Flooding rehabilitation in Lezha city.

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Abstract- *Climate change is one of the most important issues discussed worldwide, as it has local and regional impacts that profoundly affect communities. Precipitation is the most critical and key element in both the atmospheric and hydrological cycles. The variability of the precipitation regime is the main consequence of climate change which is bringing the most frequent occurrence of extreme events such as droughts and floods. There is a growing need for strategic assessments of changes in precipitation regimes in current and future conditions. The aim of this study was to evaluate the changes in the precipitation regime in the city of Lezha using the data observed from the meteorological stations of the Institute of Geosciences. By studying the data of last year's 2020 and 2021 compared to the multi-year average we understand the trends of the variability of the precipitation regime, in which we reached the conclusion that we have an increase in the amount of precipitation, which leads to rapid flooding and urban flooding. The main problem regarding urban flooding in Lezha city is because of the precipitation. Following the problem typologies which are mainly due to large areas of concrete or similar non-permeable materials, combined with dense buildings and with the lack of proper drainage road system or proper maintenance, two alternatives are seen as a solution to these problems. Worldwide, Green Infrastructure (GI) has mainly been discussed from an adaptation strategy perspective in cities and urban areas. However, we believe that GI can also function in rural and suburban areas where depopulation is prominent. After the study of the area, it was noticed that there are no free spaces as all the neighborhoods are occupied and concreted. Starting from this, the first solution concerns the conversion of concreted spaces into green spaces, this makes it easier for water to penetrate the ground surface. Green spaces have a fundamentally protective role against the effects of climate change, such as food and water scarcity, while also contributing to CO2 reduction in the atmosphere through their sink function. Adding green spaces besides soil water permeability thus contributing to the reduction of floods would help in terms of reducing pollution of the air and creating spaces that citizens can use. Many such spaces were identified in the city of Lezha that's why this proposal comes. In some areas of the city, there was a problem with the lack of open spaces of any kind due to the high density of buildings. Being impossible to intervene with the addition of green spaces in these areas, as a solution is seen in the intervention in the drainage system of the roads. The roads in these areas were very narrow and had no drainage system at all the few that had been in very poor condition. These are seen as emergency interventions to solve this problem in the city of Lezha. In conclusion, based on a broad and integrated vision of issues related to territorial and environmental systems, this proposal aims at concrete actions to ensure the adaptation of the territory and the environment to the phenomenon of urban flooding.*

Keywords: urban flood, precipitation, climate change, green spaces, territory.

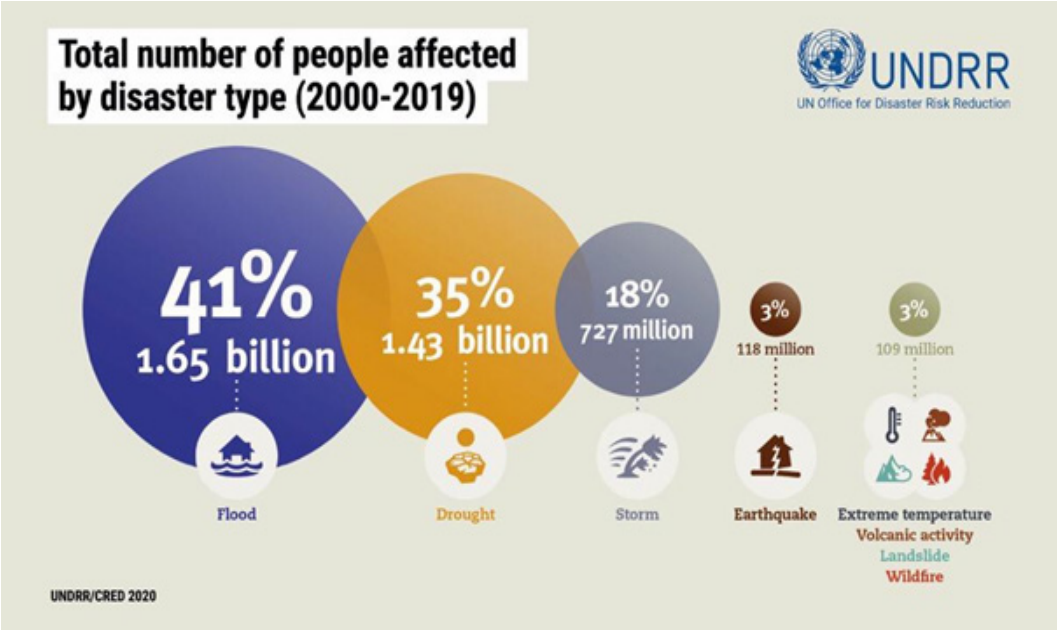

Fig.1/ People affected by disaster type (2000-2019). Source/ UNDRR

1. Introduction- Until now, changes in the global climate have occurred naturally, over centuries or millennia, due to different atmospheric cycles. Over the last few decades, human activity has been influencing changes in atmospheric composition, thus causing global climate change. Direct tangible damage includes the physical damage caused to property and contents in both residential and non-residential sectors as well as infrastructure through direct contact with flood waters (Oliveri & Santoro et al. 2000). In many flood impact assessments, only direct tangible impacts are considering the expense of the categories such as intangible impacts (Ward et al. 2011).

Climate change and urbanization are leading to more water use and increased exposure of society and assets to extreme hydrological events, such as floods, droughts, and loss of life from high temperatures or frosts. Precipitation and temperature data for the last few years show that climate change has occurred.

Several meteorological measurements have been selected for the Lezha Religion. In terms of time distribution of precipitation, the largest amount of them, about 70% is observed in the cold half of the year with a maximum in November and a minimum of precipitation in July. This fact emphasizes quite well the Mediterranean character of our country's climate.

