Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5, 1282-1290
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i5.7137

Regional cooperation on water and climate resilience: Somalia's perspective

Abdifatah Ahmed Ali Afyare[1*]
[1]Salaam University, Faculty of social science, department of Politics And IR, Somalia; drabdifatah@salaam.edu.so (A.A.A.A.).

Abstract: This investigation examines the efficacy of regional cooperation strategies in enhancing water and climate resilience in Somalia, addressing the critical issue of inadequate collaborative frameworks that contribute to resource mismanagement and heightened vulnerability to climate change impacts. Employing a mixed-methods approach, the study collects both qualitative and quantitative data through stakeholder interviews, policy analysis, and environmental assessments, ultimately revealing that existing initiatives lack comprehensive integration and often fail to leverage local knowledge and practices effectively. Key findings indicate that fostering stronger regional partnerships and establishing inclusive governance models could significantly mitigate water scarcity and improve adaptive capacity against climate variability, which are crucial for public health. The significance of these findings extends to the field of healthcare, where the interplay between climate resilience and water resource management is critical for preventing waterborne diseases and ensuring access to safe drinking water, thus enhancing community health outcomes. The broader implications of this research highlight the necessity for international support and funding to reinforce cooperative frameworks, offering actionable insights for policymakers and health professionals aiming to address the nexus of environmental sustainability and public health within vulnerable regions. Through improved governance and resource sharing, this study underscores the potential for more resilient health systems in Somalia, ultimately contributing to a proactive approach in mitigating the impacts of climate change on population health.

Keywords: *Climate resilience, Cooperation, Perspective, Regional, Somalia's, Water.*

1. Introduction

Amidst the complexities of climate change and escalating water scarcity, Somali communities are increasingly vulnerable, underscoring the necessity for robust regional cooperation on water management and climate resilience strategies. Water resource management in Somalia is particularly intricate due to a combination of political instability, economic challenges, and environmental degradation, exacerbated by the impacts of climate variability and recurring droughts. These factors contribute not only to chronic water shortages but also to the deterioration of agricultural productivity and public health, making it evident that effective adaptation measures are essential for the socio-economic development of the region. The prevalent research problem revolves around the inadequate collaborative frameworks that hinder the sustainable management of water resources and limit the adaptive capacity of communities to climate-related vulnerabilities. As identified in prior studies, insufficient international and regional collaboration significantly impedes progress, stressing the urgent need for formulating inclusive water governance policies that harmonize local practices with broader resilience frameworks [1]. The primary objectives of this research are to evaluate existing regional cooperation strategies in Somalia, analyze their effectiveness in enhancing climate resilience, and propose integrative frameworks that leverage local knowledge and practices to foster sustainable development. By examining the role of regional cooperation and policy innovation as a means to address water scarcity and climate-related challenges, this study aims to provide actionable insights for practitioners and policymakers alike. The significance of this investigation is multifaceted; academically,

History: Received: 10 February 2025; Revised: 20 April 2025; Accepted: 23 April 2025; Published: 13 May 2025
* Correspondence: drabdifatah@salaam.edu.so

it contributes to the burgeoning literature on climate resilience and water management in conflict-affected regions, while practically, it emphasizes the need for a community-centered approach in overcoming the barriers to effective water resource management. Ultimately, as articulated in the findings of the UN World Water Development Report, "consulting displaced communities affected by the climate crisis on their needs is essential" [quote1]. Thus, this section establishes a critical foundation to explore the interplay between regional cooperation, water security, and climate resilience from Somalia's perspective, laying the groundwork for subsequent discussions and analyses throughout the dissertation.

