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PARTICIPATORY MAPPING AND DELIMITATION OF FLOOD ZONES IN DOUALA, CAMEROON

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ABSTRACT

The spatialization of geographical phenomena is now based on geomatics methods and tools. This trend, which has become widespread in research circles, invites us, beyond the rendering of results, to question their relevance. Indeed, the results thus obtained are far from being realistic for reasons related to the quality of the analysis data but especially to the choice of the levels of observation. These weaknesses impose on African geographers in general and Cameroonians in particular, a paradigm shift. Instead of the work of a researcher/engineer-expert imposing a vertical vision of the territory, an approach that reverses the process could make it possible to reposition local populations in the production and spatialization of geographic information. No one better than the latter could understand and assess the constraints and vulnerabilities they face. Participatory mapping as a methodological journey integrates spoken language into a map, with the aim of giving substance to the voices of those who are poorly represented or not very visible, thereby facilitating dialogue and negotiations. Faced with what could be considered as drifts of the all-digital, is it relevant to entrust the pencil to the actors who practice the territories subjected to the phenomena subject to geographical representation? This study focuses on the development of a methodological framework for participatory mapping, based on the example of the risk of flooding in a watershed of the city of Douala. The envisaged approach is made possible thanks to semi-structured interviews based on the model of cartographic discussion groups. It emerges from this experience that the methodological approach of participatory mapping is feasible, reliable, less restrictive and moreover reproductive in several territories.

Keywords: Participatory mapping, Methodological skills, Local people, Flood risk.

1. INTRODUCTION

Floods represent a significant proportion of so-called "natural" disasters, being responsible for nearly 40% of them each year, with a number of victims that can reach several tens of thousands (L. BESSON, 2005, p. 255). Since the 1980s, the frequency of floods has increased considerably in the city of Douala, despite a decrease in rainfall since 1971, which has fallen to around 723.8 mm (G. TCHIADEU and M. OLINGA, 2012, p. 727). The geographical configuration of this city plays a crucial role in determining the measures needed to mitigate these risks. However, this delimitation has long been entrusted exclusively to "experts", whose results have often proven to be poorly adapted to the reality on the ground, thus suggesting the need for new paradigms to delimit geographical phenomena. Indeed, a growing awareness among international communities, specialists and disciplines has highlighted the limits of purely technical approaches. Nowadays, the participatory mapping approach seems to offer a more nuanced and culturally integrated perspective of phenomena, revealing aspects absent from conventional maps, often focused on rigid scientific visions. This article therefore proposes an

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innovative methodological approach of participatory mapping to assess flood risk in a peripheral district of Douala (see Figure 1).

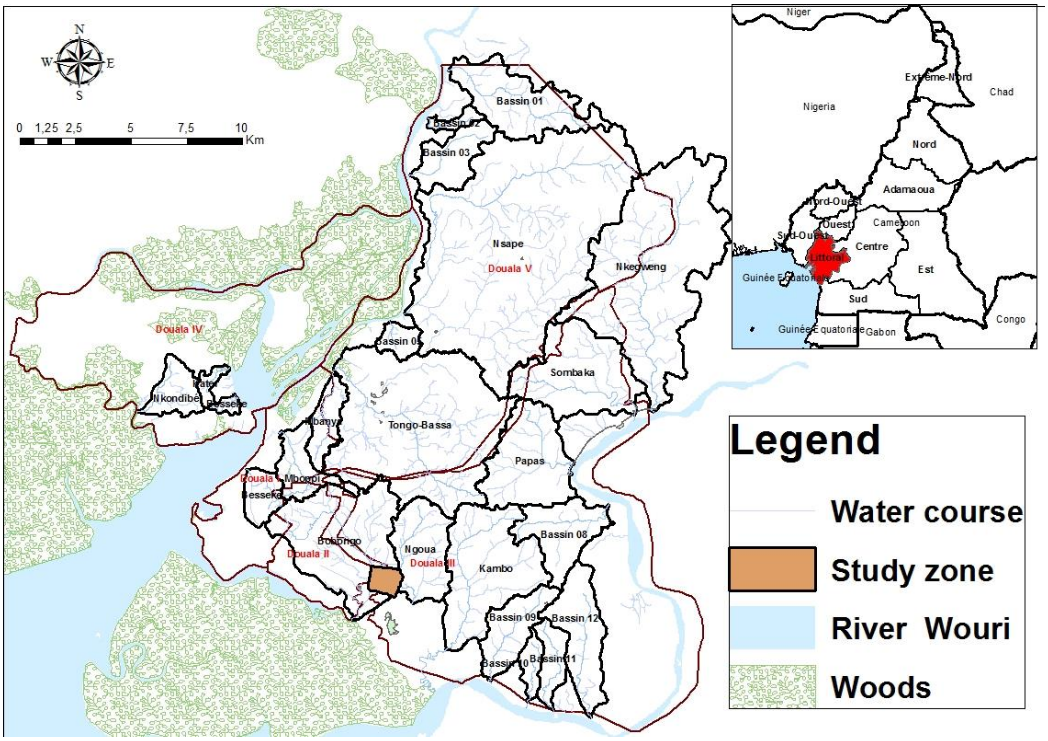

Figure 1: Location of the study area in the city of Douala. Source: Field survey conducted by S. Betto, National Institute of Cartography (INC), 2022.

