CLASSIFICATION OF NATURAL DISASTERS BETWEEN THE LEGISLATION AND APPLICATION: EXPERIENCE OF THE REPUBLIC OF SERBIA

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Natural disasters in the Republic of Serbia.

Classification of natural disasters between the legislation and application: experience of the Republic of Serbia

ABSTRACT: The paper discusses the definitions of natural disasters and recommends the implementation of definitions and classifications of natural disasters in accordance with those decreed at the Centre for Research on the Epidemiology of Disasters (CRED) and Munich Re insurance Company (Munich RE) for administrative use in the Republic of Serbia. For the Republic of Serbia, the issue of natural disasters is presented both through government documents (e.g. the Law on Emergencies and the National Strategy of the Protection and Rescue in Emergencies) and the survey of the frequency and typology of disasters. Significant discrepancies exist between older and more contemporary classifications of disasters in Serbia. They are especially emphasized in comparison to the CRED and Munich RE classifications and databases. This causes problems in the monitoring, recording and assessment of the effects of natural disasters. It is proposed that definitions be adapted and implemented into legislative and other documents.

KEY WORDS: natural disasters, classification, CRED, Munich RE, Serbia

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Contents

1 Introduction

The study of natural disasters strives to encompass all causalities in the natural environment, such as the geosphere, astrosphere and man himself. Although natural disasters present various threats to the human environment they are not always the result of processes natural to the environment; they are also resulting processes of the interaction between natural and anthropogenic systems. Understanding these interactions changes our understanding of natural disasters, and moves it from the area of solely natural phenomena to the area of social and psychological phenomena as well.

It is difficult to give a generally acceptable definition of what a natural disaster is, even in cases where natural disasters are clearly identifiable. Nevertheless, improving the contours of the definition of natural disasters could undoubtedly contribute to a better understanding of them, above all for the purposes of better classification, identification, prediction, and mitigation.

During the 1960's, natural disasters were considered uncontrollable events and a serious threat to society, particularly when disruptive circumstances resulted (Fritz 1961). The idea of the helpless society visibly damaged by powerful natural forces forms a definition according to which a disaster is a mighty and sudden event that disrupts normal functioning within a social system, and over which a society loses control (Barkun 1974). Westagate and O'Keefe (1976) were among the first to recognize the importance of the vulnerability of human society in the study of natural disasters. They defined natural disaster as the interaction between extreme natural phenomena and the vulnerability of human groups, leading to general destruction, injury and loss of life.

Alcántara-Ayala (2002) explained natural disasters as serious disturbances to the functioning of society. They injure and cause fatalities, damage buildings, infrastructure and other objects, and disrupt natural balances where threatened populations cannot resolve newly and suddenly emergent situations using only their own resources. A review of elements that have been used to define disasters was made by Alexander (1997).

In many cases, the classification of disasters was made according to (1) the speed and (2) cause of occurrence (Alcántara-Ayala 2002). In this sense, a natural disaster according to (1), has been expressed as a complex of elements which manifests on different scales of occurance in the physical environment harmful to man, or a physical event that makes a strong impact on human beings and their environment. Other conceptions, according to (2), are a strong interaction between people and nature, which leads to the occurrence and manifestation of a potentially damaging phenomenon, affecting specific environmental surroundings depending on their cause (natural or influenced by man).

As a result of this, natural disaster is defined as a sudden change in one's natural environment that also affects social and economic systems (Alexander 1993). We can understand natural disasters as sudden imbalances between forces which, while strengthening natural systems, often result in the stamping out of human social systems. The damaging effects of such imbalances depend on the relationship between the magnitude of disastrous natural events and the tolerance of human settlements to such events (Albala-Bertrand 1993). According to Tobin and Montz (1997), a disaster is an event that has an immense influence on society, and whose occurrence disrupts its usual functioning – causing both fatalities and economic losses. Hewitt (1997) explores the geographical underpinnings of risk, hazard, and disaster, emphasising human adaptation to hazardous geographical settings, social implications and humanitarian issues surrounding them. Developing his own concept of natural disaster investigation and related environmental vulnerabilities, Hewitt divides natural disasters into three different types: natural, technological and social, emphasizing the conditions and contexts in which these dangers are created or mitigated.

Russian scientists (Porfiriev 2001) treat natural disasters within the framework of emergencies, and divide them on the basis of: cause (natural, anthropogenic, biological, sociological, technological and combined); spatial distribution (as per the place of the accident, local, provincial, national, regional, global); type of cause (caused on purpose and accidental); speed of occurrence (explosive, sudden, transitional, moderate); character of the accident (unavoidable and preventable); and class of belonging (industry, construction, transport, housing-communal, agriculture and forestry).

2 Present definitions of natural disasters

The most appropriate definitions and categorizations of natural disasters are those made according to the physical cause of an occurrence, for instance: geophysical, meteorological, hydrological, climatological,
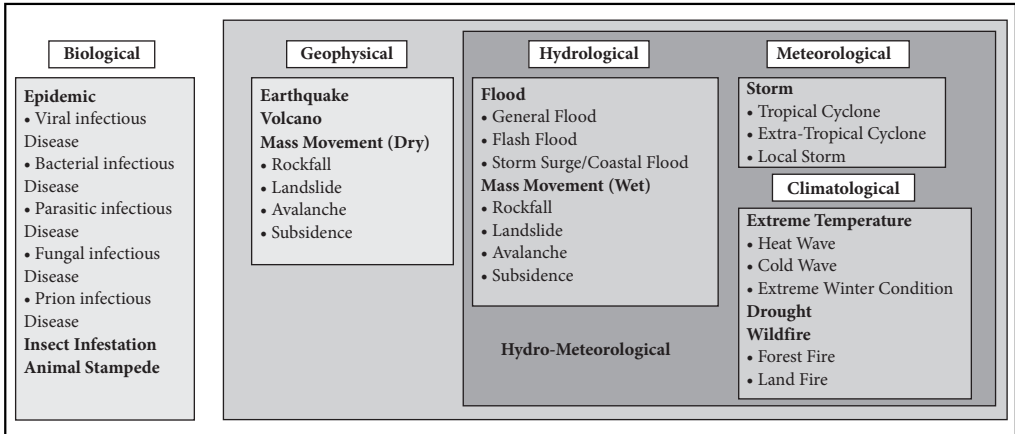
Figure 1: Classification of natural disasters within EM-DAT database (Below, Wirtz and Guha-Sapir 2009).

