# EXPLORING THE INTERPLAY BETWEEN FLOODING SUSCEPTIBILITY AND DISEASE OCCURRENCE IN ANAMBRA STATE: A GIS-BASED ANALYSIS

Anambra state is grappling with the serious issue of flooding. A substantial portion of the population, accounting for over 30%, resides in the riverine region and depends on fishing and agriculture for their sustenance (Onwuka et al., 2015). The escalating sea levels and storm surges pose a significant threat to the people's lives, infrastructure, and livelihoods in the area, as highlighted by Ezirim (2010). Nwilo (2011) has identified flooding as the most catastrophic natural calamity in the state, causing more fatalities and property damage than any other natural phenomenon.

Umuleri, with a land area of 171.6 sq. km, has a projected population of 21,438 individuals (NPC, 2006). According to research conducted by Onwuka et al. (2015) in the Umuleri community of Anambra, the 2012 flood resulted in several health issues including skin infections, cholera, typhoid, hepatitis, diarrhea, dysentery, and others. The study reported the following percentages of these health effects: 34.1%, 3.9%, 10%, 6.7%, 14%, 14%, and 17.3%, respectively. However, those impacted by the flood in Umuleri were fortunate to receive prompt shelter, assistance, and medical care from caring individuals, non-governmental organizations, and authorities, which prevented the occurrence of severe ailments (Onwuka et al., 2015).

According to a 2014 study conducted by Onyido et al., the Abagana area of Anambra has a higher prevalence of mosquitoes in ground pools and discarded tyres. This is attributed to the presence of stable water that facilitates mosquito development.

The 2018 flooding had a concerning impact on the spread of cholera, particularly in Anambra, Kogi, and Niger states, where Case Fatality Rates (CFRs) increased. Floods tend to impede access to necessities like clean water sources and healthcare services, exacerbating cholera outbreaks and contributing to detrimental health outcomes, including fatalities (Elimian et al., 2019).

As reported by Punch Newspaper on September 8th, 2023, Dr. Ejikeme Okonkwo, the Chief Medical Director of Diocesan Hospital in Okpoko, Anambra State, Nigeria, near Onitsha, has expressed concerns over a potential epidemic outbreak in the Okpoko slum community. Dr. Okonkwo has highlighted the dire sanitary conditions in the area, which increase the risk of disease transmission. The correlation between flooding, unsanitary conditions, and the occurrence of diseases is particularly alarming. Dr. Okonkwo has noted that the high population density within the community can facilitate the rapid spread of diseases. Due to stagnant water that provides a breeding ground for mosquitoes and the presence of unclean markets, the residents of Okpoko face a higher risk of malaria and typhoid fever. The situation in Okpoko underscores the intricate relationship between environmental factors, public health, and the need for government intervention.