The study site is characterized by the presence of lowlands, where the steep-sided areas, such as those located around the Lebanese Bridge, the Block 4 Bridge, and the Cité Berge Block 7, are invaded by spontaneous and precarious habitats. These areas are particularly vulnerable to flooding caused by flash floods, the overflowing of the main river ("Dinde"), as well as by the influence of the rising waters of the Wouri estuary. This district, not very suitable for increased urbanization (classified as non aedificandi according to the Urban Development Plan), is also affected by the presence of mangroves in its western part and the airport zone in its southern part, which further complicates land management and planning.

2. METHODOLOGY

Participatory mapping is based on an active and collaborative approach to research, aimed at directly involving local communities in the representation of the phenomena they face. By using tools such as participatory maps, this method allows populations to describe and visualize their own perception of the problems they face. To ensure the relevance and accuracy of the results, this approach requires the integration of several complementary datasets.

2.1 Data mobilized

The data mobilized in this study are varied and include several types of information:

2.1.1 Cartographic data

The cartographic data mainly include an aerial image from the Google Earth database of the study site (see Figure 2). This aerial image serves as a basis for the cartographic work. The use of Google Earth as a base map in participatory mapping is particularly relevant because it facilitates the engagement of local communities. By providing a detailed and familiar view of their surroundings, this technique helps residents become familiar with mapping tools and build confidence in the mapping process.

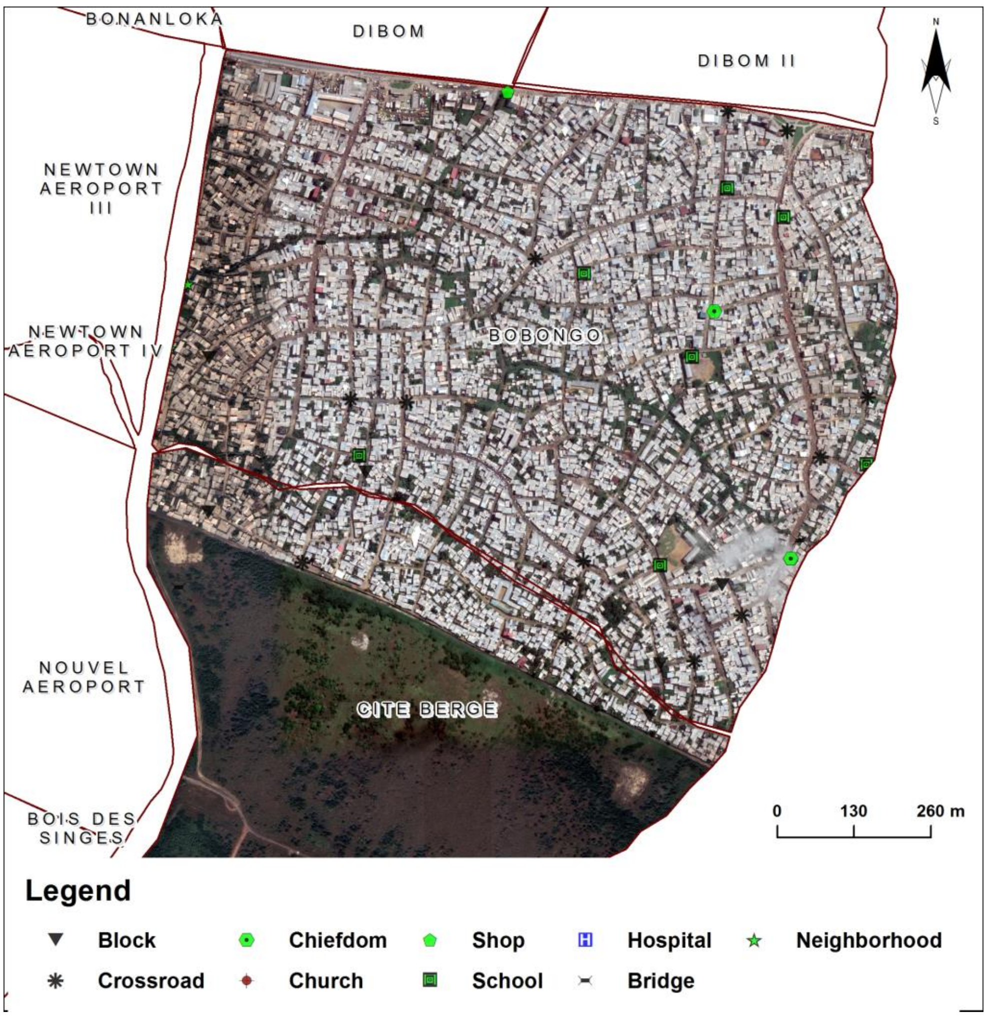

Figure 2: Background of the participatory map. Source: Google Earth ©2021, produced by S. BETTO (2022).

