

# Emergency and Disaster Reports

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## **Disaster profile of Armenia**

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## *Letter from the editors*

The *Emergency and Disaster Reports* is a journal edited by the Unit for Research in Emergency and Disaster of the Department of Medicine of the University of Oviedo aimed to introduce research papers, monographic reviews and technical reports related to the fields of Medicine and Public Health in the contexts of emergency and disaster. Both situations are events that can deeply affect the health, the economy, the environment and the development of the affected populations.

The topics covered by the journal include a wide range of issues related to the different dimensions of the phenomena of emergency and disaster, ranging from the study of the risk factors, patterns of frequency and distribution, characteristics, impacts, prevention, preparedness, mitigation, response, humanitarian aid, standards of intervention, operative research, recovery, rehabilitation, resilience and policies, strategies and actions to address these phenomena from a risk reduction approach. In the last thirty years has been substantial progress in the abovementioned areas in part thanks to a better scientific knowledge of the subject. The aim of the journal is to contribute to this progress facilitating the dissemination of the results of research in this field.

This monographic issue is about disaster risk profile of Armenia, a country is situated in mountainous Caucasus region, in Western part of the Asia, in the middle of Asia and Europe. The country is one of the 60 most disaster-prone countries in the world, exposed to multiple hazards and heightened risks of catastrophes.

The present monographic issue gives an overview of the various hazards and corresponding vulnerabilities across Armenia and the national disaster risk management.

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## List of Acronyms

AP	Action Plan
ARCS	Asset Reconstruction Companies
ARLIS	Armenian Legal Informational System
ARS	Armenia Rescue Service
BBC	British Broadcasting Cooperation
BCPR	Bureau for a Crisis Prevention and Recovery
BDP	Bureau for Development Policy
CBM	Cubic meter
CIA	Central Intelligence Agency
CRM	Climate Risk Management
DREF	Disaster Relief Emergency Fund
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Risk Reduction and Recovery
ECHO	Extreme Care Human Options
FAO	Food and Agriculture Organization
FRC	Federation of Red Cross and Red Crescent Societies
HFA	Hyogo Framework for Action
HIV	Human Immunodeficiency Virus
IFRC	International Federation of Red Cross and Red Crescent Societies
IMF	International Monetary Fund
LLRM	Local Level Risk Management
MoES	Ministry of Emergency Situations
MT	Metric tone

SHA	Seismic Hazard Assessment
SNCO	Senior (or staff) non-commissioned officers
SRC	Soviet Red Cross Society
STE	State Committee on Emergencies
SU	Soviet Union
UNDP	United Nations Development Program
UNDRO	United Nations Disaster Relief Organization
US	United States
USSR	Union of Soviet Socialist Republics
NATHAN	Natural Hazard Assessment Network
NP	National Platform
NSSP	Natural Survey for Seismic Protection
TASP	Technical Assistance Support Project
TB	Tuberculosis
WFP	World Food Program
WW1	World War 1st
WW2	World War 2 <sup>nd</sup>

## 1. OVERVIEW/ INTRODUCTION

### 1.1. Geography

Armenia is situated in mountainous Caucasus region, in Western part of the Asia, in the middle of Asia and Europe. It is located 38 degrees from South with 50' northern latitude, 41 degrees from North with 18' northern latitude, and 43 degrees from North with 27' Eastern longitude, 46 degrees from East with 37' Eastern longitude. Nowadays territory consists of 29,743 km<sup>2</sup> (11,484 mi<sup>2</sup>), according to United Nations Statistics Division. The neighboring countries are Georgia from North, Azerbaijan from East, Iran from South and Turkey from West. The altitude is 1800 above sea level. It is full of high and middle height mountains, and the highest point is Mount Aragats (4090m). The lowest point is in Debris river (375 m.). The main rivers are Araks, Hrazdan and Debet. The largest lake is Sevan, which is 1900 m. above the sea level. The surface of the lake is 1276 square km. The climate is dry and continental, with cold winters and hot summers. The average temperature in summertime is +30+35C°, and in wintertime -15-20C°. (1)

**Figure 1: The map of Armenia**



Armenia is divided into 10 regions (marz), and the capital, which is called Yerevan. The regions are Aragatsotn, Ararat, Armavir, Vayotsdzor, Gegharkunik, Kotayk, Lori, Syunik, Tavush, Shirak.

## **1.2. Short historical review**

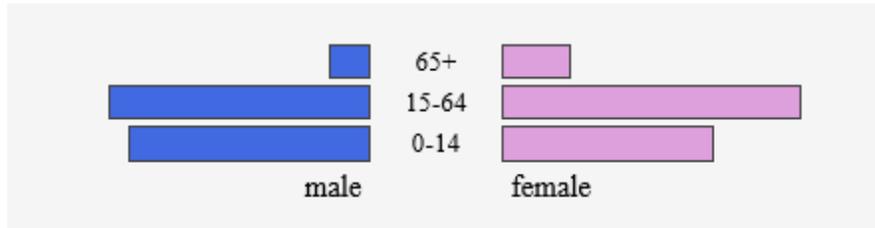
The roots of Armenian people go too deep, there are historical evidences started from 4000-2200 BC. One of the first Kingdoms was Urartu Kingdom thrived between 9<sup>th</sup> century and 585 BC, in Armenian highland. The historical Armenia was a big and influential country; it was lasting from Caspian Sea until the Black Sea. Starting from early 16<sup>th</sup> century, Greater Armenia came under Safavid Persian rule, and over centuries fell under Ottoman rule. By the 19<sup>th</sup> century, Armenia was divided in Eastern part, which was under Russian Empire, and the Western part, which was ruled under Ottoman Empire. During the later history Armenia lost a huge part of its territory. By the time of WW1, in 1915 Armenia suffered a genocide made by Turkey, losing 1.5 million of inhabitants, and having a great territorial loss in Western part of Armenia, which is now in Eastern Turkey. Many Armenians were dispersed throughout the world. After 1918, the territory of the country, which corresponds to much of Eastern Armenia, stabilized, and formed its first independency, First Republic of Armenia on May 28 of 1918. In 1922, Armenia, as long with Azerbaijan and Georgia, was integrated into Soviet Union, and remained as a part of SU until the August of 1990 referendum. Armenia got independence and formed the Republic of Armenia on September 21 in 1991. The same time Armenia had ongoing War with Azerbaijan for Nagorno-Karabakh. The war ended in 1994 with the success and victory of Armenian forces, but there are still issues and ongoing war situation with Azerbaijan in the same areas until nowadays. Armenian borders with Turkey and Azerbaijan still remain closed. (2)

## **1.3. Population/ Demography and health**

Actual population in Armenia increases and it will reach 3,044,852 in the beginning of 2018. The population density is 102.0 people per square kilometer (264.2/mi<sup>2</sup>) as of November 2017. By analyzing the characteristics of population data, we can say that Armenia population

pyramid has a contracting type, which is more common to highly developed countries with low level of birth and death rates.(3)

**Figure 2. The Population Pyramid of age, sex**



The middle life expectancy is 74. Annual birth rate is 0.3 by 2015. Average household has 3.5 members. (4)

*The ethnicity* of the population consists mainly of ethnic Armenians, 98.1%, Kurds (Yezidis) 1.1%, other 0.7%. The National language is Armenian, spoken by 97.9% of population, other spoken languages are Kurdish 1% (spoken by Kurdish minority), other languages 1%. The National Religion is Armenian Apostolic 92.6%, Evangelical 1%, other 2,4%, none 1.1%, unspecified 2,9%. During the war situation in Syria Armenia accepted 14.626 refugees, mainly ethnic Armenians from Syria. (5)

Linking to health status among the population, the main burden of disease is non-communicable diseases- particularly cardiovascular diseases, but there is an increase among Tuberculosis (TB) and HIV infection rates.

The main causes for deaths are described in a table below.