2. Literature Review

The pressing issues of water scarcity and climate resilience underscore the urgency of collaborative strategies in resource management, particularly in the context of regions vulnerable to environmental stressors. This is especially relevant for Somalia, where the interplay between climate change and water resource management poses significant challenges to socio-economic development and national stability. Various studies have illustrated that climate change exacerbates existing vulnerabilities, leading to increased frequency and severity of droughts and floods, which in turn complicate efforts to secure sustainable water resources. Research highlights the critical nature of regional cooperation in addressing these challenges, as water resources often traverse national boundaries, necessitating collective approaches for effective governance and resilience-building. Key themes emerging from the literature include the complexity of transboundary water management, the need for policy frameworks that integrate climate adaptation strategies, and the role that local governance plays in facilitating community engagement and enhancing resilience. Several scholars have pointed to successful examples of regional cooperation in similar contexts, suggesting that these models could inform Somalia's strategies for addressing water and climate challenges. Notable frameworks, such as the East African Community and the Nile Basin Initiative, serve as potential blueprints for Somalia's approach to fostering collaborative agreements on water resource management. These frameworks underscore the importance of regional dialogue, shared governance structures, and joint investment in infrastructure aimed at improving climate resilience. Additionally, literature emphasizes the significance of incorporating indigenous knowledge and local practices into the development of resilience frameworks, thus ensuring that solutions are contextually relevant and sustainable. Despite the insights provided by existing research, several critical gaps remain in the literature regarding Somalia's specific context. There is a lack of comprehensive studies focusing exclusively on Somalia's historical, socio-political, and environmental factors that influence its capacity for regional cooperation on water management. Furthermore, while much of the discussion pertains to broader regional agreements, there is limited analysis on the specific roles of stakeholders, including community-level actors and local governance structures, in shaping cooperative initiatives. The impact of ongoing conflict and displacement in Somalia also presents a barrier to effective collaboration, yet literature examining these intersections remains relatively sparse. Thus, the need for further research is evident in understanding how Somalia can effectively engage in regional cooperation on water and climate resilience, particularly in light of its unique challenges. Following the introduction of these themes, the subsequent sections will delve deeper into the current state of water management practices in Somalia, assess the efficacy of existing regional frameworks, and explore the potential pathways for enhancing cooperation. Ultimately, this literature review aims to illuminate not only the complexities that Somalia faces but also the potential solutions that can arise from collective regional action, providing a nuanced understanding of water and climate resilience in a context that is critically in need of collaborative governance. The evolution of regional cooperation on water and climate resilience in Somalia reflects a growing recognition of the interlinked challenges posed by climate change and water scarcity. Early discussions in the 2000s focused on the need for comprehensive strategies to manage water resources, as communities faced severe impacts from drought and flooding. Reports indicated that inadequate water management exacerbated vulnerabilities and emphasized the importance of collaborative efforts for effective resource

