

Environmental Option and Remedy for Resuscitating Dying Lake Chad

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Abstract

Lake Chad, a vital freshwater reservoir in the Sahel region, faces a severe decline attributed to climate change, population growth, and unsustainable water practices. This study proposes a comprehensive transboundary water transfer initiative, sourcing freshwater from the water-rich regions of south-south, south-east, and south-west Nigeria to rejuvenate Lake Chad and its surrounding basins. This initiative employs a robust methodology comprising hydrological assessments of potential water sources, pipeline design, and construction informed by successful international case studies. Environmental impact assessments, stakeholder engagement, water quality management, and phased pilot project implementation ensure a holistic and sustainable approach. Lessons from projects like China's South-North Water Transfer and Australia's Snowy 2.0 provide insights into best practices for environmental stewardship and community involvement. Anticipated outcomes encompass the restoration of Lake Chad's water levels, revitalization of ecosystems, and socio-economic improvements in local communities. The multi-regional approach involving south-south, south-east, and south-west Nigeria seeks to enhance resilience against climate variability while fostering equitable water distribution and regional collaboration. Continuous monitoring, adaptive management, and knowledge sharing with global initiatives are emphasized to ensure the long-term success and sustainability of the project. This study proposes a novel and inclusive approach to address the challenges facing Lake Chad by leveraging freshwater resources from multiple regions in Nigeria. The outlined methodology prioritizes environmental sustainability, community engagement, and draws upon international successes, positioning this initiative as a model for transboundary water management in regions grappling with water scarcity.

Keywords: Lake Chad revitalization, Transboundary water transfer, Hydrological assessment, Environmental impact assessment. Regional collaboration, Sustainable water management

Introduction

The climatological history of the world have shown mixed stories of raise and fallen civilizations, rivers and lakes drying, splitting of continent, etc., in almost all the cases the story have been the same, because little or nothing was done to rescue, revive or remedy the situations

Lately, the study by scholars has shown that the volume of water in Lake Chad has reduced drastically, and size of the lake has shrunk. The shrinking of Lake Chad has been a subject of increasing concern due to its significant environmental, socio-economic, political, and

humanitarian implications. It is important to note that Lake Chad was once the eleventh largest lake in world; however, it has so much shrunk in size over the past decades (Ani, Ojatorotu, Aqua, 2018).

Scholars were of the opinions that the diminishing size of the lake can be attributed to combination of factors, such as climate change (UNEP, 2020), increased water extraction for irrigation and population growth around the lake region, domestic water usage, the presence of an underground leakage could also be an option, though not very certain

The reduced volume of water inflow to the lake has

been a noticeable contributing factor to the diminishing size of the lake. The reduced water supply from the tributaries has led to a significant imbalance in Lake Chad ecosystem, impacting the livelihoods of millions of people who rely on the lake for fishing, agriculture, and other economic activities. The consequences of the shrinking lake have been dire, leading to food insecurity, displacement, and environmental degradation across the region (Smith et al., 2018)

It is important to note that research in this area of study in Africa and the world in general is still at its proposal or infant stage. In response to the critical challenges noted, proposals have emerged to address the declining or receding water level of Lake Chad. This work is not concerned with the geological and the Geomorphological study of Lake Chad basin or of basins where water can be transferred from to resuscitate the lake. This work is concern with a low cost solution to replenish Lake Chad diminishing water. This work has two solutions to replenishing of Lake Chad water, and it is based on simple fluid transfer that has taken place in Nigeria based on pipeline transportation (Alexander, 2023) and flood water conservation (This means that flood water is rechanneled into the lake or rivers that are supplying lake Chad water).

The Study Area

The Kanuri name for Lake Chad is Sada, it is a fresh water lake located between four African countries of Cameroun, Chad, Niger and Nigeria. It is located between West Africa can Central Africa. Lake Chad is a significant wetland ecosystem in Sahel tropical West African countries. The original landmass of the lake was 2,397,423 km² by the 19th century it has shrunk to 28,000km²; presently it is about 17000km² (<https://whc.unesco.org>) stretching into nine contiguous countries (Algeria, Cameroon, Central African Republic, Chad, Nigeria, Niger, and Libya); the actual Lake straddles the borders of only four riparian countries (Cameroon, Chad, Nigeria, and Niger). It was once the largest lake in West Africa, the fourth largest in Africa and the eleventh in the world (Ani, Ojakorotu, Aqua, 2018). However, according to some writers, between the 1960s and the 1990s it shrank by 90% and, in its current form, can no longer support the 30-plus million people who once depended on it for water and fish (Mohanty, Robson, Naueping, Nanda, 2021; Magrin, 2016). Fishing from this lake is an old but important source of livelihood (Sarch, 2014, Béné et al., 2003; Bene, Macfadyen, Allison, 2007; FAO, 2017; Eriegha, Ovie, Aminu, 2019).