The methodology adopted in this study is based on a participatory mapping approach, aimed at actively integrating local populations into the representation of the phenomena they experience.

This approach is based on the use of various types of data to ensure an in-depth and contextual understanding of flood risk.

2.2. The data used

The data integrated into this study are divided into several essential categories:

2.2.1. Alphanumeric data

These data include official information relating to the planning and urban development of the city of Douala, as well as direct observations made in the field. They include spatial reference elements and data on local cartographers involved in the study. The semi-structured interviews conducted allowed us to collect valuable information on the boundaries of flood risk areas, the causes of these floods, and the endogenous solutions proposed by the communities to combat this phenomenon. In addition, the study used various drawing tools such as colored markers, cameras, and GPS, which are essential for data collection and accuracy.

2.2.2. Acquisition of the Google Earth basemap

The basemap used for participatory mapping was acquired via Google Earth ©2021 software, provided by the QuickBird satellite. This satellite image has a spectral resolution of 50 cm on three bands (RGB) and consists of 114 images covering an area of 600 m x 400 m each. Each image comprises 4,958,677 pixels, with a pixel-level resolution of 0.22 m x 0.22 m. The images were mosaicked using the ArcGIS 10.5 geographic information system (GIS) to create a coherent and usable set for this study. The spatial landmarks were identified and located using the XY coordinates provided by the Garmin GPS.

2.2.3. Data Acquisition in Focus Group Mapping Workshop

Data collection was carried out through focus group mapping workshops, organized in several stages:

Stage 1: Participant Selection

This phase consists of identifying members of local communities who will participate in the participatory mapping exercise. Selection criteria include age (30 years and above), length of residence (more than 10 years in the risk area), and personal experience of flooding. These criteria aim to ensure that participants have a thorough and relevant knowledge of flood risks. The spatial grid technique, with units of 200 x 200 meters in the GIS (ArcGIS 10.5), was used to determine the number of participants required, namely 15 people. Although spatial gridding presents challenges, particularly in terms of locating tiles on the ground, it provided convincing results in this study.

Step 2: Organizing the Focus Group Workshop

This step involves detailed planning of the workshop, including setting the date, duration, and location of the meeting. A weekend is preferred to allow for optimal participation, while the duration is adjusted based on the participants' ability to assimilate the mapping techniques. A public space is recommended for holding the workshop. It is also crucial to prepare the necessary materials, manage invitations, and budget for operating and refreshment costs. Step 3: Training and awareness-raising of participants

This preparatory meeting, involving the selected local populations, the researcher, and the neighborhood or block chief, focuses on several aspects:

• Presentation and definition of participatory mapping
• Introduction to participatory mapping tools
• Clarification of the objectives and requirements of participatory mapping
• Discussion on the purpose of the exercise

The objective of this training is to provide participants with a general understanding of the concepts of participatory mapping, to emphasize its importance and to familiarize them with the methodology required to develop a participatory flood risk map. The risk exposure criteria are classified into three categories, detailed in Table 1 below.

Table 1: Summary of exposure indicators according to local populations

Degree of exposure	Descriptions
Weak	- Territories less affected during periods of flooding, - Water levels less than 20 centimetres, - Territories passable in the event of flooding.
Medium	- Water heights greater than 20 centimetres and not exceeding 50 centimetres. - Territories practicable for adults, impassable for old people and children. - Economic activities partially interrupted
High	- Water levels reached in residential areas above 50 centimetres and peaks of 1.80 metres during the reference floods of the years 2000, 2015 and 2020 - Territories totally affected and impassable during periods of flooding - Economic activities completely interrupted

The exposure level indicators are the result of a household survey by questionnaire of 569 households in 21 districts of the Bobongo watershed. The aim was to ask the populations their level of exposure to the risk of flooding and to justify the response. The analysis of the data obtained resulted in three categories of exposure and the summary of the indicators in the table below. However, it should be remembered that these indicators are far from exhaustive. This stage comes up against the main difficulty which is the ability of local cartographers to assimilate the lessons received on participatory mapping techniques on the one hand and their practical application during the data collection stage on the other hand. Since mapping is a specialized process that is difficult to assimilate even for specialists, the success of the participatory mapping exercise requires better training of local populations. It is obvious that after this stage, data collection becomes easier.

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Step 4: The workshop data collection phase

This step consists of collecting data inherent to the areas at risk of flooding from local populations. These data collected in the discussion group workshop are summarized in Table 2 below:

Table 2: Data collected during the mapping discussion group workshop

Data collected	Indicators	Format
The boundary of the flood zones in the study site	- Low (green color) - Medium (blue color) - High (red color)	Polygon
Landmarks	- Crossroads - Bridge - Schools - Church - Trade, etc.	Point
Endogenous causes of flood risk	- Natural (rain, relief, nature of the soil, etc.) - Anthropogenic (anarchic occupation, lack of gullies, drains, etc.)	Descriptive
Endogenous solutions to deal with floods	- Intrinsic (exposed local populations) - Institutional (the State, the City Hall, the District Hall)	Descriptive

To do this, the first task was the ability of local cartographers to find their way on the A0 Google Earth map background (Photo 1). Using the red, blue and green markers used for high, medium and low exposures respectively, the risk areas were materialized on the map background by local cartographers. Trust, discussions, questions, extreme caution, discoveries, attention are attitudes observed among populations during this sequence. With this in mind, B. MISZTAL, (2016) writes "trust makes life predictable, it creates a sense of community and it facilitates cooperation between people".