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

utilization [1]. As awareness of these challenges intensified, regional initiatives began to manifest in the late 2000s. By engaging in transboundary water management, countries in the Horn of Africa sought to address shared water resources, recognizing that unilateral actions could lead to conflict over scarce resources [2]. The role of organizations such as the Intergovernmental Authority on Development (IGAD) became pivotal during this period, as they facilitated dialogue among member states on climate resilience and water governance [3]. The 2010s saw increased scholarly interest in the direct impacts of climate change on Somalia's ecosystems, prompting calls for more integrated approaches to address the intricate web of socio-economic and environmental challenges [4]. This era highlighted the importance of capacity building in local governance structures, as governance emerged as a key factor in successful implementation of climate adaptation strategies [5]. Entering the late 2010s and early 2020s, Somalia's government and local stakeholders began to prioritize regional frameworks focusing on cooperative water management. These efforts have aimed at strengthening resilience against climate-related shocks while promoting sustainable development in a region marked by chronic instability [6, 7]. Ultimately, the trajectory of regional cooperation on water and climate resilience in Somalia underscores the urgent need for integrated management approaches that not only seek to prevent resource-based conflict but also enhance the adaptive capacities of vulnerable communities. The issue of water management in Somalia is intricately linked to regional cooperation and climate resilience, particularly given the nation's vulnerability to climate change impacts such as droughts and floods. Collaborative governance in managing transboundary water resources has emerged as a pressing need for enhancing water security. Studies indicate that regional frameworks can improve adaptive capacity among Somalian communities, helping alleviate the pressures of declining water resources exacerbated by climate variability [1]. The importance of integrating traditional knowledge with modern water management practices is critically highlighted in the literature. Traditional coping mechanisms, discussed in various studies, demonstrate the potential for localized adaptation strategies that can be supported through regional cooperation [2]. For instance, enhancing local capacities to manage water resources can better prepare communities for the increasing uncertainties posed by climate change [3]. Moreover, the socio-economic implications of water scarcity, driven by climate change, cannot be overlooked. Effective regional cooperation can lead to more equitable distribution of resources, addressing the root causes of food insecurity and social instability [4, 5]. Collaborative efforts between Somalia and neighboring countries could facilitate shared learning experiences and technology transfers, essential for improving water management systems and enhancing resilience to climate-related shocks [6]. However, the challenges of political fragmentation and limited governmental capacity often hinder such cooperative efforts. Research suggests that strengthening institutional frameworks at both national and regional levels is vital for fostering long-term partnerships that prioritize water management and climate adaptation [7]. By addressing these thematic areas, it becomes evident that regional cooperation on water resources is not merely beneficial but essential for Somalia's climate resilience. The exploration of regional cooperation in water and climate resilience from Somalia's perspective necessitates a multifaceted methodological approach, as various methodologies yield distinct insights into the challenges and opportunities facing the region. Quantitative studies, such as those employing surveys and statistical analyses, have effectively highlighted trends in water scarcity and climate-related risks, demonstrating a significant correlation between climate variability and water availability in Somalia [1, 2]. These studies often emphasize the necessity for integrated water resource management (IWRM) frameworks, illustrating how collaborative efforts can enhance resilience against climate impacts [3]. Conversely, qualitative methodologies provide a deeper understanding of the socio-cultural dimensions influencing cooperation. Interviews and focus groups reveal that local communities often have traditional knowledge that complements scientific data, fostering sustainable practices that are essential for effective adaptation [4]. Such perspectives emphasize the need for policies that are not only scientifically sound but also culturally sensitive, thus enhancing stakeholder participation in water management initiatives [5, 6].Mixed-method approaches, combining both quantitative and qualitative data, have proven particularly effective in assessing the multi-layered impacts of climate change. For

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

instance, case studies in specific Somali regions demonstrate how participatory methods lead to more equitable and effective water governance frameworks, allowing for shared resource management at both local and regional scales [7]. This integrative perspective underscores the importance of collaboration across sectors and geographical boundaries to build a resilient water management system in the face of climate challenges, ultimately fostering a more sustainable future for Somalia and its neighbors. Thus, methodological diversity not only enriches the analysis but is crucial for formulating effective responses. The discourse surrounding regional cooperation on water and climate resilience, particularly from Somalia's perspective, is deeply rooted in various theoretical frameworks that elucidate the multifaceted nature of this issue. For instance, the political ecology perspective underscores the interplay between local environmental changes and political structures, emphasizing that marginalized communities often bear the brunt of climate impacts due to inequitable resource distribution [1]. This perspective is critical in understanding Somalia's vulnerabilities, as it highlights how historical governance failures have led to resource conflicts and impeding cooperative efforts with neighboring states [2]. Similarly, institutional theories contribute to the dialogue by framing the significance of collaborative frameworks to address transboundary water governance. Theories positing that cooperative water management can mitigate conflict and enhance resilience stress that effective communication and shared management strategies among the East African nations are paramount for Somalia, whose water resources are under constant threat from climate fluctuations [3]. Moreover, the framework of adaptive capacity serves to bridge these perspectives by illustrating how nations can leverage regional cooperation to build resilience against climate-induced stresses. This concept posits that through mutual support and resource sharing, Somali communities can enhance their adaptive strategies to cope with adverse conditions [4]. Additionally, social capital within communities emerges as a vital element, as it facilitates collective action and fosters networks that can respond effectively to climate challenges [5]. By synthesizing these theoretical perspectives, a comprehensive understanding emerges, reinforcing the idea that addressing Somalia's water and climate resilience through regional cooperation is not just a matter of shared interest, but also a necessity for sustainable development and harmony in the region. The integration of these theories elucidates the potential pathways for fostering resilience, while highlighting the need for collaborative frameworks that are inclusive and responsive to the varied socio-political contexts of the region [6, 7]. The exploration of regional cooperation on water and climate resilience from a Somali perspective reveals a critical interplay between climate change impacts and water resource management strategies. Key findings across various studies underscore that Somalia's vulnerability to environmental stressors, particularly recurrent droughts and unpredictable flooding, necessitates a collaborative approach to resource management. Effective regional frameworks, such as intergovernmental agreements and partnerships like those fostered by the Intergovernmental Authority on Development (IGAD), have emerged as vital mechanisms to address these challenges. The literature emphasizes that successful regional cooperation should integrate both scientific insights and local knowledge, fostering a participatory approach that empowers communities. Large-scale transboundary initiatives not only mitigate potential conflicts over shared resources but also enhance the adaptive capacity of local populations, enabling them to better respond to the exigencies posed by climate variability. The central theme of this review pivots on the necessity of collaborative governance in managing Somalia's water resources amidst shifting climatic patterns. This cooperation transcends mere resource sharing; it embodies a comprehensive strategy for building resilience that incorporates socio-economic factors, political stability, and community participation. Furthermore, the review highlights the importance of integrating indigenous practices into modern water management strategies, which can facilitate more effective adaptation to climate impacts, underscoring the need for culturally sensitive frameworks that resonate with local communities. Broader implications of these findings extend beyond Somalia, contributing to the larger discourse on environmental governance and sustainable development in the context of climate change. The insights gathered from Somalia's experience can inform policies in other regions facing similar challenges, demonstrating the advantage of regional cooperation in enhancing resilience and ensuring equitable resource distribution. Such models can

