

THE CONTRIBUTION OF PLANNING AND URBANIZATION TOOLS TO MANAGING THE RISK OF FLOODING, THE CASE OF THE URBAN EXPANSION AREA IN THE CITY OF M'SILA, ALGERIA

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Abstract: Prevention of major risks and the management of disasters constitute a comprehensive system, developed and managed by the state and carried out by public institutions and regional groups within their respective jurisdictions, in consultation with economic, social, researcher and technical clients, the development of urban communities and the prosperity of industries, as well as the emergence of new concepts such as development in various areas, including urbanization, which has affected nature, resulting in frequent natural disasters that cause damage to human beings and property. This is why human thinking has evolved in the field of protection against the effects of natural disasters (floods) in order to preserve the human and economic component, and like the countries of the world, Algeria seeks to reduce the damage of major threats through actions taken in through the adoption of a national disaster prevention scheme by the Algerian Government and the organization of interventions and aid, in addition to various types of urban mean, The study of hazards in the city focused on the flooding risks, specifically in the expansion area, where the analyze of climatic, topographic, urban data were based on SIG, the hazardous areas within the built area were identified and classification the land occupation plans were by the degree of risk. The expansion of the city of M'sila did not take into account the major dangers in the embodiment of the tools of preparation and reconstruction.

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INTRODUCTION

Hydrological risks pose a threat to people and property in most parts of the world (Sami, Abdewahhab, Yahyaoui, & Mohammed Issam, 2020). The chaotic neighborhoods are the most vulnerable to natural hazard (Brahim, Ali, & Florina, 2014). Over the past centuries, communities have been exposed to natural disasters that leave devastating effects on property and lives, as it is difficult for them to face their effects for several reasons, including the absence of the necessary capabilities or their ineffectiveness in resisting these effects, which makes the size of the losses large.

And with the development of human communities and the prosperity of industries, in addition to the emergence of new concepts such as development in various fields, including the field of urbanization and sustainable development, in addition to the frequent occurrence of natural disasters, which are exacerbated by unplanned urbanization (Hadjar & Hamza, 2021), and the resulting damages, all of this made human thinking develop in the field of protection from the effects of natural and technological disasters with the intention of preserving the human and economic element alike, especially if most of the deaths that are recorded are caused by the collapse of buildings and roads (buildings and tools damaged, stocks and crops lost, etc.) (Louarn, 2012).

From this point of view, governments have begun to adopt a policy of prevention system (Remy & Bruno, 2019) from natural and technological disasters to protect lives and property, and to take into account all new things related to this field, while benefiting from the experiences of others in this regard.

However, the 2001 Algiers floods and the 2003 Boumerdes earthquake, which left great human and material losses and damages (Abdelkrim, 2018), led to the discovery of the weakness of the applicable legislative system, and accordingly a new law was adopted on the prevention of major dangers and the management of disasters, also, reconsidering the laws and regulations related to urbanization. Since then, Algeria has considered the planning and urbanization policy as one of the basic pillars upon which urban development is based in particular, especially in light of the problems in which this sector is floundering, such as the housing crisis and the spread of illegal housing, which is considered most affected by any disaster this makes the urbanization sector in the city at the forefront of the sectors concerned with taking care of the prevention of the risks of these disasters and confronting them with the continuous search for the most effective means and the best methods that should be applied in constructing urbanization that is more resistant to these risks.

Geographic information systems have achieved great development and effective answers to the various natural and human problems facing the city's path and the actors in the field, by providing cartographic data and updated databases that can be used for forecasting and forecasting (Kahina & Ali, 2021), as well as for management and careful follow-up of various phenomena in the urban field, and thus visualizing expected dangers and estimating its size, paths, and losses, and an attempt to reduce all of that

The city of M'sila is among the cities that have been exposed to major dangers, including floods, which are still exposed to, leaving behind many effects, such as the 1994 floods due to the rise in the level of Wad el-Qsob, which left one dead and displaced 810 families, as well as the 2007 floods that flooded the flooded areas and left 39 dead and 88 injured. Others and more than 2 billion Dinars in material losses (Directorate of Civil Protection of The State of Msila, 2007) this is despite the preparation of studies and urban plans such as the master plans for development and reconstruction, as well as land occupancy plans (Lahcen, 2014), which are supposed to take this phenomenon into account, but the danger of this latter is repeated every time and in varying degrees,

in addition to the June 2015 floods that occurred in the expansion area. The urbanization of the city of M'sila, due to the presence of the latter on a flooded area with many valleys and secondary valleys.

