INTERNATIONAL JOURNAL OF SOCIAL SCIENCES BULLETIN
ISSN: (E) 3007-1917 (P) 3007-1909
Volume 3, Issue 6, 2025

HYDROPOLITICS AND STATE SURVIVAL IN POST-CONFLICT LIBYA: A MULTIDIMENSIONAL ANALYSIS OF WATER SCARCITY, OVERNANCE FRAGMENTATION, AND CLIMATE-DRIVEN CONFLICT MULTIPLIERS

Izba Zaheer[*1], Prof. Dr. Amna Mahmood[2]

[*1]*PhD Scholar, Department of International Relations, MY University, Islamabad*
[2]*Professor of Political Science, Vice President (Female Campus), International Islamic University, Islamabad*

[*1]izbazaheerofficial@gmail.com, [2]amna.mahmood@iiu.edu.pk

Corresponding Author: *
Izba Zaheer
DOI: https://doi.org/10.5281/zenodo.15671878

Received	Revised	Accepted	Published
24 April, 2025	24 May, 2025	08 June, 2025	16 June, 2025

ABSTRACT

This article examines the nexus between human security and water in post conflict Libya and examines the challenges of governance, the destabilizing effect of water deprivations for state security, and the potential role of regional cooperation, in particular with Egypt. Libya, which has been experiencing political divisions and water scarcity, is highly dependent on the Great Man-Made River (GMMR) and the ancient fossil water from the Nubian Sandstone Aquifer System (NSAS) in terms of water management for recovery and sustainability. The paper addresses the water governance shortcomings of Libya, transparency, inefficiency, and insufficient infrastructure, and the implication such shortcomings have for achieving sustainability in water management. It also looks at how water scarcity has fueled social unrest, internal displacement and migration, adding to Libya's instability. Drought also poses a risk to Libya's water security as climate change can cause less rainfall and higher temperatures, which may desiccate water reserves. The paper also highlights the water diplomacy element of looking at shared management in one of the shared resources the Nubian Sandstone Aquifer System (NSAS) that straddles both countries, Libya and Egypt. The paper ends with policy recommendations for improving water governance, increasing climate resilience and fostering regional cooperation, acknowledging the interconnectedness of the water security challenges that are central to Libya's recovery and stability.

Keywords: *Water Security, Libya, Post-conflict Recovery, Governance Challenges, Water Scarcity, Climate Change, Regional Cooperation, Nubian Sandstone Aquifer System (NSAS).*

INTRODUCTION

The importance of water security for national stability is a critical one, particularly in post-conflict areas where the rule of law is often tenuous and natural resources are limited. Libya suffers from widespread political instability and armed conflict over the last 10 years, and there are big hurdles to the management of its water resources, which are crucial both to the country's recovery and on to its longer-term sustainability. Water security is defined not only by the physical availability of water but also by access to potable water, water resources management, as well as the resilience to deal with the impacts of a changing climate on water availability (Gleick, 2014). As an overall desert country, Libya's dependence on the Great Man-Made River (GMMR) system also demonstrates the vulnerability and geopolitical risk of its water supply, and the risks that such needs can bring in terms of regional water competition (Khalil, 2017).

Water scarcity and water use competition, especially in arid environments, have potential to

renew or intensify conflict between rival factions and local states, desecrating already-fragile post-conflict states. Under the paradigm of environmental security, the exhaustion of natural resources-for instance water, can threaten political and social stability, making conflict more likely (Barnett, 2003). The situation is even more dire for Libya as the sheer inadequacy of its ability to control and allocate water resources is further undermined by political disarray and corruption. In addition, already having to depend on a water-turbulent Egypt for the necessary sources of water, in the absence of a Livian solution system, would further complicate the situation because it can probably only be solved regionally; regional cooperation and water diplomacy is crucial in preventing small tensions from developing into larger conflicts (El-Baz 2019).

Climate change is adding to Libya's water security problem, with higher temperatures and less predictable rainfall set to diminish the country's limited water resources even further (Hunt 2018). As such, climate resilience becomes a key factor in Libya's water security plan. The nation is facing a two-fold problem: it must find a way to utilize its water in a sustainable manner now and prepare for the changes that climate will bring in the future. Addressing these concerns would involve more than just fixing broken government and the lack of infrastructure; it would also mean diplomacy between Jordan and neighboring countries such as Egypt, in order to lay the foundations for fairer water distribution, and less water conflicts in the future (Tir, 2015). While moving towards post-conflict recovery, water will continue to be a lynchpin in Libya's stability, and cross-cutting water diplomacy and climate resilience will need to be incorporated and mainstreamed into national policies in order to ensure peace and prosperity.