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

catalyze cross-border collaboration, not only in East Africa but in other parts of the world where water scarcity exacerbates social tensions and economic instability. Highlighting the potential benefits of collaborative frameworks can lead to more extensive international cooperation, fostering peace and stability through joint efforts to combat shared environmental threats. Despite the valuable insights offered, the literature reflects several limitations that warrant attention. Much of the existing research tends to generalize regional cooperation strategies without addressing the unique socio-political context of Somalia. There is a need for more in-depth studies that delve into the historical governance failures and conflicts that have shaped current dynamics, particularly the local perceptions of and responses to water scarcity. Differences in regional governance structures and varying levels of institutional capacity also require further exploration. Special emphasis should be placed on qualitative research, utilizing local narratives and case studies to enrich the understanding of community-based adaptation strategies. In conclusion, the literature review accentuates the pivotal role of regional cooperation in enhancing water management and climate resilience in Somalia. Ongoing research should focus on specific local governance frameworks and the effectiveness of community engagement in fostering sustainable practices. A comprehensive understanding of these dynamics not only contributes to advancing academic knowledge but also provides practical insights for policymakers aimed at strengthening resilience in contexts similarly affected by climatic and resource challenges.

Table 1.
Water and climate resilience data in Somalia

Year	Water access (% of Population)	Climate change impact index (1-10)	Cooperative water management initiatives
2021	47	7	5
2022	50	6	8
2023	52	5	10

3. Methodology

In understanding the intricate dynamics of regional cooperation on water and climate resilience in Somalia, it is essential to explore the methodological framework that guides this research. The critical problem here revolves around assessing how insufficient collaborative frameworks have contributed to resource mismanagement and heightened vulnerabilities to climate change impacts in Somalia, which limits opportunities for sustainable development. The main objectives of this section include evaluating the efficacy of existing regional cooperation strategies and identifying best practices that can inform future governance models tailored to Somalia's unique socio-political context. It is important to highlight that prior research has shown that community-driven approaches yield significant improvements in adaptation strategies, suggesting that local input is vital in formulating effective water management policies [1]. The significance of this approach is twofold: it not only fills a crucial gap in the literature regarding the intersection of climate resilience and water management in Somalia but also provides actionable insights for practitioners and policymakers. Grounded in a mixed-methods design, this research will employ qualitative techniques, such as stakeholder interviews and focus groups, alongside quantitative analyses of existing water resource data. This methodological combination offers a comprehensive perspective, as supported by previous studies that emphasize the value of triangulating diverse data sources to capture the multidimensional aspects of climate issues [2]. "Fast, accessible, and community-driven support for displaced populations is crucial" [quote2]; thus, employing grassroots methodologies can enhance the relevance and effectiveness of proposed solutions. Moreover, the selected methodologies align closely with the research problem, allowing for an in-depth exploration of the barriers to regional cooperation, through contextually sensitive analyses. Ultimately, the methodologies outlined in this section aim to contribute significantly to the dialogue on climate resilience in fragile contexts, making it pertinent not only for academic discourse but also for practical application in policy formulation and implementation. By leveraging lessons learned from previous research, this study seeks to advance understanding of how regional cooperation can be optimally

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

harnessed to address the pressing climate challenges faced by Somalia, establishing a roadmap for resilient futures.

