International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Assessment of the Vulnerability of Populations Bordering the Tilé Watercourse to Flooding in the Urban Commune of N'Zérékoré - Republic of Guinea

LAMAH Simon Pierre[1], BAH Amadou Lamarana[2], MATHOS Kalil Pierre[3]

[1] University of N'Zérékoré, Hydrology Department, Monts Nimba Scientific Station (SSMN) Lola, BP 50, Republic of Guinea
Corresponding Author Email: *simonpierrelamah[at]gmail.com*

[2]Abdel Nasser University of Conakry, Physics Department, Applied Energy Teaching and Research Laboratory, BP 1147, Republic of Guinea

[3]University of N'Zérékoré, Physics Department, BP 50, Republic of Guinea

Abstract: ***This study aims to assess the vulnerability to flooding of the population living along the Tilé river. A survey sheet for semi - directed and observational interviews with targets and actors is used. Excel software and Flood Vulnerability Index (FVI) formulas allowed us to process our data and arrive at the following results: 209 households were surveyed, 30% of which were considered fair and 70% poor, while 29 % of households recorded physical disabilities.189 people out of 209 (90%) prefer to take refuge with close relatives and neighbors; 4% have shelters both at the military camp and schools, 3% in schools and hospitals and finally 3% in the military camp and hospitals.66% have no means of defense against floods while 34% of households have protective walls.56% believe that the floods come from high rainfall and an anarchic occupation of flood plains; 28% believe that flooding is due to blocked gutters and agricultural activities; 14% to the obstruction of gutters and illegal constructions in flood plains and 2% to the obsolescence of the gutters.***

Keywords: Assessment, vulnerability, flooding, local populations, rivers

1. Introduction

The world's human population is vulnerable to natural disasters, which are increasing due to the consequences of socio - economic developments, land use and climate change. In recent years, the increase in the number of people affected by the adverse effects of flooding constitutes one of the most common and widespread natural hazards to life and property worldwide [1 - 3].

Since 2007, the world has experienced very heavy rainfall causing serious flooding in almost all countries [4, 5]. In West Africa, they have become more and more intense in recent years and the great spatio - temporal variability of precipitation is at the origin of the occurrence of two water risks linked to shortage (drought) and excess water (flooding) [6 - 8]. Current forecasts show that sub - Saharan Africa will be part of the areas most affected by climate change, along with small island states, coastal and deltaic regions [9, 10]. These annual floods reflect the explosive growth of cities, poverty and the inadequacy of urban planning policies. More specifically, human activities are responsible for the worsening of flooding due to urban sprawl in risk areas (*major river beds, low pressure areas, routes serving as natural outlets for water, etc.).*

The frequency of flooding and the reduction of river flows are particularly the subject of particular attention [11, 12]. Furthermore, other studies mainly focus on the analysis and management of event risk [13, 14]. However, the impact of disasters on societies cannot therefore be analyzed only in light of the simple vulnerability of populations, but must also be evaluated according to the capacities to respond to a crisis [15, 16]. This is how the concept of resilience comes into play. Along the same lines, [3] demonstrates a parametric approach in vulnerability assessment.

Today, we are trying as best we can to control this phenomenon and above all, we consider it more and more as a risk that must be evaluated and managed according to administrative, physical and environmental constraints [17 - 19].

In Guinea, floods represent more than three quarters of disasters according to the CRED EM - DAT database. The impact of these floods is, however, limited with annual losses estimated at less than 18 million US dollars [20]. Despite the strong potential of its hydrographic network, water storage and distribution capacities are very limited. The country faces the inadequacy and dilapidation of its sanitation and runoff drainage networks. The InfoRM index ranks Guinea in the regional average with an index of 4.8 (very high) comparable to Senegal (4.7) or Ivory Coast (4.9) but higher than Liberia (3, 6) [21]. According to the projected impacts of climate change on water resources, the frequency of flooding following an increase in the frequency of heavy precipitation will cause economic losses with the current occupation of the beds of the main rivers by populations [22].
In N'Zérékoré, floods seem to us to be the most recurring natural disaster in recent years because the city regularly suffers damage linked to this disaster and the capacities of municipal authorities to deal with natural disasters are very limited. In 2013, for example, floods affected 4, 260 people (1, 101 children under five years old, 1, 732 women including

104 pregnant) in the Macenta prefecture, and 921 people in Yomou [23].