Photo 1: Participatory mapping workshop

According to the cartographers, it is crucial to assign precise degrees of exposure to sites in order to prevent any form of reprisals from the residents of the neighborhood. These reprisals are all the more likely since, since 2010, the administrative authorities of the city of Douala have carried out forced and immediate eviction operations of risk areas, in particular informal settlements located near drains and low-lying areas. To date, these measures have led to the displacement of some 17,800 households spread over 23 neighborhoods (L. BRUCKMANN et al., 2019). During this session, it was noted that the population showed a strong interest in actively participating in flood risk reduction.

Step 5: Restitution and analysis of the first manual draft

After completion of the first draft in the workshop (Photo 2), the first analyses provide information on the information present on the draft and absent on the initial Google Earth map background. These are green polygons representing low exposure areas, blue polygons representing medium exposure areas, and red polygons representing high exposure areas. Next to these polygons of different colors, landmarks (crossroads, localities, etc.) are identified by the populations. These tracings were digitized and categorized in a GIS and the results of such an exercise are conclusive and provide clear information on the flood zones in the study site.

Photo 2: Presentation of the first manual draft

Step 6: Processing and analysis of the participatory map produced

The processing of the participatory map data took place in several phases. The first consisted of scanning the Google Earth A0 map into an A4 JPG image file. The second phase consisted of importing these A4 JPG images into a GIS (ArcGIS 10.5). The third phase was devoted to the calibration of the image files imported into the GIS with the pre-existing georeferenced ones in the database. The fourth phase was reserved for the digitization of the polygons drawn as flood risk areas by local populations and then its digitization and categorization in the GIS. The fifth phase was devoted to the validation and export of the areas of interest for this study (Figure 3).

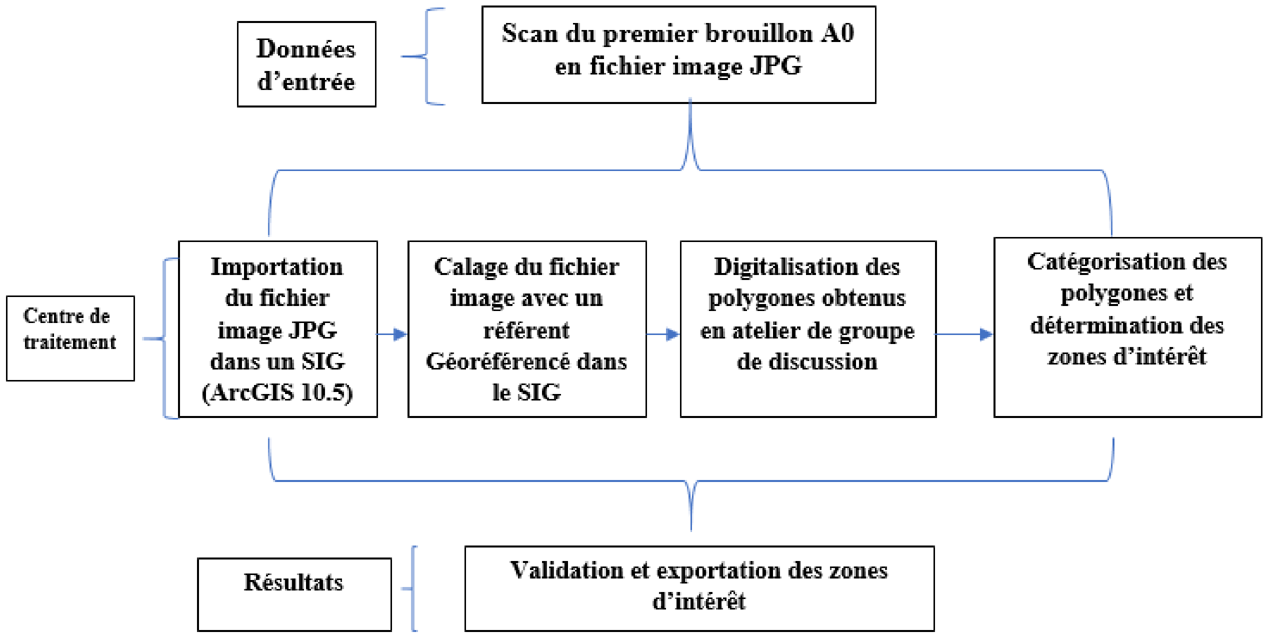

Figure 3: Methodological summary of participatory map processing.

The main results obtained after processing the plots obtained during the cartographic discussion group are raster layers whose dimensions are variable; and the interpretation is essentially based on the observation, analysis and interpretation of the layers produced during the digitalization phase.