**Table 1. Main causes of death per 100.000 population, selected years**

Cause of Death	1981	1990	1995	2000	2003	2009
Infectious and parasitic diseases	14	12	13	11	9	9
TB	4	4	6	6	6	5
AIDS/HIV	-	-	0.0	0.0	0.0	0.4
Diseases of the circulatory system	435	567	654	553	627	532

Malignant neoplasm	126	156	141	153	159	161
Diabetes mellitus	9	24	41	49	61	47
Diseases of the respiratory system	110	76	71	57	63	73
Diseases of the digestive system	34	34	38	30	39	59
Transport accidents	11	22	8	7	6	5
Suicide and intentional self-harm	4	3	5	2	2	2

(6)

#### 1.4. Economy

As already mentioned, in 1920 Armenia joined Soviet Union, and during the first period it had minimal industrial development. Starting from 1960 after the joint efforts among the countries in SU the country began to industrialize and became a significant manufacturing center. The main industry consisted of machine tools, textiles, different manufactured goods, which was supplied to other Soviet Republics. And it received raw materials and energy from other countries. The economy highly changed after gaining the independence in 1991, when several big industrial complexes were divided into small agricultural units. After gaining the independence and privatization of industry, and also having faced a huge disaster event, Earthquake in 1988, and the conflict with Azerbaijan for Nagorno-Karabakh region, country experienced severe decline in economy in early 1990s. The Government of Armenia introduced economic reform in 1995-1999 periods by the help of International Monetary Fund (IMF). And since 1994, the Gross Domestic Product (GDP) has grown, if not taking into consideration the fact of gaining external debt starting from 1991. And already in 1999 GDP per capita grew by 5%. (7)

Linking to the later economic situation of the country and wealth of the population, and basing on The World Bank data, we can say that Armenia is considered as lower middle-income country, which annually highly increased its GDP from 2000s. Actual *GDP was 10.55 billion US dollars* by 2016. In 2008 it reached its peak, which was 11.66 billion US dollars, then slow

decreases and increases, and by the latest data, in 2016, the GDP consists of 10.547 billion US dollars. (8)

*Actual GDP per capita is 3924.9 US dollars.* It is equivalent to 31% of the world’s average. From 1990 to 2016 GDP per capita averaged from 2803.01 to 3927.7 in 2015, being the lowest on 1993, equivalent to 886 USD. The latest changes in GDP per capita of Armenia are shown below.

**Figure 3. Armenia GDP Per Capita**



(9)

All households have electricity, 77% of population has improved, not shared sanitation facilities, 98% have drinking water from improved sources. (10)

The external factors are both helpful and harmful for Armenia. On one hand, ongoing ethnic conflict with Azerbaijan caused economic losses, because Azerbaijan and Turkey (Turkey supports Azerbaijan) were an important trade partner before, and after the beginning of the conflict they impose a trade embargo. On the other hand, Armenia has been received a substantial foreign aid from the international humanitarian agencies and international community. The World Bank granted Armenia significant amount of money (30 million UD dollars) as an economic aid for reducing the government’s budget deficit. On average, the country has received 200 million US dollars per year since 1990. (7)

## 2. VULNERABILITIES. DISASTER RISK FACTORS

*Կարկուտը ձեռած տեղն է ձեռում:*

*Transl: Hail is hitting in the affected place.*

Armenia faces major risks from Earthquakes, droughts, floods, hail and landslides. According to 2005 report “Natural Disasters Hotspot- A Global Risk Analyses”, the World Bank listed Armenia among one of the 60 most disaster-prone countries in the world, exposed to multiple hazards and heightened risks of catastrophes. According to it, more than 80% of Armenians are at risk of exposure to catastrophic events. In which, according to Natural Hazard Assessment Network (NATHAN), 100% of Armenians are prone to earthquakes, 98% are at risk to drought, and 31% to floods. (11)

The country has a high risk for especially natural disasters, because

- Owns high risk of exposure and vulnerability
- Insufficient capacity to manage risks.

In total, Earthquakes, floods, hail, landslides, mudflows, drought, erosion, and desertification have caused vast social upheaval and economic damage to Armenia. (12)

During the first years of independence, from 1991, the country lacked of common methodology for risk assessment and united system of collecting and using disaster management information. Moreover, there was no institution that handled the disaster risk management back then. So there have been many issues and concerns, which have increased vulnerability and exposure to above mentioned hazards among Armenian population. And these are followings.

- Need of comprehensive approach to Disaster Risk Reduction (DRR)
- Absence of DRR strategy
- Imperfection of DRR legislative field
- Lack of clarity in roles and responsibilities of DRR stakeholders
- Poor coordination among various stakeholders in DRR sector
- Insufficient level of cooperation in DRR sector

- Agency interests are a priority
- Insufficient level of knowledge and education in DRR sector
- Imperfection of awareness raising process
- Inefficient use of resources
- Insufficient level of analytical capacities
- Absence of common DRR methodology
- Imperfection of monitoring system in DRR
- Lack of comprehensive understanding of DRR in development perspective
- Need of multi-stakeholder partnership of DRR. (13)

Besides the fact of being affected by more vulnerability having less sufficient DRR management, there are geological features that increase vulnerability to disasters in Armenia. The country is being considered as a highly prone-to earthquakes country, due to its location. It is situated in seismically active zone, Alpine-Himalayan seismic belt. Earthquake magnitude reach  $M=7.1$  (according to historical and paleo seismic estimations). The average recurrence interval of large earthquakes ( $M \geq 5.5$ ) is about 30 to 40 years. The above mentioned characteristics of the seismic regime indicate a high-level seismic hazard in Armenia. (14, p. 150-151)

The last devastating earthquake was in 1988 in city called Spitak, killing 25.000 people, injuring 19.000, damaging 517.000 homes, and bringing an estimated harm to economy.

While specifying the main vulnerabilities of Armenia about the natural disasters, there is a need to mention also volcanoes. There are 5 volcanoes in the territory of Armenia, and the total population living within 30 km from a volcano consists of 1.482.611 people, which is the 50% of the total population. Taking into account that there have been no reports on volcano eruptions, these data can be considered as a potential risk factor.

Overall, the vulnerability indexes based on the international ranking are described in the table below.

**Table 2: INFORM 2017 Risk Index**

	value	Rank	Trend
<b>INFORM</b>	3.70	94	EQUAL
<b>HAZARD</b>	3.50	95	EQUAL
<b>VULNERABILITY</b>	2.90	104	EQUAL
<b>COPING CAPACITY</b>	4.90	80	EQUAL

(13)

Basing on the data available, and concluding, we can say that 100% of the territory is a seismic risk zone, and prone to disasters, 3% is prone to landslides, cause there are more than 3000 landslide areas, 300 of which are in the places where people live, 30% of the territory is prone to floods, 0.5% is prone to 12% to extreme cold, 15% to droughts, 17% to hailstorms, etc. More than 80% of the lands of territory of Armenia is prone to erosion, excess humidity. (15)

Natural and technological hazards urges the need of developing and strengthening Disaster Risk Reduction (DRR) system in Armenia.

### 3. NATURAL DISASTERS IN ARMENIA

Basing on one of the most reliable sources, EM-DAT, there is a data available of the natural disaster events from time period 1997-2016. There are described below.

**Table 3: Natural Disasters in Armenia from 1997 to 2016**

Time	Place	Disaster type	Disaster subtype	Total deaths	Total affected	Total damage ('000US\$)
22/06/1997	Goris, Sisian districts	Flood		4	7000	8000
18/07/1997	Noyemberyan city, Noemberyan district, Tavush province	Earthquake (magn.4.2)	Ground movement		15000	33000
30/05/1998	Yerevan city	Flood			144	120

06/2000	Ararat, Armavir, Gegharkunik, Aragatsotn, Shirak, Kotayq, Tavush, Lori provinces	Drought			297000	100000
05/03/2004-09/03/2004	Aragatsotn, Ararat, Gegharkunik, Tavush, Armavir provinces	Flood	Riverine flood	1		
12/05/2013-17/05/2013	Armavir province	Storm	Convective Storm		64000	60000
12/2013-02/2014	Yerevan province	Extreme temperature	Severe winter conditions(-20 degree)		12000	
24/06/2016	Karchaxbyur city (Vardanis district, Gegharkunik province), Artic city (Artic district, Shirak province)	Landslide	Landslide		750	

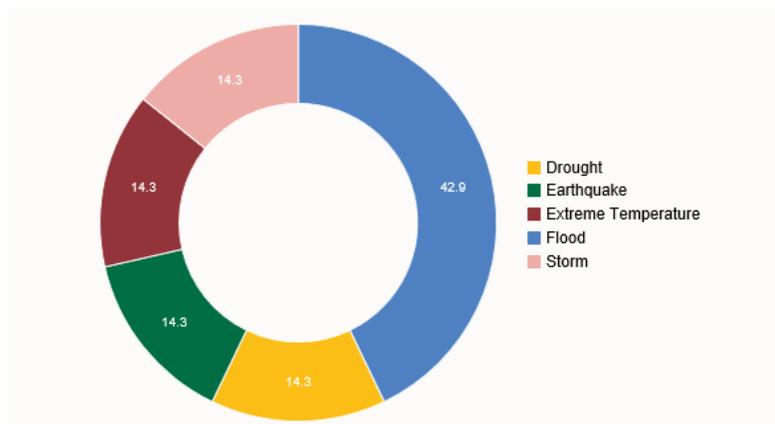
(16)

As we can see, these are the strongest natural disasters with their both social and economic impact.

**1. Drought, 2. Floods, 3. Earthquakes, 4. Extreme temperature, 5. Storm, 6. Landslides**

From 1990 till 2014 there are many databases on disasters in Armenia. Visually imagined, they have this view.