In the urban commune of N'Zérékoré, floods quite frequently affect city dwellers living on the banks of the Tilé river bed. In 2017, nearly 215 households were forced to leave their homes, affecting the health of children and polluting wells and latrines [24]. Thus, the general objective of this work is to assess the vulnerability to flooding of the population living alongside the Tilé watercourse in the urban commune of N'Zérékoré.

2. Materials and Methods

2.1 Materials

Location of the study area

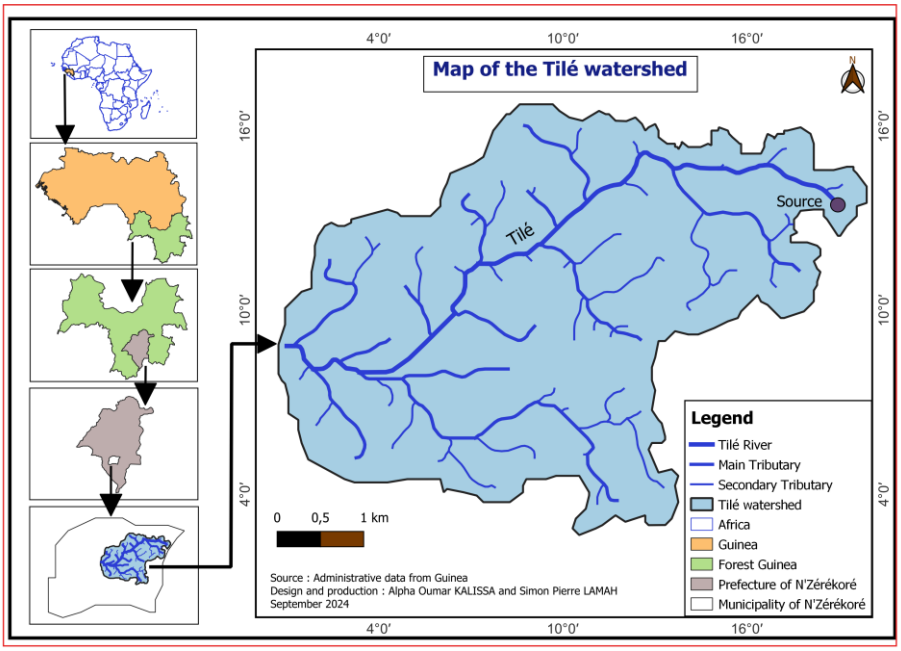

Figure 1: Map of the Tilé watershed

2.2 Data collection

To achieve our objectives, a survey based on a survey sheet was carried out with questionnaires, semi - directed interviews and observation aimed at victim communities, state services, institutions and private organizations.

2.3 Treatment methods

Using Excel software and Flood Vulnerability Index (FVI) formulas, we processed the various data collected in the field, the results of which are mentioned below.

3. Results and Discussion

Following the processing of the data collected, we present to you the results we have achieved.

3.1 Trend in vulnerability to flooding in the urban commune of N'Zérékoré

3.1.1 At the basin scale

A total of 58 indicators from literature data were taken into consideration for this geographic scale. However, only 26 indicators were used to calculate the vulnerability index.

These indicators used represent those applicable to the study area and the rest were excluded due to difficulties in adapting them to the study but also linked to the absence of reliable data as was also the case in the one conducted by [3]. Furthermore, the values of certain parameters, although retained, were defined by default as that of the storage capacity of the basin and average discharge of the river taking into account the similarity.

The values of the parameters thus retained were integrated into the FVI evaluation platform to finally arrive at the results indicated below.