biological and astronomical (Below, Wirtz and Guha-Sapir 2009). Definitions and categorizations also exist according to quantitative indices, such as number of human victims, quantity of material damage or the scope of necessary help, in order to mitigate or rehabilitate disaster effects. In the following text, definitions and classifications of natural disasters will be presented according to the above mentioned criteria, and as proposed by the two organizations: the Centre for Research on the Epidemiology of Disasters (CRED) (Guha-Sapir, Hargitt and Hoyois 2004), with its International Disaster Database – EM-DAT (Internet 1), and Munich Reinsurance Company (Munich RE) with its database NatCatSERVICE (Internet 2).

For years, CRED and Munich RE have been striving to introduce a standardized definition of disasters that would be accepted on global level. In 2006 (Below, Wirtz and Guha-Sapir 2009), CRED undertook the revision of datasets related to natural disasters and their effects. The purpose of the revision was to create a dataset involving a comprehensive survey of natural disasters, and to give proposals for improvement. CRED defines natural disaster as »a *sudden and unpredictable situation or event which causes great destruction, material damage and human suffering while these problems overcome the possibilities of local communities to solve them, on the basis of which a need is created for the outside humanitarian intervention*« (Internet 3).

In order to have such a disaster recorded in a database, it is necessary that one of the following quantitative criteria be fulfilled:
• 10 or more human victims,
• 100 or more local inhabitants struck by natural disaster,
• proclamation of a state of the emergency, and
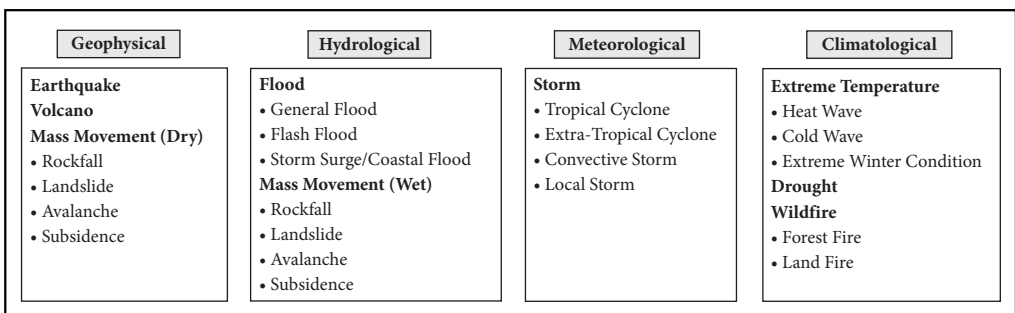• a call for international intervention/assistance (Internet 3).

Figure 2: Classification of natural disasters within NatCatSERVICE database (Below, Wirtz and Guha-Sapir 2009).

Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Geophysical	Earthquake	Ground shaking	
			Tsunami	
		Volcano	Volcanic eruption	
		Mass movement (dry)	Rockfall	
			Avalanche	Snow avalanche
				Debris avalanche
			Landslide	Mudslide, Lahar, Debris flow
			Subsidence	Sudden subsidence, Long-lasting subsidence

Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Meteorological	Storm	Tropical storm	
			Extra-tropical cyclone (Winter storm)	
			Local/Convective storm	Thunderstorm/Lightning
				Snowstorm/Blizzard
				Sandstorm/Duststorm
				Generic (severe) storm
				Tornado
				Orographic storm (strong winds)

Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Hydrological	Flood	General (river) flood	
			Flash flood	
			Storm surge/coastal flood	
		Mass movement (wet)	Rockfall	
			Landslide	Debris flow
			Avalanche	Snow avalanche
				Debris avalanche
			Subsidence	Sudden subsidence, Long-lasting subsidence

Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Climatological	Extreme temperature	Heat wave	
			Cold wave	Frost
			Extreme winter conditions	Snow pressure
				Icing
				Freecing rain
				Debris avalanche
		Drought	Drought	
		Wild fire	Forest fire	
			Land fires (grass,scrub,bush etc.)	

Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Biological	Epidemic	Viral Infectious Diseases	
			Bacterial Infectious Diseases	
			Parasitic Infectious Diseases	
			Fungal Infectious Diseases	
			Prion Infectious Diseases	
		Insect Infestation	Grasshoper, Locust, Worms	
		Animal stampede		

