Bima Journal of Science and Technology, Vol. 9(1B) Apr, 2025 ISSN: 2536-6041

DOI: 10.56892/bima.v9i1B.1263

Community-Engaged Architecture and Flooding Resilience for Lokoja, Nigeria

Allu-Kangkum E. L. A. and Umar S. D.

Department of Architecture, University of Jos, Jos - Nigeria

Corresponding Author: salihuumar8@gmail.com

ABSTRACT

The negative impact of climate change has disrupted our environment and the rapid growth of the urban built environment continues to increase the climate uncertainty and also increase the demand for resilience. In recent years there have been frequent flash floods and flooding in Nigeria and particularly in the built environment of Lokoja area of Kogi State, Nigeria. Therefore, buildings resilience and the local processes for architectural adaptation are necessary to avoid future catastrophic disasters. However, disaster prevention and resilience can only be effective when the human factor is considered and the processes for local resilience are harnessed for new architectural solutions based on community-engaged architecture. This literature review-based article is the first part of a two parts research with this being the theoretical discourse on the strategies for flooding resilience and adaptations in buildings. Whilst the second part would deal with identifying local strategies, proposed improved sustainable innovative strategies through community participation for the affected Lokoja communities. Literature suggests that, architecture is human centred, the built environment flooding resilience is attainable, community-engaged architecture and participatory processes are key to promoting acceptable sustainability in architectural practices.

Keywords: Flooding, community-engaged architecture, sustainable architecture.

INTRODUCTION

Flooding is one of the negative aspect of climate change which has brought with it challenges urban areas especially low laying riverine or coastal areas like Lokoja. Flooding in the tropics is caused by natural and or human activities which includes; Coastal flooding, Fluvial or River flooding, Groundwater flooding and pluvial or Surface water flooding (Brisibe, 2020; Mfon et al., 2022) . Floods are predicted to become more intense, more devastating and increasingly frequent in the coming years (Wolff, 2021; Rathnasiri, et al. 2024).The negative impact of climate change, in many regions of the world will continue to be experience with increased rainfall, extreme weather, increased severity in coastal and storms (Allu, 2014; Zhang et al. 2019; Vasseur et al. 2017). These warning, necessitate that, architectural buildings resilience and the local processes for adaptation need to be studied and advanced to avoid future catastrophic disasters. Thus the motivation for this theoretical article in preparation for the follow-up article which includes other methodologies involving mixed research methods.

LITERATURE

Literature suggests that, climate change is a major propelling agent to factors that intensify and elevate flooding risk, increased heavier rainfall, rise in sea level and erratic storm surges globally (Denchak 2023; Greenan et al. 2019). Also, Allu-Kangkum (2024) further suggested that, the built environment is the most vulnerable to the negative impacts of climate change globally, most especially in regards to flooding disasters which has severe cataclysmic natural events (Rathnasiri et al.,

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2024). Regardless of geographic location, the severity of floods have caused long term damages to the built environment which often include structural damages, social and economic systems of the affected communities (Faccini et al., 2021). Consequently, there are efforts to reduce this menace, in the last few years. There is a growing recognition and demand on the need to promote flood resilience of the built environment (Yereseme et al., 2022). Theoretical findings also suggest that, there are possible solutions in reducing flooding related risks and improve the resilience level.

Resilience is a crucial term for managing natural disasters to enable community to "bounce back" and return to a near normal from the pre-disturbance state (Mayena et al., 2011; Smith et al., 2010). This concept also refers to the recovery interactions between humans and the disturbed/risked environment (Zolli et al., 2012). This theoretical discourse broadly presents the architectural interventions and sustainable alignments required for flooding resilience. These include; flooding resilience knowledge, human centred architecture, the built environment flooding resilience possibilities, community-engaged architecture and participatory processes leading to promoting acceptable sustainable architectural practices.

Study Area

Studies have shown that, there are characterization to regional flooding (Parks and Kwon, 2024) and different region as have peculiarity and hence the choice for Lokoja in North Central Nigeria. Lokoja is the administrative Headquarters of Kogi State – Nigeria which has been experiencing seasonal flooding with devastating impact to its populace and the built environment. As shown in Figure 1, Lokoja is located at latitude 7°45′0″N to 7°53′30″N and longitude 6°43′0″E to 6°51′30″E, known also as the confluence city because it lies in an area where the two main Nigerian rivers - Rivers Niger and Benue meet. This attributes to making Lokoja and its environs vulnerable to flooding and Lokoja has been identified to belong to one of Nigeria's high risk flooding zone (Ologunorisa, 2004).