Table 1: Basin - wide index

FVI	FVIs	FVI_{EC}	FVI_{EN}	FVI_{PH}	FVI
Basin scale	1.00	0.00	0.781	1.00	**1.00**

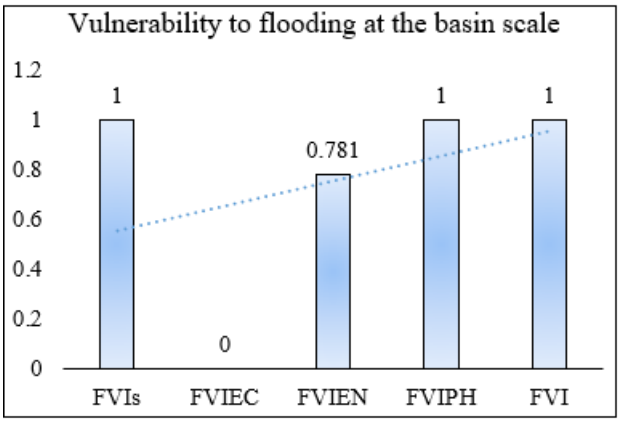

Figure 2: Vulnerability to flooding at the basin scale

This low resilience is explained by a high concentration of individuals in flood - prone areas, the absence of a warning

system and communication channels on flood risks, underestimation of the risk and an insufficiency of asphalt roads. On the other hand, economic vulnerability (FVIEC) is not significant (<0.01).

3.1.2 At the urban scale

Urbanization itself is one of the important factors leading to the flooding process. The loss of natural water retention zones linked to urban expansion towards flood - prone areas or other factors such as poor urban planning, absence or insufficiency of water irrigation canals, etc., lead to phenomena recurring floods which can endanger the lives and sources of livelihood of the urban population, especially when they are heavily populated. To determine the trend in vulnerability at the urban scale in the study area to flooding phenomena, 63 indicators were taken into account in the calculation of the FVI index and which led to the following results.

Table 2: Urban scale index

FVI	FVIs	FVI_{EC}	FVI_{EN}	FVI_{PH}	FVI
Urban scale	1.00	0.17	1.00	0.001	**0.306**

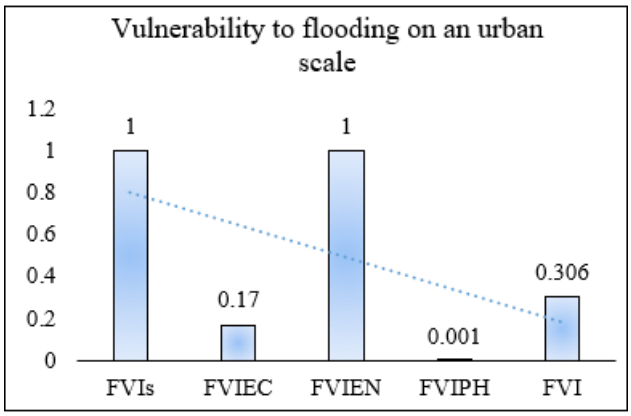

Figure 3: Vulnerability to flooding on an urban scale

3.1.3 Assessment of response capacity

The assessment of response capacity made it possible to identify the attitudes and means available to households in preventing and managing risk in their respective environments. Furthermore, it also made it possible to identify gaps requiring advocacy to mobilize adequate additional resources in the face of the threat. It was evaluated from several angles ranging from knowledge and perception of risk to the nature of the response measure at the household level. These factors influence household response measures.

Warning systems and information access routes

Under the influence of recurring floods, the respondents ended up acquiring personal experiences. For example, they declare (100%) that observation and individual experience save them from the worst. All those interviewed said they were not informed of the occurrence of floods (209/209). Lack of access to information in the context of natural disasters makes risk management and response capabilities almost impossible, such as risk reduction and the establishment of a culture of security and resilience., and strengthening intervention planning. It should be noted that sources of information such as the media sometimes relay information in a more curative than preventive context.