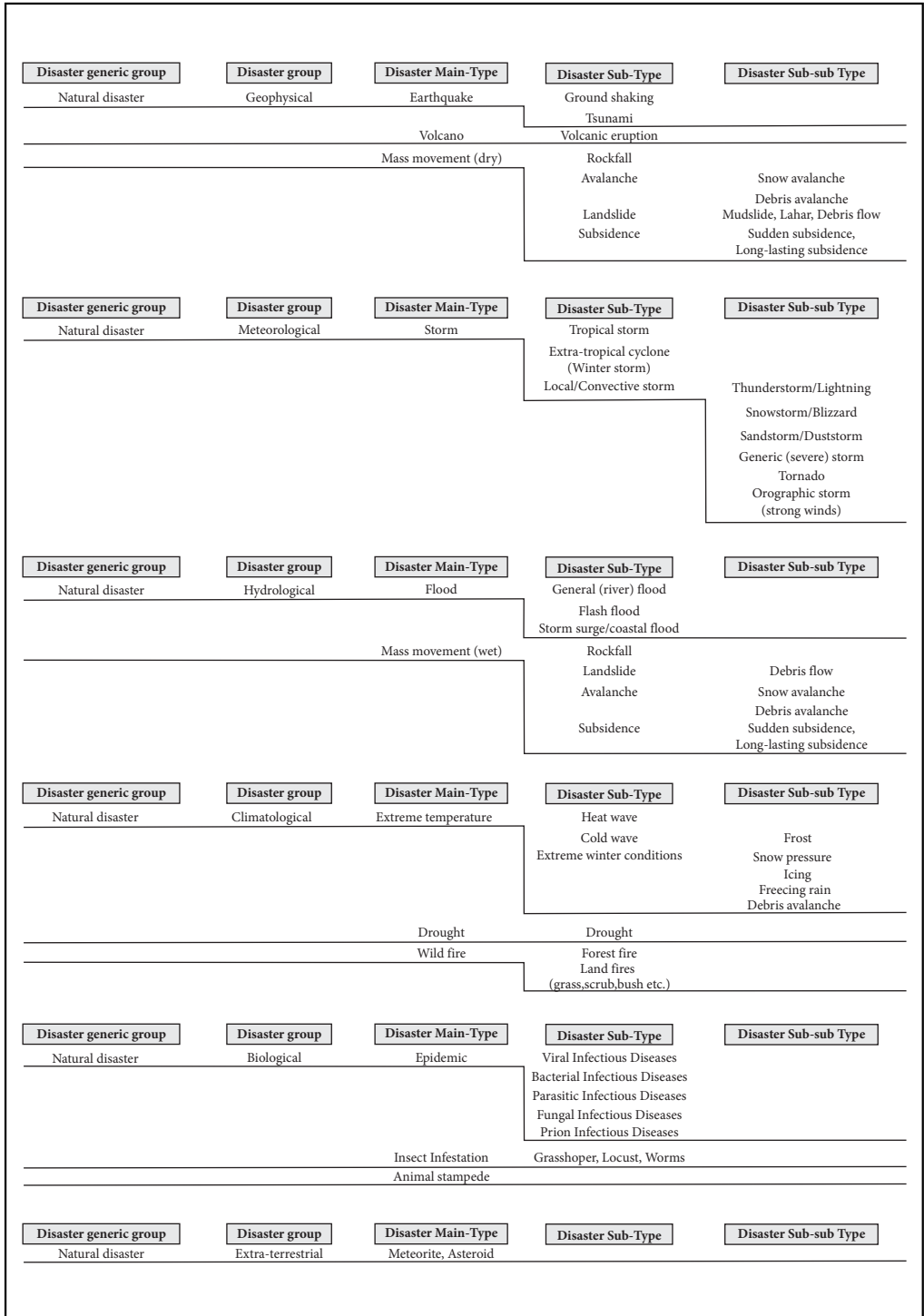| Disaster generic group	Disaster group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Extra-terrestrial	Meteorite, Asteroid		

Figure 3: Conceptual harmonization of the EM-DAT and NatCatSERVICE databases (Below, Wirtz and Guha-Sapir 2009).

Within the EM-DAT database, two basic kinds of disasters stand out: natural and technological. Natural disasters are divided according to physical cause into 5 groups: geophysical, meteorological, hydrological, climatological and biological, which encompasses 12 types and over 20 sub-types of disasters (Figure 1).

Contrary to CRED, for the purpose of the classification and categorization, the Munich Reinsurance Company (Munich RE) recognizes: minor disasters, serious and strong disasters, as well as exceptionally destructive natural disasters. Grouped in this way, they are divided into certain categories: geophysical, meteorological, hydrological and climatological, which in reality cover 9 basic types of disasters and 20 sub-types (Figure 2). During 2007, CRED and Munich RE reached an agreement on the classification of natural disasters with »Disasters Category Classification and Peril Terminology for Operational Databases« (Below, Wirtz and Guha-Sapir 2009) in order to carry out, in the most efficient way, the process of its implementation pursuant to the monitoring, registration, prevention and operative aim in critical (extraordinary) situations (Figure 3) (Internet 1 and 2).

3 Distribution of natural disasters

In the work of Alcántara-Ayala (2002), certain indications are present in the recorded disasters in the world during the twentieth century. The most important indication is that their number has been increasing. For example, in the first few decades of the century, only few tens of disasters per a year were recorded, with many of those years going without record of disaster, while in the last two decades the number increased to over 200 disasters per a year. But as Guha-Sapir, Hargitt and Hoyois write (2004, 20) »one of the main results of this apparent increase of natural disasters is the launch of active data collection by the Office of US Foreign Disasters Assistance (OFDA) in 1960 and CRED in 1973«. The increase in damages caused by disasters has been dramatic. In the first seven decades of the last century, annual damages were lower than several tens of billions of US dollars, while in the last three decades, that number has increased substantially, so that in 2011 overall damages amounted to $380 billion (Zorn, Ciglič and Komac 2012). The data on number of victims has been accessible only for the latter half of the twentieth century. The number of fatalities has varied: from several thousand during 1958, to around one million during 1959, 1965–1968 and 1985, while the number of injured gradually increases from around one million at the beginning of the observed period, to over hundred millions by its end (Alcántara-Ayala 2002). Globally, natural disasters have claimed an average of around 24,000 lives per year, in the period between 1977–1997, and have caused approximately $15 billion dollars of damage per year (Alexander 1997). In the period 1995–2011 these numbers rose to an average of around 75,000 lives per year and to approximately $115 billion dollars of damage per year (Zorn and Komac 2011; Zorn, Ciglič and Komac 2012).