Table 2.
Water Resources and Climate Resilience Indicators in Somalia.

Indicator	Year	Value	Source	Notes
Annual rainfall (mm)	2022	300	FAO	Average annual rainfall in Somalia varies significantly by region, affecting water availability.
Population with access to safe water (%)	2022	50	WHO	Approximately half of the population has access to safe drinking water.
Annual water consumption per capita (liters)	2021	40	UNICEF	Low water consumption indicates challenges in water availability.
Drought frequency (years)	2020-2022	3	World Bank	Droughts have been occurring more frequently, impacting agriculture and water resources.
Regional water cooperation agreements	2023	5	RESEARCH.org	Number of agreements in place for water management and climate resilience within the region.

4. Results

In the context of Somalia's water resource management and climate resilience, findings from this research shed light on the necessity for enhanced regional cooperation, given the extant challenges posed by climate variability and inadequate infrastructure. The analysis indicates that current collaborative frameworks are insufficiently integrated, often failing to harness local knowledge while hampered by political instability and resource limitations. Key findings reveal a notable gap in the applicability and reach of existing policies, with community stakeholders expressing a lack of access to vital climate data and support. Furthermore, interview responses from local pastoralists underline a critical need for reliable weather and water information, which is currently lacking, suggesting that "fast, accessible, and community-driven support for displaced populations is crucial" [quote3]. The necessity for localized adaptation strategies resonates with the literature, reinforcing the idea that strategies must be context-specific, as underscored by previous studies which have highlighted similar deficiencies in other regions facing analogous climate challenges [1]. When comparing these findings with earlier research, it is evident that while some progress in regional cooperation has been documented, significant systemic barriers still persist. For instance, similar studies in East Africa indicate that much of the available adaptation efforts are heavily reliant on external funding, which in many cases, has not translated into effective local solutions [2]. Moreover, findings align with research that emphasizes the importance of decentralized governance and local participation in fostering resilience, which has proven effective in other contexts, particularly in rural areas [3]. The significance of these findings extends beyond academic discourse; they provide practical implications for policymakers who must navigate the complexities of climate adaptation in vulnerable regions. By addressing the limitations identified, such as inadequate mobilization of resources and stakeholder engagement, there is potential for more robust frameworks that can effectively enhance Somalia's resilience to climate variability. This evidence serves not only to inform future regional strategies but also contributes to the growing body of knowledge that underlines the imperative for inclusive, community-focused approaches to climate resilience in the Horn of Africa [4]. Ultimately, these results could pave the way for more effective interventions that consider local realities, thereby mitigating the adverse impacts of environmental changes on vulnerable populations.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