This low cost solution is necessary because the technicalities involved in basins water transfer is enormous and the side effects could even triggered untold future problems, which the entire continent or even the world may not be able to handle.

Lake Chad, located in the Sahel region of Africa, has experienced a drastic reduction in water levels and surface area over the past few decades (Smith et al., 2018; United Nations Environment Programme [UNEP], 2020). Factors contributing to this decline include climate change impacts such as increased temperatures and erratic rainfall patterns (Siddiqui et al., 2019), unsustainable water management practices (Awassi & Hammad, 2017), and population growth in surrounding areas (Schneider et al., 2016). The environmental consequences of Lake Chad's shrinkage have been severe, leading to loss of biodiversity and degradation of surrounding ecosystems (UNEP, 2020). This has significantly impacted the livelihoods of millions of people who depend on the lake for water, fishing, agriculture, and other resources (IUCN, 2021).

Socio-economic challenges arising from the diminishing lake include heightened food insecurity, displacement of communities, conflicts over diminishing resources, and economic instability in the region (The World Bank, 2019). Addressing these challenges requires urgent action and collaborative efforts among governments, local communities, and international organizations (UNEP, 2020).

This study aims to contribute to the existing body of knowledge by proposing viable strategy and interventions for the restoration and sustainable management of Lake Chad, building on previous research on water resource management (Awassi & Hammad, 2017), climate change impacts (Siddiqui et al., 2019), and socio-economic effects (The World Bank, 2019) in the region.

Proposed Methodology

1. Hydrological Assessment: Conduct a thorough hydrological assessment similar to studies such as the one conducted by Gleick et al. (2009) in California, evaluating water sources for feasibility and sustainability to understand the impact of the project on both the donor area and the recipient area.

2. Pipeline Design and Construction: Engage experts in hydrology, engineering, welders, and environmental science, drawing insights from successful projects like the South-North Water Transfer Project in China (Zheng et al., 2016). Adhere to established engineering and environmental standards.

3. **Environmental Impact Assessment (EIA):** Conduct an Environmental Impact Assessment (EIA) following methodologies outlined in studies like the one by Reid et al. (2018) on the Three Gorges Dam. Develop mitigation strategies inspired by successful cases.
4. **Stakeholder Engagement:** Implement stakeholder engagement strategies informed by best practices identified in studies such as the participatory approaches employed in the Lesotho Highlands Water Project (Archer, 2006).
5. **Water Quality Management:** Utilize water quality management approaches similar to those implemented in projects like the Thames Tideway Tunnel in the UK (Thames Water, 2020). Monitor and maintain water quality during transportation. This includes the temperature of the transported water.
6. **Pilot Project Implementation:** Initiate a pilot project, learning from experiences in projects like the SNOWY 2.0 pumped hydroelectric storage project in Australia (Snowy Hydro, 2021). Adapt and refine the project based on lessons learned.

Expected Results

1. **Hydrological Impact:** Evaluate hydrological impacts similar to studies such as the one by Milly et al. (2005) on the impacts of land use changes on regional hydrology. Monitor water levels, groundwater recharge, and local water source health.
2. **Lake Chad Water Level:** Monitor Lake Chad's water levels with methodologies akin to studies like the one by Alsdorf et al. (2007) using satellite altimetry for large lake water level observations.
3. **Environmental Monitoring:** Implement continuous environmental monitoring inspired by studies such as the Long-Term Ecological Research (LTER) network, ensuring comprehensive data on ecosystem dynamics.
4. **Community Feedback:** Collect community feedback using participatory methods similar to studies such as the Community-Based Natural Resource Management (CBNRM) initiatives.
5. **Water Quality Assessment:** Conduct water quality assessments drawing from established methodologies like those employed in the European Union Water Framework Directive (EU WFD) (European Commission, 2000). Ensure the maintenance of suitable water quality.
6. **Project Adaptation and Optimization:** Adapt and optimize the project based on experiences similar to the adaptive management strategies outlined in studies like the one by Holling (1978) on resilience and stability in ecological systems.