**Figure 4: The frequency of the disasters in Armenia from 1990-2014**

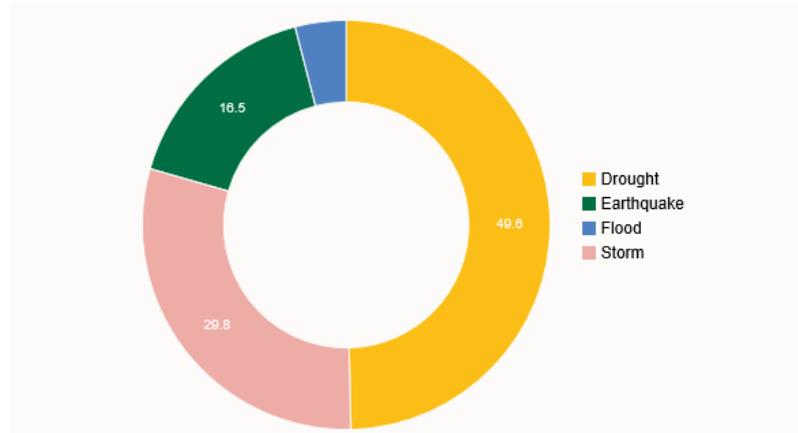


As we see, 42% of the disasters consist of floods, then equally 14.3% of them are drought, earthquake, storm and extreme temperature.

About the mortality rate during the disasters, there is **one case** from a flood in 2004.

Basing on the economic impact of the disasters during the same period, we have this picture.

**Figure 5: The economic impact of the disasters in Armenia from 1990-2014**



(13)

As we can see from historical review, Armenia has been part of Soviet Union for the time period of 1922-1990. For this reason, many international databases do not indicate the disasters occurred in Armenia before 1990. Before mentioned time they are signed as Soviet Union disasters, which makes it very difficult to differentiate the ones from Armenia. Using national sources, we can say that from time period 1966-2017, during last 50 years, Armenia suffered one huge disaster, Earthquake of *Spitak* in 1988.

#### 4. EARTHQUKES

As already mentioned, Armenia has high seismicity due to its geographical location. The country is located in the most active segment of Alpine-Himalayan seismic belt -the zone of collision of the Arabian and Eurasian tectonic plates. Earthquakes here reach 7.1 Magnitude on Richter scale, and the average recurrence interval of  $\geq 5.5$  magnitude is 30-40 years. (6)

In 2004 report UNDP stated about Armenia during 1980s being ranked the first country in the world by its vulnerability to earthquakes. Relative vulnerability is calculated by the number of persons killed per million exposed, which was 7653. (11)

Historically, there were a big number of earthquakes in the territory of ancient Armenia. For the last 50 years, earthquakes in the territory of Armenia have this image.

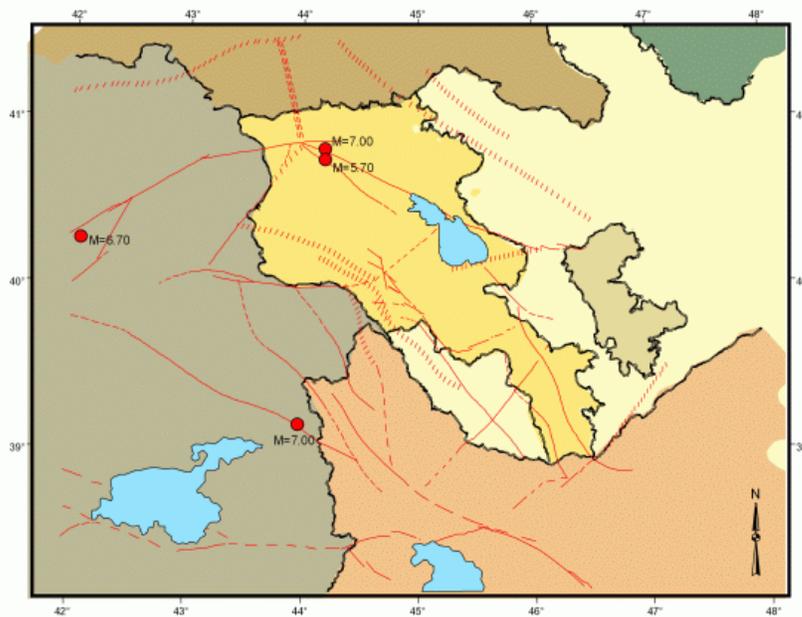
**Table 4: Destructive Earthquakes in Armenia**

Year	Location	Magnitude(Richter)
1679	Garni	7.0
1827	Tsakhkadzor	6.5
1840	Ararat	6.7
1893	Dvin	6.5
1937	Parakar	4.7
1972	Talin-Arouch	6.5
1988	Spitak	7.0

(6), p. 8-9

The main strongest earthquakes ( $\geq 5.5$ ) of the territory of Armenia and surrounding territories during the time period of 1962 to 2007 is shown on the map below.

**Figure 6: The map of the strongest earthquakes ( $\geq 5.5$ ) from 1962 to 2007**



(17)

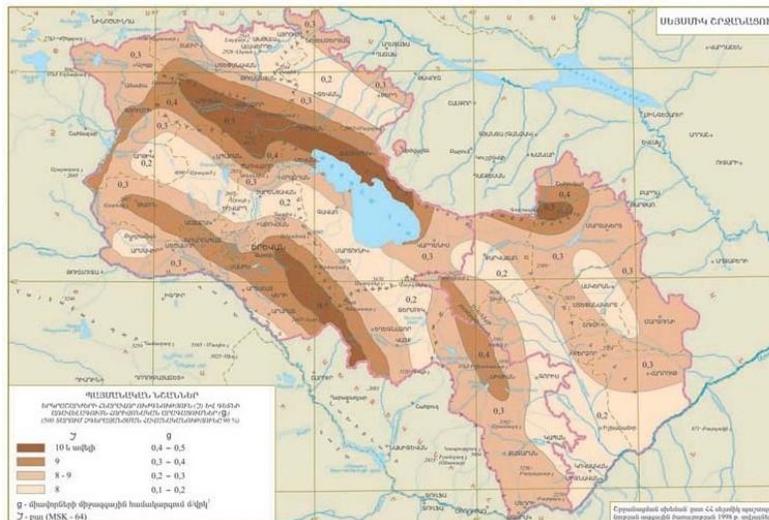
#### 4.1. Risk assessment and hazard analysis

A precise assessment of seismic hazard (SHA) is the basis of the successful seismic risk reduction activities. The assessment can include several uncertainties and requires a probabilistic approach. This must be accompanied with hazard monitoring. Monitoring of a current seismic hazard means mainly a short-time prediction of seismic events, which is the most complicated task in seismology.

Before the disaster in 1988, the risk of hazard was underestimated, the buildings were not following the required level of high magnitude seismic risk, and the seismic resistance was too low the standards. And this was one of the reasons, as well as the absence of state policy in the field of seismic risk reduction, which led to the disaster in 1988 on Spitak. After this disaster, the seismic risk assessment was revised. Basing on the new assessment standards, the expected acceleration of the earthquakes throughout all the country is 0.4.g. In case of Spitak earthquake, the main amount of buildings constructed before the earthquake, were designed for seismic risk of about 0.1-0.2g, according to former Soviet Union measures. (14) p. 150-151

On the map the more earthquake-prone zones there are mentioned with dark colors. As we can see, high seismic risk zones include the major part of the territory.

**Figure 7: The map of seismicity of Armenia**



(18)

Yerevan, which holds 40% of population in the country, is one of the highest seismic zones. Recent analyses of Yerevan building stock revealed that an earthquake of magnitude  $\geq 7.0$  would destroy most buildings, potentially kill 300.000 people.

The National Seismic Defense Service has warned in RFE/RL Armenian Service reports, that most of the residential houses in Yerevan cannot stand a strong earthquake and need an urgent strengthening. Gurgen Namalian, the head of urban planning, during his report to journalists on the anniversary of the earthquake in 2011, December 7, pointed out the poor Soviet Union construction standards as the main reason of such big human loses. He said that around 60% of them are vulnerable to quakes of more than 8 in 12-point scale. By mentioning the seismic risks of the region, he said also that the main big cities in Armenia are constructed in the third seismic zone, where the anticipated earthquakes measure 9 points and more. He also ensured, that mostly new buildings, which are residential buildings and offices, follow the seismic security standards set by the National Seismic Defense Service. (19)

#### **4.2. Case study. 1988 Earthquake**

According to the Armenian National Seismic Protection Service data, on December 7, 1988, in the North areas of Armenia, there was a devastating earthquake, which then was called the earthquake of Spitak, pointing out the epicenter of the earthquake, which was the city Spitak (means white in Armenian). It has its name because of the many buildings from white stones. After the earthquake, though, it was hard to recognize colors of buildings, the city was fully destroyed. The earthquake occurred in 150 km to South from the Caucasus Mountains range highland polis, located in the Small Caucasus. The tectonic nature of Small Caucasus is mainly complicated, but it is characterized by the pressure and condensation of the Earth crust, and by the shift of Eurasian and Arabic platforms. The geological parameters of the Earthquake are 40.92 latitude and 44.22 longitudes for the main shock and 40.85 latitude and 44.22 longitudes for the aftershock. The exact time of the main shock of the earthquake was on 7 December 1988, at 11:41:22 by local time with **7.0** magnitude by Richter scale and with 7 km depth, accompanied by the following huge aftershock at 11:45:43 with **5.7** magnitude with 7 km depth. By the intensity scale the earthquake was evaluated as relevant to 10 points in the epicenter Spitak (out of 12), 9

in Leninakan, and 8 in Kirovakan. The earthquake occurred during the wintertime and at that hour people were usually at workplaces, children were at schools or in kindergarten, so mainly the inhabitants were in closed areas, inside the buildings, considering the fact of the cold weather during the winter, and this was one of the reasons of the terrifying high mortality. The earthquake hit three main cities. Besides Spitak, there were significant damages in the second city of Armenia, Gyumri (by that time it was called Leninakan), another city Kirovakan, and many villages.