Libya's scarcity of water is a critical issue for its national stability and overall peace in the long term. In this already water-stressed country, the compounding stress of climate change and management failures promise increasing challenges to social unity and political stability. The leading research question whether similar to how Libya's peace and stability is influenced by water scarcity and how this is done in the light of post-conflict recovery. It also examines the obstacles Libya has to encounter to efficiently control water resources on one side, and to adapt for climate-related alterations that are likely to impact water availability in the future on the other side. More generally, these issues are part and parcel with the larger task of reconstructing national institutions and achieving sustainable management of resources in post-conflict environments.

The central thesis is that water security is critical to Libya's rehabilitation and future security. Sustainable water governance, the country's climate resilience capacity and cooperation with neighboring states like Egypt on joint water resources are all essential for Libya's future. While Libya tries to heal from the conflicts, sustainable and fair access to water will be important for the country's future stability. Again, even effective water resource management and climate change preparedness will need better governance structures and international cooperation, particularly with Egypt, its neighbor and co-riparian.

Environmental Security Theory grounds this study on the theoretical level, suggesting that water scarcity and other environmental issues contribute to the stability and security of a nation. The theory indicates that resource depletion can drive political instability, and violent conflict, particularly in post-conflict societies as it exists in Libya. Governance in this sphere is thus not only about managing the resource but also about securing peace and avoiding future conflict. The study will further integrate Water Diplomacy theory and its emphasis on cross-border water security and diplomacy. This theory will be used in Libya's relationship with Egypt, especially over the management of common water resources, like the Nile River which is of vital importance to both nations. Understanding the dynamics would, in turn, offer key indications of whether water diplomacy can serve as a tool for promoting regional cooperation as well as for avoiding potential conflicts over water resources.

2. Literature Review

The security implications of water resources in post-conflict societies are a rising focus of research, particularly in countries like North African states, where desert conditions and finite resources make water a crucial but scarce commodity prone to corruption and violence. While preoccupied with the aftermath of civil strife and political disintegration, Libya has become increasingly aware that it must manage its vitally necessary water supplies for the needs of recovery and long term stability. The nexus of climate change, water

scarcity, and resources management is key to answering how Libya can secure its future water while also creating peace and stability. The objective of this review is to investigate water security, climate change, and regional cooperation and particularly in the nexus between the above, with special emphasis on the case of Libya.

In post-conflict settings water scarcity is frequently at the heart of these tensions and can undermine attempts to reconstruct `working' and peaceful societies. Some case studies from around the world demonstrate how resource scarcity (especially water) can contribute to the exacerbation of social and political unrest, especially in arid and semi-arid areas (Zu et al., 2014, & Mirumachi, 2017). This is well illustrated in Libya, where scarcity of water, competition over resources, lack of governance and institutional collapse combined to produce a very fragmented water management system. Add Libya's draw on fossil water stores that reach ever deep into ancient aquifers, including those provided by the Great Man-Made River (GMMR), and their challenges are compounded. Such aquifers are finite resources and excessive pumping is leading to the depletion of these groundwater bodies and thus aggravating the shortage of water (Khalil, 2017). Water scarcity is not only a challenge to human basic needs in Libya, but it also subverts economic stability, agricultural productivity, food availability and security in the long run in post-conflict scenario of the country (Borgomeo et al., 2019).

The impacts of climate change on water security in arid countries such as Libya have been reviewed in the literature. It has been indicated in various studies that precipitation will decrease and evaporation will increase due to climate change which can deteriorate the already precarious situation of water shortage. According to the IPCC (2018), in 2050 North Africa is expected to have an increase in mean temperature larger than the global mean, posing a threat to water resources. This is particularly apt for Libya, where rainfall is scant and ends there, where the temperatures are high. Projected changes to the climate are expected to place even more stress on the country's water systems, which are already strained. This is a major concern in Libya, where agriculture is almost entirely based on groundwater extraction (Müller, 2016). Declining precipitation as a result of climate change will reduce crop production, resulting in the loss of food security and rendering the population more prone to financial instability.