Park & Kwon (2024) have identified regional characterization as a new approach based on their study for community engaged flooding resilience solution. The regional characterizations identifies flooding communities and assess the impact of flooding in such communities and proffer solutions that are suitable to the community based findings derived from community based engagement studies. This discourse narrows its findings from three communities of Adankolo, Gadumo and Ganaja based on their location in the confluence area, the causes and the impact felt by the communities adopted by an earlier study conducted by Buba et al. (2021).

Deducing from Figure 1 the selected three urban communities in Lokoja are low lying within the confluence and plain of the two rivers as shown in the topography of the Lokoja basin and these allude to the vulnerability of Lokoja. Furthermore, Figure 2 captures the evidence of flooding disaster in the recent times in Lokoja, where residents, commuters and other economic activities were halted as a result of flooding.

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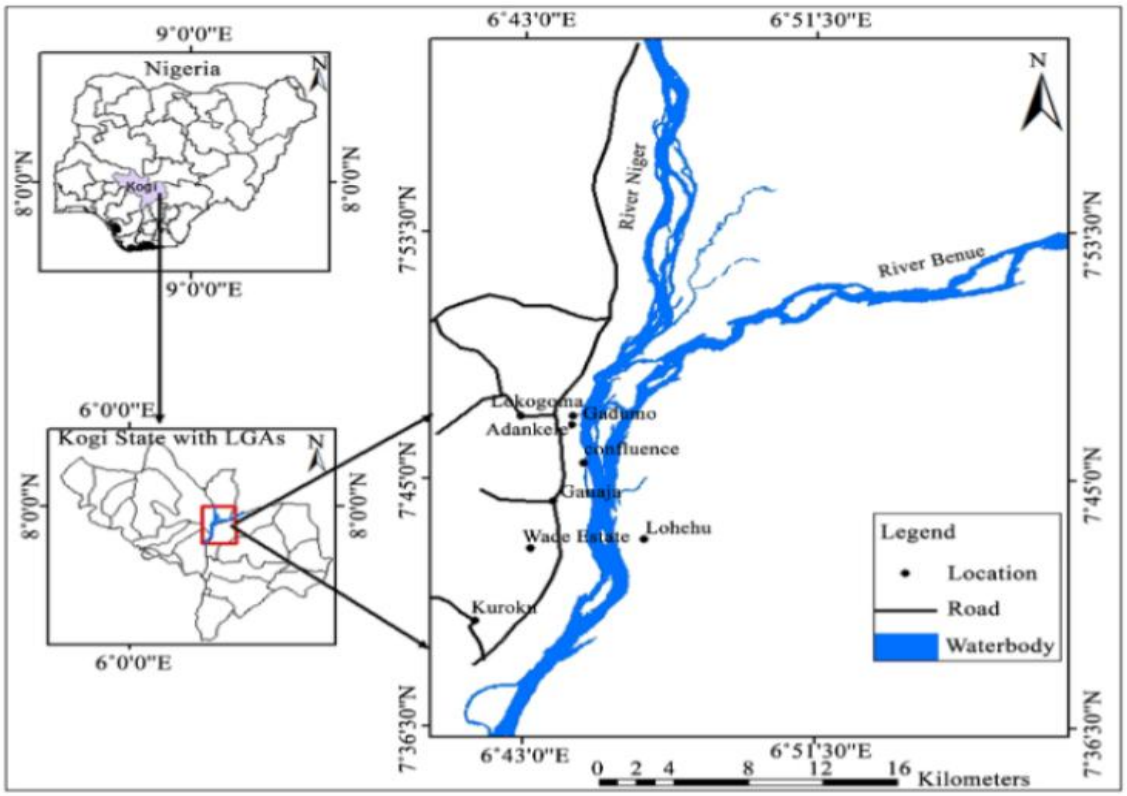

Figure 1: Map of Lokoja showing existing major water body.

Source: Adefisan & Egiku (2018).

Figure 2: Travelers, Residents Stranded As Flood Grounds Lokoja.

