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Assessing and Mitigating the Global Freshwater Crisis (6)

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MONITORING WATER QUALITY OF LAKE CHIVERO USING DIGITAL EARTH AFRICA

**Abstract**

Chivero is a reservoir on the Manyame River in Zimbabwe. It provides the main water supply for Harare and used for purposes of irrigation, fishing, and habitat for birds. However, over the years the lake has faced pollution, siltation, and invasion of water hyacinth due to urban growth and climate change. As home to such a delicate ecosystem, seasonal changes in the lake's water levels, water quality and salinity can have huge impacts water provided to the city of Harare. DE Africa was used to study the changes in water extent and quality over time and made comparisons with rainfall data from Climate Hazards Group InfraRed Precipitation with Station data {CHIRPS}. The study finds that Lake Chivero's water quality is declining due to increased levels of nitrogen and phosphorus, likely caused by urbanization and agricultural activity. DE Africa's Modified Normalised Difference Water Index (MNDWI) provided water extent from January 2017 to December 2023 in comparison with the rainfall data generated by CHIRPS, indicating highlights drought in October 2020 and floods in early year 2021 because of tropical cyclones Eloise 11 to 27 January 2021 and Guambe February 11 to 22 February 2021.

After measuring the water extent, water quality was estimated using Normalised Difference Chlorophyll Index (NDCI) developed by Mishra and Mishra in 2012, which inform presence of algae and implemented by DE Africa using Copernicus Sentinel 2's 13 spectral bands. High values of NDCI indicate the presence of chlorophyll-a. By performing the relevant calculations across six years of data {January 2017 to December 2023}, variations in chlorophyll level were noted indicating higher NDCI values periods of drought in January 2018, October 2019, and November 2020. Extra water can dilute the salinity and alkaline levels of lakes, creating a less hospitable environment for algae - and therefore a reduced food source for flamingos. Where water extent and chlorophyll concentration have both increased it is likely that the rainwater washed additional nutrients into the Lake, strengthening algae populations. DE Africa provided a spatial comparison at differ NDCI levels and dates with very high NDCI noted on Sentinel 2 imagery on 13th March 2017, and low NDCI on 2 December 2023. These findings have implications for climate risk management and sustainable development goals.