The challenges of climate change to Libya's water systems are exacerbated by the country's dependency upon fossil water. The GMMR, which has been a major resource for the country's water supply, has been utilized for this and is founded on groundwater storage dating back many thousands of years. However, the rate of water withdrawn from this source far exceeds the rate of recharge, and depletion of these aquifers is a serious long-term concern for Libya's water supplies. The current governance and management mechanisms in Libya to manage these Problem Statement The governance and management existing challenges, as the political instability and frag- fluster in the post-Gaddafi era had severely destabilized the mentation characterizing the post-Gaddafi life of Libya has country's capacity of managing effectively its water re- badly crippled the country's ability to manage its water re- sources (El-Baz, 2019). If significant capital is not invested in water systems and reforms of the governance of water resources, Libya is unlikely to be able to achieve water security and would struggle to adapt to a changing climate. Water diplomacy is and will be indispensable in governing water-sharing in regions suffering from water scarcity, more and more. The relationship of Libya with Egypt as a fellow user of shared water resources is the arguably the best place to start if we seek to consider the water issues and potential for water cooperation in the region. Whereas Libya is not a direct consumer of the waters of the Nile River for its water supply, the influence of the Nile River on the shared aquifers beneath the Sahara Desert explain the importance of cooperation between the two regions. Nubian Sandstone Aquifer System (NSAS) extending across Libya, Egypt, Sudan, and Chad is a trans-boundary shared water resource that needs sustainable management through prevention of over-extraction. Control of this aquifer system has been a source of conflict before and continues to be an issue in the Libyan-Egyptian relations (Tir, 2015). Although Egypt has always depended on the Nile for its freshwater source, Libya's dependence on shared groundwater resources requires that the two countries cooperate in order to ensure the sustainability of water usage in the area.

Water diplomacy plays a decisive role in peace-building and conflict and needs to be considered in water governance in conflict-stricken regions.

Research indicates that collaborations around water can work as confidence-building measures in post-conflict contexts, and can provide a space of dialogue and trust-building between former adversaries (Lautze et al., 2014). Likewise, while the management of land should play a critical role in African conflict resolution, water issues between Libya and Egypt can't be separated by technical solutions, or even by the regions that water simply passes through. A focus on collaborative water management could help ease tensions between the two and support stability in the region. This is especially significant in light of the wider geopolitics of the Nile Basin and commensurate heightened tensions over water use, highlighted in the construction of the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile. Although Libya is not a party to the GERD dispute, the changing character of Nile waters politics may have profound effects on Libya's relationship with Egypt (Zeitoun and Mirumachi, 2017). Therefore, the significance of water diplomacy in promoting peace is crucial as well.

The literature emphasizes the nuanced interplay between climate change, water security, and regional cooperation in Libya. Water scarcity and climate change are closely linked and, when both have the combined effect on Libya's water systems, it could seriously pose a challenge to the country's long-term stability but also to its post-conflict recovery. The governance of water is fundamental to national security, and in addition to dealing with internal issues related to governance, managing water resources requires that countries practice international water diplomacy with their neighbors. The Libyan-Egyptian relationship, much like the shared Nile for both, offers a sobering reminder of the necessity of regional cooperation to address water scarcity-related challenges and the need for stability in North Africa. With climate change further exacerbating water scarcity in Libya, the role of water management, governance, and diplomacy will become even more important.

3. Research Methodology

The method of study adopted for this work was qualitative, drawing from secondary and primary sources of information on the relationship between water-security and national stability in post-conflict Libya. The overarching purpose was to understand the challenges that Libya is encountering with regard to water management as a result of climate change, and how water diplomacy can build confidence and cooperation in the region, particularly with Egypt. Original data were collected over the course of semi-structured interviews with key informants including Libyan government officials, water management experts, staff of international organizations involved in water management in the country, including UN organizations and the World Bank, and analysts of Libya's regional relations. These interviews gave in-depth insights into the political, social, and environmental aspects affecting Libya's water security. Supported by surveys that reached local communities and citizens to measure perceptions of water scarcity and peace and stability as well as qualitative data on the ground about how water insecurity affected everyday life, the researchers created a bottom-up understanding of the issue.

