the main cause is the human factor (in about 98 percent of all forest fires). (Forest Fire Suppression in Bosnia and Herzegovina, Sarajevo, 2014)

According to some unofficial sources, the main reasons for forest fires in BiH are agricultural burning (field clearing in spring and stubble burning in summer) and negligence when lightingfires in or near forests. There are some cases of arson, but these are not proved as there is noofficial investigation or court verdict. Lightning is a minor cause of forest fires (fewer than 2percent of cases).

One of the main problems in B&H is the existence of areas contaminated by landmines. The current area contaminated by landmines is estimated at around 1,176.5 km2 or 2.3 percent of BiH territory (Figure 34), of which 129,774.6 ha or 10.5 percent are forests or forest land (The Legacy and Challenges of the Aerial Fighting of Wild Fires in Bosnia and Herzegovina Involving Land Mines, Zadar, 2015). Thisrepresents a particular problem for the implementation of the forest fire protection measuresprescribed during forest management activities. In addition, it is almost impossible to organizeforest fire suppression activities, from either the ground or the air.

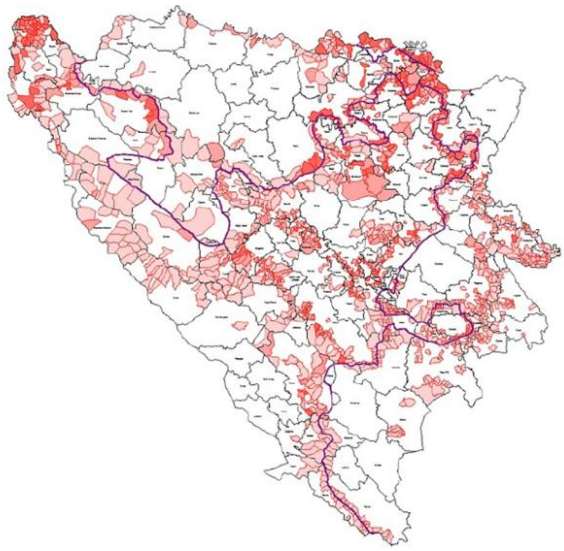


Figure 34: Distribution of mines The Forest Sector in Bosnia and Herzegovina, Regional Office for Europe and CentralAsia of the Food and Agriculture Organization (FAO) of the United Nations, 2015

3.2 Kosovo*

3.2.1 Established practices for risk management

During last years civil protection system in Northern Kosovo* municipalities existed on its own, without any serious development. It was solely oriented towards response, without paying due attention to disaster prevention and risk reduction. This attitude is considered nowadays inappropriate, especially in the region prone to different types of disasters: earthquakes, floods, forest fires, drought, and environmental emergencies.

Kosovo* disaster management system, although being yet quite response-oriented, has started to consider proper risk assessment and emergency planning as cornerstones of the overall disaster management strategy.

In the interviews some (but not all) Northern Kosovo* officials considered disaster risk reduction and disaster prevention issues as important; however, there is no system in place to institutionalize those issues and to implement and enforce them. Due to the lack of expertise and proper financing municipalities have never made risk assessments or disaster management

plans. In most of the cases individual households are left with responsibility to protect themselves. Municipal authorities and emergency services respond to incidents only post factum and don't make any analysis of recent emergencies to improve the situation for instance for excessive snowfalls in winter; floods in spring; drought and forest fires in summer.
The local level is responsible for:

- management system for protection, rescue and assistance at the local level;
- monitoring of risks, warning and alarming the population about potential threats;
- equipment with electronic communication tools for protection needs, rescue and assistance in accordance with a unique system of communication and information;
- planning and implementation of preventive measures;
- processing of risk assessment and emergency response plans;
- organization, development and management of personal and reciprocal protection;
- organization, management and implementation of protection, rescue and assistance at the local level;
- defining, organizing and equipping units and SPRA utilities and other organizations in this field;
- the supply of necessary resources for emergency accommodation in cases of natural and other disasters;
- developing and carrying out training programs of local importance;
- coordinating emergency response plans and other protection operations for rescue and assistance with neighbouring municipalities;
- supplying with basic conditions of life and restoration, recovery from natural and other disasters;
- identification of organizations of special significance for protection, rescue and assistance at the local level;
- international cooperation in the protection, rescue and assistance under this law.
- When in natural and other disasters the protection, rescue and aid are requested, the local levels will initially deploy firefighting units and use their own civil protection resources (which are usually quite scarce). When the degree of risk and disaster exceeds the capacity of local emergency services and current resources at local level or when they can't be obtained by the local neighbours, the central authority should provide them from other regions. If available forces and resources are insufficient to cope with necessary rescue and aid operation, then a municipality through EMA may request the deployment of other civil protection resources, including the international ones.
- themayor, as the executive chief of the municipality, is responsible for public safety and wellbeing of the citizens in that municipality. The Mayor:
- is responsible for coordinating local resources to address the full spectrum of actions of prevention, preparedness, response and recovery from incidents in the context of all risks, including natural disasters, technological accidents and other contingency;
- on certain emergency circumstances, has political power to make, amend and repeal of the orders and regulations;
- assures leadership and plays a key role in communication with the public and helping people, businesses and organizations to deal with the consequences of any emergency declared within the jurisdiction of the municipality;
- encourages participation in mutual aid and exercises its authority to enter into

agreements for mutual aid with other municipalities to facilitate the exchange of resources;
- requests central support when concluded that local capacities are insufficient, surpassed or Exhausted

3.2.2 Assessment of risk management aspects

Due to the specific situation of Northern Kosovo*, only municipal authority level was involved into response and relief activities. In all municipalities establishment of municipal Crisis Commission for emergencies is envisaged; they actually convened during April floods. According to representatives of the municipalities, the Crisis Commission is chaired by the Mayor; operational staff is chaired by Director of Civil Protection Department. Unfortunately, municipalities could not provide written procedures of the Crisis Commission work as well as coordination plans. Representatives of the municipalities orally confirmed that there were coordination plans for emergencies in place. It is not obvious, whether and how the municipal Crisis Commissions in Northern Kosovo* municipalities fulfil the duties of the Unified Command. To some extent, they certainly do, but in certain cases they may simply lack necessary competence and level of authority. For example, it was mentioned that a Mayor of a municipality in case of lack of resources may directly call assistance from KFOR. According to the interviewed KFOR official, it contradicts the correct procedures for KFOR intervention as their assistance in emergency situations might be required by governmental structures only.
Fire Service – there are three fire stations in Northern Kosovo*: in Mitrovice/Mitrovica, Zubin Potok and Leposaviq/Leposavić. The main purposes of their deployments are forest fires, but they respond to other incidents, such as floods, traffic accidents, accidents with animals. Their equipment dates back to 1970-80-es, last 5-6 years they haven't seen any other financial support than from the municipality.
According to the EU policy and "Administrative Instruction on the Methodology of the Compiling Risk Assessment and Plans for Protection and Rescue" municipalities have to conduct risk assessments and renew them on yearly basis. However, this is not a compulsory procedure and there is no mechanism to check and evaluate these risk assessments at central level. In the reviewed municipalities neither risk assessments nor even hazard assessments have been ever compiled.
Lack of capacity in terms of risk identification also impacts early warning. In Northern Kosovo*, there are no early warning mechanisms to inform authorities and the public about developing trends of risks – that increases population exposure to various natural hazards. As mentioned above, early warning and alerting are closely linked to hydrometeorological monitoring. Since 1999, the Serbian system RHMZ is not in operation and there is only one measuring point on the river Ibar- Prelez.
After signing of Brussels Agreement from 19 April 2013 first contacts between municipal authorities and commanders of Fire Units from Northern Kosovo* with EMA officials were made.
Emergency Response Number – in the four municipalities on the North of Kosovo* people use emergency number 193 to call a Fire Station. Firefighters are the first responders in any emergency situation. Information to police, ambulance, local authorities goes through separate channels (numbers) and seems to be rather chaotic. Disasters do not recognize state or ethnical

borders, therefore access to emergency assistance should be equally granted to the whole population.

