

Detailed Report

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1. How does your visual inform a decision or action that furthers one or more of the key competition SDGs ([zero hunger](#), [clean water and sanitation](#), [climate action](#))?

Our visual output informed that while developing countries such as Nigeria face the stress of climate change and water access. Using eight major cities (6 million) in the South East of Nigeria as a study area, we found that urban settlements in these cities are under Urban Heat Island (UHI) effects, experiencing temperature variance from +1°C (+1.8°F) to +7°C (+12.6°F) compared to the rural peripherals, while 31% of the population do not have water access within 1km. In the visual, regions within 1km access
2. How did you create your submission? Include the tools you used (e.g., Python, Excel, specific python packages), how you processed the data, and (if applicable) how you managed your codebase. If you have a public repository with code, you can share a link here.
 - Aggregating raster data to hex grids
 - o Landsat 8 imagery [1] were downloaded through the USGS for the study area (South East Nigeria) through the following filters:
 - Time range: 01/31 – 04/30 for year 2018 to 2023
 - Cloud cover was set to <10%
 - o A mosaic image was created from the downloaded imagery using QGIS
 - o A water mask was applied to the Landsat 8 imagery from the Global Surface Water dataset in QGIS
 - o Using tutorial from this [link](#), land surface temperature was calculated for each pixel in QGIS
 - o Population data were extracted from High Resolution Settlement Layer [2]
 - o H3 grids at resolution 8 were generated using Python with the python package h3-py
 - o For each hex grid, the average land surface temperature (LST) was calculated using zonal statistics in QGIS
 - o Metropolitan-scale boundary data were downloaded from the local government area boundaries from GRID3 dataset [3].
 - o Global Land Cover and Land Use 2019 [4] were downloaded and aggregated to the H3 grids and grids defined with built-up areas are defined as urban boundary within the metropolitan, while the rest are defined as rural
 - o For each city, the mean rural land surface temperature was calculated (Python)
 - o For each hex within the urban boundary, $UHI_i = LST_i - T_{rural\ mean}$ (Python)
 - Water point data preprocessing
 - o Water point data in Nigeria were downloaded from GRID3

- A buffer of 1km were created for each water point and overlay with the hex8 grids to extract population within 1km access of water points
- Grid data were visualized using QGIS

3. What motivated you to choose this topic?

The SDG6 suggests that access to safe water, sanitation and hygiene is the most basic human needs while billions of people still lack access to these services. According to [5], Nigeria ranked 177 among 180 countries in terms of sanitation and drinking water in the year of 2022, and ranked 43 among 46 countries in the SSA region. To understand this in detail, according to [6], only 67% of the population in the nation use basic drinking water services. As such, although Nigeria is a ranked mid-income by the World Bank, its infrastructure development, especially water infrastructure, is noticeably low compared to countries in the same region and same economic level.

4. How did you learn about the broader context of your chosen issue (e.g., historical, social, political)? This could include drawing on the lived experiences of team members, reading articles and literature, conducting interviews with community members, etc. Did what you learned change your approach?

Universal access to basic human needs such as clean water is common in developed countries. However, developing countries seem to lack resources to achieve goals like this. We aim to understand what data are available and could be useful to help to facilitate the planning in building the underlying infrastructure. However, during our research, we found that in countries where water access points are limited, data are also limited to identify coverage and people in need. Thus, we could only use data available to construct our analysis,

5. What are the ethics and/or equity issues you considered? What are some possible strategies or approaches for addressing them?

This is not applicable.

6. Would your team like to share the URL of an interactive visualization?

This is not applicable.

Reference

- [1] Landsat8, EarthExplorer, USGS. <https://earthexplorer.usgs.gov/>
- [2] Nigeria: High Resolution Population Density Maps + Demographic Estimates. HDX. <https://data.humdata.org/dataset/highresolutionpopulationdensitymaps-nga>
- [3] GRID3. <https://data.grid3.org/>
- [4] Global land cover and land use 2019. Global Land Analysis & Discovery. <https://glad.umd.edu/dataset/global-land-cover-land-use-v1>
- [5] Wolf, M. J., J. W. Emerson, D. C. Etsy, A. de Sherbinin, Z. A. Wendling, et al. 2022. Environmental Performance Index 2022. New Haven, CT: Yale Center for Environmental Law and Policy. <https://epi.yale.edu/downloads/epi2022report06062022.pdf>.
- [6] Water Sanitation and Hygiene National Outcome Routine Mapping 2021, UNICEF <https://glad.umd.edu/dataset/global-land-cover-land-use-v1>