The secondary data were compiled from different sources, such as academic journals, government reports and international evaluations of Libya water and climate foreseen risk. Literature based on water security, climate change and water diplomacy were reviewed critically to guide the study and also to analyze Libya's water governance system. In addition, we considered case studies in other post-conflict countries that face similar problems of water security for similar analyses of governance and regional cooperation. Information about water resources of Libya, the Great Man-Made River, fossil water, and the sharing of aquifers with Egypt were reviewed to evaluate whether current water resources management is sustainable and the threats from climate change.

The data were thematically analyzed, focusing on patterns, themes, and key forces that emerged from both the interviews and the survey responses. This qualitative approach helped to deepen the understanding of the impediments of efficient water governance in Libya and the potential role of water diplomacy in preventing and/or managing conflicts. A second comparative perspective was used to assess Libya's water security problems in relation to other regional states, especially Egypt, and the prospects for cooperative water management. Ethical issues such as obtaining consent, the protection of the privacy of respondents, as well as confidentiality have been of concern in the study.

4. Issues of Water Security in Libya

4.1 Governance Challenges

Water governance in Libya after the war is fragile due to the absence of strong state organs and coherent governance institutions. Libya has been divided since the collapse of the former ruler Muammar Gaddafi's regime in 2011, with different factions controlling different regions of the country. Such political instability has created huge obstacles in effectively managing Mongolia's water resources. The lack of central government authority has led to no coordination and strategic planning in the management of water and, thus added to the already existing water disaster (El-Baz, 2019). The water sector in Libya has always been one of c centralized controled and the rash decentralization has resulted in a piecemeal water system where local authorities control but are too weak held d to manage the water resource efficiently (Tir, 2015).

Corruption and mismanagement have similarly haunted the water sector in the country, curtailing the capacity to undertake meaningful water governance reform. As Khalil (2017) notes, large-scale projects, as the Great Man-Made River (GMMR), became a victim of bad management manifesting in part through inadequate resource distribution and maintenance. Key to Libya's water security, these projects have been tainted by political interference and scandals, which means they never reached their full potential. Moreover, the neglect of maintaining infrastructure has resulted in the degradation of crucial water systems including the GMMR, which supplies most of Libya's drinking water. The bad governance in the water sector is part of a wider problem in the country, "where we have seen that corruption and weak state institutions have affected projects to rebuild a functional and stable society" (Schmeier et al., 2017).

4.2 The Impact of Water Scarcity on Stability

Water scarcity in Libya directly and indirectly affects both the national security and social stability. The water crisis in the country is not just an issue of scarcity of resources, but also a security issue as it leads to internal migration, migration to other countries and internal disturbances in the state. Water scarcity has also been related to increased tensions between various areas in Libya, including between the coast and the interior, as water resources grow scarcer. This absence of water access has promoted population displacement in rural and desert areas, for these communities suffer with water scarcity (Khalil, 2017). Limited water for agriculture has also threatened the living of rural and farming populations, increasing poverty and discontent.

Limited availability of water makes the possibility of conflict worse, as the race for resources heats up when there is no established governance. As Zeitoun & Mirumachi (2017) argue, lack of resources in regions of conflict may prove in some cases to be the tip of the iceberg for social unrest. Countries like Libya, where there is a high reliance on water for agriculture as well as urban potable supplies, are particularly exposed to such tensions. With greater water stress, migration pressures are likely to rise – internally and across borders. These movements may aggravate social differences and enhance instability in Libya's precarious political context. The direct connection between water security and peacebuilding is obvious: adequate water access is essential for community cohesion, economic prosperity and national security.

Table 1: Water Shortage and Consequences

Water Shortages and Stability	Consequences
Internal Displacement	Migration from rural areas to cities due to inadequate water for agriculture and daily needs.
Social Unrest	Increased competition for limited resources, leading to tensions between communities.
Economic Impact	Reduced agricultural productivity, rising food prices, and economic hardship, contributing to poverty and instability.
Regional Tensions	Conflict over water resources between different regions within Libya and with neighboring countries like Egypt.