The first shock with magnitude 6.8 struck at 11.41 a.m. by local time in Armenia. The epicenter was situated north of the city Spitak, 32 km to the northeast of the city Leninakan, 25 km to the northwest of the city of Kirovakan, and 15 km southwest of the city of Stepanavan. The earthquake affected 40% of the territory of Armenia including the population of 960.000. Above mentioned four cities and 17 districts suffered heavy damage. (17)

Basing on international sources, EM-DAT publishes the following data. On December 7, 1988, 07:41:24.2 UTC, parameters of the earthquake were 40.987 N, 44.185 E, depth 5 km, magnitude 6.2 mb, 6.8 MS. At least 25,000 people killed, 19,000 injured and 500,000 homeless in some cities of Armenia, which are Spitak, Leninakan, Kirovakan. Economic damage totaled is 16.2 billion dollars. (16)

By relief web data, the magnitude of the 1988 Earthquake was 6.9 on Richter scale, and the data about people dead in the earthquake, is the same, 25000. (20)

Many retrospective researches and analysis have been done after the earthquake for finding out the main reasons of such big loses and for better preparedness in the future. Using the data of one of them, a comprehensive study done by several research groups and analysis collection, the peculiar feature of that strong seismic event was its complex character, consisting foreshocks, multi-phase main shock with the consequent strong aftershock and prolonged aftershock activity.

The Spitak earthquake is characterized by a specific prolonged aftershock activity lasting until up to 1991, attenuating gradually. The detailed analysis of the aftershock activity was performed by the seismologists from different countries, (USSR, USA, France) with the organization of observations since 1988. (21, p. 354-355, 368-370)

The Spitak seismic event went down to the history as one of the biggest natural disasters and as an earthquake which parameters were not adequate to the amount of destructions.

### 4.3. Impact of the Disaster

The 1988 Spitak earthquake is considered as one of the significant earthquakes in the world earthquakes history. The quake caused deaths and damages also in neighbor countries. In Turkey 4 people died, 200 houses damaged in the Tuzluca-Kagizman-Kars area. And it was felt also Iran, in Tabriz-Orumiyeh area. National Center for Environmental Information (NOAA), has this earthquake, which contains information on the world numerous earthquakes of high significance, published also data on the Spitak Earthquake. Based on it, we have this image.

**Table 5: The Impact of the Spitak Earthquake**

Total death	Injured	Affected	Homeless	Total affected	Total damage
25000	12000	1100000	530000	1642000	14000000

(22)

Linking to the official reports of the Soviet Civil Defense, 25000 people were killed under the debris of collapsed structures. 514000 people became homeless. Mainly the cities affected, but as well in rural areas 58 villages were totally destroyed, 61.000 dwellings were lost. 169 settlements in affected rural areas with population of 146.500 were 34% destroyed. Around 200 school buildings, 180 kindergartens, 160 hospitals and clinics were destroyed. The total damage to industry was estimated at 1.900.000.000 Rubles, which is equivalent to 16 billion US dollars.

The closest city to epicenter Spitak, with 18.500 population, was 100% destroyed. The city of Leninakan with 232.000 population was 75% destroyed. The city of Stepanavan with 21.800 population was 67% destroyed, and the city of Kirovakan with population 171.000 was 25% destroyed. (23)

Basing on another reliable source data, Reliefweb, the losses were followings in the tree mainly affected cities.

**Table 6. The most affected tree cities**

City	People affected	Size of the damage
Spitak	300.000	Utterly destroyed

Leninakan	20.000	30% destroyed
Kirovakan	160.000	Less severe damage

(20)

Overall, 17% of the population of the country was affected. Considering the fact that late 20<sup>th</sup> century was very active productive and industrial period for the Soviet Union, as well as for Armenia, a huge negative impact on economy was caused by the fact of damaged factory buildings and equipment, damage to agricultural fields and gardens. The loss of industrial and agricultural production was represented around 40% of economic activity of the republic. For sure this kind of disaster had a big negative impact on the social-economic situation for not only time of disaster occurrence, but for the following 20 years.

Considering the historical framework of strong earthquakes, they are always accompanied with a high level of probability of by mass casualties, psychophysical and social shocks in the communities.

The probability of an analogous disaster being repeated in the future depends on how correctly the reasons of such destructions will be discovered and solved.

Besides of many gross errors which are found in seismic micro zonation of cities, other mistakes have been discovered.

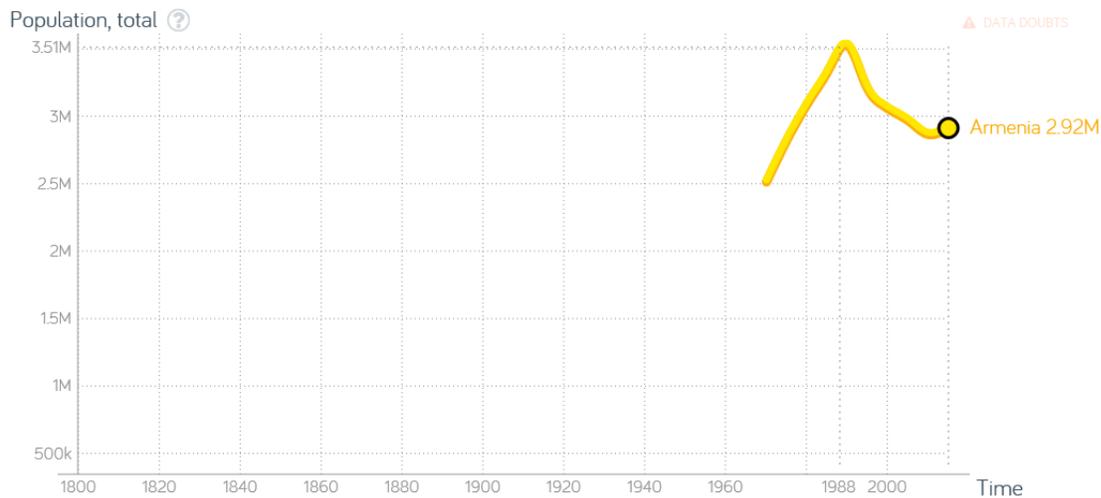
- Bad errors in the seismic zonation map, where the 10-intensity Spitak zone was indicated as a 7-intensity zone.
- There is an insufficiently developed code of earthquake proof construction
- Poor construction quality
- Poor quality of construction materials
- Infringement of maintenance rules in buildings and structures
- Lack of an adequate control over the earthquake resistant construction.

On its turn, these mistakes are caused by the economic and social problems of society, while the seismic zonation errors consider profound methodological and technological gaps as well.

(21, p. 368-369)

The earthquake included 1/3 of the area of the country with 130.000 inhabitants. For making the impact on the population of such a disaster more visual, here is shown the population decline core made by a specific tool, which is Gapminder.

**Figure 8: The decline of the Population in Armenia after the Earthquake in 1988.**



(24)

For a deepened analysis and making the impact of the disaster more visual, we can compare two earthquakes occurred in different countries with almost the same strength and in the near time range (1 year), and we have the following image.

**Table 7: Comparison of the impact of two similar earthquakes**

Place	Armenia	Loma-Prieta
Date	December 7, 1988	October 17, 1989
Strenght(Mag. Rexter)	6.9	7.1
Mortality	>25000	67
Injured	31000	2435
Homeless	514000	7362
Economic damage	16 Bill. USD	7.8 million USD

(25), p.97

#### 4.4. Response to the Disaster

##### 4.4.1 Local Response

2-3 days after the earthquake a huge amount of people from different parts of the country were involved in rescue works in the affected area. Although this kind of help from citizens of the country was necessary, but again not that effective because of lack of experience and knowledge on reacting to the emergency situations. This had a negative impact on rescue works as well, and sometimes even led to inappropriate deaths. Overall, by the help of citizens and rescue workers, 45.000 people were taken out from the collapsed building remains, 12.500 people were hospitalized. (17)

Many analysis have been done since the earthquake both after the quake immediately, and many retrospective analysis to find out the reasons of incredibly big losses.

The main reasons found as a result for the researches were followings.