3.3 Serbia

Strategic dimension of the protection and rescue system in the Republic of Serbia is established in an integral way by adoption of the National Protection and Rescue Strategy (2011) and it has been normatively regulated by the Law on Emergencies (2009). The starting point in the new system is the principle by which the crisis is to be solved at the place of its occurrence; consequently, significant part of responsibility has been transferred to local governments, but it is not followed by necessary legal institutional upgrade of the system, material and technical investment as well by the appropriate personnel measures.

Adoption of the Law has not caused the expected reaction in the sense of its execution. Due to absence of political will to deal with the protection and rescue matters as well as for some other reasons, the Law has not brought the expected results so far.

From the moment of the Law adoption there have been small number of the attempts to systematically consider the problems and make a deeper critical analysis and more serious empiric research of the ways in which the system really does function in practice in all its organizational, institutional, normative, material and other aspects, as well as in all the phases of crisis, i.e. emergencies (prevention, preparation, reaction and rehabilitation). The problem relates both functioning of the system and its efficiency on local level.This is an attempt to analyse the system of emergency management in Serbia within the project *Analysis of Civil Security Systems in Europe – ANVIL* within the Programme FP17 financed by the European Commission, (Kesetovic, 2013) to describe and make systematic and critical analysis of the normative and legal regulation of emergency management as well as role of local governments, and to make an analysis of the economic effects of emergencies to local governments (Radovic and Jovanovic, 2011).

The abovementioned facts imply a much deeper problem than it can be seen in the quotes from the given documents. Namely, the basic reason for generating of the bad strategic documents, nonexistence of the doctrinaire documents and sketchy legal solutions lies in poor quantum of knowledge about the protection and rescue issue.The reason for justifying such a claim can be found on all levels of management in the state administration. Although the Law on Emergencies precisely demands“training” on the level of elementary and secondary education, it has never begun to live in practice.

3.3.1 Established practices for risk management

The protection and rescue system in the Republic of Serbia has derived from the regulations of the Constitution of the Republic of Serbia(Official Gazette of RS, 2006).Besides other issues, the Constitution defines competence of the state and municipality to take care ofthe environmental protection and protection in case of natural and other disasters.

Various system laws in the Republic of Serbia set the obligation of "organization of protection against natural and other bigger disasters and creation of the conditions for their elimination, i.e. reduction of their consequences".

National Strategy for Protection and Rescue was adopted in 2011. The basis for the strategy creation was the Law on Emergencies, which points to nonexistence of the adequate personnel who can provide analysis of the system on strategic level and make connection among the documents which arrange and direct the system. Besides the Law, the basis for creation of the National Strategy can be also found in other national and international documents such as: National Programme for Integration of the Republic of Serbia into European Union, National Strategy of Sustainable Development, Strategy of National Security of the Republic of Serbia, Millenium Aims of Development which have been defined by the United nations members and Hyogo framework for action 2005 - 2015: *Development of Resistance of the Nations and Communities to Catastrophies*.

National strategy provides fulfilling of the recommendations given by the European Union for development of national protection system: establishment of institutional, organizational and personnel conditions for providing protection in emergencies; education of well-trained personnel; forming and training of the existing firefighting and rescue units in all places where they should do new jobs; development of the capabilites to, in case of a catastrophy, respond in the most efficient way, including elimination of the consequences caused by terroristic attacks; providing the material aid for support of implementation of the National Strategy; training of the firefighting and rescue units of MIA, firefighting units in companies and voluntary firefighting associations, civil protection units (specialized and the general purpose ones); training of the citizens for acting in emergencies, of volunteers etc.

The aims of the Strategy development show that the framework for the system development has been planned to be a comprehensive one in order to make a platform which would provide the guidelines for keeping susteinability of protection and rescue system.

It has been planned for the national strategy to be implemented through the action plan for its realization which will be made within six month from the day of the National Strategy adoption. The action plan should define detailed realization of strategic activities as well as the persons in charge of its realization, indicators of success, time frame for its realization and necessary financial means.

New framework for reduction of risk in case of disaster was made in 2015 under the name Sendai Framework for Disaster Risk Reduction 2015-2030, which gave the basic guidelines relating arrangement of protection and rescue system, i.e. guidelines for its development.

Risk Management National Programme (http://www.obnova.gov.rs/uploads/useruploads/Documents/Nacionalni%20program%20upravljanja%20rizikom%20od%20elementarnih%20_nepogoda.pdf) in case of natural disasters was adopted in December 2014. The Action Plan for implementation of the Republic of Serbia RiskManagement National Programme in case of natural disasters (2016-2020) has been completely harmonized with the Sendai Framework for Disaster Risk Reduction 2015-2030, adopted on 18 March 2015 during the Third World Conference for Disaster Risk Reduction.

The Law on Emergencies establishes the basis of the integral protection and rescue system. The most important advantage of the Law is the fact that it puts the local government units into focus. It is logical if we take in consideration the fact that natural disasters and other accidents first affect the protected values on the territory they occured on. Contrary to the Constitution and the Law on Local Governments which only in general authorize local government to

organize protection of the field of emergency situation mamangement, the Law on Emergencies as the basic law defining this field defines this field, duties, right and obligations of the local governments in details.It is defined in the Law that the local government units are one of the subjects in protection and rescue system on the territory of the Republic of Serbia in accordance with the Law and other regulations, programmes, plans and other documents which define organization, development, preparation and use of the forces and means for protection and rescue, as well as taking the protection and rescue prevention measures.

Protection and rescue principles are established and, as one of the protection and rescue principles, there is the principle of graduality in engagement of the forces and means according to which the forces and means to be used first are the ones from the territory of the local government. It means that they respond to an emergency at the place where it occurs, i.e. in the local community, and that the Republic forces and means are engaged only in case capacities of the local community are not sufficient. This approach is totally correct, but since there are not the provisions for regulation of the obligations of following and activating of the protection and rescue forces on the Republic or regional level, there is disproportion relating the time of responding and providing help. The result is lack of response which puts the local government units in a bad position due to lack of people and means. The problem can be solved by making the protection and rescue plans which still do not exist in practice.

The bylaws relating emergenciesprovisions of which are related to the entire system have closely defined the necessary elements important for the system functioning. These bylaws are the following instructions, regulations and ordinances:

- Instruction on Methodology of Risk Assessment and Protection and Rescue Plans in Emergencies „Official Gazetteof RS“, No 96 issued on 5 October 2012,
- Statute on Performing Evacuation "Official Gazette of RS", No 22 from 31 March 2011
- Regulation on Contents and Way of Making Protection and Rescue Plans in Emergencies "Official Gazette of RS", No 8 from 11 February 2011,
- Regulation on Obligatory Means and Equipment for Personal, Mutual and Collective Protection against Natural Disasters and other Accidents "Official Gazette of RS", No 3 from 24 January 2011,
- Regulation on Composition and Way of Work of the Emergency Staffs „Official Gazette of RS“, No 98 from 24 December 2010,
- Regulation on Amount and Right to get One-time Financial Aid „Official Gazette of RS“, No 98 from 24 December 2010,
- Regulation on Use of Belongings for the Needs of Protection and Rescue and the Way of Exercising the Right to Get Compensation for their Use - „Official Gazette of RS“, No 10/13 from 30 January 2013,
- Rule book on Organization and Way of Engagement of the Special Civil Protection Units
- "Official Gazette of RS", No 26 from 15 April 2011,
- Rule book on the Way of Collection and Payment Dates Relating the Means to be Directed as a Dedicated Revenue Fund Budget for Emergencies“Official Gazette of RS ", No 14 from 4 March 2011, No 28 from 26 April 2011,
- Rule book on Contents of the Information about Dangers, Measures and Actions in Case of Accident - "Official Gazette of RS ", No 18 from 9 March 2012,
- Rule book on the Way of Assessment of the Value of the Construction Part of the

Objects and the Way of Calculating Compensation for Shelters „Official Gazette of RS“, No 78 from 10 August 2012,

- Rule book on the Way of Making the Plan of Protection against Accident „Official Gazette of RS“, No 82 from 22 August 2012,
- Rule book on Kinds and Quantity of Hazardous Matters, Facilities and other Criteria based on which the Plan of Protection against Accidents is Made and Measures which are to be Taken to Prevent the Accident and Limit the Effects upon Life and Health of People, Material Goods and Environment -„Official Gazette of RS“ No 08/13 from 24 January 2013.