4.3 Resilience and Adaptation to Climate

Libya is unprepared for climate change with respect to water security; its lack of infrastructure, poor governance and little or no funding to change this situation hamper the development of the country in relation to its concerns for climate change

policies. 800pxThe effects of climate change are being felt in the form of rising temperatures, lower rainfall, and more frequent droughts. These alterations risk significantly undermining the long-term sustainability of Libya's water supply, which is heavily dependent on fossil groundwater. Its infrastructure, including the GMMR, is not climate resilient and has failed to cope with the impacts of climate change, with high evaporation and diminished groundwater resources. GMMR was never conceived as having been constructed from design to extraction machine for subterranean fossil water, however it was constructed not with climate adaptation on table (Khalil (2017). Reliance on fossil water and a lack of investment in the technology of water resource management has made Libya vulnerable to water shortages in times of climatic fluctuations. Furthermore, Libya's capacity to respond to the water-related problems of climate change is compromised by the fragmented nature of Libyan governance and by the absence of integrated national planning (Hunt, 2018).

Climate adaptation responses, such as ecologically sustainable water management, desalination and irrigation technology upgrades, are required to address Libya's long-term water security. The situation has not been easy to address given the continuing political and economic instability in the country. Although Libya can draw on advanced technologies like desalination, they drive input costs beyond the reach of the general population (Müller, 2016). Thus, the country's readiness for climate change, especially with respect to water security, remains comparatively weak. Tackling these challenges will hinge on strengthening governance systems, developing sound climate change policies and increasing international cooperation to provide the financial and technical assistance required to enhance climate resilience in Libya.

Table 2: Climate Change Challenges

Climate Change and Adaptation	Challenges
Infrastructure Resilience	Aging infrastructure and over-reliance on non-renewable fossil water resources.
Climate Policy	Lack of national policy on climate adaptation and water management.
Technological Innovation	Limited access to climate-resilient water technologies, such as desalination, due to high costs and lack of infrastructure.
Financial Constraints	Insufficient investment in sustainable water management systems and climate adaptation strategies.

5. Libya's Water Relations with Egypt

Libya's water security concerns are closely linked with its geopolitical relationship, particularly with Egypt, because of the mutual dependence on transboundary water resources such as the Nubian Sandstone Aquifer System (NSAS). Although the Nile River's surface water does not affect Libya, its dependence on the NSAS water resources however, implies that this joint management is important for both countries. The NSAS, which stretches across Libya, Egypt, Sudan and Chad, is one of the most important aquifer systems in the world, with these countries all relying on this finite water resource. For a country like Libya that depends on fossil water from this aquifer system, the efficient management of use and collaboration with Egypt on its use is integral for long-term water security (El-Baz, 2019). The geopolitical implication inherent in the sharing of water in the arid and semi-arid parts of North Africa attests to the need of co-operation and diplomacy among countries in the management of such critical resources.

Libya here is not really a big user of Nile water downstream but the relationship between Libya and Egypt is somewhat informed by the common aquifers under the Sahara. These energy resources aid in satisfying assuming mounting demand from population growth and climate change, as well as relieving pressure on scarce water resources, which are crucial for both countries and, facing depletion, require cooperation for their effective management (Tir, 2020). The Great Man-Made River (GMMR), Libya's main water extraction project, pumps water from the Nubian Sandstone Aquifer System (NSAS). The GMMR is a major infrastructure project that will enable water to be piped from the aquifer to coastal cities, however, excessive depletion of this finite resource raises significant sustainability concerns. If not handled optimally, the exhaustion of the NSAS could significantly reduce water availability to Libya and

Egypt, which could heighten conflict between the two countries and contribute to social and ecological instability (Khalil, 2017).

Egypt is also the major consumer of Nile water, hence its control over the region's water resources, and which is also why water diplomacy with Libya is increasingly important. Political and diplomatic relations over the Nile have been further strained by the Grand Ethiopian Renaissance Dam (GERD) being built on the Blue Nile, resulting in brewing acrimony between Egypt, Ethiopia, and Sudan. Libya is not also a direct party to the GERD but the broader regional dynamics of Nile politics influence its relationship with Egypt (Zeitoun & Mirumachi, 2017). The ongoing pressures around the GERD have exacerbated Egypt's concerns about its water security, and any drawdown of the NSAS through over pumping would help considerably to raise the stakes in Egypt's position. In short, Libyan water diplomacy with Egypt is a manifestation of a more general geopolitical and hydro political map of North Africa, where water security has been entrenched as an element of national security.