**RESULT**

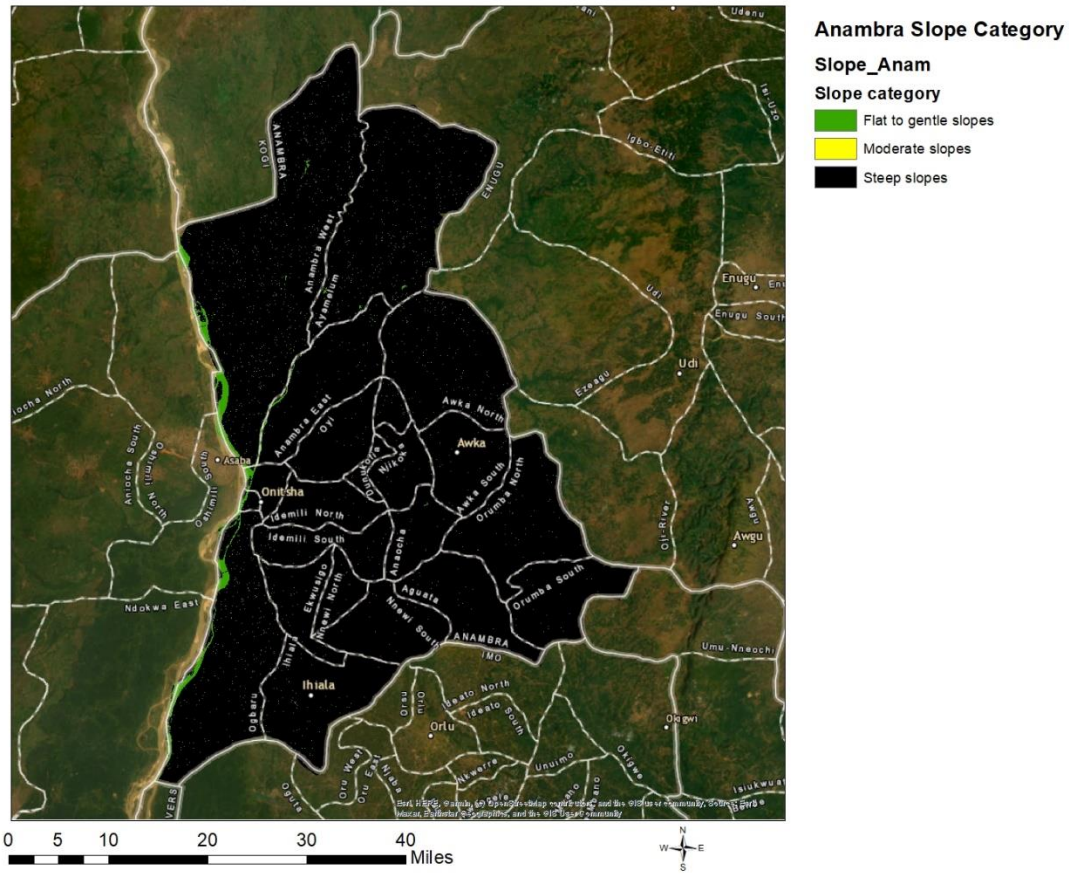


**Figure 1: Showing Slope Category for Anambra**

The slope analysis revealed that Anambra State boasts a diverse range of terrains, with some areas featuring gentle slopes and others steeper gradients. This variation is a crucial factor to consider when planning land use. The southern parts of the state, particularly those near the riverbanks, feature flatter and lower-lying terrain. The coastal regions, specifically those adjacent to the River Niger, have a nearly level topography with minimal slope. As a result, these areas are prone to riverine flooding during the rainy season. Noteworthy areas at risk include Anambra West Local Government Area and parts of Ogbaru Local Government Area. These areas require special attention in terms of development and disaster preparedness. The central regions of the state have moderate inclines, making them more suitable for urban development and agriculture. However, erosion control measures may be necessary. The northern regions of Anambra State feature higher elevations and more pronounced slopes, rendering them less vulnerable to flooding. However, thoughtful planning may be necessary to minimize soil erosion and ensure sustainable land use.