In 2010, the EM-DAT database recorded 373 natural disasters. These claimed around 300,000 human lives, directly or indirectly affected 270 million people, and caused $130 billion dollars worth of material damage. The two largest disasters in 2010 were the Haiti earthquake in January 12, that killed around 220,000 people and the heat wave in Russia, that killed around 56,000 people (Internet 1). In 2011, the number of recorded disasters amounted to 332. In that year, the most significant disaster occurred in Japan, where a magnitude 9 earthquake and consequent tsunami hit the country, killing around 16,000 people, and causing $210 billion dollars in economic damages (Münchner … 2012; Zorn, Ciglič and Komac 2012) (Figure 4-a).

Natural disasters indicate global variability both regarding their type and frequency, as well as their continental distribution (Figure 4-b). Cavallo and Noy (2010) wrote that, between 1970 and 2008, 96% of all deaths and 99% of all people affected by natural disasters were recorded in the following three areas: Asia-Pacific (60% of all deaths and 90% of those affected), Latin America and the Caribbean (8% of all deaths and 3% of all those affected), and Africa (27% of deaths and 6% of all those affected). In 2011, natural disasters on the American continent were predominantly meteorological (39%) and climatological (33%) events. Europe was mostly hit by hydro-meteorological disasters (6%), Africa by climatological (28%) and hydrological disasters (25%), Asia by geophysical (78%) and hydrological (44%) disasters, and Oceania by meteorological (7%) and geophysical (6%) disasters (Internet 4).

The significance of natural disasters is growing. Therefore, there is a need for better research of disasters, particularly in relation to the social sciences. This is especially important for countries that are more frequently challenged by the social, economic and environmental after affects of natural disasters. The
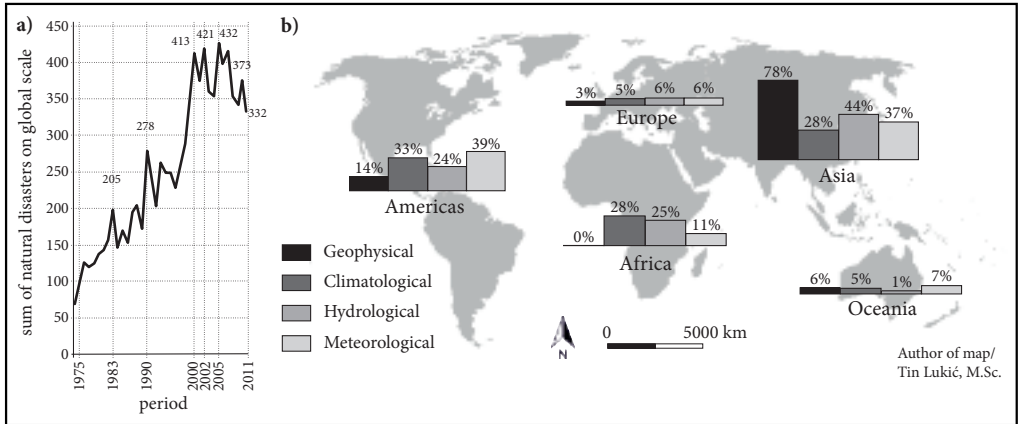
Figure 4: A number of recorded natural disasters in the world from 1975–2011 (without biological hazards) (a) and their global distribution in 2011 (b) according to CRED (adapted after Internet 4).

results of these investigations contributes to a better understanding of existing practices in social capacity building, as well as more accurate assessments of strengths and weaknesses pertinent indealing with natural disasters and their consequences (Kuhlicke et al. 2011).

4 Natural disasters in the Republic of Serbia

Serbia is a continental country located in south-eastern Europe on the Balkan Peninsula. Due to its specific geographic location, located on the border of the south-eastern part of the Pannonian basin and the Balkan peninsula, various types of natural disasters occur. In the period between 1900 and 1940, 100 natural disasters occurred every decade. Between 1960–1970 there were 650 natural disasters, between 1980–1990 there were 2,000 and in the ten-year period between 1990–2000 the number of disasters rose to a staggering 2,800 (Nacionalna … 2011). With this increase of disasters, there is an increase in damages (Table 1).

Table 1: Assessed damages in weather dependent sectors in the Republic of Serbia without the Autonomous Province Kosovo and Metohija (Southwest Serbia) (adapted after Nacionalna … 2011).

Sector/weather-related disasters	Mean annual economic loss in millions of US dollars	Mean annual loss of human lives
Agriculture/floods	$40 million–$105 million	Several to tens
Water-management/floods	$24 million	–
Agriculture/hail, heavy and abundant precipitation, strong wind	$90 million	Several to tens being thunderstruck
Agriculture/draught, frosts	$490,000	No losses
Power production (heating power)/ extremely low air temperatures	$9 million	Several to tens
Maintenance of roads/snow/ice/frosts	$43 million	–
Accidents on highways, regional and localroads caused by bad weather range annually from $1,300,000 to $1,600,000.		
Commercial air traffic	$660,000–$880,000	–
TOTAL	$203 million–$590 million	from several to 160

In the Republic of Serbia, disasters are treated through two main legislative documents: the Law on Emergencies of the Republic of Serbia (Zakon … 2009) and the National Strategy of Protection and Rescue

in Emergency Situations (Nacionalna … 2011) encompassing the systems of prevention, mitigation, protection, rescue and rehabilitation. In both documents, certain conceptual lacks occur that would be discussed in the following paragraphs.