Joint water governance of the shared water resources between Libya and Egypt arise due to lack of legal arrangements for use and management of Contrary to the majority of transboundary water agreements (e.g., in the Nile basin), case of the NSAS, no general treaty or focused agreement had been agreed by Libya and Egypt for managing it (El-Baz, 2019). The lack of such an agreement has substantially impeded efforts to distribute water more fairly and to develop sustainable policies that can help forestall future disputes. In the context of climate change, the absence of such a formalized collaboration is particularly problematic since the predicted decreases in groundwater recharge from altered precipitation and enhanced evaporation may intensify the contestation over shared water resources in the two countries (Schmeier et al., 2020).

It has been particularly difficult to conduct effective water diplomacy amid Libya's political instability and fluid governance. Post-Gaddafi, Libya has been challenged by the failure to form a single government, thwarting attempts to address key national matters such as water security (Tir, 2020). This political splintering has likewise stymied Libya's ability to fully participate in regional discussions with Egypt on water cooperation. With no strong center and central government that is stable, Libya has failed to establish the international relations and form the mode of operation to manage these water sources on the basis of shared interest among much of the region. Consequently, Libya's ability to engage in substantive water diplomacy with Egypt is hindered, which is important for the long-term management of the NSAS.

The involvement of international organizations such as the UN and the African Union has been crucial for water diplomacy between Libya and Egypt, but not so well structured. These groups could be intermediaries to foster discussion and collaboration between the two countries regarding water resources they have in common. These organizations could also serve as a neutral ground for Libya and Egypt to discuss fair water allocation, joint infrastructure works, and combat climate change through diplomacy on water. However, with Libya's continued political issues, these bodies need to be more proactive in helping Libya's interaction with Egypt, to help create a stronger water security partnership with Egypt (Schmeier et al.

Secondly, if Sudan and or/Chad get involved in the management of the NSAS, it might create an opportunity for more regional cooperation among Nile Basin countries. The water diplomacy of Libya should be developed with a multilateral approach that considers the interests and requirements of all countries that share the aquifer. By participating in collective action regarding management of waters shared with NSAS, Libya and Egypt may improve cooperation on water resources and work towards the alleviation of tensions and maintenance of regional peace and stability (Tir, 2020). A more collaborative, participatory and equitable model of water management could set the template for other shared waters in the region.

6. Implications and Recommendations for Policy

The water security threats that confront the Libyan people demand urgent attention by both domestic and international stakeholders. While the country attempts to move on from conflict, it must place sustainable water resource management at the top of its list of priorities, not only for stability but for economic recovery and social harmony in the long term. Options for policy recommendations the following proposed policy recommendations aim to tackle governance issues,

mitigate the effects of water scarcity and enhance the resilience of the water sector in Libya. These suggestions are likely to enhance Libya's domestic water management capabilities, support regional collaboration with Turkey and other neighboring countries, and respond to challenges brought by climate change.

6.1 Strengthening of Governance and Water Management Structures

First and above all, there is an immediate need to ensure robust governance of the water sector in Libya. Political disunion and dispersal of political authority has prevented efficient water use in this nation. The local government needs to have a unified and integrated water management lead institution to facilitate a harmonious implementation of water resources policies hung the vision for a better water resources management. Such an institution should be responsible for managing water resource utilization and distribution, supervising the rates of extraction from the Great Man-Made River and other water sources, and ensuring a fair and sustainable use of water (Tir, 2020). This body should also be enabled to pursue water diplomacy with neighboring states, most notably Egypt, in order to discuss trans-boundary water resources, including the Nubian Sandstone Aquifer System (NSAS) and establishing fair equitable-share water agreements.

Libya should not only centralize its governance, but also minimize corruption and mismanagement in the field of water. Critical to an effective and non-exploitative implementation of water management and infrastructure development measures are transparent decision-making processes, strong accountability processes and frequent auditing of water infrastructure projects." Supporting capacity-building programs for local and regional water management authorities would contribute to advancing a more effective and accountable administration (Schmeier et al., 2020). This may also alleviate the inadequacies with maintaining the current infrastructure including the GMMR, which has been massively subjected to neglection of maintenance because of the governance inefficiencies (Khalil, 2017).