For better preparation for natural disasters such as floods, the presence and fluidity of communication is essential (*see figure 4).*

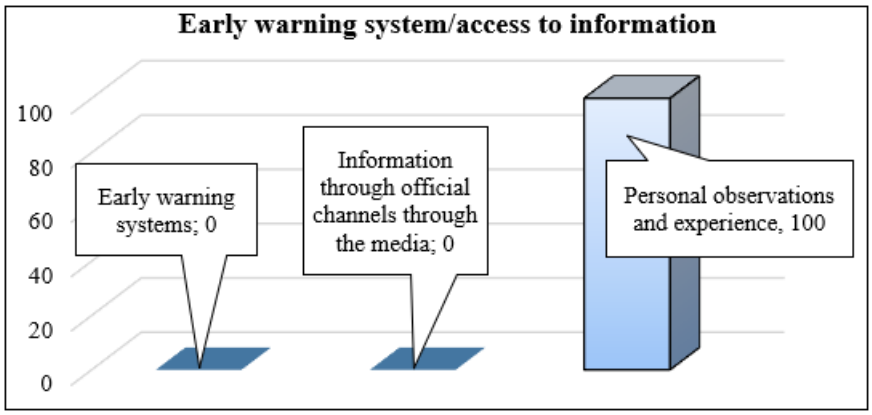

Figure 4: Early warning system/access to information

Knowledge and perceptions of flood risk among disaster victims

Our respondents, although all aware of the risk (100%), on the other hand have very fragile prevention measures reflecting their state of poverty. Faced with this challenge and in an effective risk reduction approach, their participation and integration into different risk management programs should be prioritized. These would help limit the impacts resulting from flooding processes and identify the real needs of the people affected (*see figure 5).*

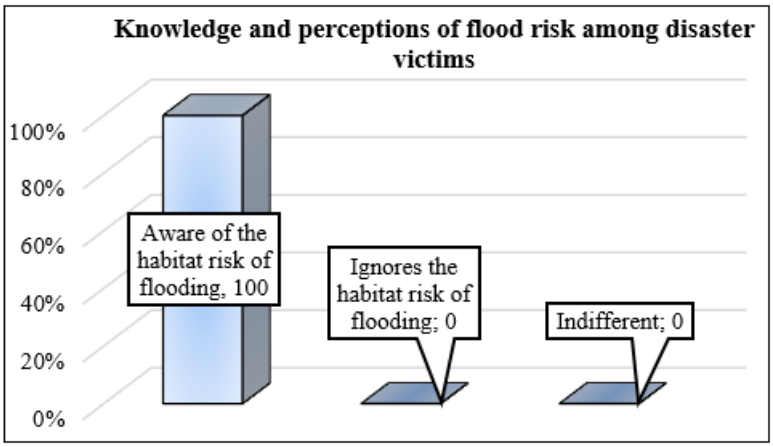

Figure 5: Knowledge and perceptions of flood risk among disaster victims

Knowledge of the source and risk

Our surveys confirm that floods occur either following high rainfall and anarchic occupation of floodplains (56%); Obstruction of gutters and agricultural/market gardening activities in flood plains (28%); Obstruction of gutters and illegal construction in flood plains (14%); and finally quite simply the obsolescence of the gutters (2%). However, the most amplifying factor remains linked to the anarchic occupation of urban space, particularly flood - prone areas to which most households are victims. Furthermore, the obsolescence of runoff drainage networks also poses enormous problems, as highlighted by 2% of our respondents (*see figure 6).*