MATERIALS AND METHODS

In order to carry out this study, it is necessary to obtain a set of data that we need to analyze with a set of programs and means according to the type of processing required. In this, we have resorted to using satellite images and processing them with ARC map and Global Mapper software so that we can create a geographic information system. The risk of flooding has been addressed in this research through a basic perspective, which is the submergence of surface waters of the M'sila valley stream to the urban structure of the city. In order to assess the risk of flooding by flooding the surface waters of the valley and floodplain, we have identified the following variables: population density, slope, proximity and distance from the valley and floodplain, nature of land occupation, rainfall intensity and levels prior to water inundation, and using all these variables as factors through which we construct a matrix of the risk in order to determine the city's sensitivity to flooding risk.

RESULTS

The city of M'sila is one of the inner Algerian cities located within the following geographical coordinates: Between two viewing circles: '35.48°, '35.67° north of the equator. Between linear length: '4.57°, '4.48° east of Greenwich line the north-south link is the seat of the state. The city is characterized by economic diversification. Municipality of M'sila. Estimated Area 252 km2 operated by (214,661) inhabitants, with a population density of (925) inhabitants according to the municipal Bureau of Statistics 2014 (Salim & Makhoulfi, 2019).

The municipality of M'sila is located in the far northern border of the wilaya, as it is bordered on the North by the municipality of El-Euch, on the east by EL Metarfa and Souamaa, on the south by Ouled Madhi and on the West by Ouled Mansour municipality (Figure 1).

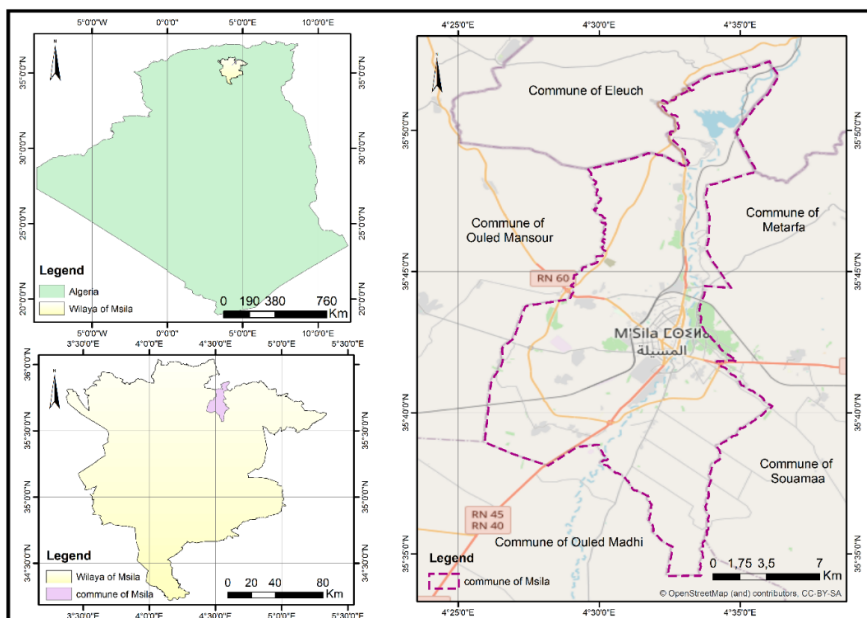


Figure 1. Location of the field of study City of Msila (Source: Treatment of the researchers by Arc Map 10.2.2, 2023)

The new expansion areas are located in the city of M’sila exactly in the northern part of the city, where they are organized 17 land occupancy plans witch recover 1410 hactars (The directive Plan for The Planning and Reconstruction of The Municipality of Msila, 2008) (Figure 2).