3. RESULTS

3.1 The participatory map of local populations at risk of flooding in the study site

The following map (figure 4) shows the areas identified as being at risk of flooding by the populations. The polygons of different colors provide information on the degrees of exposure of residential areas to the flood threat.

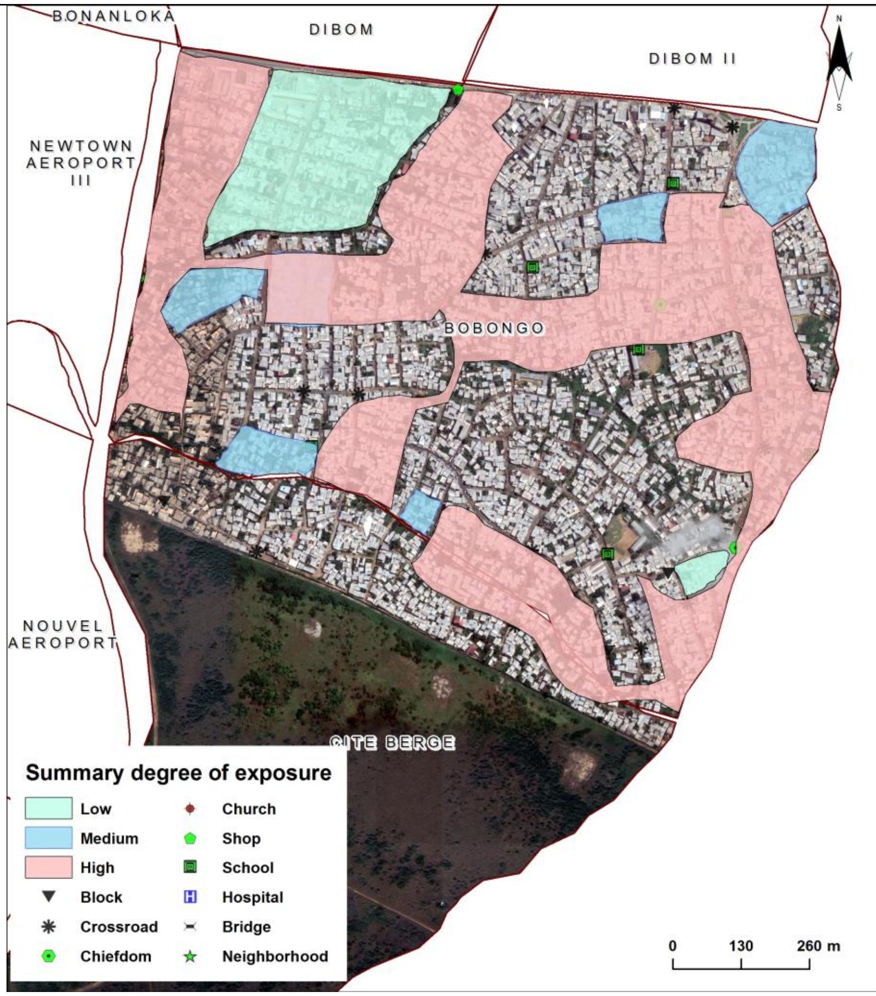

Figure 4: Overlay map of the degrees of exposure to flooding in the site. Source: Google Earth ©2021, field survey, produced by S. BETTO (2022).

The observation of the raster layers produced makes it possible to draw up a summary table (Table 3) of the flooded areas according to the degrees of exposure to the risk of flooding in the study site.

Table 3: Summary of exposed areas according to the degree of exposure

Total Household of Study Area	Low Exposure Household	Medium Exposure Household	High Exposure Household	Total households exposed
5569	288	282	1926	2496

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The study site has a total of 5,569 households. There are 288 households or 5.17% of the total sample with low exposure to flood risk in the study site. Similarly, 282 households or 5.06% of the sample are exposed to an average risk. 1,926 households or 34.58% of the sample have a high exposure to flood risk in the study site. It appears that 44.81% of households or 2,496 households are exposed to the risk of flooding in the study site. Based on official data provided by the National Institute of Statistics in 2021, the population growth rate in the main cities of Cameroon (Yaoundé and Douala) is 15% and the size of households in its various cities is estimated at 5.3 people. Based on this logic, the study site would have an average of 29,516 people; and 13,229 people would be exposed to the risk of flooding.

Areas with a high degree of exposure are located along watercourses that are constantly influenced by the tides, as well as in areas with steep and marshy terrain where altitudes are less than 4 metres. These areas are particularly unfavourable to the rapid flow of rainwater and wastewater towards the drains. Indeed, they promote the persistent stagnation of runoff water. The soils there remain continually saturated with water, and this saturation, combined with the heavy rains typical of the months of July, August and September, creates exceptional and problematic conditions. Photos 3 and 4 below perfectly illustrate this phenomenon, highlighting the scale of the

Photo 3: Flooding after a flash rain at the place called social case block 3

Photo 4: Flooding after a flash rain at the place called Bobongo "petit paris"

Photos 1 and 2 highlight the floods in the so-called block 1 and block 3 with a high degree of exposure according to the populations

The delimitation made by the populations goes beyond that made in the PDU and that of the risk experts in the city of Douala (A. AMANEJIEU, 2015; G. TCHOUNGA, 2020). The areas with an average degree of exposure are observed in the shallow reliefs between 4 and 6 meters above sea level. As for the areas with a low degree of exposure, they are observed in the more or less elevated areas between 7 and 9 meters above sea level. However, these delimitation may vary depending on the extent of the floods, the exceptional nature of the rains. This delimitation is part of the duration, the experience (daily experience) of the risk phenomenon at the neighborhood scale.