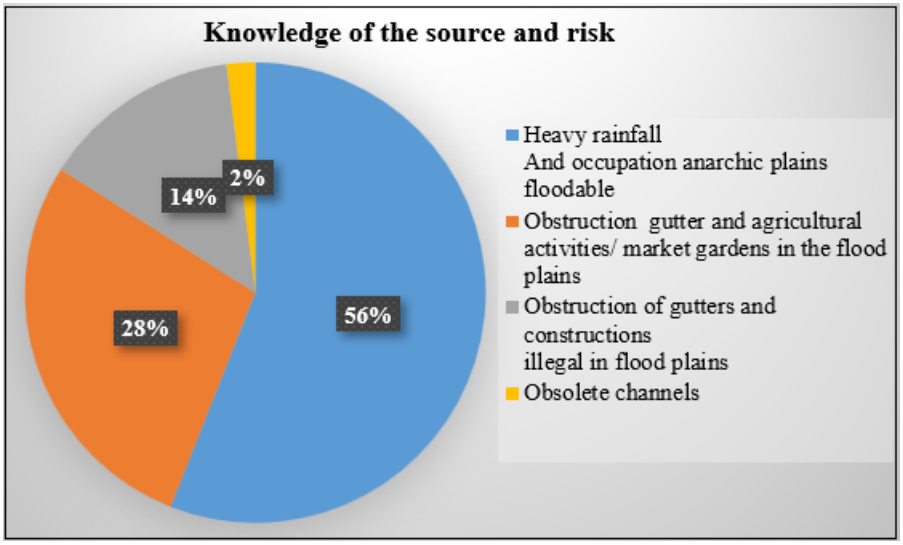

Figure 6: Knowledge of the source and risk

Defense mechanisms developed against flooding

Almost all of our respondents have not yet developed any means of defense against floods (66%) which affects them more or less and only 34% of households have low walls blocking the water from access the house are built. In some homes, the action of the water ended up dilapidating the houses and out of fear, some households ended up abandoning their homes. Alongside the construction of barrier walls, the opening of gutters and the reinforcement of the reinforced concrete base were noted (*see figure 7).*

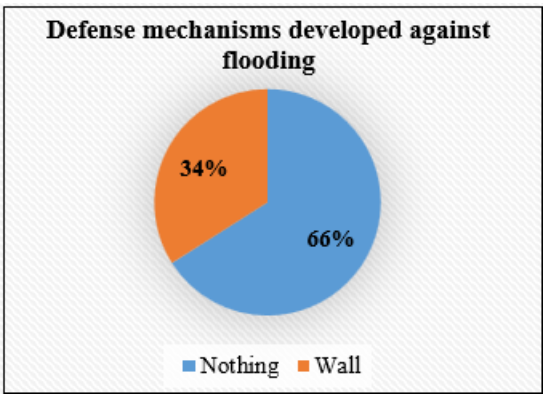

Figure 7: Defense mechanisms developed against flooding

Improvised emergency shelter

At the end of the surveys, 189 people out of 209 (90%) interviewed preferred to take refuge with close relatives and neighbors in the event of a disaster preventing them from

accessing their home. Others reported having shelters at both the military camp and schools (4%), schools and hospitals (3%) and finally the military camp and hospitals (3%); *see figure 8*.

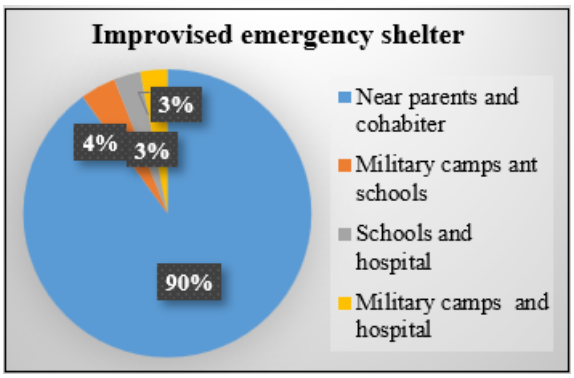

Figure 8: Improvised emergency shelter

Financial support

According to our surveys, only 40% of victims received any assistance while 60% declared having received assistance in their disaster. This assistance is most often financial and fully obtained (100%) from international institutions such as the Red Cross (CR), the European Union (EU), International Organization for Migration (IOM) and the World Food Program (PAM); *see figure 9*.

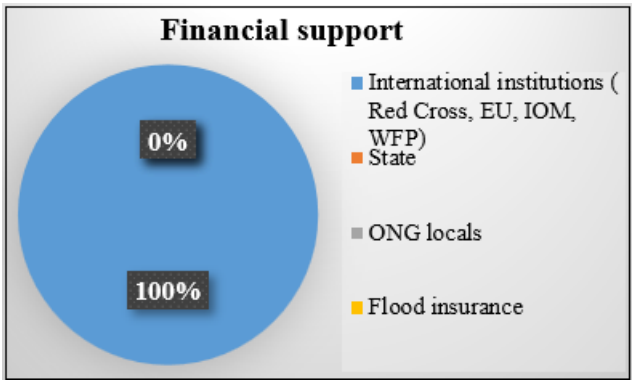

Figure 9: Sources of financial support

Nature of the response at the household levels

Out of 209 households visited, none had an adequate or reputable response measure. Only 30% were rated fair and 70% poor (*see figure 10).*