- In the whole republic the seismic danger was underestimated, and the seismic rate was considered around 7-8 magnitude, although during the Spitak earthquake it was 10 in the epicenter Spitak, and from 8-9 in other areas, 9 in Stepanavan, and 8-9 in Vanadzor.
- The organizations for evaluating the situation found out that there were many mistakes while structuring and constructing the buildings, the rules of seismic security were not followed.
- The quality of constructions and the materials were poorly chosen and different from the ones adjusted.
- The character of the fluctuations. The vertical oscillations of the vibrations brought to the damage of the high buildings.
- The duration and repetition of the fluctuations (5 minutes).
- The delay and bad management of rescue work and aid brought to the great number of deaths.
- The absence of awareness and behavioral skills during extreme situations among the inhabitants. (17)

The local government was not ready to a relevant or sufficient response to the disaster. On the other hand, the hospitals and medical points of the region were completely or partly destroyed as a result of the quake, so there was a huge need of help from the other regions and cities of the country, and moreover, external help for responding to the disaster.(26)

#### **4.4.2 International Response and media**

There was a huge humanitarian aid delivered after the earthquake from different countries and humanitarian agencies. Beginning from the following day of the earthquake, many politicians from Soviet Union (Boris Sherbin, Yuri Batalin, Lev Voronin, Ivan Silaev and others) came to the disaster zone and contributed to the rescue and resilience works. Boris Sherbin was heading the resilience works for Leninakan (Gyumri), where the hitting, electricity and water systems were shocked, and so he contributed greatly to all the work done to recover all those problems occurred after the quake. Armenia got humanitarian aid and support from around 113 countries from the world. Many rescue workers, doctors, engineers and other specialists were coming to Armenia from Georgia, Russia, Ukraine, Kazakhstan and other Soviet Union countries. International community was sending aid, mainly food, medicine, medical and engineering equipments, tents by planes, trains and other means of transportation. Around 170,000 injured people were taken to the hospitals for further treatment in Caucasus region and Russia.

Overall, by 1990 January Armenia got 35 million US dollars from the international community. Italy built a whole district in the epicenter of the quake, Spitak, which was then called "the Italian village". Norwegians built a modern hospital, which was called after Fridtjof Nansen, and English government built a school in Spitak, and Margaret Thatcher herself was present for the opening of the school. (27)

Armenia was in the center of international attention and aid after the devastating earthquake, international media as well was full of topics of Spitak earthquake.

*BBC* linked to the 25<sup>th</sup> anniversary of the Spitak Earthquake. According to it, Mikhail Gorbachev canceled his official meeting in US and instead moved to Armenia, to Spitak, and called international organizations to help Armenia overcome the consequences. The Soviet Union authorities revealed that there has been no disaster contingency plans. Soviet Union was heavily criticized for the fall in rescue works.

*BBC* links also the humanitarian aid received from French humanitarian company *Medecins du Monde* some days after the quake. It consisted of mainly of blood transfusion equipment and dialysis machines. (28)

After three days of the event, on December 10, 1988, the *New York Times* published an article with an intriguing title, saying that deaths may reach 50.000, and fortunately, it did not become a reality. Though the mortality rate was awfully big, at least it did not reach those predictions. The bad preparedness and delay in rescue works lead to much more deaths, and with better preparedness and response there would be possible to escape many of them. One more prove to this is that, as New York Times says in the same article, after two days of the quake, the rescue workers were able to still hear some voices from the ruins, and lots of people were still around to find their family members. The source also points out the weakness of the Soviet Union Politburo commission, which was created and aimed to deal with the quake, and it has been considered as one of the worst disaster responses. Itself the comity criticized local forces for the slowness in providing with food and shelter of the victims from the quake. New York Times itself was based on the Russian sources on the theme and is full of citations from Russian news, the title as well is based on Health Minister's, Yevgeniy I. Chazov's words. Stating the chaotic situation on the disaster area the Soviet authorities did not release any death toll then, saying that the quake and the rescue efforts hampered their ability to judge the exact scope of the disaster. (29)

International and humanitarian help was delivered through passing some important steps. First, basing on the UN reports, the next day, on December 9 USSR Mission in Geneva has informed the UN Disaster Relief Coordinator of USSR Governments to accept the international assistance for the victims of the earthquake. After, two UNDRO officers arrived in Yerevan for need assessments for international assistance and in cooperation with Soviet Committee established to direct relief operations.

After, the Government of France sent relief team, which consisted of 190 men, 22 doctors, 21 dogs, 76 CBM of relief supplies.

Government of Switzerland sent disaster corps, team consisting of 37 people and 22 dogs, and 8 MT of relief goods.

United Kingdom Government rescue team with thermal imaging equipment for locating people trapped under debris.

There were assistants from other countries as well, like Germany, Italy, USA, and from European Community.

German Red Cross sent a special plane with relief goods. According to report from Soviet Red Cross (SRC), first relief consignment airlifted to Soviet Armenia on December 7, consisted of tents, stretchers, medical and first aid kits, kitchen utilities, etc. The first requirements from Soviet Red Cross were medical goods, as antibiotics, syringes with needles, blood collection containers, blood substitutes, surgical catgut and silk, food concentrates. (20)

After the quake, Switzerland, particularly Swiss Humanitarian Aid organization implemented also long-term program and activities in Risk reduction, reconstruction and rehabilitation and not only in Armenia, but in South Caucasus regions, involving Georgia and Azerbaijan focusing as well on the impact of Nagorno-Karabakh and Abkhazia and South Ossetia conflicts. Overall, the cooperation lasted from 1999 to 2016, helping to reach in better levels of Risk Reduction and preparedness compared to the other countries in Middle East. (30)

#### **4.4.3. Nowadays situation**

In 2008, marking the 20<sup>th</sup> anniversary of the disaster, a web-page is made for coordinating all the information about the Spitak Earthquake of 1988. It contains all the history, damages, holds the analysis of the disaster and information about response to the disaster, the lessons learnt, all the scientific and media links concerned to this disaster, as well as information about other earthquakes worldwide, and an archive of monthly reports about recovery starting from January 2010. (31)

After almost three decades, 27 years of the quake the housing of the survivors is not completely solved. In 2015 the president Serj Sargsyan in his official report promised to complete the housing problems in the second city of Armenia, Gyumri by the end of 2016. There were 24000 houses destroyed in Gyumri, there was no left any building higher than 5 stores undamaged. After the earthquake they implemented housing program which helped 21000 displaced families to get new houses. Around 1000 families, which is 9000 people still are living in shipping containers, which were meant to serve as temporary houses, another 1000 people living in houses without essential utilities. The containers are impossible to heat, so the

temperature there is as outside, which makes living there impossible. The mayor of the city Gagik Balasanyan mentioned that there were families who sold the apartments they were given due to the economic reasons, and went on living there. So this still remains one of the priority problems in urban development. (32)

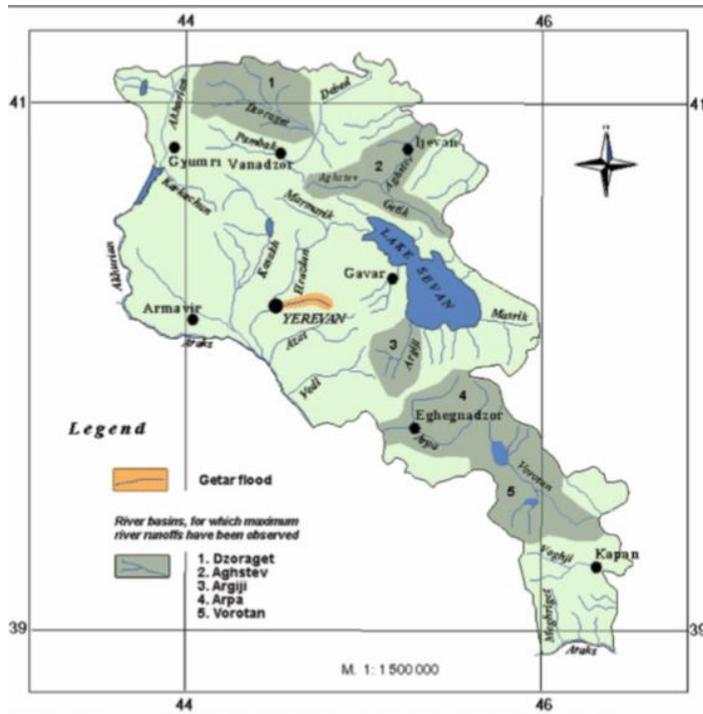
After the earthquake and the lessons learnt the constructions of buildings are being done based on the seismic security standards. Comparing, before, during the Soviet Union period, started from 1960s, there was a huge amount of constructions, buildings in a small amount of time. In one year there were constructed due to retrospective calculations, around 100 building, and the quantity then was more valued than the quality, especially from seismic security point of view, as a result of which the seismic risk was underestimated. The same was in Leninakan, where from 1978 to 1988, in 10 years there were constructed 238 buildings, 80% of which was destroyed as a result of the earthquake, and the other 20% were destroyed by an explosion because they were impossible to reconstruct. (33)

## **5. FLOODS**

Floods are temporary submersion of normally dry land due to the unusual contribution of volume of water in a given area. In this case, the area is the territory of Armenia, which contains risks of mainly river floods.