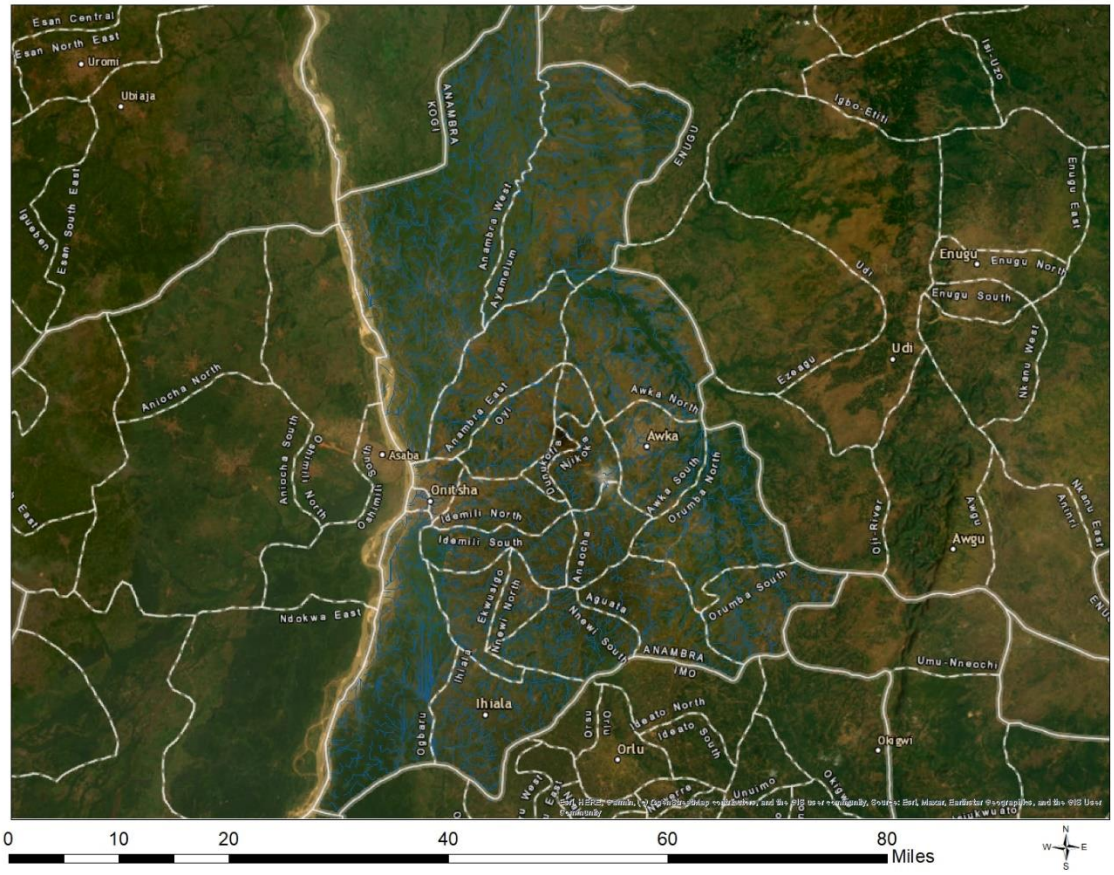


**Figure 2: Showing Stream Network Map in Anambra State**

Within the framework of a flood susceptibility assessment carried out in Anambra State, the stream network is of fundamental importance for comprehending the intricacies of flooding in the area. Examining the stream network highlights the natural channels for drainage which primarily consist of streams and rivers, and showcases their significant impact on flood risk. Regions that border or are situated close to these waterways are more vulnerable to flooding, underscoring the crucial need for floodplain management and heightened awareness of the risks linked to flooding.