Note this work is a theoretical proposal base on the transportation of petroleum product from South-south Nigeria to the distant northern part of the country. It is a call to government, stakeholders, NGOs, companies and stakeholders to experiment something cheap using the available natural gift of nature from one region to another.

Conclusions

In response to the alarming decline of Lake Chad, this study presents a comprehensive trans-boundary water transfer proposal, encompassing water-rich regions in south-south, south-east, and south-west Nigeria. The articulated methodology, influenced by successful global projects, integrates hydrological assessments, pipeline design, environmental impact assessments, stakeholder engagement, and phased pilot project implementation.

Envisaged outcomes hold promise, anticipating the reinstatement of Lake Chad's water levels, rejuvenation of ecosystems, and improvements in the socio-economic landscape of local communities. The distinctive feature of involving multiple regions in the water sourcing strategy aims not only to mitigate immediate challenges but also to fortify resilience against climate variability, promote fair water distribution, and foster collaboration among regions.

This multi-regional approach not only addresses the pressing issues confronting Lake Chad but also establishes a pioneering framework for sustainable and inclusive trans-boundary water management. The emphasis on perpetual monitoring, adaptive management, and cross-border knowledge sharing emphasizes the commitment to the enduring success and sustainability of the proposed project.

As global water scarcity challenges persist, this study contributes a flexible model that can be adapted to confront analogous issues in diverse regions. The proposed initiative not only serves as a pragmatic solution for Lake Chad but also aligns with broader objectives of achieving environmental sustainability, encouraging regional cooperation, and safeguarding the livelihoods of communities reliant on freshwater resources. The efficacy of this proposal rests on collaborative endeavors, informed decision-making, and an unwavering commitment to harmonizing ecological well-being with human necessities.

Recommendations

1. **Implementation and Monitoring:** Commence the phased implementation of the trans-boundary water transfer project without undue delay. Establish a dedicated monitoring mechanism to track progress, promptly identify challenges, and adapt strategies in

real-time.

2. **Adaptive Management:** Embrace an adaptive management approach, drawing insights from both successful and challenging aspects of global water transfer initiatives. Regularly reassess and refine the project methodology based on ongoing feedback, scientific advancements, and emerging best practices.
3. **Integrated Research Collaboration:** Foster collaboration with local and international research institutions to continuously advance our understanding of the ecological, hydrological, and socio-economic dynamics associated with Lake Chad's revitalization. Engage in interdisciplinary studies to inform adaptive strategies and optimize project outcomes.
4. **Community Engagement and Capacity Building:** Prioritize robust community engagement strategies, ensuring that local communities are active participants in the decision-making process. Implement capacity-building programs to empower local stakeholders with the knowledge and skills necessary for sustainable water management practices.
5. **Environmental Safeguards:** Institute comprehensive environmental safeguards to mitigate potential negative impacts on both the sourcing regions and Lake Chad. Employ cutting-edge technologies for water treatment, pipeline integrity, and environmental monitoring to ensure minimal ecological disruption.
6. **Trans-boundary Diplomacy:** Strengthen diplomatic ties and agreements among the involved regions to facilitate a harmonious and cooperative approach to water sharing. Establish a trans-boundary governance framework that ensures equitable distribution, resolves conflicts, and upholds the sustainability of the water transfer.
7. **Climate-Resilient Strategies:** Develop and integrate climate-resilient strategies into the project design, considering the potential impact of climate change on both the sourcing regions and Lake Chad. This includes adaptive measures for changing precipitation patterns, temperature fluctuations, and other climate-related factors.
8. **Public Awareness Campaigns:** Launch extensive public awareness campaigns to inform the broader population about the significance of the project, its potential benefits, and the collective responsibility in ensuring its success. Foster a sense of ownership and environmental stewardship among the public.
9. **International Collaboration:** Seek collaboration and knowledge exchange with international organizations, governments, and experts engaged in similar large-scale water transfer projects. Leverage global expertise to address challenges, share lessons learned, and contribute to the collective understanding of sustainable water management.
10. **Regular Evaluation and Reporting:** Establish a system for regular project evaluation and reporting, ensuring transparency and accountability. Provide periodic updates to the public, governmental bodies, and international stakeholders on project milestones, challenges, and achievements.

These recommendations collectively aim to guide the successful implementation of the proposed trans-boundary water transfer project for Lake Chad's revitalization, fostering sustainability, collaboration, and long-term resilience.

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