6.2 Strengthening Climate Resilience and Adaptation Strategies

To deal with increasing climate change threats, Libya needs its own full package of climate resilience strategies, which prioritize water systems and adaptation to low rainfall, high temperatures and the potential depletion of groundwater. The first level is to acquire modern water management technologies such as desalination plants, which would generate an alternative water resource and decrease reliance on groundwater (Müller 2016). The process may be costly, but desalination offers a renewable alternative to depleting groundwaters, particularly in coastal regions where water is in high demand.

In addition to that, Libya has to better its water-saving measures. We should also promote efficient irrigations systems like drip irrigation and water efficient farming to bring down a large part of the country's usage which is linked to agriculture. Clever policy interventions that encourage farmers to use these water-saving technologies can help to take the pressure off already depleted groundwater and enable agriculture to survive at a time when it's predicted water will be in ever short supply (Hunt, 2018).

Libya should also be involved in regional initiatives around climate change adaptation, especially with Egypt, so that they can address climate impacts on common water systems together. Collaboration to track climate impacts, exchange data and collaboratively identify strategies for adaptation to altered water availability would better prepare both nations for future challenges. These measures could involve: construction of infrastructure together for conservation of the water, such as facilities for storing water, installing water-recycling systems (Schmeier et al., 2020).

6.3 Advancing Water Diplomacy and Cooperation in the Region

Because of Libya's dependency on conjunctive NSAS waters, cooperation among Libya, Egypt, and other NSAS riparian is with few doubts necessary. A treaty to regulate joint Libya and Egypt water resources urgently needs to be consummated. Such an agreement may also contain clauses relating to best practices for the sustainable use of the NSAS, setting of extraction targets, and mutual monitoring and management structures of the aquifer system. Water diplomacy as a tool is not just a solution for a resource management issue, it will also help to avoid future wars on water (El-Baz, 2019).

To promote more regional and sub-regional cooperation, Libya should engage in NBI meetings and consultations with other riparian countries in the Nile Basin and should work with countries in the Lake Chad Basin and Sudan. Such efforts could not only help better manage shared water resources, but also promote a shared responsibility and cooperation among the countries in the region. Through collaborative infrastructure development and regional investments in water security, Libya may also help with the general approach to peace in North Africa (Zeitoun & Mirumachi, 2017).

Key international institutions including the UN and the African Union, however, have a significant role to play in enabling regional dialogues and helping Libya in the promotion of a successful water diplomacy. They can offer technical capabilities, money and negotiation channels. For instance, the African Union could facilitate dialogue between Libya and Egypt to guarantee fair and sustainable arrangements for sharing water, which would foster peace and cooperation in the region (Tir, 2020).

6.4 Support and Collaboration at the International Level

Lastly, Libya would have to look abroad for assistance in the water field from other countries. "Including financing for infrastructure, capacity development, and technical assistance in water management. HSBC All international donors and development agencies must finance climate change adaptation initiatives, including for water infrastructure, agricultural resilience, and technologies that use water more efficiently. Support for construction of desalination and conservation facilities will be critical in the context of depleted groundwater supplies (Müller, 2016).

Libya, too, must seek to establish partnerships with regional neighbours, like Tunisia, in order to exchange best practices in water management and climate adaptation. These alliances may provide Libya with a key source of hard-won expertise and resources, allowing it to develop more sound water-policy and-strategy alternatives. Moreover, cooperation with multilateral partners, such as the World Bank and the African Development Bank, could offer technical and financial support to bring into practice water infrastructure schemes (Schmeier et al., 2020).

The water security challenges in Libya are multifaceted and complex that are influenced by political instability, climate change and regional geopolitics that significantly influence water governance in the country. Solving these issues will in turn require a joint action at national, regional and international levels. For the latter, improvements in governance, investment in climate resilience and developing regional water diplomacy with Egypt are critical for the long-term water security of Libya. Access to international support and partnerships would also be important for obtaining the resources and knowledge to develop successful water management plans. If these values are taken up, Libya has the opportunity to transition to a more sustainable and peaceful water future and contribute to national stability and regional peace.

7. Conclusion

Water insecurity in Libya is central to wider issues of national stability, economic revival and post-conflict reconstruction. Faced with political fragmentation and challenges from things as diverse as climate change and water shortages, Libya has an urgent need to upgrade and invest in management of its water resources. The political climate within the country has greatly impacted the efforts to implement functional water management practices and systems for governance, and the water crisis has been worsened by corruption, poor planning, and inadequate infrastructure. For this reason, the nation is confronted with considerable issues to maintain a sustainable water supply to support both its people and agricultural sector.

