URBANIZATION AND URBAN HEAT ISLAND ANALYSIS OF LAGOS, NIGERIA: USING REMOTE SENSING AND GIS ANALYSIS TO DETERMINE URBAN HEAT AND DISEASE OUTBREAK

Final Result:

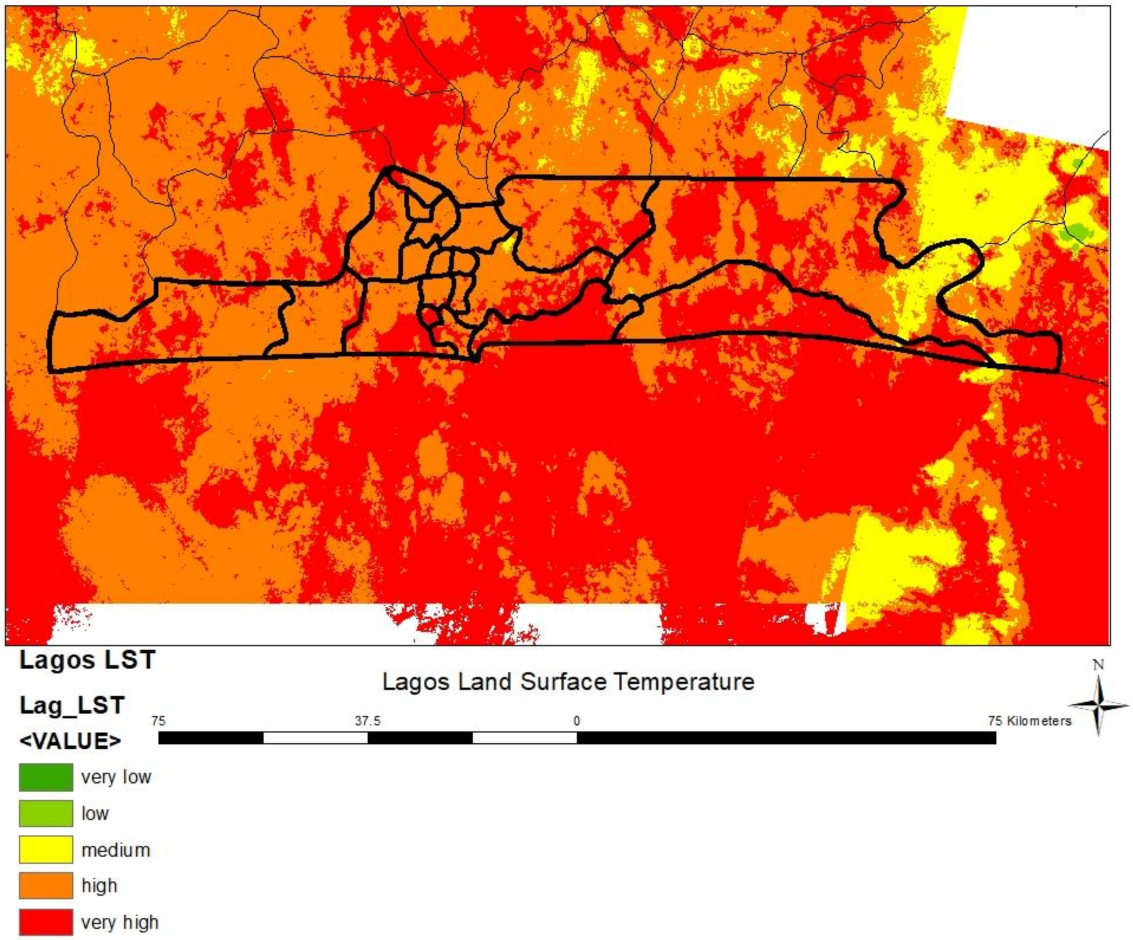

Figure 1: Showing land surface temperature of Lagos, Nigeria.