The field of fire protection which is arranged by the basic Law on Fire Protection “Official Gazette of RS“, No 111 from 29 December 2009 as well as numerous bylaws is closely connected with Emergency Management. Namely, the local government units, within their competencies defined by the Constitution and Law on Fire Protection, organize and provide the conditions fire protection measures realization and provide help in elimination or reduction of the consequences caused by fire and they make the acts for improvement of the fire protection. The local government units make the plan of fire protection units, define implementation of fire protection measures in spatial and urbanistic plan of local government and provide consent of MIA relating implementation of fire protection measures for certain objects in the process of issuing the utilization aproval.

There are a number of laws which are connected to emergency management and their provisions put certain activities in the local government competence. For example, The Law on Waters ("Official Gazette of RS",No 30/2010and 93/2012) puts certain competencies relating protection against harmful effects of second-order waters (measures and works for protection against ice, erosion and torrents and for removing of consequences of such effects of water) under competence of local government units.

Instruction on Methodology of Risk Assessment and Protection and Rescue Plans in Emergenciesis a document which in more details defines elements and way of risk assessment from the aspect of presence of risk in case of natural disasters and other accidents in the Republic of Serbia.

Risk assessment relating natural disasters and other accidents is the basic document for making the protection and rescue plan in emergencies on the level of the Republic of Serbia and the protection and rescue plan in emergencies on the level of the state administration, autonomous provinces, local government units, commercial companies, other legal entities and other organizations and the risk assessment is made by all the subjects defined by the Law on Emergencies. Those in charge of making the assessment should form an expert team for the Assessment making and the team should be composed of experts in their respective fields which are important for protection and rescue, i.e. risk assessment.

The Assessment is the document which identifies danger, source and form of possible threat, possible effects and consequences, assessment of threat-risk, considers the forces, means and prevention measures as response to dangers caused by natural disasters and other accidents, considers protection and rescue of lives and health of people, animals, material, cultural property and environment.

The assessment defines position and features of the territory, possible vulnerability of critical infrastructure, identification of the danger, risk assessment, assessment of necessary forces, means and prevention measures for protection and rescue in case of natural disasters and other accidents.

The assessment contains: Introduction; Position and features of the territory; Assessment of critical infrastructure from the aspect of its vulnerability to natural disasters and other accidents; Identification of the danger and assessment of natural disasters and other accidents risk; Assessment of necessary forces, means and prevention measures for protection and rescue; Conclusion.

3.3.2 Assessment of risk management aspects

Having in mind theoretical and practical postulates of protection and rescue system, it can be concluded that these are the fundamentals for arrangement of risk management system in case of natural disasters and other accidents in the Republic of Serbia.

Protection and Rescue Strategy

Principal characteristics of Protection and Rescue Strategy from the aspect of its influence upon establishment of risk management are:

- The strategy has involved existence of the need for risk management in an acceptable way;
- Necessity of establishment of risk management system has been precisely pointed out in each element of the Strategy;
- It makes connection between the postulates of risk management system and the European Union documents;
- Policy of risk reduction should be accepted by all the parties interested in the issue;
- There is need for eastablishment of National platform for disaster risk reduction as a national mechanism for emergency situations;
- The fundamentals for disaster risk reduction and increase of resistance to disasters can be found in being familiar with dangers as physical, social, economic and ecological threats certain communities and the community as a whole can face, as well as in being familiar with the long and short changing threats and vulnarabilities. Response should correspond that knowledge;
- The adopted standards and methodology of the natural disasters and other accidents risk assessment and identification are in accordance with the EU recommendations;
- Consequences about risks they can face as well about possible options and measures that can be taken in order to reduce threat and improve preparation;
- Contents and topics from the field of protection and rescue and risk reduction in case of disaster should be introduced into national curricula in all educational institutions;
- There is functional connection between science research organizations and the key actors of protection and rescue integrated system;
- Cooperation with media in the field of promoting the policy of risk reduction in case of disasters and reporting before, during and after emergencies;
- Development of awareness and culture of citizens' security in the field of protection, rescue and disaster risk reduction.

Conclusion on ranges of the Protection and Rescue national Strategy:

- It has been made in accordance with the Hyogo framework for action 2005-2015;
- It does not follow the Sendai framework 2015-2030 postulates and that is why it can be considered as outdated and dysfunctional;
- Strategy must have sustainability for a longer period of time and it has to predict making of the doctrinaire documents which will follow the changes on medium-term level;
- Legal solutions arise from the strategy and doctrinaires;
- The strategy must be based on risk management and founded on systematic foundations of protection and rescue system;
- It should predict modular organization of the system thus enabling adjusting to the changes of the system parts, without disturbing those who do not need the changes;
- It should enable compatibility with the documents in the surrounding countries and European Union;
- The system should be established on the quality and coordination with positive world and European standards;
- Specially educated staff is a necessity and they should possess knowledge and vision about the way of making such documents in accordance with time and society needs.

Risk Management National Programme in case of natural disasters and the Action Plan for implementation of the Republic of Serbia RiskManagement National Programme have been harmonized with the Sendai Framework for Disaster Risk Reduction 2015-2030 and they are directed towards building of the appropriate long-term risk management system in case of natural disasters in the country.

The Law on Emergencies

The Law on Emergencies defines the basic tasks of protection and rescue system: 1) programming and planning of the measures and activities relating protection and rescue; 2) protection as a group of prevention measures directed to strengthening resistance of the community, elimination of possible threat causes, reduction of the natural disasters effcts, prevention of other sorts of accidents and, in case they do occur, reduction of their consequences; 3) coordination when establishing, making and carrying out the National Protection and Rescue Strategy; 4) rescue and help which involve operational activites to be taken in order to rescue people, material goods and environment; 5) reduction and elimination of direct consequences of natural disasters and other accidents which means that mesaures and activities must be taken in order to establish necessary conditions for life of the citizens in the affected area; 6) organizing, equipping and training of protection and rescue forces; 7) organizing, equipping and training of the state agencies, commercial companies, other legal entities and enterpreneurs for protection and rescue; 8) organizing and training of the citizens in the field of personal, mutual and collective protection; 9) giving and asking for help and cooperation with other countries and international organizations; 10) management, leadership and coordination of the subjects and forces of protection and rescue system in emergencies; 11) other activities and tasks in protection and rescue field.

From the aspect of the influence upon establishment of risk management system principle characteristics of the Law on Emergencies are:

- The Law should arise from the guidelines contained in strategic and doctrinaire documents;
- The Law must keep pace with the contemporary solutions arising from experience of the surrounding countries;
- The Law must be adapted to the needs and capabilities of the society;
- The existing Law contains majority of the elements by means of which protection and rescue system can be arranged;
- The Law must not be in conflict with other laws;
- The Law must regulate all segments of protection and rescue system through the system of bylaws;
- The law sets the postulates of functioning which keep the character of the system on all levels of management;
- The Law must be implementable on the level of local government unit.