Extreme weather events and impacts on land, (especially agricultural land) environment, and economy. Climate change has triggered some extreme weather events with impacts on the territory, and agricultural land, such as :

- Floods, flash floods
- Extreme temperatures
- Heat waves
- Frosts
- Droughts
- Storms
- Landslides
- Forest Fires
- Desertification of the land, which has affected about 1/3 of the territory
- Physical degradation of land and loss of productive capacity
- Damage to nature and infrastructure

According to DesInventar, a disaster information management system, almost 4 000 disaster events occurred in Albania between 1852 to 2013. It is estimated that floods (38 percent) have caused the highest economic losses during the period 1990-2014, followed by flash floods (33 percent) and landslides (7 percent).

According to the latest data all over the world the biggest risk is from flooding, and our greatest focus should be there, to adapt climate changes in urban planning. Groundwater flooding results from high groundwater levels, and coastal flooding is due to tidal surges and waves (Saul et al. 2011). Progress has been made in developing realistic simulations of the evacuation processes, using techniques such as agent-based modeling (Dawson et al. 2011) and probabilistic methods (Kolen et al. 2012). Flooding is known to be linked to the outbreak of diseases (Ahern et al., 2005). These diseases range from bacterial outbreaks such as leptospirosis and diarrhea through to vector-borne diseases such as malaria.

Precipitation (mm)	Year 2020	Year 2021	Average ('62-'90)
January	66.9	432.4	154.5
February	93.6	144.2	127.8
March	116.8	132.3	132.7
April	38.3	95.4	121.4
May	23.9	59.5	89.5
June	39.4	21.6	70.4
July	0.3	0.0	35.8
August	105.3	48.6	58.3
September	200.4	11.6	86.5
October	338.8	106.7	141.0
November	0.0	136.5	187.6
December	239.8	226.8	157.3

Table 1 Monthly amount of precipitation in Lezha City, the Year 2020, 2021 and average '62-'90

2. Materials and methods

Distribution in space-time of atmospheric precipitation in the Albanian territory depends on many factors among the most important are the general circulation of air masses, altitude, distance from the coastline, etc. These factors as well as many local factors make the distribution of precipitation in our country to be varied from the northern Alps with annual precipitation of about 3000 mm, to the southeastern areas where it falls on an average of 700 mm. In terms of time distribution of precipitation, the largest amount of them, about 70% is observed in the cold half of the year with a maximum in November and a minimum of precipitation in July . This fact emphasizes quite well the Mediterranean character of our country's climate.

Data of precipitation, gathered from the stations of the Meteorology Department, in the Institute of Geosciences, evaluated with the proper software, homogenized, and filled the full series, in order to compare old averages and actual data, to find out how the precipitation regime is changing. There are two ways in which data are collected. There are two types of stations. The first is a manual pluviometer, which measures the amount of rain. These surveys are carried out once a day on the hour 07:00 and are recorded in registers and diaries which are then sent to the Institute of Geosciences, where they are processed based on WMO methodologies and standards. The second is the digital pluviometer which has sensors and gives the data in real-time in the servers of the Institute of Geosciences.

3. Results and Discussions

Lezha is part of the Mediterranean Climatic Zone, and part of Central Mediterranean lain subzone, and the northern hilly Mediterranean subzone as shown in the map below:

To make an assessment of the amount of precipitation over the city of Lezha during 2020 and 2021, there has been taken in consideration the amount of precipitation measured by the meteorological monitoring stations in comparison with the multi-year average, and we notice that we have deviations in the amount of precipitation, as shown in the table and graph below.

As seen in the graph above the precipitation regime has changed during these 2 last years. In January 2021 when there was a big flood in Albania, in Lezha there was 432.4 mm of rain, while in normal years we had 154.5, which means around 278% of the amount. Even other months in the winter are above the average and the months in the summer are less the amount. After analyzing the data about the precipitation these two last years it is noticed that the problem of flooding is partly from the change of the precipitation regime

The main problem of flooding in the city comes as a result of the addition of buildings within the neighborhoods of the city, without changing the infrastructure. Following the problem typologies which are mainly due to large areas of concrete or similar non-permeable materials, combined with dense buildings and with

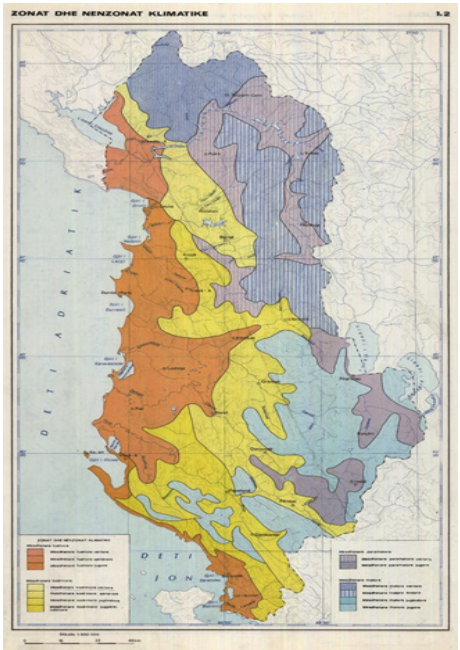

Fig.2 / Climatic zones and subzones in Albania

Fig.3 / A part of the city with proposals

the lack of proper drainage road system or proper maintenance, two alternatives are seen as a solution to these problems. This is a map of Lezha City and there are identified the buildings. In the red circle is the part of the city that is being analyzed, zoomed in, in the second figure. Green is the concreted space to turn into green space.
With yellow are the spaces seen where is necessary the intervention in the drainage system of the roads.

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