In the Law on Emergencies of the Republic of Serbia, the concept of »natural disaster« is defined as: »*phenomena of hydro-meteorological, geological or biological origin, caused by natural forces like: earthquakes, flooding, flash floods, heavy rains, lightning, hail, drought, rockfalls and landslides, snowdrift and avalanches, extreme air temperatures, ice formation on water courses, epidemics of contagious diseases, epidemics of cattle-related contagious diseases, and occurrence of pests and other natural phenomena on a large scale that can threaten human health and lives, or cause other damages on a larger scale*« (Zakon … 2009). The mentioned classification of »natural disasters« is not in full accordance with the contemporary classification of natural disasters as presented by the CRED and Munich RE.

The primary discrepancy is a result of ignoring the physical causes of disaster. Firstly, in Serbian legislation, hydrological and meteorological disasters are not terminologically separated. They are described with one term as »hydro-meteorological«. Secondly, the group »climatological disasters« (Figure 3) is not mentioned at all, although drought as a sub-type is mentioned. The lack of hierarchical classification leads to even greater confusion when talking about the mitigation of natural disaster consequences in Serbia. In the Republic of Serbia's legislation, certain types of disasters, like hail (Gavrilov et al. 2010; 2011; 2013), are not mentioned in the classification of CRED and Munich RE. The need arises to harmonize the classification of natural disasters in Serbia with international standards, and above all, with the classification presented by CRED and Munich RE.

Besides the term »severe weather« as pertaining to natural disaster, Serbian legislation also uses the term »extraordinary situation« defined as: »*the condition when risks, hazards, or effects of disasters, extraordinary events, and other threats to inhabitants, environment, and material goods are of such range and intensity that their occurrence or their effects cannot be prevented or removed through the regular action of competent authorities and services, so that for their mitigation and prevention, it is necessary to use special measures, forces, and means with and increased work regime*« (Zakon … 2009). It is necessary to clearly distinguish »natural disasters« from »extraordinary situations«. These similar concepts have very different meanings. »Extraordinary situations« should be treated as a condition stemming from the effects of natural disasters, and never as a category that corresponds identically to the term »natural disaster«. At the same time, the announcement of extraordinary situations asks for the application of certain operative mechanisms that are used as measures of prevention and mitigation of natural disaster effects.

4.1 Disaster types in Serbia between legislation and application frameworks

According to the adopted CRED and Munich RE classifications, the Republic of Serbia is vulnerable to the majority of natural disasters. The most frequent natural disasters in Serbia are:
- earthquakes (their strength usually does not exceed magnitude 4 or the intensity of VII-IX degrees of MCS-64 scale) (Figure 5),
- storms,
- hail,
- strong winds,
- draughts,
- floods,
- landslides,
- rockfalls,
- forest fires,
- avalanches (Anđelković 2009; Dragićević et al. 2010; Dragicevic et al. 2011; Gavrilov et al. 2010; 2011; 2013; Hrnjak et al. 2013).

Among natural disasters with serious risks for people and their activities, **floods** have been the most common in terms of frequency, their threat level and the damages they cause being severe. Large quantities of precipitation and melting snow cover can result in an abrupt rise of water levels, and the formation of a long-lasting flood wave in major rivers (Gavrilović 1981). Floods threaten 10,968 km^2 which represents 12.4% of the Serbia's territory (Milanović et al. 2010). Formation of floods in Serbia is also influenced by a rather high density of watercourses (747 m/km^2), intense erosion processes and the presence of the
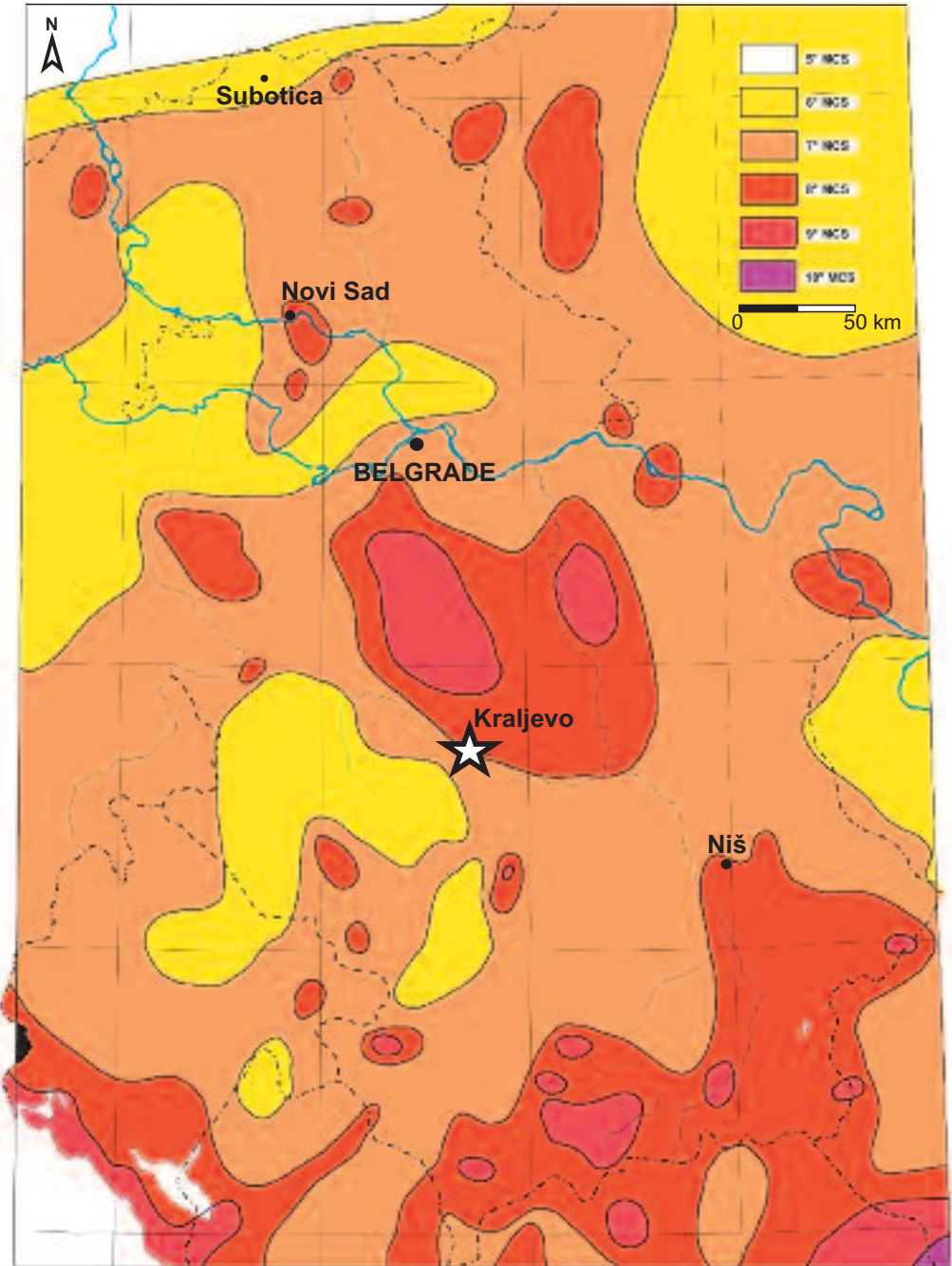
Figure 5: Seismic map of Serbia with Kraljevo area highlighted (adapted after Jovanović and Srećković-Batoćanin 2006).