Conclusion on the ranges of the Law on Emergencies:

- Since the existing Law represents the basis for making the Strategy, it does not have a developmental capacity;
- It regulates the unique protection and rescue system on territory of the entire country;
- It defines the subjects of protection and rescue system;
- The system of defining the concepts is unacceptable from the aspect of the rules for defining and adequacy for the needs of its understanding;
- It defines competencies of the state agencies, regions and local government units, as well as competencies of the commercial companies, other legal entities and individuals;
- The Law defines emergency risk leadership; the relation with emergency risk management has not been established, and consequently the connection between management and leadership bodies has not been developed on different levels of management in normal and emergency situations;
- Making of the vulnerability assessments and protection and rescue plans are defined and that makes the foundation for risk management in case of natural disasters and other accidents;
- Civil protection elements and way of their engagement in emergencies are precisely defined;
- Planning and programming of protection and rescue system is defined in a special issue, as well as the way of financing, but it has never begun its life in practice in a unique way except for the one on the level of budgeting in the Republic budget. The units of local governments do not have a common attitude towards budgeting of the system on their respective territories, and that is why there are significant differences in the amount of the allocated funds.

Bylaws

Bylaws have resulted from the Law and they have several general characteristics:

- The entire bylaws documentation has not been made resulting in the effect of "tied hands" of local government units in sense of taking the necessary steps for the system forming;

- The adopted bylaws are mostly of general character, without the necessary details which should regulate the important elements of the system and
- The solutions in certain bylaws are outdated and do not follow contemporary trends and need.

The Instruction on Methodology for making the Risk Assessment in case of Natural Disasters and other Accidents

Based on the National StandardA.L2.003 Social Security – Risk Assessment in Protection of People, Property and Business- published in 2010 by the Standardization Institute of Serbia, i.e. its annex *Emergencies*, a part of methodology for vulnerability assessment in case of natural disasters and other accidents. It is labeled here as Attachment 1: Methodology of Vulnerability Assessment. The standard has been made within the commission A292 Security and Resistance (thenA223 Social Security) on the basis of the international standard ISO 31000 RiskManagement.
Having in mind the abovementioned facts, a conclusion can be made that the methodology has completely or mostly been made in accordance with the international and national standards but in accordance with the national needs as well.

From the moment of adoption of the Instruction with Methodology in 2012, certain percentage of the activities relating creation of risk assessments and protection and rescue plans has been done. Small number of local governments has approached the problem of the assessment making in a proper way. They have sent qualified people to get licenses and started the process of their making. A part of local governments has chosen"outsource"for these jobs, while most of the local governments have not started the activities at all.
When natural disasters are concerned, it is important to emphasize that the existing methodology for risk assessment considers the following dangers:

- ND-1 Earthquakes;
- ND-2 Escarpments, landslides and erosions;
- ND-3Floods;
- ND-4Stormy wind;
- ND-5Hail;
- ND-6Snow blizzards, snow drifts and ice;
- ND-7 Droughts;
- ND-8 Epidemics;
- ПН-9 Epizooties.

Even plant diseases are mentioned in a part of the text, but they are omitted from the methodology part.
It is also important to say that the methodology considers three kinds of technical and technological dangers as well. They should be considered together due to possibility of multi-risk.
Characteristics of the approach to risk management in case of natural disasters and other accidents in the Republic of Serbia are:

- There are methodological tools for making the risk assessments and protection and rescue plans which, in their very structure, demand revision and simplification;

- The existing system has all the elements for making of high-quality and comprehensive assessments and for transparent quantification of all information and scenarios;
- The basis of the idea for the system making was the belief that protection and rescue system would in parallel produce the personnel with knowledge about risk management;
- The work on risk management within protection and rescue system has been reduced on random actions in cases when there are conscientious individuals with a vision in the system, i.e. in cases of ''fear'' of inspections;
- In cases when risk assessment is completed, no further implementation and materialization into management process are performed;
- The key persons in management chain (The Staff Commander, Deputy, Head, Staff members etc) in most cases do not have knowledge, motivation or need to deal with the matters relating risk assessment. That is why the entire procedure is reduced to fulfillment of legal form;
- Level of training and readiness of all the actors in protection and rescue system is very low from the aspect of their work in emergencies;
- As for types of elementary education and expertise, there is enormous variety among personnel in the management bodies and that contributes to the level of incompactness of the formed bodies;
- The persons trained in the educational system possess theoretical knowledge without empirical basis;
- Positive methodology for risk assessment entirely respects the existing project and all other documentation which can influence upon certain risks and which is regulated by some other law;

The previously mentioned documents make a new foundation for building of protection and rescue system based on Vulnerability Assessment in case of natural disasters and other accidents, which guarantees development and building of the system in accordance with real needs dimensioned according to the dangers which really threaten territory of certain subject.

Having in mind the fact that an accident first occurs on the territory of a local government unit and that the law recognizes that, the reason for transfer of majority of competences to the local government unit is justified. Bearing in mind the abovementioned facts, the local government unit has the need and competence to generate the documents necessary for the protection and rescue system building in order to materialize the system.
Operationalization of protection and rescue system and rescue on level of a local government unit is done by creating the following documents:

A) Enactments and decisions:

- The decision on organization and functioning of civil protection
- Act on naming the trained legal entities important for protection and rescue
- Act on forming the emergency staff

B) Planning documents:

- Vulnerability assessment in case of natural disaster and other accidents

- Protection and rescue plan in natural disasters
- Plan and program of development of protection and rescue system and rescue on territory of the respective local government unit

By making the abovementioned documents, the system is getting the framework for its practical implementation within a unique protection and rescue system in the Republic of Serbia.

It is necessary to harmonize these documents with the documents of higher level of management. In that way, emergency management is enabled, irrespectively of the level of involvement of the higher-level forces.

4 Analysis of responsible institutes

The responsible authority for implementing risk management of natural disasters differs from one country to another. Please provide any responsibilities for coping, rebuilding and prevention practices, if any information is available. Additionally, please outline the qualifications of their staff and point out any lack of qualified employees.

4.1 Bosnia and Herzegovina

4.1.1 Organization structure-State Level

The system for protection and rescue in B&H has its structures organized on different levels: state level, entity level, cantonal level, city level and municipality level. After the Framework Law on the protection and rescue of people and property in the event of natural or other disasters in Bosnia and Herzegovina has been enforced the responsibilities of different authorities and institutions of B&H was determined in the field of international cooperation, as well as international cooperation and coordination as well as cooperation and coordination with entity civil protection units and authorities in charge for civil protection of Brcko District. The jurisdiction of the institutes and bodies of B&H regarding systems for protection and rescue are very often separated between two or more institutions and on the state level the consist of:

Council of Ministers of B&H (CoM)

Pursuant to the Framework Law, the Council of Ministers of B&H on the state level manages the system of protection and rescue when natural and other disasters exceed the capacities of the authorities at the lower levels. The Council of Ministers declares the state of a natural or other disaster on a part or the whole territory of Bosnia and Herzegovina upon the proposal of the Coordination Body of Bosnia and Herzegovina of protection and rescue or under the request of the authorized entity or Brcko District, which had already declared a state of natural or other disasters.

CoM is responsible for establishing and Development Program of protection and rescue system at the level of the institutions and authorities of Bosnia and Herzegovina, and its submission to the Parliamentary Assembly for adoption. CoM brings the methodology for development of risk assessment of Bosnia and Herzegovina from natural or other disasters, Risk Assessment B&H and plan of protection and rescue from natural and other disasters institutions and bodies B&H.

CoM decides on seeking international assistance for protection and rescue, and coordinates the implementation of standard operating procedures for its acceptance following the declaration

of natural or other disasters. Additionally it also decides on the provision of international assistance in the event of natural or other disasters.