Source:https://leadership.ng/travellers-residents-stranded-as-flood-grounds-lokoja/(Accessed 04/11/2024).

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Table 1: Major Causes of Flooding in Lokoja.

	Adankolo		Gadumo		Ganaja	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
Heavy rainfall	15	24.2	34	44.7	33	42.9
Overflow of rivers	47	75.8	41	54.0	44	57.1
No response	0	0	1	1.3	0	0
Total	62	100	76	100	77	100

Source: Buba et al, 2021.

The result from an earlier conducted research by Buba et al. (2021) showed that, in all three communities the overflow from the rivers Benue and Niger recorded the highest percentages which ranges between 41% and about 76%. Heavy rainfall came second with a range between 15% and about 45% and this confirms the flooding vulnerability of Lokoja due to its geographical location and proximity to the two rivers.

Table 2: Impact of Flooding in Lokoja.

s/n		**Adankolo**	**Gadumo**	**Ganaja**
	Affected areas		**Figures (%)**	
1	Farmlands	47 (58)	52 (41.6)	60 (42.5)
2	Markets	12 (14.8)	31 (24.8)	42 (29.8)
3	Transport systems	21 (25.9)	41 (32.8)	33 (23.4)
4	Electricity supply	1 (1.3)	1 (0.8)	6 (4.3)
Total		**100**	**100**	**100**
	Built environment			
1	Collapse houses and shops	6 (75)	5 (50)	4 (80)
2	**0thers**	4 (25)	5 (50)	1 (20)
		100	**100**	**100**

Source: Adopted from Buba et al, 2021.

The consequences climate change and the resultant flooding are catastrophic and affect every sphere of human life which covers economic, environmental and social systems (Allu, 2014; Wang, 2021). These catastrophic events have been recorded in Lokoja in both Figure 1 and Table 2. Findings in Table 2 show that collapsed houses and shops were the worst affected with 75% and 80% in Adankolo and Ganaja communities respectfully, whilst 50% was recorded for Gadumo community which had its farmlands affects with the highest figure of 52%. In Adankolo 58% of farmlands were affected 42.5% was recorded for Ganaja. A close look at Table 2 clearly shows that, buildings had the most negative impact of flooding in the selected three communities of Lokoja. Therefore, the built environment resilience needs attention especially the interrelationship with flooding resilience.

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The Built Environment and Flooding Resilience

Flooding in the urban built environment areas is not just the result of heavy rainfall, overflow and extreme climatic events but also related to the changes in the built-up areas themselves (Douglas et al., 2008). The challenge with the built-up areas is that it is a multi-sector in nature because of the different professionals involved in its creation. According to Cumiskey et al. (2019) there must be a deliberate action by government to enhance, encourage capacity integration among sector-specific professionals, promote communities inclusiveness, and create understanding on the influence of sustainable practices for flooding resilience. Other areas towards improving flooding resilience include; retraining and knowledge support, resource allocation and related policy formulations (Bonfield, 2016; Brisibe, 2020; Lukas, 2021).

Subsequently, government intervention and guides for the built environment would be necessary and would work better when each of the professional group involved is able to study and develop sector-based flooding risk strategies. Architecture being the construction and built environment leading profession would be required to look inward for its strategies towards built environment resilience in curbing the menace of flooding. The initial emphasis would therefore be with particular focus to the architectural intervention relating to human-centred architecture.

Human-Centred Architecture for Flooding Resilience

Due to Climate change, the rising sea levels and urban flooding will continue to influence the design and shape of our cities for flood resilience. Yet, research exploration of resilience in architectural and urban design remains limited and where available not much depth has been covered (Ke, et al., 2023). An earlier study by Roaf (2009) has suggested flooding resilience in the urban built environment is achievable with architectural design. As a follow-up to Roaf's suggestion Mannucci et al. (2022) study asserts that, sustainable design strategies are key to flooding resilience in the urban built environment especially when the affected community input is given consideration in the design requirement. This means every flooding prone location must have all of its human data, geographic indices and scientific data properly synergized and aligned sustainably before resilience strategies are adopted, rather than employing 'one-strategy-one-fits- all' resilient architectural design adaptations.