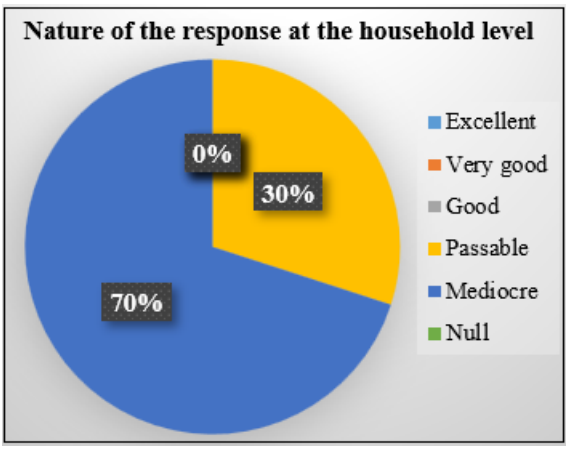

Figure 10: Nature of responses

3.2. New strategies for strengthening response capacities for community resilience to flood risks

Following the results of the household survey, it appears essential to define new mechanisms to reduce vulnerability to flooding both at the urban scale and at the basin level in the study area. These mechanisms, with the aim of strengthening the community's response capacity to flood risks, arise both from the results of the study, field observations but also from the review of the available literature deemed relevant to the context of the flood. 'study.

4. Conclusion

At the end of this work, we came to the following conclusion:

- 209 households were visited, 30% of which were considered fair and 70% poor;
- 29% of households surveyed have already experienced physical disabilities;
- 189 people out of 209 (90%) surveyed prefer to take refuge with close relatives and neighbors in the event of a disaster preventing them from accessing them at home;
- 4% reported having shelters in both the military camp and schools, 3% in schools and hospitals and finally 3% in the military camp and hospitals;
- 66% of our respondents have not yet developed any means of defense against floods which affects them more or less while 34% of households have built walls blocking water from accessing the house.
- 56% of surveys estimate that flooding comes from high rainfall and/or uncontrolled occupation of flood plains;
- 28% of respondents believe that flooding is due to the obstruction of gutters and agricultural/market gardening activities in flood plains;
- 14% to the obstruction of gutters and illegal constructions in flood plains and 2% to the obsolescence of gutters.

However, the most amplifying factor remains linked to the anarchic occupation of urban space in particular and flood - prone areas to which most households are victims.

References

[1] Balica S. F. (2007) Development and Application of Flood Vulnerability Indices for Various Spatial Scales. *MSc thesis for the partial fulfilment of requirements for the Master of Science degree at the UNESCO - IHE Institute for Water Education, Delft, the Netherlands.157p.*

[2] Balica S. F, Wright N. G. (2009) A network of knowledge on applying an indicator - based methodology for minimizing flood vulnerability. *HydrolProc 23.2983 - 2986. Page 14, 104*

[3] Balica S. F. (2012) Applying the Flood Vulnerability Index as a Knowledge base for flood risk assessment. *Master of Science in Hydraulic Engineering and River Basin Management UNESCO - IHE, Delft, the Netherlands.170p.*

[4] Boko M. et F. Afouda, Climat Agriculture et Ressources en eau d'hier à demain. XXVIème Colloque international Association Internationale de Climatologie.8 pages. En ligne.

[5] Mills, D. M. (2009) Climate Change, Extreme Weather Events, and US Health Impacts: What Can We Say? *Journal of Occupational & Environmental Medicine, 51, 26 - 32.* https: //doi. org/10.1097/jom.0b013e31817d32da

[6] Diarra D. (2010) Impact des changements climatiques en Afrique de l'Ouest. *Direction nationale de la météorologie, Bamako - Mali, 35 pages. En ligne.*

[7] Bechler - Carmaux N. Mietton M. and Lamotte M. (2000) Le risque d'inondation fluviale à Niamey (Niger). Aléa, vulnérabilité et cartographie Source: *Annales de Géographie, 109e Année, No.612 (mars - avril), pp.176 - 187*