lower courses of large international rivers in its territory. As the most common natural disaster in Serbia, floods potentially threaten 1.6 million hectares (18 % of Serbia's territory) (Gavrilović et al. 2012). The largest
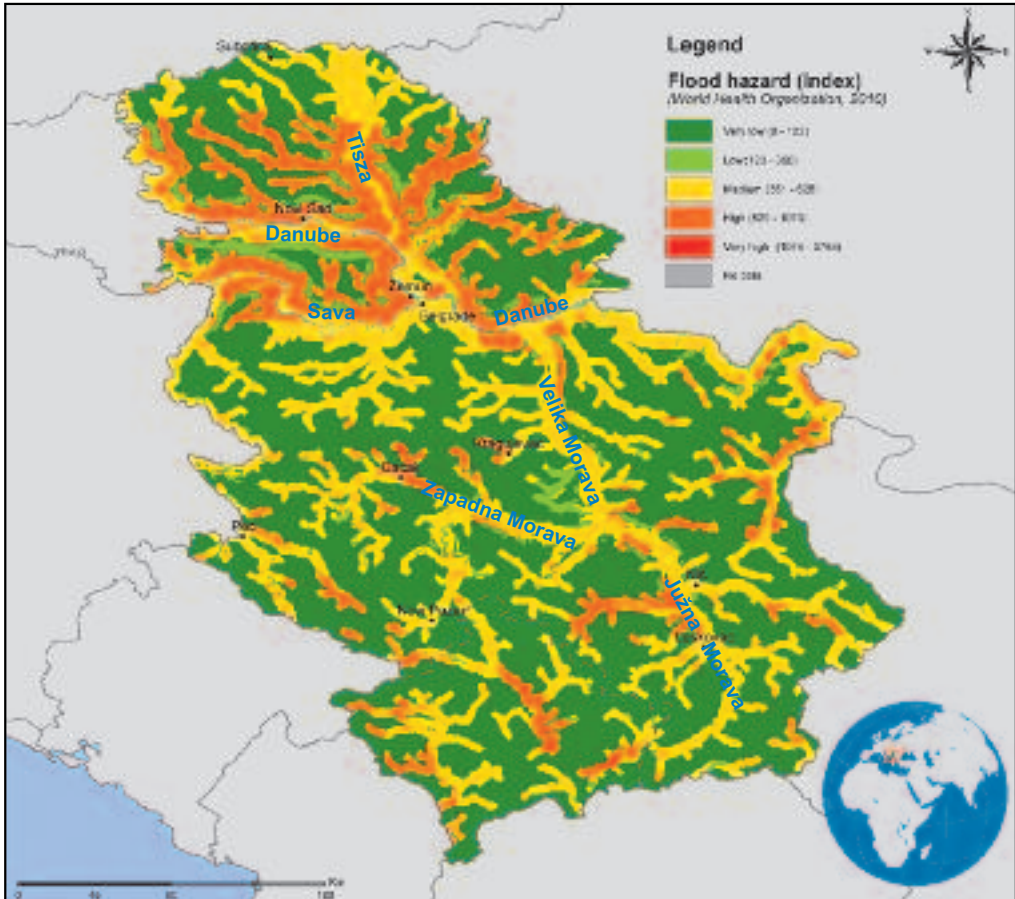
Figure 6: Flood index map of Serbia (adapted after Internet 5).

areas exposed to floods (flood hazard index) are located in Autonomous Province of Vojvodina (North Serbia), Posavina (Region) and Pomoravlje (Region) (Figure 6).

The system for the protection against floods consists of 3,460 km of defence dams along the rivers, 820 km of regulated water courses, 930 km of channels and 39 accumulations and retentions for blocking flood waves. In 80% of the land threatened by floods are plots designated for agricultural growth. Furthermore, floods threaten 512 large settlements with numerous industrial facilities, 4,000 km of roads and 680 km of railroads (The Spatial Plan of the Republic of Serbia 2010). The largest inundated areas are located in the river valleys of the Tisza River (2,800 km^2), Sava River (2,243 km^2), Velika Morava River (2,240 km^2) and the Danube River (2,070 km^2) (Gavrilović et al. 2012). The main causes of floods in the Tisza River valley include mild riverbed slopes, the nature of the geological substratum and wide alluvial plains (Milanović et al. 2010). The average width of the flooded belt is about 10 km. In the Sava and Danube rivers, floods are caused by precipitation, as well as by the coincidence of flood waves in their tributaries. In the entire drainage basin of the Velika Morava River (including the Velika Morava River and its head-waters, Južna Morava River and Zapadna Morava River) about 35% of flood-exposed areas are protected by embankments, and floods mostly occur in unprotected areas (Gavrilović et al. 2012).