Community-Engaged Architecture and Participatory Processes

Wheater and Gober (2015) opined that scientific innovations must acknowledge community education and strategic outputs must be derived from result from adapting an iterative and community inclusive approach to the resilient management for both proactive and responsive actions to extremes conditions like flooding. The study conducted by Karrasch et al. (2021) in Europe has suggested a 'Flood Resilience Rose' as a management tool for flood transformation as well illustrated in Figure 3. In this figure there are actionable interactions between all stakeholders – government, built environment professionals, other scientists and the flooding communities. However, geographical and climatic characterization would be required for contextual application to architectural design and retrofits for the tropics and specifically for Lokoja.

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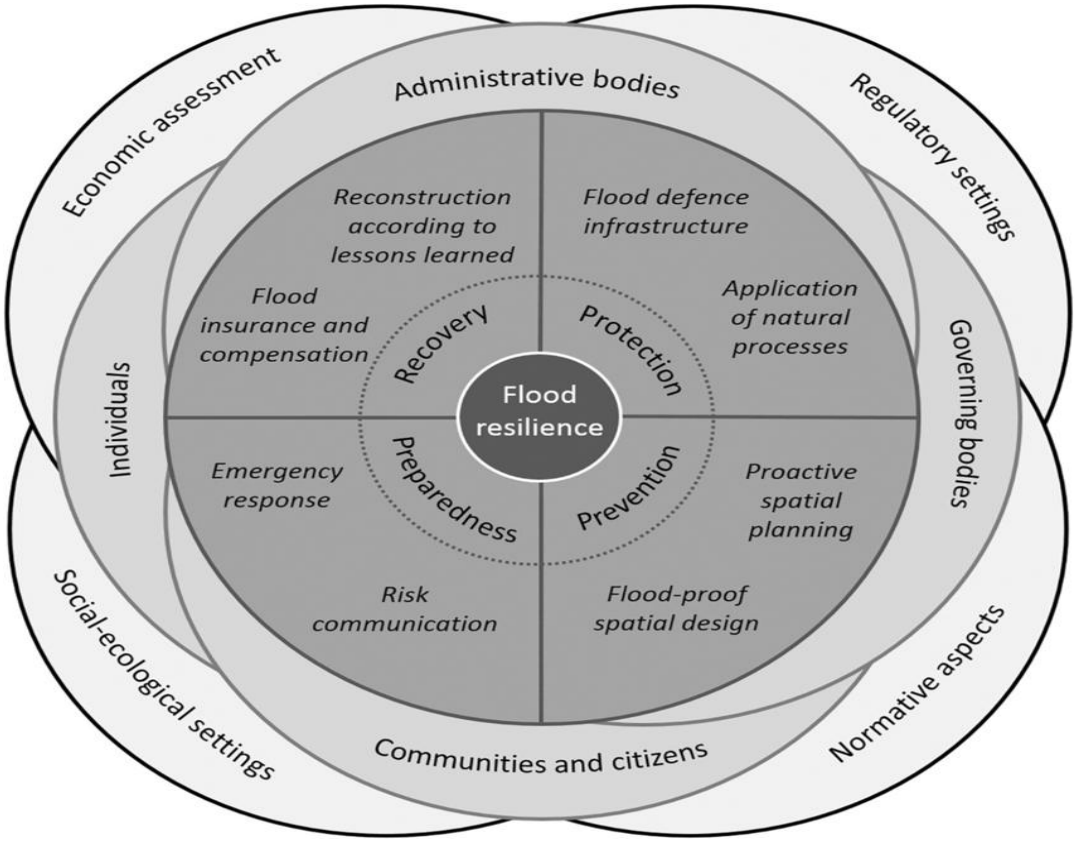

Figure 3: Flood Resilience Rose.

Source: karrasch et al. (2021).

Forrest et al. (2020) in their study also suggested that, affected flooding communities must be engaged in strategy that is geared towards mitigating the negative impact of flooding in the built environment. On the other hand, Park and Kwon (2024) identified regional characterization as a new approach based on their study for community engaged flooding resilience solution. This is because community engagement is able to provide tailored solution (Puchol-Salort & Schiano-Phan, 2018). Therefore, architects must engage communities and adapt sustainable measure for the actualization of sustainable flooding resilience designs for places like Lokoja. Thereafter a design and retrofit framework may be developed for buildings in flood prone locations.