The total surface area of the study site is 156 hectares. The results revealed that 47 hectares (30%) of the surface area are highly exposed to flooding, 9 hectares (6%) are moderately exposed and 12 hectares (8%) have a low degree of exposure. The total surface area exposed to flood risk in the Bobongo watershed, calculated from the flooded polygons, is 69 hectares (44%). The workshop concluded with a round table discussion on the causes, consequences and solutions to the flooding problem. The information that results from it is interesting and complementary in understanding the territories at risk of flooding in the study area. Table 4 below highlights the information from the round table.

The results of the study revealed that a total of 5,569 households face various levels of flood risk in the study site. Of these households, 288 (5.17%) are classified as having low exposure to flood risk, 282 (5.06%) have moderate exposure, and 1,926 (34.58%) are highly exposed. In sum, 2,496 households, representing 44.81% of the total, are located in flood risk areas.

According to official data provided by the National Institute of Statistics in 2021, the population growth rate in Cameroon's main cities, including Yaoundé and Douala, is estimated at 15%. With an average household size of 5.3 people, the estimated total population of the study site is approximately 29,516 people. Of this population, approximately 13,229 individuals are exposed to flood risk.

Causes, consequences and measures to reduce flooding

The causes, consequences and solutions to the flooding problem were also discussed and the results are presented in Table 4. The information is important and complementary to understand the flood risk areas in the study area.

Table 4: Summary of causes and solutions to flooding according to the local populations exposed

Causes	- Proximity to the main watercourse "Dinde" - The tidal phenomenon - Heavy rains - The lack of channels and drains - Obstruction of drains by developments, - Poor management of household waste - The rise of capillary action - The anarchism of the population - State laxity - The steep-sided terrain does not facilitate the flow of water, the channels are non-existent, the populations do practically nothing to remedy the problem.

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Solutions	- Drain construction - Cleaning existing drains - The establishment of a vigilance committee for irresponsible residents - Sanctions for people who build on drains - Awareness-raising, communication on the risk of flooding and measures and practices to be adapted before, during and after a flood.

The study highlighted the complexity of the causes of flooding, revealing that they result from a combination of multiple and interdependent factors. According to the participants, flooding occurs mainly during the rainy season. Among the physical factors identified are the proximity of the "Dinde" River, whose regular overflows lead to flooding, as well as the phenomenon of tides, intense rainfall and a high level of the water table, which quickly becomes saturated after rain events.

In addition, human-induced causes have been identified as major catalysts of flooding in the region. These causes include inadequate drainage infrastructure, with channels and drains often missing or blocked, as well as the obstruction of drains by unregulated construction. Careless disposal of waste in waterways and storm drains, thus blocking the free flow of runoff water, also contributes to the worsening of the flood phenomenon.

The consequences of flooding identified include: destruction of buildings, prevalence of water-borne diseases, damage to household property, increased crop growth, pollution of well water and destruction of roads.

Faced with these proposals, the populations have not remained indifferent. They are developing interesting adaptation strategies (cleaning drains, embankments, etc.) which are however not very effective in strengthening resilience to risk phenomena. Local public policies for flood management are developing several approaches to combat flooding in the city of Douala. The ad hoc approach based on the management of hazards, spontaneous, curative and reactionary a posteriori of the occurrence of floods (cleaning of primary watercourses, rehabilitation of gutters, eviction of rights-of-way occupied by dwellings). The planned approach based on the issues exposed (roads, drainage, drinking water, public lighting, collection of household waste, schools, health centers, sports and cultural facilities, etc.). These efforts have not, however, reduced exposure to the phenomenon of flood risk in the city. The approach developed does not always take into account exposure and sensitivity to flood risk in these precarious neighborhoods, which complicates the effectiveness of the actions carried out (D. TOUKEA and J. M. OLINGA, 2017). Far from being exhaustive, the approach of this study provides some answers to the ineffectiveness of the actions taken to combat it. Firstly, the participatory approach takes into account exposure to flood risk. Secondly, the approach is based on understanding the phenomenon under one of the dimensions of social vulnerability via the perception and representation of local populations necessary for more efficient risk management.

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3.2 Comparison of flooded areas from the participatory map to those from the PDU of the study area

The superposition of flooded areas from local populations with those from the PDU (figure 5) provides information which reinforces the positions of researchers according to which there is a gap between the representation of risk by local populations and the official representation defined by public institutions (N. VERLYNDE, 2018; E. BECK, 2001; B. FISCHHOFF et al., 1978).