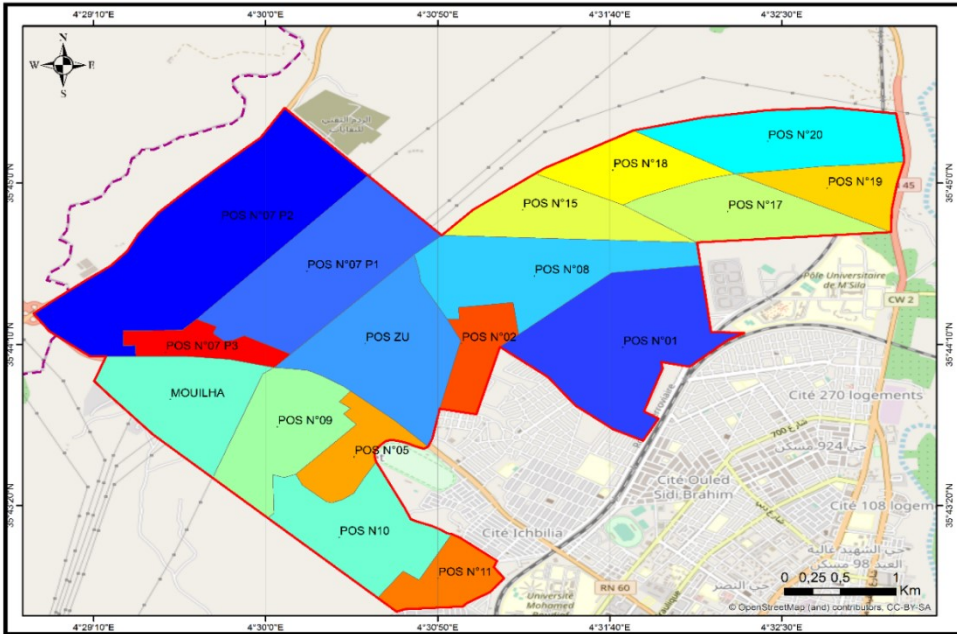


Figure 2. Distribution of the 17 lands occupancy plans of study area (The new expansion areas of Msila) (Source: Treatment of the researchers by Arc Map 10.2.2, 2023)

In order to analyze the exposure and impact of floods on the study area, we decided to use the geographical information systems GIS, by collecting and exploiting the various necessary data on the study area and processing them using the Arc GIS program (Figure 3)

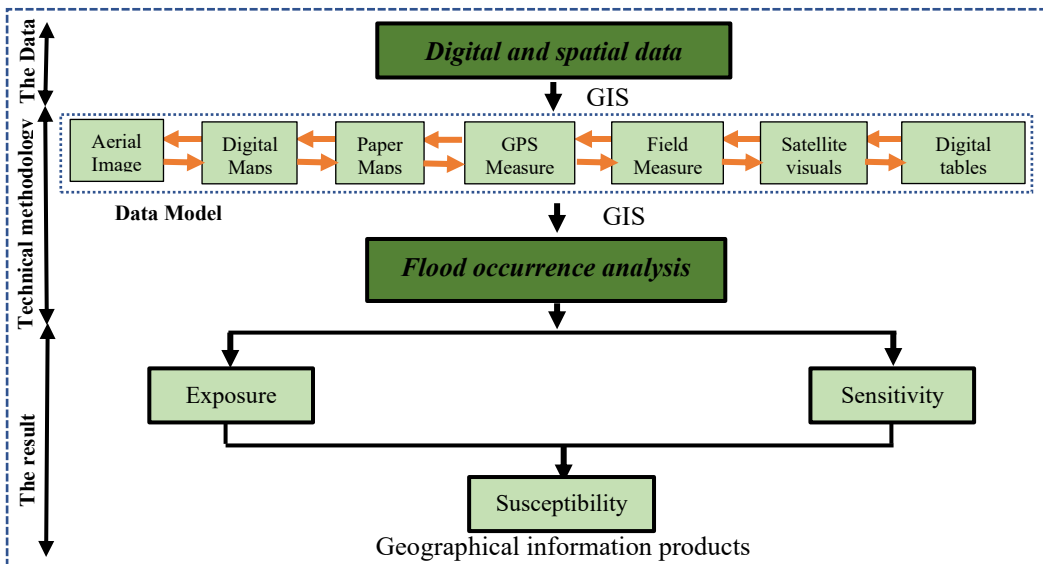


Figure 3. Stages of data analysis of the study area

(Source: Treatment of the researchers, 2023)

The topography of the study area has a medium inclination, extending from the borders of Bu Khmisa in the north to the Dra' al-Haja area in the south, with a maximum height from the north estimated at 550 meters above sea level and a minimum height from the southern side estimated at 475 meters above sea level. As shown by the two plans (topographical plan of the study area, section + elevation chart) (Figure 4).