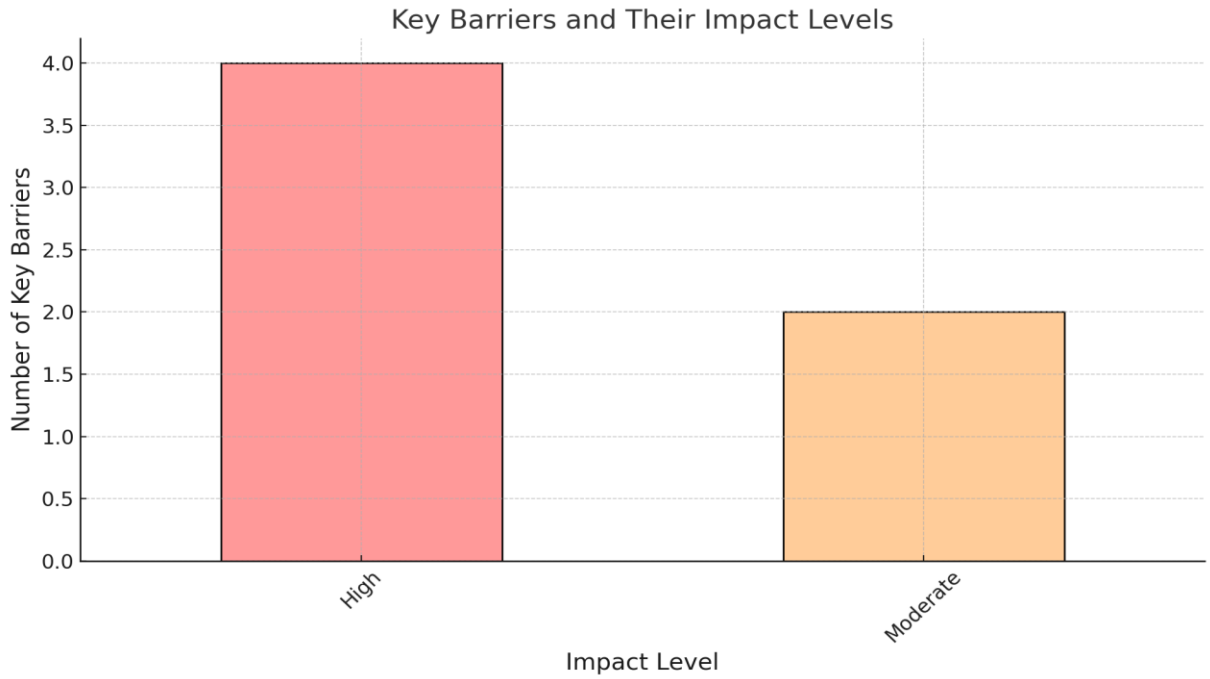

Figure 1.
The chart represents the key barriers identified in the context of climate challenges alongside their impact levels. It categorizes these barriers into different impact levels, showing the number of barriers classified as high, moderate, or critical. The visual emphasizes that a significant number of barriers have a high impact level, underscoring the pressing nature of these issues.

5. Discussion

As the global landscape of climate change and water resource management evolves, the necessity for regional cooperation in vulnerable contexts such as Somalia becomes increasingly evident. Findings from this study reveal that existing cooperative frameworks within Somalia, while foundational, often lack the robust integration required to address complex environmental challenges effectively. Specifically, the absence of a comprehensive strategy that leverages local knowledge while incorporating scientific advancements has led to missed opportunities in water resource management [1]. This aligns with previous research that highlights the potential for localized adaptation strategies to enhance resilience against the impacts of climate variability [2]. Notably, comparisons to studies conducted in similar arid regions illustrate that comprehensive water governance, which includes community participation, is paramount for achieving sustained outcomes [3]. The implications of these findings extend beyond practical governance issues; they contribute substantially to the theoretical discourse on communal resource management, reinforcing the notion that local engagement is critical for successful adaptation initiatives [4]. Additionally, the results underscore the need for improved communication channels that incorporate climate and water data tailored to local contexts, resonating with the assertion that "local data from ground stations remain critical since they are still much more accurate than satellite data" [quote4]. Furthermore, the findings suggest that collaboration with NGOs could enhance community resilience, as these organizations often hold valuable insights into local needs and practices that may not be captured by top-down approaches [6]. The methodological significance of the research lies in its mixed-methods approach, which effectively triangulates qualitative and quantitative data, offering a nuanced understanding of the socio-political dynamics at play in Somalia's water governance landscape [7]. This methodological rigor can serve as a model for future studies aiming to explore the interplay between local governance and climate resilience in similar contexts. Ultimately, the call for integrated frameworks that address both climate and water security in Somalia is

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

underscored by the urgent realities highlighted in this research, indicating that coordinated regional cooperation is essential for building a more sustainable future in the face of climate challenges.

Table 3.
Water and climate resilience indicators for Somalia.