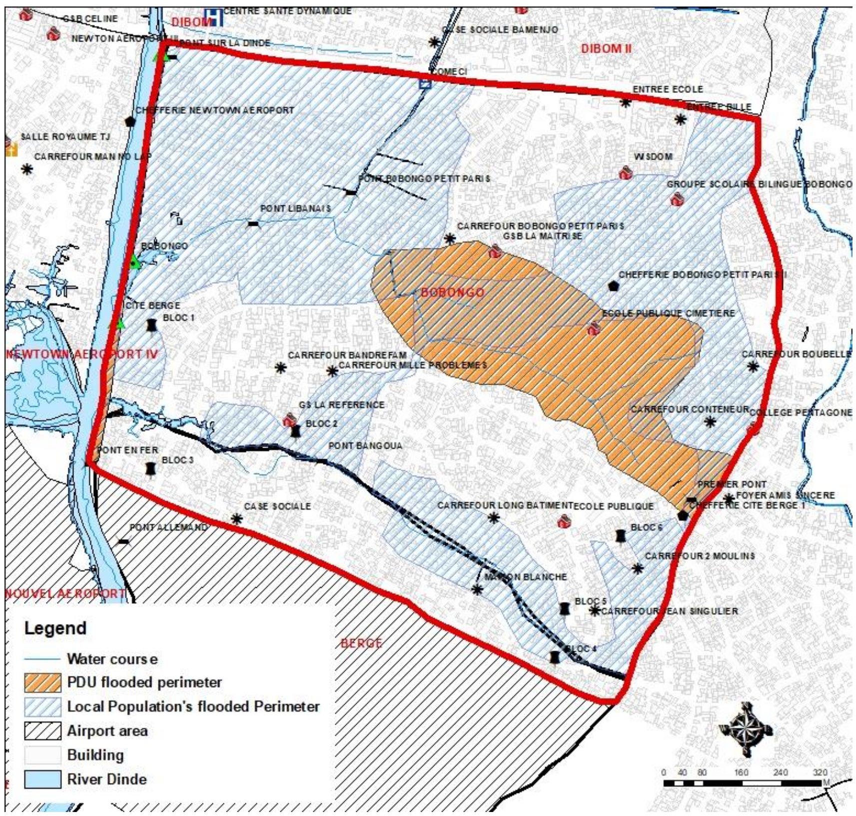

Figure 5: Superposition of the flooded area of the local populations to that of the PDU. Source: INC, field survey, produced by S. BETTO (2022).

The first important observation is that the populations estimate the flooded area at 68 hectares, while the PDU estimates it at 17 hectares. A difference of 51 hectares, which is largely significant and could contribute to the failure of a flood control project. Secondly, the areas identified as at risk by the populations more or less do not coincide with those of the PDU. However, it is important to qualify these remarks because the scale of observation and restitution of the two maps are different. There is a need to really take into account the local populations because their vision and knowledge could contribute to better managing the phenomenon. It is still important to see this involvement of the populations as a contribution, a vision that complements the approaches developed by the public authorities and experts on natural risks.

Participants' Observations and Reactions

During the workshop, participants demonstrated a keen interest and motivation to learn digital and remote mapping techniques. This enthusiasm translated into active involvement in all phases of the training. The fact that participants had experience collaborating with each other in various contexts fostered a high level of interaction and cooperation throughout the workshop. During the field data collection sessions in the pilot communities, the group also established links with the disaster management committees of each community as well as with some local households. The majority of the latter expressed interest in digital mapping activities, seeing it as a promising way to provide innovative solutions for their environment.

Participants were fully engaged in both the classroom and field activities, and in-depth discussions took place on the potential and applications of digital mapping. Indeed, they expressed a clear preference for the participatory and collaborative processes offered by digital mapping, considering them superior to conventional vulnerability and capacity assessment (VCA) methods. The interactive and inclusive nature of these new approaches was particularly well received. At the end of the workshop, a collective reflection on the advantages and limitations of conventional approaches compared to digital mapping was conducted. Participants acknowledged that, while paper maps have some advantages, including their ease of creation, their resistance to technological failures and their suitability for groups less familiar with technological tools (e.g. older people), they also have major disadvantages. They highlighted that, in practice, it is often difficult to ensure broad and representative participation in traditional mapping processes. Often, only a small fraction of the community, mainly youth and women, take part in discussions, while other groups are marginalized. In addition, paper maps, although practical, wear out easily, are expensive to reproduce and do not allow for rapid updating of information. Their lack of spatial precision and standardization also constitutes an obstacle to their use and integration into other tools.

In contrast, participants praised the benefits of digital mapping, particularly its ability to be shared more widely, easily modified, and updated regularly. They highlighted that participatory digital maps could involve a wider range of community members, including traditionally marginalized groups, due to the transparency and accessibility of the process. However, some reservations were expressed about the widespread adoption of these new technologies. A key concern was the potential exclusion of older people, who are often rich in local knowledge but technologically disadvantaged. Participants also highlighted challenges related to the limited capacity of communities to independently manage these new processes, as well as problems with irregular access to electricity and internet in some areas. Other questions arose about ownership of map data, what types of information should be included in maps, and how these new mapping methods could be extended to address broader community issues beyond simply identifying flood risks. Participants' enthusiasm for digital and remote mapping, and their desire to continue these activities, was palpable throughout the discussions, as evidenced by some of their final statements.