The figure above shows the urban heat line drawn by digitizing the area of Lagos using polyline on the land surface temperature layer, and the legend shows the varying temperature levels. The land surface temperature analysis was done by obtaining raster images (C2 L2 LandSat 8/9 OLI/TIRS band 10) from earth explorer, and I used the mosaic to new raster tools to merge the raster images together, and with the use of raster calculator the merged raster images was used to get the land surface temperature (LST) using the multiplicative factor (0.00341802) and additive factor (149) to get the LST in kelvin and the covert to degree Celsius, 273.15 was subtracted. Below are the raster images downloaded

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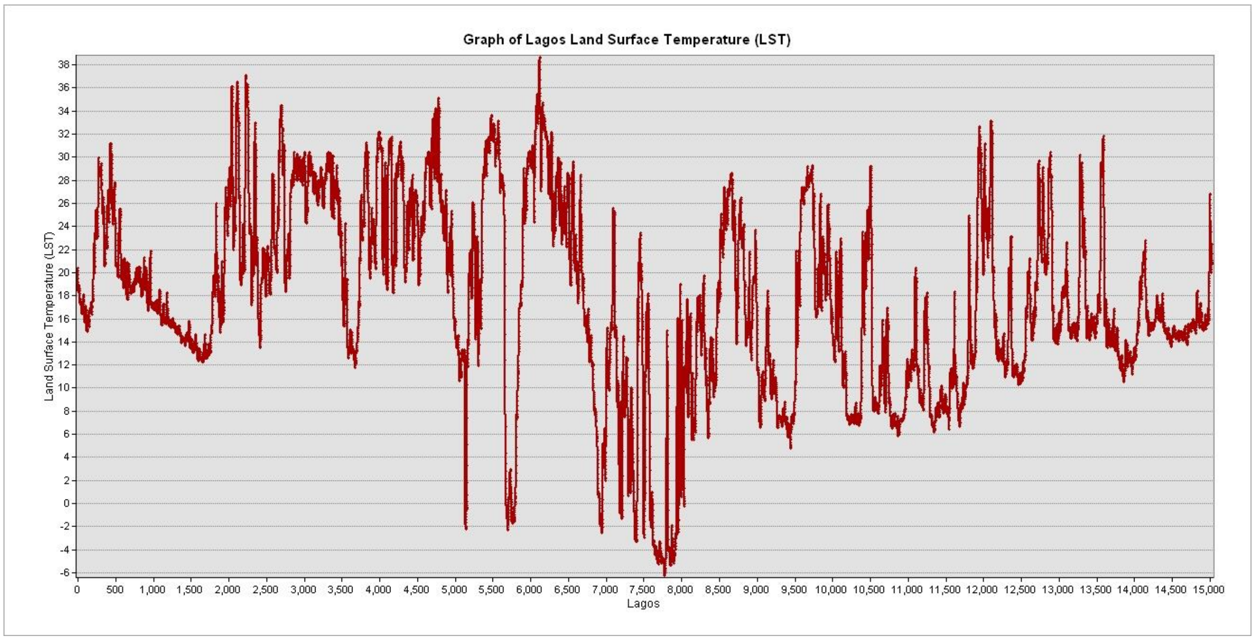

Figure 2: Showing the Lagos, Nigeria Urban Heat Island Analysis graph.

The figure above shows the urban heat island analysis graph of Lagos State, Nigeria, which was gotten by the stack profile tool, the digitized area of Lagos State, Nigeria, and the land surface temperature of gotten. The temperature in the graph was above 38^0c as seen in the graph.

RELATIONSHIP BETWEEN DISEASE OUTBREAK AND HIGH URBAN HEAT IN LAGOS, NIGERIA.

Lagos has surpassed it's carrying capacity and is now an overcrowded city. Despite this, individuals from rural areas continue to flock to Lagos in search of improved survival opportunities (Shelter Right Initiative, 1997; Folarin, 2007). To address the escalation of diseases, growing cases in Lagos State, and the urban heat island effect, health authorities, urban planners, and the community must come together. A comprehensive approach to these concerns can effectively enhance disease prevention and advance overall urban health.

The connection between disease outbreaks, elevated case counts in Lagos State, Nigeria, and the urban heat island effect is intricate and impacted by numerous variables. The primary culprits behind the urban heat island effect are human pursuits and a scarcity of greenery, which can intensify disease transmission in heavily populated metropolitan regions like Lagos. This can ultimately lead to the propagation of illnesses such as dengue fever and malaria. Among the significant vector-borne illnesses that are most susceptible to changes in environmental conditions, are malaria, schistosomiasis, and dengue infection included (Martens 1998; Martens et al. 1999; Rogers and Randolph 2000), although a considerable range of infectious diseases, including cholera (Pascual et al. 2002), lymphatic filariasis (Sattenspiel 2000), and tick-borne encephalitis (Randolph and Rogers 2000) may also be encountered, with potentially profound consequences for human health.