Recent major floods occurred in July 1999, March and April 2000, June 2001 and 2002, April and May 2005 and March and April 2006 (Gavrilović et al. 2012) (Figure 7). The flood that occurred in 2006 was the greatest flood ever recorded in Serbia (with the estimated damage being around 35.7 million Euros),

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Figure 7: Pek River flooding in the Kučevo area in 2001.

with a recurrence period based on an estimation of the 100-yr flood. It was estimated that 225,000 ha was flooded, which is 5% of the total agricultural land in Serbia. The flood of April 2005 in central Banat (Region) caused damage to private property, agriculture and public infrastructure, producing around 12.6 million Euros worth of damage (Gavrilov 2005). Approximately 3 million Euros were spent on flood prevention works (The Spatial Plan of the Republic of Serbia 2010). Floods were also recorded during November 2007 and 2009 in an area of southern Serbia (Milanović et al. 2010). It would be difficult to classify and establish these floods according to CRED and Munich RE criteria on the basis of the presented data (Gavrilović et al. 2012; Milanović et al. 2010; The Spatial Plan of the Republic of Serbia 2010).

Concerning the investigation of flood distribution in the Republic of Serbia, there are also some important issues regarding the data that was available for use in the conception of the legislative and applicative framework. For instance, »flood areas threaten 10,968 km^2 which represents 12.4% of the whole territory of Serbia« according to Milanović et al. (2010). However, Gavrilović et al. (2012) point out that floods »potentially threaten 1.6 million hectares (18% of Serbia's territory)«. This reflects problematic differences in the available data up to 4% of the potentially threatend teritory. All the aforementioned issues present not only differences in the methodological approach of data collection, but also differences in faulty methodological conception regarding flood registration and database formation. Therefore, in Serbia, it is necessary to establish a classification of disasters based on physical causes, or: the »origins of the disaster« (Alcántara-Ayala 2002). This would greatly facilitate creating a classification model of natural disasters that is in accordance with contemporary methodological approaches (e.g. EM-DAT and NatCatSERVICE international databases). Improvement of hydrological measurements, observation and monitoring of areas susceptible to flooding is needed in order to provide more detailed and reliable datasets, which can be useful in the assessment of the effects of this type of natural disaster and ascertaining measures necessary for their mitigation.

Around 56,000 km² (approximately 50% of Serbia's territory) of the Republic of Serbia is affected by **erosion**. On average, about 40 million cubic meters of sediment yield are produced annually (Milanović et al. 2010).

According to Perović et al. (2012) up to 25% of Serbia's territory is threatened by **landslides and rock fall**. In spring, due to the melting of snow masses in conjunction with precipitation, a great number of landslides occur. In 2006, a great number of damaging active landslides were recorded. The damage was estimated at 25 million Euros (Perović et al. 2012).

Great **forest fires** occurring in 2007 on Stara Planina (mountain), in Deliblato Sands (area) and in the area of Mačva (Region) encompassed 17,500 ha (forests cover 30.7% of the national territory) (Dragicević et al. 2011). In the Republic of Serbia, a series of minor **earthquakes** occurred in the past several years, with the most serious and damage-inflicting earthquake occuring in the the area in and around Kraljevo (town) in 2010 (Figure 5). The intensity of the earthquake was VII–VIII degrees according to MCS-64 scale (Dragićević et al. 2010).

In cases of landslide, rock fall and forest fire, the legislation and application framework of Serbia treat these types of disasters as primary disasters, whereas according to CRED and Munich RE criteria, they are considered disaster sub-types: as »mass movement-wet« and »wild fire«, respectively (Figure 3) (Internet 1; 2; 3). In contradiction to previous cases, the earthquake in Kraljevo corresponds very well to the CRED and Munich RE classification of natural disasters.

Hail disasters in Serbia are very unique. After 46 years of continuous operative experience with hail suppression Gavrilov et al. (2013) has shown that hail increases occur in Serbia that are contrary to expected precipitation given the use of hail suppression. Hail disasters are very much pronounced in the Serbian legislation framework (Zakon … 2009). Meanwhile, hail disasters are not present in CRED and Munich RE classifications or databases.

Knowledge of aridity is necessary to explain the characteristics of the geographical landscape. Increasing aridity due to global warming can be a natural disaster, with the threat of desertification (Lungu et al. 2011). The work of Hrnjak et al. (2013) showed that there is no aridity change in Vojvodina (North Serbia) in the more recent period between 1949 to 2006. Aridization can be measure of **drought,** as well as a a disaster sub-type. The legislation framework in Serbia does not make a clear distinction between drought as natural disaster and aridity as a long term indicator of drought. This kind of disaster type is likewise not present in the CRED and Munich RE classifications nor databases.

4.2 Databases and vulnerability assessment

The EM-DAT database (Internet 1) allows the comparison of types of natural disasters by country, and the assessment of their influence on populations. Available data includes the number of victims hit and injured by a disaster (natural or technological), assessments of economic damage and a list of potential donors of humanitarian aid. This database also includes data for Serbia (Internet 6). Due to extensive changes to political borders, data can only be found for the territory of the Republic of Serbia since 2007. For previous years, the available data can be regarded only as average value for the area of Serbia and Montenegro (Yugoslavia). Data analysis and quality monitoring are possible only through the application of a systematic-methodological approach. This approach must be based on harmonized classifications of natural disasters for the purpose of productive legislative implementation for prevention and mitigation measures related to disaster consequences.