Coordination Body (CB) of B&H for protection and rescue

Coordination Body has the primary coordination role at the national level and coordinates the activities of protection and rescue in the whole territory of Bosnia and Herzegovina, while the lower levels are responsible for the management, which is in line with the Framework Law.
In accordance with the Framework Law, CB of B&H, at the request of a lower organizational level authority, proposes to the CoM to declare a state of natural or other disaster on the territory of Bosnia and Herzegovina, as well as the termination of such state. This provision indicates that the primary function of this body is coordination, and not a body that issues orders/commands which belongs to the authorities at the lower level.
This body coordinates the activities in the protection and rescue with the institutions and bodies of the entities and Brcko District (BD) and the institutions and bodies at the state level, after CoM declares a state of natural or other disaster on a part or the whole country. This body also coordinates the reception and delivery of international aid and donations in the protection and rescue, following the declaration of natural or other disasters. A significant segment of jurisdiction of the coordination is within this body. This body monitors the implementation of the imposed measures and submits reports to the CoM on their activities. CB of B&H, if necessary, invites other institutions, bodies, agencies, organizations and experts on specific issues of interest for protection and rescue in B&H or abroad to participate in the work without the right to vote. Members of CB of B&H shall submit to the Ministry of Security information necessary for the operation of CB of B&H, if necessary, and at least once every three months.

Ministry of Security of B&H (MS)

This ministry as well coordinates the field of protection and rescue in Bosnia and Herzegovina. MS, through the Department for Protection and Rescue, performs professional and all other administrative tasks in the field of protection and rescue.
MS coordinates the activities,e.g. coordinates activities and tasks of protection and rescue and the exchange of data, information and reports on conducted measures regarding protection and rescue. MS is also responsible for ensuring the implementation of the Framework Law and other regulations in the field of protection and rescue, pursuant to that Law. MS carries out the Security Policy of B&H within its jurisdiction.
MS in coordination with other members of the system for protection and rescue in Bosnia and Herzegovina is responsible for drafting and proposing a set of strategic and operational documents in the field of protection and rescue. This set of documents, among other things, refers to the development of the Program of protection and rescue, the Risk Assessment of Bosnia and Herzegovina, Protection and rescue plans, different by-laws on international cooperation especially giving and receiving of international assistance during disasters.
CoM on the proposal of the MS adopted the Guidelines for international coordination regarding receiving, sending and transit of international help for protection and rescue. MS, among other things, is responsible for the implementation of international cooperation in this field as well as procedures for communication between the institutions and bodies of Bosnia and Herzegovina and the institutions and bodies in B&H with the entities in the event of natural or other disasters, as well as the procedures for providing information to the public.

Very important segment of the jurisdiction is the request from the Ministry of Defense for engagement of the Armed Forces of B&H in case of natural or other disasters, following the exhaustion of available civilian resources to respond in such events.
MS provides working conditions for the CB B&H and performs professional and administrative tasks for the needs of the body.

Operation and Communication Center - 112
With the aim for permanent collection of data on all types of phenomenon and dangers that can lead to natural or other disaster, the CoM within MS has established the Operation and Communication Center - 112. The obligation to form such a center arises from Directive 2002/22/EC and other mechanisms the Council and the Parliament of the European Union aimed at strengthening the capacities of systems for civil protection of the Member States of the European Union.

Ministry of Defense of B&H (MD)

In the event of natural or other disasters of large scale, when civil structures for protection and rescue with their forces, resources and capacities are not able to provide an adequate response the Armed Forces of B&H (AF) are involved. B&H Presidency at the request of civilian authorities responsible for rescuing people and property in the event of natural and other disasters brings the Decision on the implementation of activities for engaging the Armed Forces of B&H. MS B&H on the basis of the stated procedures in charge of receiving requests from the entity governments and BD authorities in case of need for the assistance of the Armed Forces in connection with natural or other disasters. After receiving the request, the MS performs a procedure that will ensure the continued engagement of the AF of B&H. Engaging AF of B&H to assist civil authorities in responding to natural or other disasters is carried out in accordance with the Law on Defense of Bosnia and Herzegovina (B&H Official Gazette, 88/05).

Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (MFTER)

Ministry of Foreign Trade and Economic Relations within its jurisdiction at the state level has certain responsibilities on the issue of water management in the Department of Water resource of this ministry. Within its jurisdiction, MFTER is responsible for conducting foreign policy on water management in the field of competence relating to the preparation and signing of international agreements, while the entities are responsible for the implementation of these agreements. CoM adopted at the end of January 2015 the Action plan for flood control and river management in B&H for the period 2014-2017.

Directorate for Coordination of Police Bodies of Bosnia and Herzegovina (DCPB)

Directorate for Coordination of Police Bodies of B&H was established as a government agency within the MS. Some of its responsibilities are communication, cooperation and coordination between the police authorities of Bosnia and Herzegovina, as well as the organization and implementation of physical and technical protection of persons and facilities of the B&H authorities and the diplomatic and consular authorities which are specifically protected in accordance with relevant laws. Also, DCPB is one of the signatories of the Agreement on mutual assistance and cooperation of five agencies responsible for law enforcement. The signatories of this agreement, in addition to the Directorate for Coordination of Police Bodies (DCPB B&H), and the State Investigation and Protection Agency (SIPA), Border Police of B&H, Federal Police (FUP) and the Ministry of Internal Affairs of Sarajevo Canton (MUPKS) . The

agreement is designed for the needs in crisis situations that require emergency response in order to preserve public order and protection of life or property, and that go beyond the current capabilities of individual agencies.

State Investigation and Protection Agency- SIPA

SIPA is one of the signatories of the Agreement on mutual assistance and cooperation of five agencies responsible for law enforcement.

Ministry of finance and treasury B&H

Provides financial assistance in crisis situations.

4.1.2 Organizational structure for protection and rescue at lower levels

Obligations and the needs of organization, preparation and implementation of protection and rescue of people and property in the Federation of Bosnia and Herzegovina, are formulated by the Law on Protection and Rescue, as well as implementing regulations arising from this law.
This law prescribes and defines the rights and duties of the Federation of Bosnia and Herzegovina, cantons, cities and municipalities in the area of protection and rescue. All of these levels of government establish appropriate bodies of civil protection by the law and other regulations, such as:

- Federal Civil Protection - for the Federation of Bosnia and Herzegovina,
- Cantonal Administration of Civil Protection - for areas of Cantons,
- Municipal/City/Civil protection - in all municipalities (city).

The composition of the stated bodies of civil protection for all levels of the organized civil protection operational centers are formed in accordance with the Regulations on the organization and functioning of the operational centers of Civil Protection ("Official Gazette of B&H", 8/07).

Implementation of the Law on Protection and Rescue

In addition to the formation of these structures of the civil protection which are formed with the aim to carry out administrative, professional and other activities in the field of protection and rescue, for all levels of government in the Federation of Bosnia and Herzegovina formulate appropriate act on the establishment of professional and operational body for the management of protection and rescue actions, ie. Staff civil protection.

At the federal level

After the Federal Civil Protection became an independent organization which directly responds for their work to the Government of the Federation of Bosnia and Herzegovina, its scope of work and all other issues of importance are formulated, which are important for the organization and functioning of this body, by the Law on Federal Ministries and other bodies of the Federal Administration ("Official Gazette of the Federation B&H", Nos. 48/99, 19/03, 38/05, 2/06, 8/06, 61/06 and 48/11).
According to the Regulation on the organization of protection and rescue services of the Federation of Bosnia and Herzegovina ("Official Gazette of the Federation B&H", Nos. 58/06, 40/10, 14/12 and 66/12) different federal services for protection and rescue have been established among which is the Federal Institute for seismology and hydrometeorology FHMZ – Sarajevo.

At the cantonal level

After the enforcement of the Law on Protection and Rescue, in all cantons in the Federation of Bosnia and Herzegovina, Cantonal Administration of Civil Protection have been formed but until now they have not been fully staffed and equipped with adequate materials as we as not fully operational.
Headquarters of civil protection as professional and operational bodies which are to manage protection and rescue actions have been established in all cantons but they are not fully equipped and not fully operational.
Commission to assess the damage caused by natural and other disasters have been established in all cantons of the Federation of Bosnia and Herzegovina.