Flooding and Sustainability

Flood risk management spans across several of the 17 Sustainable Development Goals (SDGs). From water management, climate change, sustainable use of terrestrial ecosystems, sustainable cities and communities, and to particularly resilient infrastructure (Binns, 2022; Mannucci, et al., 2022). Furthermore, Binns (2022) states that, Sustainable management of flood risk is reciprocal to the development of knowledge of the flood risk, its likelihood to occur and the ability to create sustainable resilient flood risk management strategies that interacts with affected communities. According to Ashley et al. (2020) concepts of resistance, resilience and adaptability are now enhanced through the lens of sustainability for the strategy towards

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providing effective disaster coping mechanism and other environmental future changing drivers.

Summarily, the importance of the aforementioned connections, the need for sustainable resilient strategies and public education cannot be ignored for the new building design and retrofits for the existing buildings. Thus, in architecture, sustainable strategies must be initiated from design, to actualization of appropriate structures that are effective and informed by policy guided and community inclusive decision-making via possible frameworks for resilience in buildings.

CONCLUSION

Flooding is one of the natural and man-made disasters that affect human well-being, environmental settings, economic and social structures. Sustainability through the lens of sustainable architecture is identified as a channel for flooding resilient solutions in urban built environment. However, currently, there is dearth of research on flooding resilience, and where there are, it is observed to lack depth in terms of design and practices of urban architectural designs. Contextualized community-Engaged Architecture and Participatory Processes are identified as key to promoting sustainable architectural design, retrofit strategies and practices for the urban built environment flooding resilience in flooding prone locations like Lokoja.

REFERENCES

Allu, E. L. A. (2014). Climate change and buildings in Nigeria: a search for mitigation and adaptation framework for residential buildings design guide. PhD Thesis submitted to Leicester School of Architecture, De Montfort University (DMU) Leicester, UK. https://www.dora.dmu.ac.uk/browse?type=author&value=Allu,%20Evelyn

Allu-kangkum, E. L. A. (2024). Sustainable energy security and climate change: the way forward for nigeria. emerging issues, prospects and opportunities. In The Nigerian Environment: A Book of Readings. In Choji, I. D., Binbol, N. L. & E. L. A. Allu-Kangkum, A. Y. Ali, S. D. Wapwera and T. Aga (Eds.), Emerging Issues, Prospects and Opportunities in The Nigerian Environment: A Book Of Readings. 20 – 25. Jos, Nigeria. Nigerian Environmental Society (NES) ISBN: 978-978-785-600-0.

Ashley, R., Gersonius, B. & Horton, B. (2020). Managing flooding: from aproblem to an opportunity. *Phil. Trans. R. Soc*. A 378: 20190214, 1 - 22. http://dx.doi.org/10.1098/rsta.2019.0214

Binns, A. D. (2022). Sustainable development and flood risk management. *Journal of Flood Risk Management,* 15(2), 1 - 3.

Bonfield, P. (2016). The property flood resilience action plan. Department for Environment, Food and Rural Affairs. UK, Government. 1- 48.

Brisibe, W.G. (2020). A comparative review of the implications of flooding on architecture and planning policies in the UK and Nigeria, *Journal of Architectural Engineering Technology*, 9(1), 230, 1-9.

Buba, F. N., Obaguo, S., Ogar, O. & Ajayi, F. O. (2021). A participatory assessment of the impact of flooding in some communities in Lokoja, Kogi State, Nigeria. *American Journal of Climate Change,* 10, 12-31. https://doi.org/10.4236/ajcc.2021.101002.

Douglas, I. Alam, K. Maghenda, M., Mcdonnell, Y., Mclean, L. & Campbell, J. (2008). Unjust waters: climate change, flooding and the urban poor in Africa. *Environment and Urbanization*, 20(1),

DOI: 10.56892/bima.v9i1B.1263

187-205. https://doi.org/10.1177/0956247808089156

Faccini, F., Luino, F., Paliaga, G., Roccati, A. & Turconi, L. (2021). Flash flood events along the west Mediterranean coasts: Inundations of urbanized areas conditioned by anthropic impacts. Land, 10(6), 620. https://doi.org/10.3390/land10060620

Forrest, S. A., Trell, E. M. & Woltjer, E. J. (2022). Merging citizen contributions, roles and interactions with public authorities in Dutch pluvial flood risk management. *International Journal Water Resource Development,* 1–23.