"In the past, we were not very involved in these processes, but now we have the skills to collect data and create maps that we can share globally. Processing the information once collected takes a lot of time and effort, which, although sometimes difficult, is a rewarding experience.

Today, I am fully confident in my ability to train others. I am proficient in editing and updating digital maps. Our ambition is to map all communities and make this work accessible to the world." »

More significantly, the social mobilizers group has taken the initiative to schedule regular mapping sessions following the workshop. These sessions will be supported remotely by the Nepal Flood Resilience Program team, ensuring ongoing monitoring and coaching to reinforce the skills acquired.

4. DISCUSSIONS

This research was mainly aimed at illustrating the importance of participatory mapping for the delimitation of territories at risk of flooding. The results obtained reveal the complexity inherent in formalizing a specific methodology for this approach. Nevertheless, experiments conducted on a global scale (R. Chambers, 2006; N. Verlynde, 2018) have demonstrated the effectiveness and relevance of this method, particularly in contexts such as Douala, where no official methodology exists for mapping flood risk areas.

Until now, flood risk mapping in this region has mainly relied on hydrogeomorphological approaches, centered on topographic analysis (M. O. Zogning Moffo et al., 2013). Although this work has made important contributions, in a context marked by the absence of official mapping (L. Bruckmann et al., 2019), it has notable limitations. Indeed, the errors generated by the Digital Terrain Model are significant enough to make its use at a local scale unreliable (G. Schumann et al., 2008). Furthermore, this traditional approach omits non-physical parameters, such as social and anthropogenic factors, and suffers from approximate morphological analyses. It also encounters difficulties related to the scale of observation and data restitution.

In response to these challenges, the participatory approach offers an innovative alternative. It allows observation at a finer scale and is based on more accessible datasets, often provided directly by the affected local populations. The integration of local knowledge improves the accuracy of the data collected and strengthens the effectiveness of risk management strategies. This approach thus makes it possible to overcome the methodological constraints of previous methods and to adapt prevention and intervention measures to the specific realities of the communities concerned.

The results of this study also reveal a significant gap between the flooded areas perceived by local populations and those defined in the Urban Master Plan (PDU). Residents exposed to flooding tend to delineate much larger affected areas than those identified by the authorities. This divergence is consistent with the findings of R. D'Ercole and J. P. Rançon (1999), who show that people facing a threat often perceive much larger risk areas than those defined by experts and public institutions.

In addition, the participatory approach implemented in this study introduces a broader temporal framework, integrating collective memory to map flooded territories: residents remember the places where water appeared and the times when these events occurred. This approach contrasts with that of experts, who must map theoretical areas likely to be heavily affected, but which do not always reflect the reality of changing hydrological conditions and the complexity of aggravating factors.

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In short, participatory mapping proves to be a method that is both realistic and appropriate in a context marked by the lack of reliable data. It stands out for its suitability to the local scale and for the interest it arouses in various fields of study. Its application in several fields has demonstrated the enthusiasm and concrete results it generates. It should nevertheless be emphasized that the different approaches to participatory mapping should not be opposed, but rather seen as complementary, providing varied perspectives on the human and territorial issues to which populations are exposed.

The participatory mapping used in this study, despite some methodological limitations, constitutes an innovative and pragmatic approach in a context where traditional risk management tools are insufficient. The comparison between the participatory flood zone map and that of the Urban Master Plan (PDU) reveals a significant gap between the perceptions of local populations and the assessments of public authorities. Residents identified flooded areas of 68 hectares, significantly higher than the 17 hectares estimated by the public authorities, highlighting a clear underestimation of the risk by the latter.

Flood management, although proactive, remains limited and temporary when carried out by local communities. At the same time, the actions of the authorities, which mainly focus on drain cleaning and eviction operations, fail to resolve the problem in a sustainable manner. The adoption of policies based on erroneous zoning, whether underestimated or overestimated, contributes to the worsening of the situation, leading to the failure of public interventions. This study thus highlights the urgent need to reassess methodological approaches to spatializing risks. By combining data from participatory mapping with traditional methods, it is possible to improve the management of exposed territories.

Participatory flood risk mapping is proving to be a crucial contribution, particularly for developing countries that struggle to adopt official and reliable methodological approaches. Less demanding in terms of data and accessible to a wide range of communities, it can be adapted and reproduced in various geographical contexts. The results obtained, which faithfully reflect the reality on the ground, illustrate its potential as a complement to conventional risk mapping methods. Consequently, this approach constitutes a promising way to strengthen the effectiveness of public policies in risk management. By integrating precise information adapted to the real needs of territories at risk, it promotes more inclusive management where the voice of exposed populations is taken into account, thus contributing to better resilience to natural risks.

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