The geological characteristics of the Armenia Republic land make it prone to various natural disasters, which occur due to different geological and climate change reasons as well as anthropogenic triggers. The ones affecting water safety, floods, mudflows and landslides are typical for Armenia. According to the data of the State Committee on Emergencies (STE), the vulnerability of the Republic of Armenia to natural disasters shows the following picture: landslides 2.2%, high hazard mudflow territories 20-30%, inundated territories about 11%.

**Figure 9: The Hydrological Network of the Republic of Armenia**

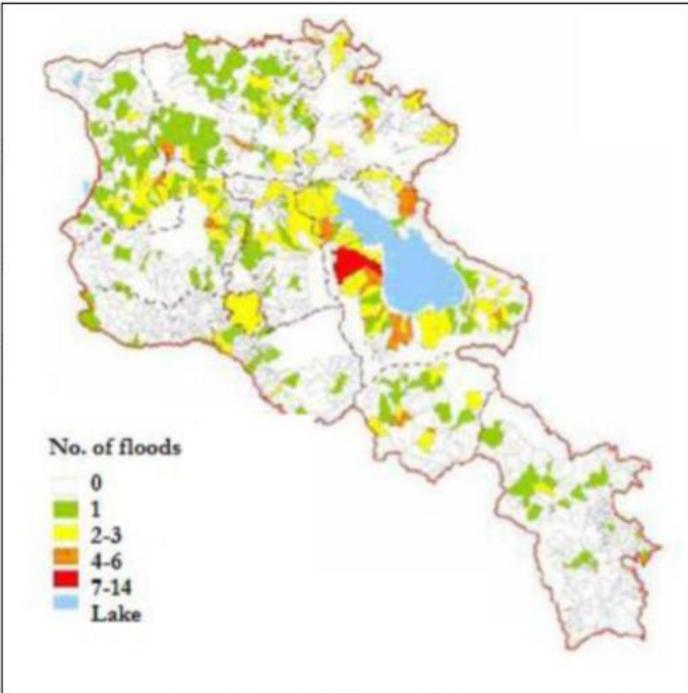


Basing on the data of the State Committee on Emergencies (STE), during the most intense period for the floods, in 2004-2006, the damage caused by floods and mudflows was estimated at US 5-6 billion \$. (34 p. 215-216)

### 5.1 Risk assessment and hazard analyses

Floods in Armenia are most prevalent during the springtime, when there are intensive snow melt periods. During this time river volumes increase up to ten times their normal level. The river basins of Araks, Hrazdan and Aghstev rivers are more prone to floods. Once every two years there are flash floods in the river basins of Meghri, Vedi and Goris. Overall, melting snow and heavy rainfalls increase the risk of mudflows in many parts of the country. The floods rarely bring human losses, but they are always accompanied by huge economic losses. There are many floods happening from 1994 to 2007 that caused a wide economic damage at US\$ 41 million.

**Figure 10: Floods reported in Armenia from 1994 to 2007**



Source: SEI & UNDP, 2009

(35, p. 27-28)

The risk of especially river floods in Armenia is classified high. Damaging and life-taking river floods can happen once in the next ten years. There should be taken specific project planning decisions, project design and construction methods by taking into account the high risk of hazard.

## 6. DROUGHT

Some factors like reduced precipitation and humidity increase the risk of drought in some parts of Armenia. Around 120-160 days in a year there occurs high temperature and hot winds in Ararat valley and other lowlands, which make those regions more vulnerable and prone to droughts. The regions which are more drought-prone, have above average levels of poverty. Mainly these regions are Shirak(77.3%), Lori (61.7%), Aragats (57%). (33, p. 28)

The significant drought in Armenia was in 2000, which affected mainly South of Armenia, Syunik region. 65% of Syunik region was directly affected by the drought, which include 85% of the local population, which was integrated in agriculture. Many families put all their investments in soil and had no outcome as a result of the drought. Considering the fact that in the majority of villages, 70% of the food is produced locally, during the dry periods the whole population was

placed in danger, as the crops fail. In March/April of 2001, due to the World Food Program's Armenia Food Security Assessment report, more than 65% of Syunik region was affected by the drought. In total, 8697 very poor and 16588 poor people in this region were facing Kcal deficit. The main cash crops growing in the villages of Syunik region were wheat and barley. There were no irrigation systems in the area, and in some villages people have to walk in medium 5 miles for taking even portable water. The harvest was burnt without water, so the people could not use it even as an animal food. They had to take their livestock further and further in the mountains for searching new pastures. So also the livestock was severely affected by the drought. In its turn, the lack of available fodder for livestock caused decrease in milk and dairy products. (36)

### **6.1. Risk assessment and hazard analysis**

The droughts have never directly led to human losses, but there are significant economic losses in the governmental and agricultural levels, and poverty, famine among the more vulnerable people. The agriculture sector of Armenia accounts for one-third of GDP, with approximately 20% are based on agriculture products and 10% on food manufacturing. (33, p. 31)

Over the past thirty years, Armenia has faced an increased mean temperature. The main targeted territories for hot winds and decreased precipitation and humidity are Ararat valley, Vayk and Syunik. About 15% of agricultural territory is prone to droughts. As a result of climate changes and increased human activity the desertification has increased. Armenia faced also electric crisis in 1991, and due to the lack of forest management as well, there were massive illegal woodcutting, which stripped the local forests. Overall, during the period of 1990-1995, Armenia lost around 20% of its forest cover, over 63.000 hectares. Now desertification threatens some 80% of Armenia, with 50% of severe desertification. (11)

According to Center for Research on the Epidemiology of Disasters, the natural disaster with the more economical damage since independence in 1991, was the drought in June 2000, which affected 300.000 people and caused US\$ 100 million of damage.

Taking into account the big damage brought by drought to population, agriculture and economy during the year of 2000, in 2001 international humanitarian agencies, particularly

Humanitarian Aid Office (ECHO) allocated 200.000 Euros to the victims of drought in South Armenia, mainly to Vayots dzor and Syuniq regions. By performing the aid, European Committee linked to the decrease in food stock in families and the risk of malnutrition of children in the area.

(6)

*ATC appeal Armenia. Drought assistance:* The World Council of Churches Round Table performed a 6-month food distribution program in the affected rural areas of South Armenia. Highlighting the impact of the drought in Central and South Asia, Middle East and Caucasus, the Round Table Association mentioned that extremely high temperatures and low precipitation in the summer months have led to significant losses of crops and livestock, deterioration of sanitary conditions. Since June 2000, hot and dry conditions affected the crop production. The Round Table targeted mainly the Northern regions of Armenia, particularly Tavush, Shirak, Lori and Gegharkunik, where the crop and potato crop was severely damaged. The reduction of river waters due to the drought led to poor irrigation systems and the impact was 27 percent down for wheat production and 40 percent of potato production.

According to government data, overall grain losses were more than 100.000 tons which costs USD 13.3 million. Potato loss was valued more than 90.000 tons, which is equivalent to USD 10.4 million, vegetable loss was around 70.000 tons, which cost USD 5.8 million, and the losses in forage units was 116, 4 tons, equivalent to USD 5.4 million. Agriculture suffered losses of around USD 40 million.

FAO/WFP estimated that more than 94.250 households were in need of food assistance in rural areas, the most affected and the most in need seven regions, which are Syunik, Shirak, Tvaush, Lori, Aragatsotn, Kotayk, and as well Nagorno-Karabakh region. (36)

## **7. SEVERE WEATHER CONDITIONS AND EVENTS (INCLUDING HAILSTORMS, STORMS)**

The main temperature in Armenia fluctuates between -5°C to 17°C. It varies between the regions. During the summertime, in August, the average temperature is 10°C in mountainous regions, and 24-26°C in lowlands. During wintertime, in January, the average temperature varies from -13°C to 1°C. The highest temperature recorded in Armenia was 43.75°C in Meghri and

Artashat and 42°C in Yerevan. The lowest temperature recorded was -42°C in Paghakn and Ashotsk.

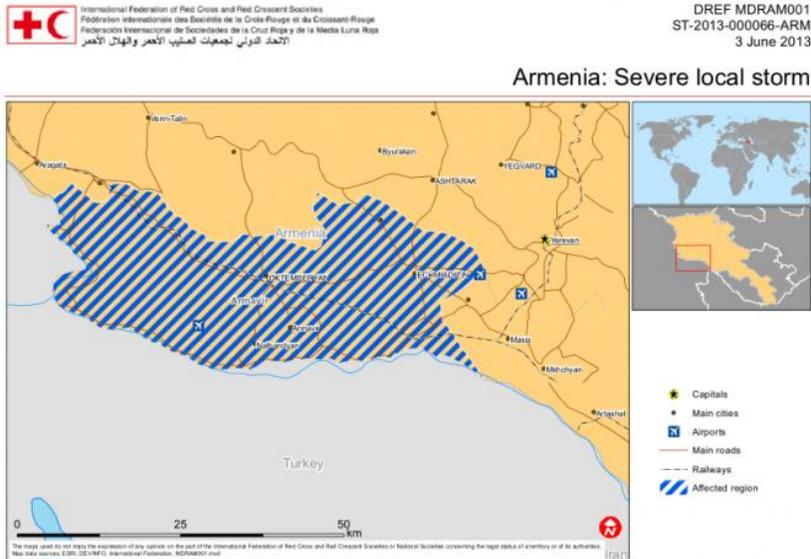
Due to its mountainous terrain and geographical location Armenia has several climate zones. On the altitudes from 375m to 4090m, which is the highest point in Armenia, there is a strong influence on the climate. Another influential factor is the western and eastern air flows, which bring cold arctic air masses from the North and hot air masses from the South towards the Meridian. (33, p. 20)

These factors lead to severe weather conditions and events, such as storms, hailstorms, extreme cold weather etc.