At the municipal / city level

Since the Law on Protection and Rescue has been enforced, to this day the process of forming municipal/city civil protection services that perform administrative, professional and other tasks of protection and rescue from the jurisdiction of the municipality is still in process.

Commercial companies and other legal persons

referred to in Article 32 of the Law on Protection and Rescue.

Organizational structures for protection and rescue

In accordance with the obligations under the Law on Protection and Rescue and implementing regulations arising from this law, after collection and analyzing the indicators of the implementation of these commitments, it has been conclude that the state of the organization structure of the protection and rescue system in the Federation of Bosnia and Herzegovina is uneven in the cantons and municipalities and therefore does not contribute to the efficiency of the system for protection and rescue in the stage of prevention, rescue and elimination of consequences. There are 10 cantons and organization is different in each and every one. As per report conducted by the Center for Security Studies (June 2010), not even one level of organization (municipality, canton, entity) has a complete equipped Service for protection and rescue.

4.1.3 Individual structures according to natural hazards

Floods

In accordance with the Constitution of B&H and the constitutions of the Federation of B&H and Republic of Serbian and Arbitration Award on Brcko District, responsibilities for water management (i.e. For the development, protection, use, protection from the harmful effects-flood) are the responsibility of the entities and the Brcko District.
At the same time, B&H foreign policy is the responsibility of B&H institutions. The entities have the right to establish special relations with neighboring countries, consistent with the sovereignty and territorial integrity of Bosnia and Herzegovina, and with the consent of the Parliamentary Assembly may enter into agreements with states and international organizations. When it comes to B&H water resources management, this means that the conclusion of appropriate international agreements (both multilateral and bilateral) is responsible only B&H, but they are responsible for their enforcement entities and District. This constitutional arrangement has allowed establishing the jurisdiction of the Ministry of Foreign Trade and Economic Relations to perform certain tasks and duties. Department of Natural Resources,

Energy and Environment Ministry, in this sense, is responsible for carrying out the normative legal, study-analytical and information-documentation tasks.

The current organization of flood control

The Government of the Federation, on the basis of provisions of the flood protection plans and proposals of the Federal Minister of Agriculture, Water and Forestry, has adjudicated on the Main plan of operational measures against floods, the beginning of each year for the current year.

Organization of the management structure of the system of water management in B&H is shown in Figure 35.

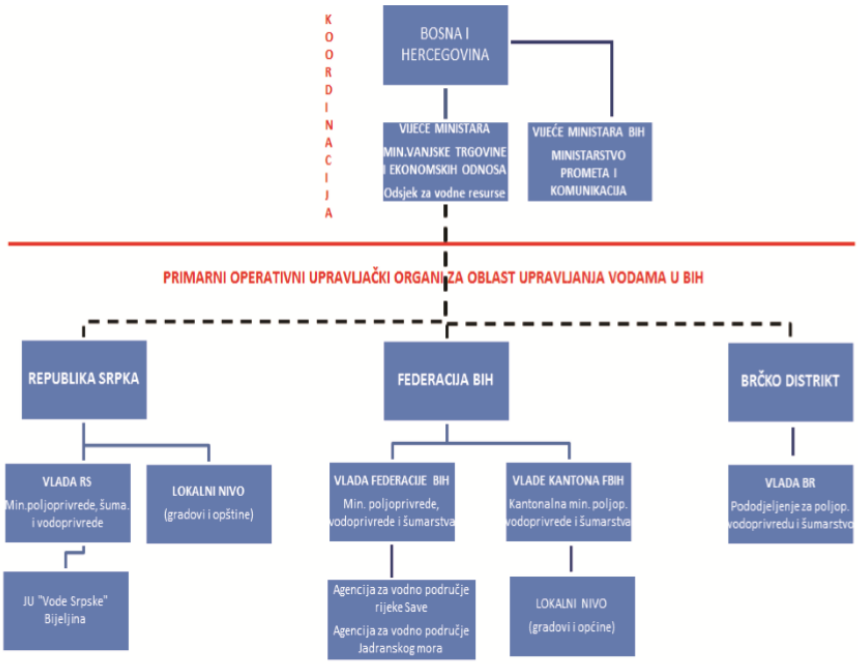


Figure 35: Organization of the management structure of the system of water management in B&H

Federal Ministry of Agriculture, Water and Forestry (Ministry) was established pursuant to the Law on Federal Ministries and performs administrative, professional and other tasks related to the competence of the Federation in the area of Agriculture, Water and Forestry.

According to the Law on Water,. have established agencies for river basins as professional institutions "for the implementation of water management tasks", namely: the Agency for the Sava River Basin (Sava RBD), based in Sarajevo (www.voda.ba) and the Agency for Water Area of the Adriatic Sea (AVP Adriatic sea), based in Mostar (www.jadran.ba).

In the Federation, in addition to federal, in water management participate and cantonal ministries, responsible for the subject area: Una-Sana canton, Cantonal Ministry of Agriculture, Water and Forestry, (www.vladausk.ba); - Posavina Canton, the Ministry of Agriculture, Water and Forestry, Water Management Division (www.zupanijaposavska.ba);

- Tuzla Canton, the Ministry of Agriculture, Water and Forestry (www.vladatk.kim.ba); - Zenica-Doboj Canton, Ministry of Agriculture, Forestry and Water Management, Department of Water and Forestry (www.zdk.ba);- Bosnia-Posavina Canton, Cantonal Ministry of Economy (www.bpkgo.ba); - Central Bosnia Canton, the Ministry of Forestry, Water Management and Agriculture, the Department of Water Resources, in charge of operations of the water sector in

Range Canton (www.sbk-ksb.gov.ba) Cantonal Ministry of Economy (www.bpkgo.ba); - Central Bosnia Canton, the Ministry of Forestry, Water Management and Agriculture, the Department of Water Resources, in charge of operations of the water sector in Range Canton (www.sbk-ksb.gov.ba);
- Herzegovina-Neretva Canton, Ministry of Agriculture, Forestry and Water Management (www.vlada-hnz-k.ba); - West Herzegovina Canton, Ministry of Physical Planning, Resources and Environment, (www.vladazzh.com); - Sarajevo Canton, Ministry of Economy, Department of Agriculture, Water and Forestry. (www.privreda.ks.gov.ba); - Livno Canton, Ministry of Agriculture, Water and Forestry (www.vladahbz.com)
Responsibilities of water management are mainly the cantonal ministries of Agriculture, Water and Forestry, similar to the federal level, while in some cases the jurisdiction of the ministries of economy
Unlike the water sector where the state level there is no formal authority which is in control of waters, in the area of protection and rescue of people and property in the state of natural and other disasters, the state has jurisdiction, and is responsible for the planning and implementation of measures.

Droughts

Meteorological disasters, i.e., the management of these hazards in B&H at the state level are regulated by the Framework Law on protection and rescue of people and property from natural or other disasters in Bosnia and Herzegovina ("Official Gazette", No. 50/08). On the basis of this law, the drawing up methodologies for the development of risk assessment of Bosnia and Herzegovina from natural or other disasters have been instructed. This document should include detailed risk assessment of all natural hazards, including the drought, and will serve as a platform for the adoption of appropriate legislation for all levels of government in Bosnia and Herzegovina.

Under the Article 10 of the provision of the UNCCD, Bosnia and Herzegovina is preparing National Action Programmes (NAPs) to, among others, identify the factors contributing to and practical measures necessary to combating desertification and land degradation, and mitigate the effects of drought. In this framework, NAPs should enhance national dimatological, meteorological and hydrological capabilities and the means to provide a drought early warning system. This includes strengthening drought preparedness and management at local, sub-regional, regional, entity and national levels and incorporating long-term strategies to mitigate the effects of drought, in line with national policies for sustainable development. Strategically, country should come with recommendations for drought related policies and legislation to facilitate the implementation of the NAPs, in particular at national drought mitigation strategies and contingency plans.