[8] COLBEAU - JUSTIN, L., DE VANSSAY, B., WEISS, K., CHARHAOUI, K. (2002) Analyse de l'impact psychosociologique auprès des sinistrés des inondations de la Somme, Appui à la Mission interministérielle sur les crues de la Somme, *Ministère de l'Aménagement du Territoire et de l'Environnement, D4E, Paris.149 p.*

[9] DARA (2013) « Indice de Réduction des Risques (RRI) en Afrique de l'Ouest. Analyse des conditions et des capacités de réduction des risques de catastrophes. *Le Cap - Vert, la Gambie, le Ghana, la Guinée, le Niger et le Sénégal ».30pages*

[10] GEMENNE, F. (2011) « Climate - induced population displacements in a 4 C+ world », Philosophical Transactions of the Royal Society A: *Mathematical, Physical and Engineering Sciences 369 (1934), pp.182 - 195.*

[11] Mahat, S. B., Omar, R., Man, H. C., Idris, A. I. M., Kamal, S. M. M., Idris, A., et al. (2020) Influence of Substrate to Inoculum Ratio (S/I) on the Treatment Performance of Food Processing Wastewater Containing High Oil and Grease (O&G) in Batch Mode. *Desalination and Water Treatment, 203, 267 - 278.* https: //doi. org/10.5004/dwt.2020.26231

[12] Douglas, E. M., R. M. Vogel et C. N. Kroll. (2000) « Trends in floods and low flows in the United States: impact of spatial correlation », *Journal of Hydrology, vol.240, p.90 - 105.*

[13] Evans J. et S. Schreider. (2002) « Hydrological impacts of climate change on inflows to Perth Australia », *Climatic Change, vol.55, p.361 - 393.*

[14] AGO Expédit Evariste, PETIT François & OZER Pierre. (2001) Analyse des inondations en aval du barrage de Nangbeto sur le fleuve Mono (Togo et Bénin).15 pages.

[15] Leclerc, M., B. Morse, J. Francoeur, M. Heniche, P. Boudreau et Y. Secrétan. (2001) Analyse de risques d'inondations par embâcles de la rivière Montmorency et identification de solutions techniques innovatrices. *Rapport de la Phase I, 118 pages.*

[16] Ludvina C - J. Stratégies de faire face dans le cas d'une inondation catastrophique: Analyse des paramètres psychosociaux dans les procédures de gestion de crise. *Laboratoire de Psychologie Environnementale UMR 8069 Université René Descartes. Page 3.*

[17] Monirul, M., Q. Mirza, Q., R. A. Warrick et N. J. Ericksen. (2003) « The implications of climate change on floods on the Ganges, Brahmaputra and Meghna Rivers in Bangladesh », *Climatic Change, vol.57, p.287 - 318.*

[18] Saint - Laurent D. (2008) « Inondations en milieux urbains et périurbains », *Environnement Urbain / Urban Environnement [Online], Volume 2.*

[19] Tomethy D. Y. (2017). Exposition et vulnérabilité face aux risques d'inondation au Burkina Faso: Cas de la ville de Dori. *Mémoire de master de l'Université Libre de Bruxelles.89 pages.*

[20] Saint - Laurent, D. & Hähni, M. (2008) Crues et inondations majeures des villes de l'Estrie: variations climatiques et modifications anthropiques (Québec, Canada). *Environnement Urbain / Urban Environnement, 2, 50–72. https: //doi. org/10.7202/019221a.*

[21] InfoRM (Index for risk management). (2016) Capacités nationales en matière de réduction des risques et de gestion des catastrophes en Guinée.

[22] MEEF. (2018) Ministère de l'Environnement des Eaux et Forêts. Seconde communication nationale à la Convention Cadre Des Nations Unies sur les changements climatiques.1*62 pages, pages 68 – 79.*

[23] PPADD (2017) (Programme Prioritaire d'Appui au Développement Durable 2018 - 2020). *Région administrative de N'Zérékoré. Page 22 - 23.*

[24] BRAH (Bureau Régional de l'Action Humanitaire) (2017) Rapport d'évaluation des dégâts causés par l'inondation dans la nuit du 03 au 04 juillet 2017, *SENAH Bureau Régional N'Zérékoré Guinée.35p.*