**Hailstorms** are among the biggest natural hazards for the agricultural sector: about 15-17% of the country's agricultural area is in the risk of suffering from hail damage. In 2002, hail damage was so intense, in Northern Armenia, that American government provided emergency wheat seed. (6)

Between the days of 12 to 17 May of 2013, devastating hail storms damaged almost all yield capacity in some regions of Armenia, especially in Armavir region. 46 communities and 12800 households were affected from the disasters, the agricultural fields and gardens were fully or partly destroyed. This was around 5000 hectares of agricultural lands in the region. More than 7100 households lost all their farms yield capacity based on the reports of rapid assessment conducted by the Armenian Ministry of Agriculture and Armenian Regional Emergency Commission.

**Figure 11: Severe local Storm in Armenia, 2013**



Basing on the assessment performed by local communities and ARCS DRT the main needs of affected population were basic hygiene means and food. They got assistance from local authorities and private sector, mainly seeds, diesel for hitting.

Armenian Red Cross Society distributed humanitarian aid to 15 most affected communities in Armavir region. For making the aid happen the Danish Red Cross Community allocated 49.000 euro. As a result, 4000 people were distributed by hygiene kits and food, which could serve them for 2-3 months. (37)

### 7.1. Risk assessment and hazard analysis

The main creator of risks for extreme temperature, storms, hailstorms and many other events containing hazard or disaster risks is the climate change, and for a better disaster preparedness and plan for disasters, we must analyze to understand how changes in temperature and precipitation, as well as the future extreme weather will affect the society and all the sectors including economy, agriculture, human and animal lives, etc. UNDP developed a series of climate change adaptation resources. The Climate Risk Management brings together the disaster risk management and climate change adaptation mechanisms. The Report Climate Risk Management in Armenia was lead by the Climate Risk Management- Technical Assistance Support Project (CRM, TASP), a joint initiative by the Bureau for a Crisis Prevention and Recovery (BCPR) and the Bureau for Development Policy (BDP) in UNDP.

Extreme temperature, storms and hailstorms greatly affect the economy of the country. 67% of the population lives in urban areas, but many of them are still involved in the agricultural sector, which is composed of 340.000 small farms. The average land holding is around 1.4 hectares. Irrigation system provides only 64% of the arable land, besides its poorly managed and. Taking into consideration all these factors, it is becoming clear the damage brought to the economy because of climate-driven shocks and events during 2000 to 2010 years in Armenia. Major droughts in 2000, 2006 and 2010 combined with other hazardous events such as hail storms, early frosts and spring floods brought to an economic crisis, which highlighted the vulnerability of farmers to climate-based shocks. (35)

## 8. TECHNOLOGICAL DISASTERS

Basing on EM-DAT database, there have been occurred these technological disasters during the time period of 1992-1998.

**Table 8. Technological Disasters in Armenia**

Time	Place	Disaster type	Disaster subtype	Total deaths	Total affected
08/03/1992	Erevan	Industrial accident	Explosion	21	
26/12/1993	Gyumri	Transport accident	Air	35	
27/05/1993	Gyumri	Transport accident	Rail	30	48
01/06/1994	Artic	Miscellaneous accident	Collapse	5	750
04/12/1998	Yerevan	Miscellaneous accident	Explosion	11	12

(16)

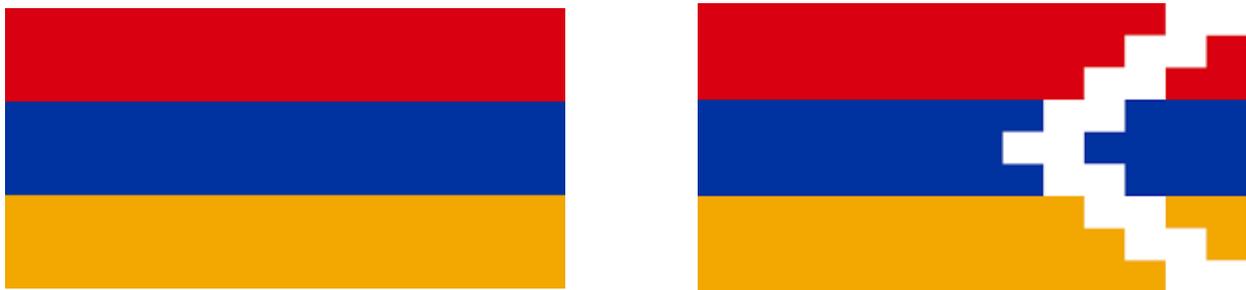
There are big sources of risks in technological disasters as well in Armenia. Basing on the fact, that there are 27 chemical factories, which use ammoniac, chlorine, chlorine acid, nitric acid

and other chemical materials, in case of lack of management there can be high risks of explosions and technological disasters also. More than 1500 enterprises are highly explosive. There are also approximately 100 reservoirs, atomic electrical power station and other buildings containing risks of technological disasters.

(11, p.6)

## 9. NAGORNO-KARABAKH CONFLICT

**Figures 12, 13: Armenia and Nagorno-Karabakh Republic (Artsakh) National Flags**



Armenian Revolutionary Federation (ARF) states, that Karabakh has always been a part of Armenia at least for 3000 years. It simply could not be a part of Azerbaijan because a state like that did not even exist before 1918. After one and a half year of Azerbaijan being announced as a republic, Bolsheviks signed contracts for giving not only Karabakh, but also other Armenian lands to Azerbaijan as a punishment for Armenia for not obeying Bolshevik rules and for continuing to resist Turkish army. The Bolsheviks made all the borders in territory the way that for gaining an independence one country needed the agreement from other republics as well, and this is one of the main basis for internal conflicts, one of which is Nagorno-Karabakh conflict.

The conflict began in 1987, when the inhabitants of Hadrut, ethnic Armenians, started riots claiming against the Azerbaijani aggression. As an answer to this, Azerbaijan increased the aggression, and this was the reason for the start of a massive conflict between two countries.(38)

The ongoing conflict between Armenia and the neighbor country Azerbaijan for the Nagorno-Karabakh region was chronologically the first conflict during the Soviet Union period, is one of the biggest conflicts still in the region, and one of most complicated from the resolution perspective. (39)

The conflict is more complicated due to involvement of other countries in it. Thus, Russia is committed to defend Armenia, and Turkey is pledged to defend Azerbaijan.

During the April of 2016 military clashes, there were more than 300 clashes, and more than 100 military officers and civilians were killed. The so called “four day war” started when the presidents of Armenia and Azerbaijan were in Washington for the nuclear security summit.

Either sides could consider taking provocative actions regarding Nagorno-Karabakh for the reason of advancing some political, military or economic goals. There was never a stable state in the borders, shooting went on during the two decades

The United States, Russia, and France- co-chairs of the Organization for Security and Cooperation in Europe (OSCE) Minsk Group, which is responsible for resolving the conflict, used diplomacy to halt the violence. But still they have been unable to revitalize peace process. The South Caucasus region does efforts to reduce the European Union’s energy dependence on Russia and has been a major recipient of Western foreign investments and aid. So, Azerbaijan, Georgia and Turkey have benefited by the new oil and gas pipelines, but because of the conflict Armenia can’t benefit it too, and this has a direct impact on *Armenian economy*. Other factors effecting the economy is the huge amount of expenses used for weapons, tanks and for strengthening the military, which could be used in other means in case of absence of the conflict.

The likelihood of another fight outbreak similar the one of April 2016 or stronger, is significant. Heavily armed military units are deployed in close proximity to one another along the line between Nagorno-Karabakh and Azerbaijan. (40)

To describe the military preparation of Armenia, we need to mention the main forces. They are Armenian Armed Forces, Ground Forces, Air Force and Air Defense, “Nagorno-Karabakh Republic” Nagorno-Karabakh Defense Force (NKSDF) 2011. Military Service has two years obligatory conscript service for the male between 18 to 27 years, as well as voluntary military service for the same age range. 17 year olds are eligible to cadets at military institutions, where they are classified as military personnel. (41)

Swiss Humanitarian Aid, by basing on the humanitarian principles of neutrality and impartiality while implementing its activities, still from 1990s, after the outbreak of the conflict,

has supported both Armenian and Azerbaijani citizens in the ICRC operations for collecting data and establishing information about 4500 missing people from both countries.