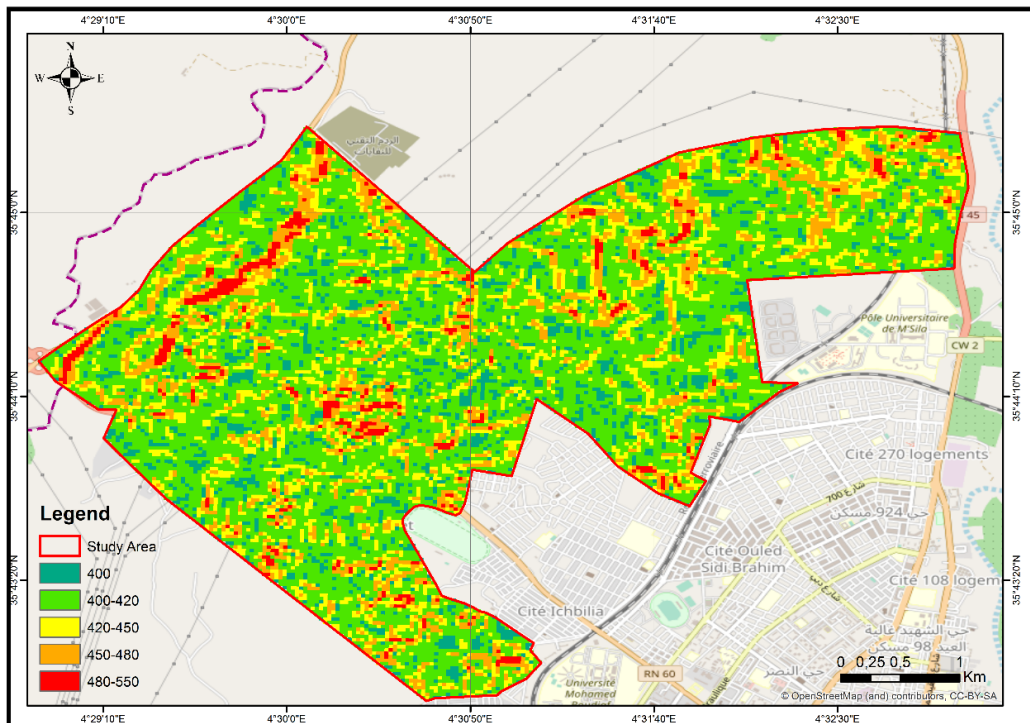


Figure 4. different elevations in the study area
(Source: Treatment of the researchers by Arc Map 10.2.2, 2023)

Danger is defined as a phenomenon, material, human activity, or dangerous conditions that may lead to loss of life, injuries, other health effects, damage to property, loss of means of living and services, economic and social disruption, or environmental damage. (United Nations Secretariat, 2009), the study area is a flood area due to the passage of the Bortam valley, which made it exposed to floods, which are defined as a hydrological phenomenon resulting from a sudden rise in the water level that deviates from its normal course to flood the larger flood bed and the adjacent plains (Ahmed, 2005), in the past years, the city experienced floods that led to material and human losses, and therefore we will present the areas affected by the floods that occurred in recent years (2007, 2015).

After the floods that the city of M'sila was exposed to on April 12, 2007, as well as the floods of September 23, 2007, when the expansion area was subjected to large torrents that resulted in material losses, as a result of the flood of Bortam valley, where the places designated for social housing (Ali, Mahmoud, Kahina, & Brahim, 2019), both individual and collective, were flooded with water due of the Bortum Valley floods (Figure 5).



Figure 5. The study area was exposed to floods
(Source: Data of the Directorate of Civil Protection of the wilaya of M'sila, 2007)

In 2015, the study area was subjected to floods that destroyed housing, equipment, and roads (Directorate of Civil Protection of The State of Msila, 2015). The losses accumulated after the losses that occurred in 2007 again, the floods also submerged and damaged many roads and sidewalks, as well as damaged some networks, such as the sewage network, electricity, water and other basic structures (Figure 6).