Wild fires

The organizational set-up and institutional arrangements in the forest sector are shown Figure 36.

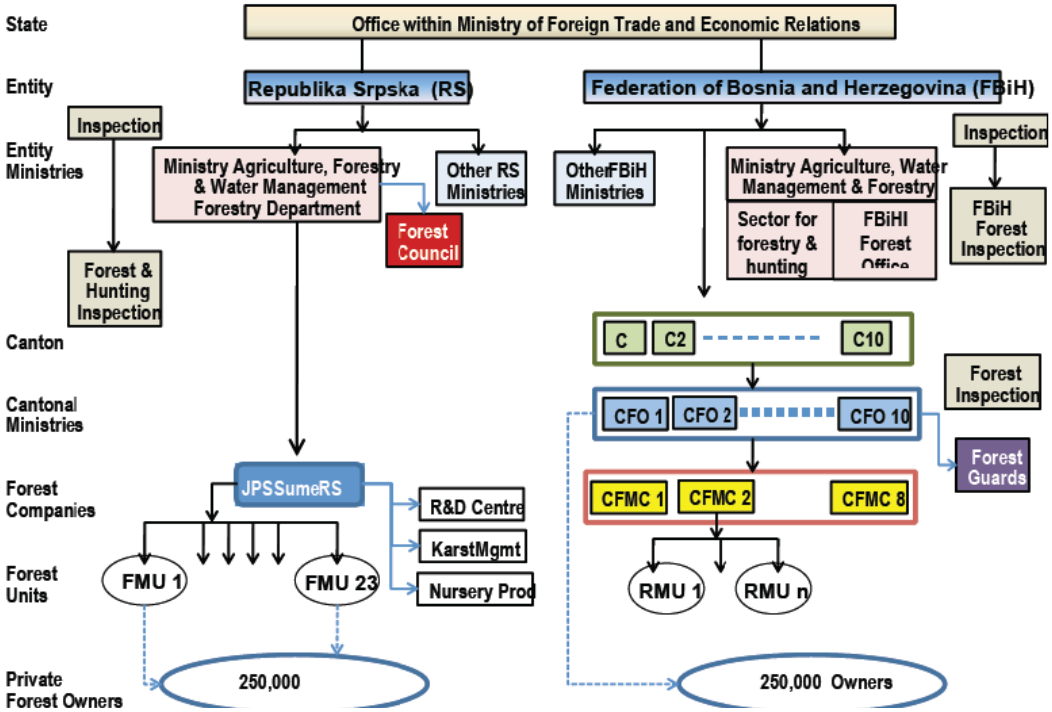


Figure 36: Organizational set-up and institutional arrangements (The Forest Sector in Bosnia and Herzegovina, Regional Office for Europe and Central Asia of the Food and Agriculture Organization (FAO) of the United Nations, 2015)

Direct competences in the forestry sector are held at entity level (FB&Hand RS) and at the level of Brcko District. The institutions at these levels are responsible for thedevelopment of forest policy as well as for the development and implementation of forestlegislation. Among its competencies, the Ministry of Foreign Trade and Economic Relations (MOFTER) is responsible for tasks and duties falling within the jurisdiction of the state of BiH, including the definition of policies and basic principles, the coordination of activities and theconsolidation of entity plans with those of international institutions in the areas of agriculture,energy, environmental protection, the use of natural resources and tourism. The Sector forAgriculture, Food, Forestry and Rural Development operates within MOFTER, and in terms offorestry issues deals mainly with coordination activities.

In FB&H, forest management competencies are devolved to the cantonal governments. Each canton is responsible for the forest resources within its administrative boundaries.
At FB&H level, there is a Forestry Department within the Ministry of Agriculture, Water Management and Forestry (MAWMF). The main bodies within the MAWMF are:

- the FB&H Forest Office (FFO), which is responsible for forest silviculture and protection, forest utilisation, subsidies and support payments for forestry, as well as the development and monitoring of processes in forestry, induding an overall monitoring role in relation to activities within the forest sector; and
- the FB&H Forest Inspection (FFI), which performs overall inspection services safeguarding the implementation of all actions relating to the Law on Forests within FB&H. In the absence of an adopted law, the FFI also operates under the Law on Inspection.

At cantonal level, responsibility lies with the MAWMF of FB&H, with the exception of Sarajevo Canton, West-Herzegovina Canton and Bosnian-Podrinje Canton, which fall under the responsibility of different ministries. In this respect, further important bodies are:

- the Cantonal Forest Office (CFO), which controls the activities of the cantonal forest management companies (CFMC) and provides advice and support to private forest owners. The CFO prepares forest management plans (FMP) for all private owners and plays a major role in guarding and protecting forest resources, including from illegalactivities; and
- the Cantonal Forest Inspection (CFI), which forms part of the Cantonal InspectionService. Their role is essentially the same as that of the FB&H Forest Inspection.

Federal Civil Protection and cantonal governments and municipal/city civil protection, become an essential professional body in the field of fire protection and fire fighting with the task to ensure the implementation of the Law on Fire Protection according to the Law on Fire Protection. On the basis of the available data it is clear that until now not all cantons have passed the cantonal law. Cantonal law on fire prevention and firefighting passed in five of the 10 cantons in the Federation of Bosnia and Herzegovina (Tuzla, Zenica-Doboj, Una-Sana, Central Bosnia and Sarajevo Canton).

4.1.4 General comments on responsible institutes

The unique political structure of B&H has an impact onthe functioning of its public institutions and on all areas of public life. As a consequence, a large number of institutions (at state, federal,cantonal and municipal level) are involved in natural disaster protection. In order to organize theiractivities and competences, there are also a large number of legal acts (laws, sub-laws,rulebooks etc.). All this helps to explain why the system of natural disaster protection in B&H is not asefficient as it should be. It can be concluded that the number of laws regulating this issue shouldbe dramatically decreased, while the harmonization of the most important legal acts amongentities and institutions should be ensured. This is one of the most important preconditions forthe better functioning of the natural disaster protection system in B&H.

The existence of a proper early warning system for natural disasters may significantly improvepreparedness for natural disaster protection in B&H. At present there is no early warning system inB&H. Taking into consideration the specific local context in B&H, this system can only beseen as a temporary solution and the need for a national early warning system remains.

The problem of ensuring the existence of well-trained personnel and firefighters and appropriate equipment also exists in B&H. There is a need for training centres at entity level, butwith the same (i.e. harmonized) training programs.

The problem of the contamination of forests and forest land with landmines has already beenemphasized.

4.2 Kosovo*

It is evident that existing civil protection resources (firefighting units in the municipalities) are far not enough to perform large-scale operations in case of emergencies. They are not so big in numbers and, at present, can rely in the best case only to resources from neighbouring Northern

Kosovo* municipalities. Firefighting units' equipment is scarce, obsolete and non-sufficient. Firefighters frequently are in need of spare parts and technical facilities. In Zubin Potok Fire Unit there is only one outdated chemical protection suit, however risk of chemical accidents is very high because of Trans-European Motorway (E80) passing through the municipality area. The Fire Unit has neither absorbents nor other equipment to respond to potential chemical accident. The fire fighters in Northern Kosovo* regularly train themselves on job, but obviously it is not enough to be updated and well-prepared.