Malaria transmission is currently restricted to regions with warmer climates. However, the emergence of anthropogenic global warming and climate change has the potential to expand the geographic area for malaria transmission. This is because the Plasmodium malaria parasite and Anopheles mosquito vector are highly dependent on temperature for their life cycles. Furthermore, the habitats of immature Anopheles are heavily influenced by local hydrodynamics and rainfall. (Eikenberry et al., 2018). Lagos is prone to mosquito-borne diseases such as malaria due to its tropical climate and breeding grounds for mosquitoes.

The urban heat island effect exacerbates the conditions that are favorable for mosquito breeding and habitat expansion. Warmer urban areas are also a cause of concern for the spread of dengue fever through the Aedes mosquito vector. Various environmental factors, such as temperature, humidity, rainfall, and wind speed, can impact the incidence of malaria by affecting mosquito and parasite life cycles or human, vector, and parasite behavior. Research conducted by Gubler et al. (2001) and Koenraadt et al. (2004) shows that malaria, one of the deadliest diseases in human history, claims the lives of approximately half a million people each year, with the majority being children under the age of five who reside in tropical Africa.

According to a publication **"Mathematical modeling of Climate Change and malaria transmission dynamics: a historical review"** (Eikenberry et al., 2018) establishes a clear link between temperature and the rising incidences of malaria. Another publication **"Modeling the effects of weather and climate change on malaria transmission"** (Paul and Edwin 2010) also establishes a clear link between temperature and malaria incidence. To address this issue, a multi-faceted approach is required, including effective mosquito control measures, incorporation of green spaces into urban planning, and improved sanitation and waste management to reduce disease transmission. Public health campaigns focused on disease prevention, especially during high temperatures, are essential in mitigating the situation.

REFERENCES

Eikenberry, S.E., Gumel, A.B. Mathematical modeling of climate change and malaria transmission dynamics: a historical review. *J. Math. Biol.* 77, 857–933 (2018). https://doi.org/10.1007/s00285-018-1229-7

F. A. Folarin. "Perception of Crowding by Residents of Some High-Density Areas of Lagos". Nigerian Journal of Business and Social Sciences, Vol. 1, 19-31, 2007

Gubler DJ, Reiter P, Ebi KL, Yap W, Nasci R, Patz JA. 2001. Climate variability and change in the United States: potential impacts on vector- and rodent-borne diseases. Environ Health Perspect109:223-23311359689.

Koenraadt CJM, Githeko AK, Takken W. 2004. The effects of rainfall and evapotranspiration on the temporal dynamics of *Anopheles gambiae* s.s. and *Anopheles arabiensis* in a Kenyan village. Acta Tropica90(2):141-15315177140.

Martens P, Kovats RS, Nijhof S, de Vries P, Livermore MTJ, Bradley DJet al.. 1999. Climate change and future populations at risk of malaria. Global Environ Change9(Suppl 1):S89-S107.

Martens P. 1998. Health and Climate Change: Modelling the Impacts of Global Warming and Ozone DepletionLondonEarthscan Publications Ltd.

Pascual M, Bouma M, Dobson AP. 2002. Cholera and climate: revisiting the quantitative evidence. Microb Infect4(2):237-245.

Paul Edward Parham and Edwin Michael. Modeling the Effects of Weather and Climate Change on Malaria Transmission. Environmental Health Perspective Volume 118 No.5 https://doi.org/10.1289/ehp.0901256. May 2010.

Randolph SE, Rogers DJ. 2000. Fragile transmission cycles of tick-borne encephalitis virus may be disrupted by predicted climate change. Proc R Soc Lond B267:1741-1744.

Rogers DJ, Randolph SE. 2000. The global spread of malaria in a future, warmer world. Science289(5485):1763-176610976072.

Sattenspiel L. 2000. Tropical environments, human activities, and the transmission of infectious diseases. Am J Phys Anthropol Suppl31:3-31.

Shelter Rights Initiative. "Practical Issues in Human Settlements and Health". Lagos: Mbeyi and Associates (Nigeria) Ltd, 1997