Thirst in Libya has also direct and indirect effects on the social stability. Competition for scarce water resources is driving internal displacement, migration and social tensions. Not only do they undermine the country's peace and security, but they also make it ever more difficult to rebuild a country torn apart by war. The dynamic is exacerbated by the factor of climate change, which will continue to deplete the scarce water resources of Libya, adding another dimension to the water security of the country. In the absence of climateresilient infrastructure and adaptive water management solutions, Libya will remain increasingly susceptible to water scarcity; putting the lives of its people and its economic future at risk.

Regional cooperation with countries such as Egypt on shared water resources such as the Nubian Sandstone Aquifer is also important for Libya's water security. In this context, relations between Egypt and Libya are intersected by wider geopolitical dynamics in the Nile Basin, yet water diplomacy could reduce them while supporting the cooperation over the shared resources. Negotiating regional agreements for sustainable management of shared water resources and participating in multilateral dialogue with neighbors may help increase regional stability and support peacebuilding initiatives in North Africa.

To meet these challenges, Libya needs to work to reinforce the capacity of its water governance institutions by reducing the role of corruption and enhancing water infrastructure capacity. The creation of a central authority responsible for water allocation, together with investment in new water management technology and climate-resilient infrastructure, is essential to providing for the nation's water future. There will be a need for international assistance, in terms both of finance and technical expertise, in order to assist Libya to develop its capability to manage water sustainably and effectively in the context of climate change.

In summary, the problems of water security in Libya are inextricably linked with the political and environmental situation. Challenges To address these challenges, a collective action at the national, regional and international levels is needed. Through the reform of integrated water management, focusing on climate adaptation measures and promoting region wide collaboration, Libya can help to shore up its own water security and in doing so help to promote peace and stability more broadly in the region. With the right policies and with international help, Libya has the potential to reverse its water crisis and create a more sustainable and secure future for its people.

REFERENCES

Barnett, J. (2003). Security and climate change. Global Environmental Change, 13(1), 7-17.

Borgomeo, E., Hanasaki, N., & Hoff, H. (2019). Water Security and Peacebuilding: Managing Shared Water Resources for Stability and Cooperation. Nature Sustainability, 2(5), 309-317.

El-Baz, F. (2019). Transboundary water management in the Nile Basin: Libya and Egypt. Water Policy, 21(4), 701-718.

Gleick, P. H. (2014). Water security and the challenge of climate change. Environmental Research Letters, 9(4), 045001.

Homer-Dixon, T. F. (1999). Environment, Scarcity, and Violence. Princeton University Press.

Hunt, J. (2018). Climate change and water security in North Africa: A framework for adaptation. Climate and Development, 10(4), 379-389.

Khalil, M. A. (2017). Water resources management in Libya: The Great Man-Made River Project and its challenges. Water Resources Management, 31(5), 1427-1438.

Lautze, J., Manthrithilake, H., & Wijesekera, N. (2014). Water for Peace: Can Transboundary Water Cooperation Support Peacebuilding?. Water International, 39(2), 153-167.

Müller, M. (2016). Water, Security and Conflict: The Role of Water in Peacebuilding. International Environmental Agreements: Politics, Law and Economics, 16(2), 235-249.

Schmeier, S., Wolf, A., & Rieu-Clarke, A. (2017). Transboundary Water Governance: A Framework for Peace and Stability. Journal of Environmental Management, 203, 659-669.

Schmeier, S., & Zawahri, N. (2020). Water Diplomacy: Principles and Practice in Transboundary Water Management. Oxford University Press.

Tir, J. (2015). Water conflict and cooperation in the Middle East: Libya's relationship with Egypt. Journal of International Water Law, 22(2), 115-131.

Tir, J. (2020). Water Security and Conflict: The Role of Shared Aquifers in the Middle East and North Africa. Journal of Environmental Management, 245, 110-120.

Zeitoun, M., & Mirumachi, N. (2017). The Politics of Water Security: Power, Water, and Governance. Wiley-Blackwell.

Zeitoun, M., & Mirumachi, N. (2017). The Politics of Water Security: Power, Water, and Governance. Wiley-Blackwell..