It was mentioned that municipalities have standby agreements with owners of heavy machinery that can be used in response to emergencies. It could be observed on the photos and videos made during flood response operations that responders were using cranes, heavy trucks, rubber boats and other equipment. Most probably it was timely and sufficient, as no one specifically mentioned the contrary. Having standing contracts with private companies is a good solution for preparedness, not only for floods, but also in case of forest fires, landslides, earthquakes and other emergencies. However, a degree of company's reliability has always to be taken into consideration and possible back-up solutions prepared. Use of trained voluntary resources for response operations is almost non-existent. There are no voluntary firefighting units in the municipalities. In many cases, especially in remote villages organized and trained teams of volunteers can be at the frontline of first response. Here Red Cross can make its contribution, training volunteers to respond to disasters. That means not only first aid, but also evacuation of endangered people, urgent property protection measures, and supportive activities during forest fire fighting operations.

4.3 Serbia

The Law on emergencies recognizes Sector for Emergency Situations (SES) as a unique body within Ministry of Interior Affairs (MIA) in which all the emergency services from MIA and Ministry of Agriculture and Environmental Protection are integrated(Ninkovic and Kesetovic, 2015).Sector for Emergency Situations is a specialized organizational unit of MIA which coordinates activities of all the state and civilian institutions involved in crisis and emergencies management on all levels of political territorial organization (Ninkovic and Kesetovic, 2015). General organizational scheme of SES is shown in the Figure 37.

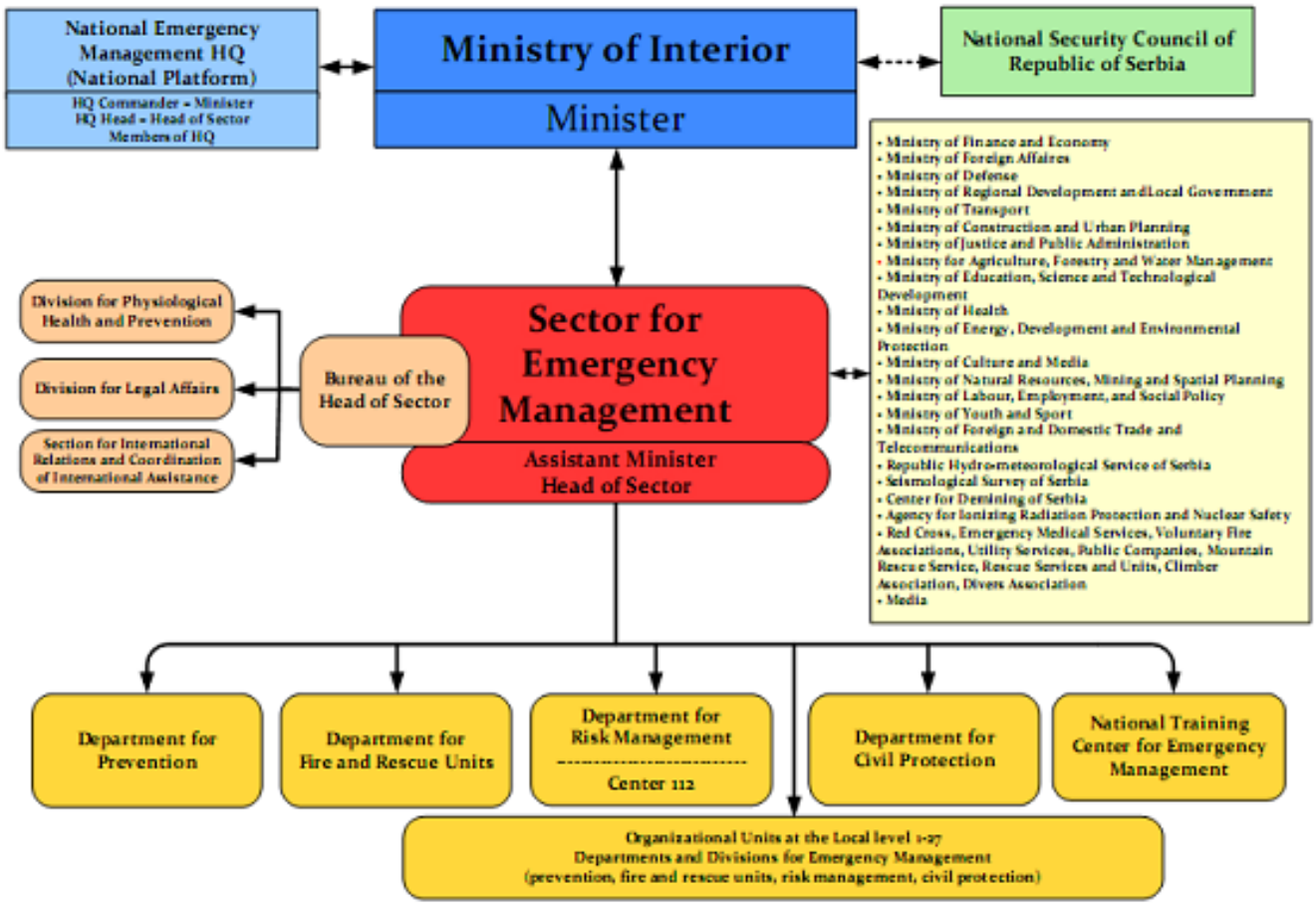


Figure 37:Organizational scheme of Sector for Emergency Situations (Ministry of Interior, 2017)

National Assembly is responsible for adoption of the Protection and Rescue National Strategy, while the Government is responsible for all system aspects of civil protection (adoption of plans, risk assessment and other documents, giving the order for general mobilization of civil protection units, monitoring etc.) (Ninkovic and Kesetovic, 2015).

This approach is based on use of civil agencies and operations, while military capacities are engaged on the demand of SES when other resources are not sufficient (Ninkovic and Kesetovic, 2015). Besides SES, other ministries, agnecies and special organizations have their role in risk management within their competencies and there are some specific situations in which they can be the key actors (for example, Public Health Institute in cases of pandemic) (Ninkovic and Kesetovic, 2015).

Every administration management level is responsible for preparation and response to a crisis within its constitutional and legal mandate and the operational capacities (Ninkovic and Kesetovic, 2015). The units of local government, town or municipality have primarily operational role, while a region is mediator between local and province or national level of authority (Ninkovic and Kesetovic, 2015). As for the national level, SES deals with strategic issues, planning, coordination and monitoring of the system (Ninkovic and Kesetovic, 2015).

Sector for Emergency Situations has organizational units on regional and local level which act within the staff for emergency situations (Ninkovic and Kesetovic, 2015). Local staffs for emergency situations are permanent bodies (they have permanent members) which are formed

by the local authorities for the area of the local government unit (Ninkovic and Kesetovic, 2015). In case of a special crisis, the local staffs can be strengthened by experts from various fields (Ninkovic and Kesetovic, 2015). The staffs consist of commander, the deputy and members (Ninkovic and Kesetovic, 2015).The staff commanders are mayors or municipality presidents (Kesetovic, 2014). The town or municipality deputy commander is deputy mayor, or municipality president deputy or member of the town or municipality council (Kesetovic, 2014). Representatives of the state agencies organizational units, local government bodies, public companies, health institutions, centres for social work, Red Cross, Mountain Rescue Service, associations of citizens etc. are also members of the staffs (Kesetovic, 2014). Besides the already listed, there is also the staff head who is representative of the competent service.

Having in mind composition of the staffs(most of the staff members are the persons appointed there for political reasons) (Kesetovic, 2014), it is clear that work and functioning of the staffs are often made significantly difficult due to frequent personnel changes in the city/town/municipality leadership, leaders of the town/city management bodies, public and public utility commercial companies and other legal entities as well as due to insufficient experience and level of training for performing the jobs in the conditions of emergency situations (Kesetovic, 2014). The National Training Centre is in charge of the staff commanders' education. It often happens that, due to political changes, some persons do not stay for a longer period of time at the position of a staff commander after completed education (Kesetovic, 2014). In fact, political background of the staff leaders and members results in personnel problem, because protection and rescue of people is done by the persons to whom it is an extra job.

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