Figure 6. The study area was exposed to floods
(Source: Data of the Directorate of Civil Protection of the wilaya of M'sila, 2015)

The study area extends over a complex hydrographic network of reefs and valleys of the second and third degrees, forming the main stream of the Bortum Valley, which passes through most of the land occupation plans for the urban expansion area, which poses a risk of flooding to the residential neighborhoods and equipment programmed in the land occupation plans, like what he witnessed the land occupation plan. N° 05 in 2007 and 2015. Sensitivity is the integration of the social, economic and geographical aspects in a comprehensive way in order to develop a multi-criteria and scale analysis (Tariq, 2010). We examined the area and matched the proposed plans and buildings on the ground and identified the threatened sites in the event that the area was exposed to

floods, where The degree of danger was classified according to the rank of the valley, so that we identified the dangerous points according to the neighborhoods and the land occupation plan as shown in the plan of the buildings at risk (Table 1):

Table 1. Identify buildings and areas at risk
(Data source: Directive plan for planning and reconstruction of M'sila, 2008)

Land occupation plan	The neighborhoods	Degree of danger
Plan N°05	400 social housing	
Plan N°05	100 house SAHLI	
Plan N°05	Promoter neighborhood Safari Rabah	
Plan N°07	2000 house ADL	
Plan N°09	BATIJEK	
Mouilha neighborhood	93 evolutionary dwellings	
Plan N°02	Social housing	
Plan ZU	Neighborhood KIA	

Note: The red color indicates 1st degree of risk, the blue 2nd degree and the pink 3rd degree of risk

There are many statistical methods by which the degree of risk can be assessed, but the simplest and most effective is to describe the degree of risk as very high, high, medium, low, and very low. And assessing the degree of risk depends on two characteristics, the first is the impact of the risk and the second is the probability of the risk occurring (Atef, 2008).

By using geographic information systems GIS and applying them to the various waterways located in the urban expansion area of the city of M'sila (Bortum valley), we were able to identify the areas at risk of flooding, as well as the degree of danger (Table 2):

Table 2. Identification of endangered land occupancy plans
(Data source: Treatment of the researchers by Arc Map 10.2.2, 2023)

Region	Land occupation plan	Area (Ha)	Achievement progress rate %	Degree of danger
A	L O P N°01	146	80%	
	L O P N°02	35	30%	
	L O P N°07 P1	130	40%	
	L O P N°07 P2	218	Not realize	
	L O P N°08	106	40%	
	L O P N°15	62	Not realize	
	L O P N°17	70	Not realize	
	L O P N°18	51	Not realize	
	L O P N°19	40	Not realize	
L O P N°20	88	Not realize		
B	L O P ZU	113	90%	
	L O P N°05	61	90%	
	L O P N°09	70	60%	
	L O P N°07 P3	28	70%	
	L O P Mouilha	56	Unplanned neighborhood	
C	L O P N°10	100	Not realize	
	L O P N°11	36	Not realize	
TOTAL	17 Plans	1410		

Using the spatial analysis tools of geographic information systems, the urban expansion area was divided into three regions, according to the degree of danger. The first region (A) is called the safe area and is characterized by a very low degree of danger, the second region (B) is characterized by a lower degree of danger, while the third region (C) is characterized by a high degree of danger, because the land occupation plans are located on the flood area of the Bortum Valle (Figure 7).