Ke, X., Yang, W., Misheng, L., & Ranting, Z. (2023). Urban and architectural design from the perspective of flood resilience: Framework development and case study of a Chinese university campus. *J. Asian Archit. Build. Engineering*, *22*, 3100–3114.

Lucas, B. (2021). Urban flood risks: Impacts and management in Nigeria. K4D Helpdesk Report 948. Brighton, UK: Institute of Development Studies. DOI: 10.19088/K4D.2021.018.

Mannucci, S., Rosso, F., D'Amico, A., Bernardini, G., & Morganti, M. (2022). Flood resilience and adaptation in the built environment: how far along Are We? *Sustainability*, *14*, 4096. https://doi.org/10.3390/su14074096

Manyena, B. O'Brien, G., O'Keefe, P., & Rose, J. (2011). Disaster resilience: a bounce back or bounce forward ability? Local Environment, *The International Journal of Justice and Sustainability.* 16(5), 417–424.

McMartin, D. W., Sammel, A. J., & Arbuthnott, K. (2018). Community response and engagement during extreme water events in Saskatchewan, Canada and Queensland, Australia. *Environmental Management*, 61, 34–45

Mfon, I. E., Oguike, M. C., Eteng, S. U., & Etim, N. M. (2022). Causes and effects of flooding in Nigeria: a review. *East Asian Journal of Multidisciplinary Resource*. (EAJMR) 1(9), 1777–1792. doi:10.55927/eajmr.v1i9.1261

Ologunorisa, T. (2004). An Assessment of flood vulnerability zones in the Niger Delta, Nigeria. *International Journal of Environmental Studies*. 61(1), 31-38. DOI: 10.1080/0020723032000130061.

Park, K., & Kwon, S. A. (2024). A study on the relationship between flood safety awareness and vulnerability/resilience, Heliyon, 10, (21), https://doi.org/10.1016/j.heliyon.2024.e39819

Puchol-Salort, P., & Schiano-Phan, R. (2018). Sustainable architecture and social engagement for flooding and drought resilience. PLEA, 1- 8

Rathnasiri, P., Adeniyi, O., & Thurairajah, N. (2024). Overcoming data utilization challenges for built environment flood resilience. *Strategies and best practices. Journal of Flood Risk Management*, 17(3), 1 – 20. https://doi.org/10.1111/jfr3.129862

Roaf, S., Crichton, D., & Nicol, F. (2009). Adapting Buildings and Cities for Climate Change: A 21st Century Survival guide (2nd Edition). Oxford, Architectural Press, UK. 2009.

Smith, B. W., Tooley, E. M., Christopher, P. J. & Kay, V.S. (2010). Resilience as the ability to bounce back from stress: a neglected personal resource? *J. Posit. Psychol*. 5 (3), 166–176.

Sun, X., Li, R., Shan, X., Xu, H. & Wang, J. (2021). Assessment of climate change impacts and urban flood management schemes in central Shanghai,

DOI: 10.56892/bima.v9i1B.1263

International Journal of Disaster Risk Reduction, 65, https://doi.org/10.1016/j.ijdrr.2021.102563

Wang, Y. (2021). Physical vulnerability of individuals to coastal flood hazards in urban areas, A PhD Thesis submitted to Stevens Institute of Technology, New Jersey- USA, 1 - 166

Wheater, H. S., & Gober, P. (2015). Water security and the science agenda. *Water Resour Res* 51:1–19. https://doi.org/10.1002/2015WR016892

Wolff, E. (2021). The promise of a "people-centred" approach to floods: Types of participation in the global literature of citizen science and community-based flood risk reduction in the context of the Sendai Framework. *Progress in Disaster Science*, 10, 1 - 11. ISSN 2590-0617. https://doi.org/10.1016/j.pdisas.2021.100171.

Yereseme, A. K., Surendra, H. J., & Kuntoji, G. (2022). Sustainable integrated urban flood management strategies for planning of smart cities: A review. *Sustainable Water Resources Management,* 8(3). https://doi.org/10.1007/s40899-022-00666-5

Zolli, A., & Healy, A. M. (2012). Resilience: Why Things Bounce Back, Hachette, UK. ISBN 1451683804, 9781451683806.