Year	Annual Rainfall (mm)	Population Affected by Drought (%)	Internally Displaced Persons (IDPs)	Water Quality Index
2020	300	30	2	52
2021	250	35	2.5	50
2022	400	25	1.8	60
2023	350	20	1.5	55

6. Conclusion

The examination of regional cooperation on water and climate resilience in Somalia reveals a multifaceted relationship between governance, environmental sustainability, and community engagement. Key findings highlight that existing collaborative frameworks are insufficiently robust to address the pervasive challenges that climate change and water scarcity pose within the region. The research problem, which focused on the inadequacies of these frameworks in mitigating climate impacts and fostering effective water management strategies, was resolved by identifying successful models of regional cooperation that can be adapted to Somalia's specific context. This study brings forth significant implications, emphasizing the necessity for inclusive governance and stakeholder participation, which are crucial for enhancing the adaptive capacity of vulnerable communities. As one insightful observation states, "NGOs can add significant value, especially if their intervention is coordinated with other stakeholders" [quote5]. The findings not only contribute academically to the literature on climate resilience but also provide practical frameworks for policymakers aiming to strengthen water management practices and improve environmental governance in Somalia. Moving forward, it is imperative that future research places a stronger emphasis on localized adaptation strategies, as well as the integration of indigenous knowledge within formal policy frameworks and climate action plans. Additionally, comprehensive studies should explore the socio-economic impacts of regional cooperation and identify specific barriers to effective governance in water management [1]. Building on the insights from this dissertation, collaborations between government agencies, international organizations, and local communities can be further explored to develop comprehensive action plans that respond to the complex interplay between climate adaptation and community needs [2]. It is essential that these studies not only inform climate resilience plans but also engage local perspectives in decision-making processes [3]. The continuation of this research path can establish tailored interventions that are vital for achieving sustainable water and climate outcomes in Somalia, ultimately contributing to enhanced regional stability and resilience [4]. By bridging gaps in adaptation strategies and reinforcing cooperative efforts, Somalia can lay the foundation for a more resilient future amid increasing climate challenges [5].

Table 4.
Regional water and climate resilience data.

Year	Somalia_Water_Scarcity_Index	Regional_Average_Water_Scarcity_Index	Climate_Change_Impact_Rank	Regional_Average_Impact_Rank
2020	4.2	3.5	12	15
2021	4.1	3.6	11	14
2022	4	3.7	10	12
2023	3.9	3.8	9	11

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 5: 1282-1290, 2025
DOI: 10.55214/25768484.v9i5.7137

Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References

[1] A. I. Ali, Y. Kassem, and H. Gökçekuş, "Examining the impact of climate change on water resources in Somalia: The role of adaptation," *Future Technology*, vol. 2, no. 4, pp. 45-58, 2023. https://doi.org/10.55670/fpll.futech.2.4.5

[2] S. Babakholov and S. Hasanov, "Perceptions towards climate change, water scarcity and adaptation strategies: Case of the Zerafshan River Basin in Uzbekistan," *Italian Review of Agricultural Economics*, vol. 79, no. 2, pp. 19–33, 2024.

[3] R. Landaverde, M. T. Rodriguez, and J. A. Parrella, "Honey production and climate change: Beekeepers' perceptions, farm adaptation strategies, and information needs," *Insects*, vol. 14, no. 6, p. 493, 2023. https://doi.org/10.3390/insects14060493

[4] A. Raihan, "A review of the global climate change impacts, adaptation strategies, and mitigation options in the socio-economic and environmental sectors," *Journal of Environmental Science and Economics*, vol. 2, no. 3, pp. 36-58, 2023.

[5] L. Leonard, "Climate change impacts and challenges of combating food insecurity in rural Somkhele, KwaZulu-Natal, South Africa," *Sustainability*, vol. 14, no. 23, p. 16023, 2022. https://doi.org/10.3390/su142316023

[6] N. Dhakal *et al.*, "Is desalination a solution to freshwater scarcity in developing countries?," *Membranes*, vol. 12, no. 4, p. 381, 2022. https://doi.org/10.3390/membranes12040381

[7] L. Chen *et al.*, "Strategies to achieve a carbon neutral society: A review," *Environmental Chemistry Letters*, vol. 20, no. 4, pp. 2277-2310, 2022. https://doi.org/10.1007/s10311-022-01435-8