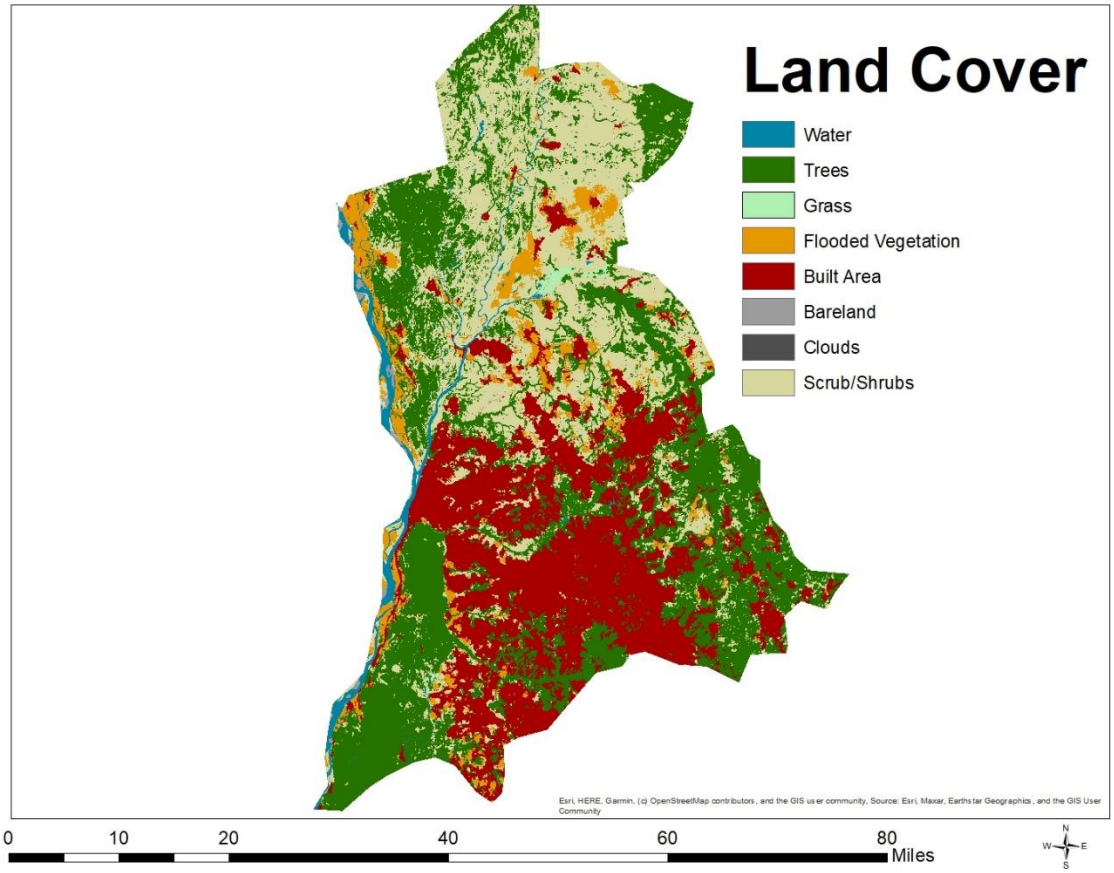


**Figure 3: Showing Anambra land cover**

The land cover analysis shows important findings regarding effective flood management strategies in Anambra State. The analysis highlights the region's significant human settlements and infrastructure, resulting in the development of numerous built-up areas that are at a higher risk of flooding due to increased impervious surfaces. The analysis indicates the extent of infrastructure development, such as built-up areas and transportation networks. Without proper drainage systems, rapid urbanization can worsen flooding in the state. Agricultural land covers a significant portion of the state, and while it may not directly contribute to flooding, it can disrupt local hydrology when natural vegetation is converted to farmland, increasing the risk of flooding downstream. It is crucial to consider the presence of water bodies when understanding flooding dynamics. When these bodies are swollen due to heavy rainfall or upstream events, they can cause flooding in adjacent areas, particularly in low-lying regions.

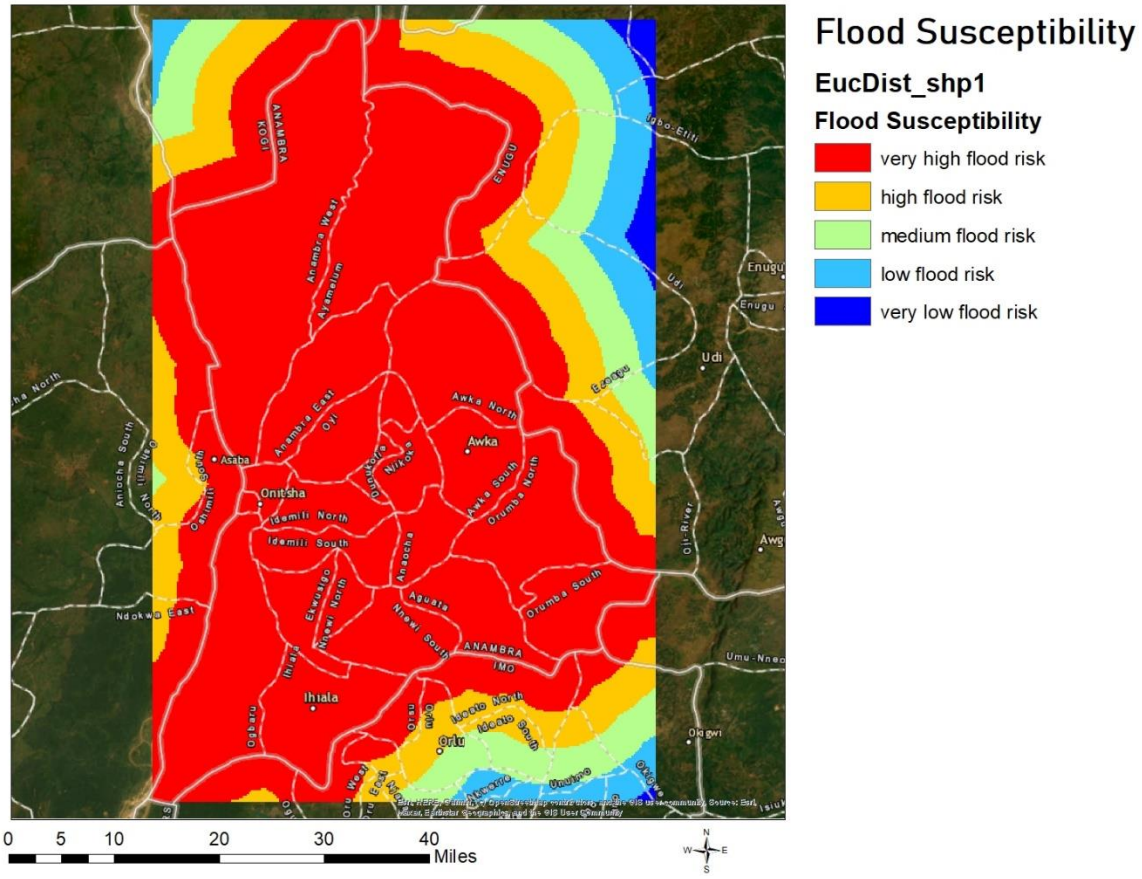


**Figure 4: Showing Flood Susceptibility of Anambra State**

The flood susceptibility analysis revealed that numerous areas in Anambra are at high risk of flooding, while others exhibit a lower susceptibility. The following regions were identified as being particularly vulnerable:

- **Anambra West Local Government Area**: Situated along the banks of River Niger, this region is prone to seasonal flooding, especially during the rainy season. Communities such as Umueze Anam, Nzam, and Aguleri are at a higher risk.
- **Ogbaru Local Government Area**: The low-lying terrain and proximity to the River Niger make areas like Atani, Okpoko, and Ogbunike in Ogbaru highly susceptible to flooding with frequent inundations reported in the past.
- **Onitsha**: Onitsha is highly susceptible to floods which may be due to rapid urbanization, blocked drainage systems, and encroachment into floodplains. The central business district and low-lying residential areas are particularly vulnerable.
- **Ayamelum Local Government Area**: Due to its proximity to the River Niger and flat terrain, Ayamelum may frequently experiences flooding, affecting communities including Umueri, Omasi, and Onugwa.
- **Awka, the state capital**: Although Awka is not directly adjacent to a major river, poor drainage systems and urban expansion may have increased susceptibility to flash floods, particularly in areas with inadequate infrastructure.

- **Idemili North and South Local Government Areas**: These areas are susceptible to flooding due to their proximity to the Nkisi and Imo Rivers, which may overflow during heavy rainfall.

## CONCLUSION

Understanding the correlation between flooding and disease in Anambra State is both urgent and complex. This study sheds light on the intricate dynamics involved, emphasizing the critical role of geographical, environmental, and socioeconomic factors in determining the vulnerability of different regions within the state. Anambra State varied topography results in varying degrees of susceptibility to flooding, with low-lying areas, particularly those along the River Niger banks, such as Anambra West, Ogbaru, and neighboring communities facing repeated challenges. Urban centers like Onitsha and Awka are also at risk due to rapid urbanization, inadequate drainage systems, and encroachment into floodplains.

The impact of flooding on public health cannot be underestimated, as evidenced by the spread of diseases like cholera, typhoid, and skin infections. Access to clean water and healthcare services can become limited during floods, exacerbating existing health conditions and leading to fatal outcomes, particularly in regions with a high Case Fatality Rate (CFR). To prevent such catastrophic events, it is imperative that disaster preparedness and floodplain management become top priorities in the state's development agenda. Any measures to mitigate flood risks must take into account both geographical and human factors, including terrain, proximity to water bodies, urbanization, and land-use practices. To ensure the well-being and resilience of the population in Anambra State, especially those residing in flood-prone areas, a comprehensive approach to flood management is essential. This approach should integrate geographical information, infrastructure development, and public health considerations to safeguard the health and safety of all citizens.

**REFERENCES**


Elimian, K. O., Musah, A., Mezue, S., Oyebanji, O., Yennan, S., Jinadu, A., ... & Ihekweazu, C. (2019). Descriptive epidemiology of cholera outbreak in Nigeria, January–November, 2018: implications for the global roadmap strategy. *BMC Public Health*, *19*(1), 1-11.

Ezirim, G. E. (2010). "Climate Change and National Security: Exploringthe Conceptual andEmpirical Connections in Nigeria". Journal of Sustainable Development in Africa.Vol. 12, No. 4

National Population Commission(NPC), (2006). "The Nigerian national population censusresults"

Nwilo, P.C. (2013). "Geospatial Information in Flooding and Disaster Management inNigeria".7th Annual lecture of Faculty of Environmental Sciences, NnamdiAzikiwe University, Awka. June, 6, 2013.

Onwuka, S. U., F. O. Ikekpeazu, and D. C. Onuoha. "Assessment of the environmental effects of 2012 floods in Umuleri, Anambra East local government area of Anambra state, Nigeria." *International Research Journal of Natural Sciences* 3.1 (2015): 1-15.

Onyido, A. E., Ugha, C. N., Eneanya, O. A., Umeanaeto, P. U., Egbuche, C. M., Obiechina, I. O., ... & Nwangwu, U. C. (2014). Malaria vector bionomics in Abagana community of Anambra State, Southeastern Nigeria. *Journal of American Science*, *10*(2), 157-162.

Punch Newspaper September 8, 2023, Expert warns against disease outbreak in Anambra community (punchng.com)