It goes on to implement and plan more actions from 2017 to 2010 for strengthening the regional cooperation among the countries, basing on the new strategy of SDC, SECO, FDFA's Human Security Division. The Swiss organization's has emphasis on economic development of rural areas, and disaster risk reduction. (30)

## 10. DISASTER RISK MANAGEMENT

There are several local and international institutions occupied for the effective disaster risk management in Armenia. Main players of DRR NP are

- Governmental authorities in Armenia
- Ministry of Emergency Situations
- International and donor organizations working in the field of DRR
- UN
- Armenian Red Cross Society
- Scientific Institutions
- Civil societies and experts.

The governance of Armenia mainly involved in disaster risk management, consists of Ministry of Emergency situations (MOES), the National Survey for Seismic Protection (NSSP), the State Reserves Agency, National Center for Technical Security (NCTS), Armenia State Hydro-meteorology and monitoring (ASH) SNCOs.

In 2008, the Government established the risk management priorities for MOES. They are the followings.

- ✓ To develop a program for risk assessment and emergency preparedness,
- ✓ To develop the response and aid recovery from emergencies
- ✓ Coordinate a government-wide policy on risk mitigation.

MOES is the institution in Armenia which coordinates all joint, multi-agency emergency management policies. The other institutions, which were formed independently or under other Ministries' mandate, all work under the MoES structure. (11)

The governance of Armenia, Ministry of Emergency situations (MoES), applied international organizations for engaging experts in Capacity Development process for Natural disasters risk reduction in January 2010. As a result, UNDP experts were engaged in UNDP Armenia actions together with MoES for designing and facilitating better capacity in DRR. Hyogo Framework for Action (HFA), was selected as a basis for measurement and actionable indicators of identifying the existing situation and desired level of capacity in DRR. Based on result of capacity Development plan, an Action Plan has been recommended to strengthen the DRR in Armenia. The AP focuses on three capacity areas.

- Core organizational capacities
- Technical capacities
- Community engagement and cooperation (11)

Basing on probabilistic risk assessment techniques, which uses various mathematical modules and calculations to combine different disaster scenarios, taking into account vulnerabilities.

## **11.POLICIES AND PROGRAMS**

Realizing the role of Disaster Risk Management (DRM) in the country's sustainable development, Armenia, in face of the Government of Armenia, was one of the first in the region to launch strategic review of its Disaster Risk Management capacities in order to reform the policies, take the appropriate measures and relevant investments for increasing the country's resilience to disasters and natural hazards. Recently, the Minister of Emergency Situations presented the Armenian National Disaster Management Strategy and its Action Plan for implementing in the 2017 Global Platform for Disaster Risk Reduction in Cancun, Mexico. The National Strategy was based and fully balanced with the Sendai Framework Action 2015-2030 and was improved in April 2017, was supported by the *Japan-World Bank Program for Mainstreaming Disaster Risk Management in Developing Countries*, administrated by GFDRR and UNDP.

During two decades after the Spitak Earthquake, the Governance took important steps in legislation for risk reduction and emergency management systems, strengthening not only the

disaster response systems, but also disaster preparedness and mitigation. The most important changes were the 2008 Law on Prevention of Emergency Situations, the National Platform for DRR, and the program of *National Disaster Risk Reduction Strategy* was officially established and adopted in 2010 by the government and National Strategy on DRR with the Action Plan in 2012. The aim of those strategies is mainly better coordination of DRR. (42)

On March 2012, the Government of Armenia signed a legal document in which approved.

-The Disaster Risk Reduction National Strategy

-The Disaster Risk Reduction National Strategy Action Plan (41p. 19-20)

For the implementation of the strategy plan, it points several phases of the programs, which are

-**Short-term programs**, which consider the strategy activities with the duration of 1-2 year of implementation period

-**medium-term programs** include the activities that can supply the short-term programs and the implementations of legal and methodological principles.

-**long-term programs** have a long-term implementation period, which is from 5 to 7 years. For the long-term programs relevant financial means should be available.

-**procedural programs** have continuous nature; they repeat principles and functions and ensure the implementation process of the programs. (44)

*The National Disaster Risk Management Program*, which was suggested by World Bank, is aimed to support the Government of Armenia to better advance disaster resilience by making some important steps:

1. Improving disaster risk information
2. Enhancing disaster risk reduction
3. Strengthening disaster preparedness
4. Improving understanding of fiscal disaster risks and risk financing options.

For implementing the program, the World Bank was supposed to work with relevant ministries for implementing the five components, which are institutional strengthening, risk identification, risk reduction, disaster preparedness and financial protection. Effective cooperation among government agencies in Armenia was crucial for success in disaster risk

reduction efforts. The program was supposed to support adjusting Armenia's existing National Strategy on Disaster Risk Reduction to align with the Sendai Framework, adopted in March 2015, and also the UN Sustainable Development Goals. The implementation of the program was supposed to be accompanied by trainings and meetings with the stakeholders groups and partners. (45)

DRR Strategy together with Hyogo Framework of Action (HFA) implementation countrywide was initiated through provision of practical tools and relevant guiding materials. DRR regional teams were established through the 10 regions (marz) of Armenia for providing the support of DRR strategy and HFA implementation.

Armenia was the first country to adapt UNDP's *capacity assessment methodology* to the area of disaster risk reduction.

A new *National Disaster Observatory and Crisis Management Center*, operating under the Ministry of Emergency Situations, enabling 18 ministries to systematically collect, analyze, share and interpret data. Using all this data made it possible to create hazard maps.

In June 2011, the Ministry of Emergency Situations of Armenia and the Interior Ministry of Montenegro signed a *Memorandum of Understanding* for deepening the cooperation in Disaster Management and Response.

In 2011, the capital Yerevan, the second largest city Gyumri, also Alaverdi and Kapan signed the "Making the Cities Resilient: My city is getting Resilient" campaign. Also, Local Level Risk Management (LLRM) module was implemented in 40 communities of Armenia for increasing the resilience in the local levels. Additionally, for mainstreaming the DRR development, *Community Risk Certificate* is developed as a planning tool. (12)

Supporting the aim of analyzing and learning the experience and disaster preparedness and response systems among developed countries, in 2016, Armenia's Deputy Minister and Head of Crisis Management Center under the Ministry of Emergency Situations participated in **Japan's 36<sup>th</sup> Comprehensive Disaster Prevention Drill of Nine Prefectural and City Governments in Saitama City**. Armenia was also one of the first countries in South Caucasus that was accredited by **the International Search and Rescue Advisory Group (INSARAG)** in 2015, which makes the

Armenian Ministry of Emergency Situation a part of international urban search and rescue efforts for post-earthquake response systems. (42)

Basing on the “ARNAP” foundation’s program on DRR development, the implementation of the program would have many benefits for the field. The expected outcomes are these.

- DRR strategy and improvement of DRR sector legislative field
- The effectiveness will increase in DRR
- Introduction of DRR mechanism, development of a common methodology and creation of databases
- Strengthening the DRR capacities, education and knowledge, and raise the awareness. (46)

*Mitigation strategy for Earthquakes:* Taking into account vulnerability especially to earthquakes in Armenia, many programs and policies are being designed for the mitigation of this disaster risk.

In 1999, the government of Armenia adopted the strategy of seismic risk reduction. Several institutions under the coordination of the Natural Survey for Seismic Protection (NSSP) developed a uniquely structured program.

The program considers.

- Seismic codes and standards
- Seismic strengthening and upgrading of existing programs
- Earthquake resistant construction
- Education to population
- Emergency response and recovery

Based on feasibility, mitigation strategies point on strengthening the most vulnerable buildings in Armenia, in which the local governmental bodies of the cities play a big role. Under their requires the cities should

- ✓ Develop a seismic risk map
- ✓ Identify high risk districts
- ✓ Assess the maximum possible accelerations

- ✓ Analyze ineffective response to earthquake and estimate potential building damage
- ✓ Prioritize the constructions according to retrofit urgency
- ✓ Design retrofit methods for different types of buildings
- ✓ Retrofit the most vulnerable buildings, according to the priority list.

(14), p.150-151)

## **CONCLUSIONS**

1. Due to its geographical features, Armenia is prone to natural hazards and disasters as earthquakes, floods, hail, landslides, mudflows, drought, erosion, and desertification, and during time they have caused vast social upheaval and economic damage to Armenia. (11)
  
2. Armenia has a high risk for especially natural disasters, because
  - Owns high risk of exposure and vulnerability
  - Insufficient capacity to manage risks. (12)
  
3. Natural and technological hazards urge the need of developing and strengthening Disaster Risk Reduction (DRR) system in Armenia.
  
4. Armenia's international cooperation is highly developed, and policies and programs developed are corresponding to the international standards. Armenia can highly succeed in DRM and DRR if the Government follows The National Strategy in DRR and Action Plan more and put them more in action.

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