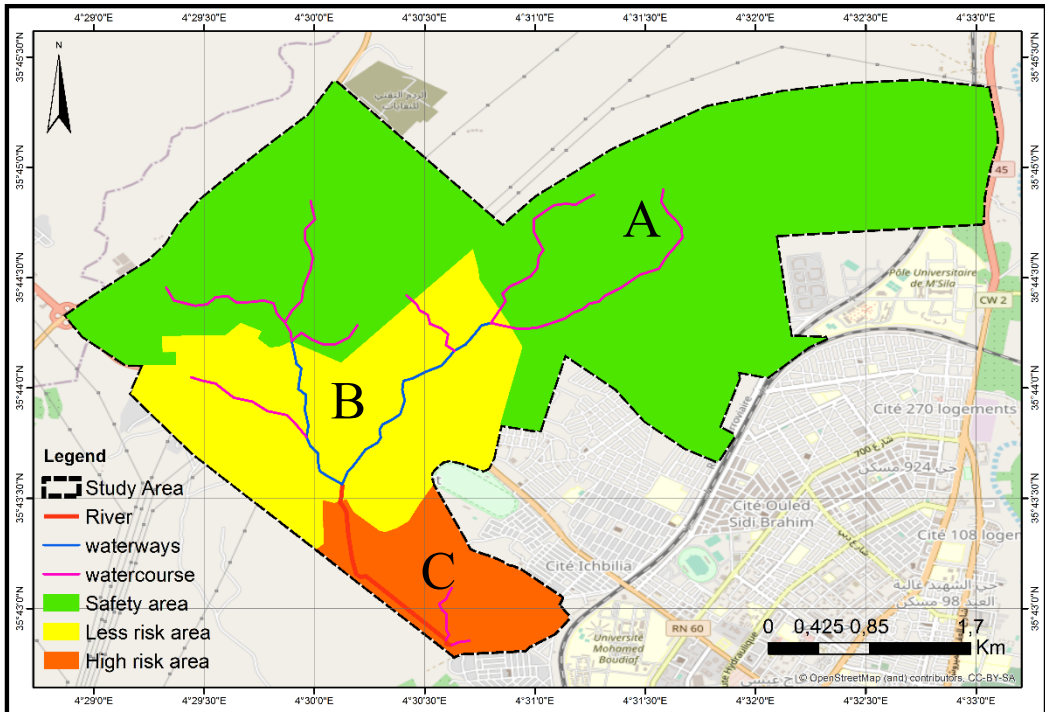


Figure 7. Land occupation plans for at risk of flooding
(Source: Treatment of the researchers by Arc Map 10.2.2, 2023)

DISCUSSIONS

Through the analytical study of the risks in the city, the risk of flooding was studied, specifically the urban expansion area, in which the climatic, topographical and urban data and data were analyzed, depending on the geographical information systems SIG, and the dangerous areas were identified within the built area and the land occupancy plans were classified according to the degree of severity.

Great dangers are a challenge for man because they threaten his life and his environment, the flood risk is also one of the most devastating natural hazards that cause loss of lives (Makhlouf Adel, Djamel, & Yahyaoui, 2021). Urbanization tools are a means of organizing, planning and protecting the urban space (Law 90/29, 1990). The risk of floods can be prevented and reduced by including studies and technical solutions within the law. The presence of multiple valleys and watercourses in the expansion area of the city, as shown in the hydrographic network plans. The city of M'sila witnessed significant population growth, which affected the urban needs of the citizen. City expansions (land occupancy plan) did not take into account the area's topography and geophysical characteristics. Collective housing was the most vulnerable to flooding due to the existence of a sanitary void. Neglecting the study of major risks in the preparation of development and reconstruction projects.

CONCLUSION

Despite the fact that the city of M'sila is characterized by a topography with a very low slopes, it is often exposed to the danger of flooding, especially on the urban expansion area, as happened in the years 2007 and 2015, leaving great damage represented in significant material and human losses estimated at 2 billion dinars, according to the report of the directorate of protection civilian state of M'sila, Therefore, in order to preserve property and lives for peoples , it is necessary to avoid establishing land occupation plans on the flooded lands of the valleys, or using technical methods to combat the risk of floods (water drainage system), therefore, we propose the following:

It is necessary to take into account the major risks during the preparation of the planning and reconstruction tools, especially the Master plan for planning and construction.

Classification of land occupancy plans and expansion areas during the preparation of the master plan for development and reconstruction according to the degree of danger and sensitivity, and to determine the type of studies required during the preparation of the land occupancy plan (executive study).

Creation of a national organization for technical control of floods, similar to the National Authority for Construction Control, so that construction cannot begin without approval from this authority.

Preparing terms book in order to included protection and prevention materials from major risks.

Coordination between the various interveners in the urban project and protection from major risks (local groups, civil protection, security authorities, state construction services, civil society, etc.)

It is necessary to organize forums and open days to raise awareness of the danger of floods for citizens and keep pace with developments in this field for researchers and technicians.

Inclusion of major dangers in educational programs.

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