Unfortunately, all aforementioned data are not publicly available in the Munich RE database. Figure 8 shows the vulnerability of weather dependent economic sectors, from the point of view of hydro-meteorological disasters and severe hydro-meteorological events ranging from a medium to high-degree of influence in the Republic of Serbia. A basic problem with this tendency in the study of natural disasters is terminological disharmony with the CRED and Munich RE databases. The document »Study on Economic Benefits of RHMS of Serbia« (2005) considers »hydrometeorological hazards« as: hydro-meteorological phenomena which represent, by their intensity, duration or time of occurrence, hazard to human security and damage to economic sectors. These phenomena are dangerous when they reach critical values or characteristic hydrometeorological/weather values. There are other »severe hydrometeorological events« which, by their intensity, duration or time of occurrence, do not reach critical values, but may represent damage to dependent economic sectors. Clearer and more uniform disaster classification con-
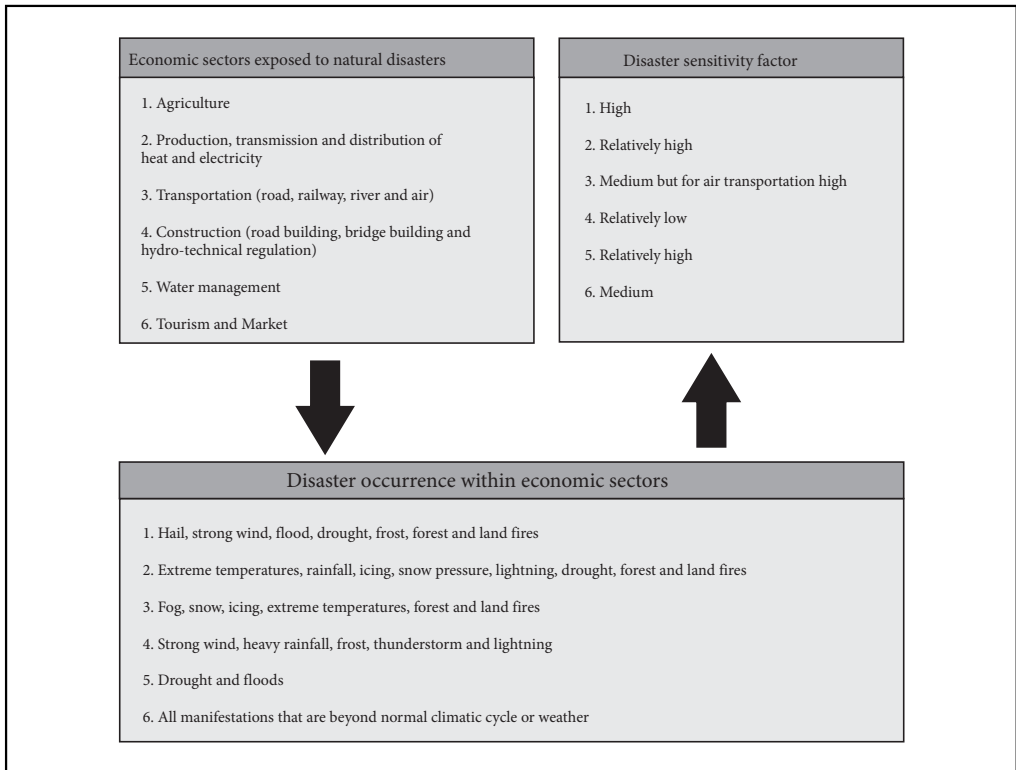
Figure 8: Vulnerability of weather dependent economic sectors in Serbia (adapted after Nacionalna … 2011).

cepts in Serbia, clearly aligned with international classifications (e.g. CRED and Munich RE) are imperative for standardization, both legislative and applicative.

The damages assessed (Nacionalna … 2011) in weather dependent economic sectors, including accidents on highways, regional and local roads (Table 1) indicate that it is necessary to work on upgrading monitoring, warning and alarm systems. So-called »hydrometeorological« disasters need to be divided into climatological, meteorological and hydrological groups, as well as further types and sub-types. Natural disasters should be observed within scientifically based, published, cited, widespread and applicable international classifications.

5 Conclusion

Adequate definitions of disasters and their correct classification greatly facilitate the application of prevention mechanisms, rehabilitation and prediction of their effects. »One of the major challenges in the field of disaster data is to overcome limitations induced by a lack of clear standards and definitions, which leads to inconsistent reliability and poor interoperability of different disaster data compilation initiatives« (Below, Wirtz and Guha-Sapir 2009, 1).

In the Republic of Serbia, natural disasters are considered in the Law on Emergencies of the Republic of Serbia (Zakon … 2009) and National Strategy of Protection and Rescue in Emergencies (Nacionalna … 2011). Due to the terminology in these documents, derived differences can lead to general confusion, so it is necessary to establish a hierarchical classification of disasters based on their causes as for example suggested by CRED and Munich RE. Such classification should then be implemented in legislative and other documents regulating the area of natural disasters. In this way, significant harmonization would be achieved

in the area of disasters in Serbia, with the more significant data bases EM-DAT and NatCatSERVICE. Incorporation of standardized classifications is important not only for the strengthening of legislative and other applicable frameworks used for the purpose of vulnerability reduction, but also for the prevention and mitigation of natural disasters in the Republic of Serbia. Standardization would mean an important step towards monitoring and identification of natural disasters on local and regional scales in Serbia. Such a step would emphasize the importance of risk assessment and management programs that are developing in this part of South-East Europe.

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