

**Review Article**

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What's The Better Route; Climate Justice and Right to Water

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Climate change is analogous to a pandemic unleashed from Pandora's box, with far-reaching consequences for our planet. Given its irreversibility, adaptation and mitigation strategies have become essential tools for humanity to alleviate its devastating impacts. Access to safe drinking water and sanitation is a fundamental human right. Climate change exacerbates water scarcity, reduces predictability, and impairs quality, disproportionately affecting vulnerable communities. Rising temperatures intensify droughts, floods, and storms, threatening development and ecosystems. Population growth, land degradation, and groundwater extraction worsen these impacts. Water demand for energy, agriculture, and industry strains this limited resource. The uncertainty surrounding future climate outcomes cannot justify delayed action. To restrict global warming to less than 2°C above pre-industrial levels by 2100, immediate measures are crucial, which midwife (births) water adequacy policy. Water adequacy policies must prioritize sustainability, community involvement, and climate resilience. Also, legal frameworks should establish clear rights and responsibilities regarding water use, protecting this vital resource. Furthermore, effective policies can enhance water security, reduce vulnerability, and promote social justice. Integrating climate considerations into water governance supports climate-resilient agriculture, livelihoods, and ecosystems, human well-being, and ensuring a water-secure future.

Keywords: Climate; ecosystem; water; agriculture**Introduction**

Water is a "not to do without" resource, essential to life; a threat to it is a threat to life itself, a reality that demands our utmost attention. Its ubiquity across the globe belies the stark truth of its uneven distribution and the escalating challenges to its availability and quality. Every living organism, from the smallest microbe to the largest whale, requires water for survival. Without water, the fundamental process of photosynthesis, the engine of most ecosystems, grinds to a halt, cascading through the food web with devastating consequences [1]. Climate change, a looming specter over our planet, is intensifying these water-related impacts,

manifesting as increased frequency and severity of droughts and floods, alongside rising average temperatures and precipitation extremes. The consequences are far-reaching and profoundly impact human societies and the natural world. The intricate web of life depends on a delicate balance of water availability.

Plants, the foundation of most terrestrial ecosystems, rely on water for transpiration, nutrient uptake, and overall growth. A lack of water leads to wilting, reduced yields, and ultimately, death. This directly impacts agriculture, a sector crucial for human sustenance. Droughts, increasingly prevalent due to climate change, cripple

crop production, leading to food shortages, famine, and economic instability. Simultaneously, the increased frequency and intensity of floods overwhelm ecosystems, destroying habitats and causing massive displacement of both human and animal populations. The fertile topsoil, essential for agriculture, is washed away, leaving behind barren land unsuitable for cultivation. Beyond agriculture, water scarcity affects various other sectors. Industries rely heavily on water for manufacturing processes, cooling systems, and sanitation. Water shortages lead to production cuts, factory closures, and economic downturns. The energy sector, particularly hydropower, is directly affected by fluctuating water levels.

Decreased river flows reduce hydroelectric power generation, impacting energy security and potentially leading to blackouts. Furthermore, water plays a critical role in public health. Access to clean, safe drinking water is paramount in preventing waterborne diseases such as cholera, typhoid, and diarrhea, which disproportionately affect vulnerable populations in developing countries. Contaminated water sources exacerbate public health crises, straining already limited healthcare infrastructure. The unequal distribution of water resources exacerbates existing social and economic inequalities. Many regions face chronic water scarcity, leading to conflict over dwindling supplies. Competition for water resources between different user groups – agriculture, industry, and domestic use – often results in tensions and disputes. Transboundary water resources, shared between multiple countries, present particularly complex challenges, requiring international cooperation and agreements to manage water sustainably.

The lack of access to safe water, particularly for women and girls, often necessitates long and arduous journeys to collect water, hindering their education, economic opportunities, and overall well-being. This gendered burden of water scarcity further perpetuates existing inequalities. Without much ado, it is the aim of this article to provide mitigating strategies to this violation of right to water [2].

Impact of Climate on Water Policy

It has been said that “Climate change is water change,” underlying a reflection of the effects of climate change on water bodies. These two major impacts – a rise in temperature and altered precipitation patterns – ripple outwards, affecting ecosystems, economies, and human societies in profound and interconnected ways. The consequences are multifaceted and often exacerbate existing vulnerabilities, creating a complex web of challenges that demand urgent and coordinated action. The most immediate and readily observable impact of climate change on water is the increase in temperature. Warmer air temperatures directly translate to warmer water temperatures in rivers, lakes, and oceans. This seemingly small shift has cascading effects on aquatic life. Many species have narrow temperature tolerances; exceeding these thresholds can lead to stress, reduced reproductive success, disease outbreaks, and ultimately, population decline or even extinction.

Coral reefs, often referred to as the “rainforests of the sea,” are particularly vulnerable. Rising ocean temperatures cause coral

bleaching, a phenomenon where corals expel the symbiotic algae living within their tissues, leading to their death and the collapse of entire reef ecosystems. These ecosystems support immense biodiversity and provide crucial coastal protection, making their loss a significant blow to both ecological and human well-being. Beyond corals, the increased temperature affects the distribution and abundance of fish species, impacting fisheries and the livelihoods of millions who depend on them. Furthermore, warmer water holds less dissolved oxygen, further stressing aquatic life and potentially creating “dead zones” where oxygen levels are too low to support life. Altered precipitation patterns, the second major impact, are equally significant [3]. Climate change is intensifying the hydrological cycle, leading to more frequent and intense extreme weather events.

This manifests as more intense rainfall in some areas, resulting in flooding and increased runoff, while other regions experience prolonged droughts. Increased flooding overwhelms water treatment facilities, contaminates water sources, and damages infrastructure, leading to water scarcity and public health crises. The increased runoff also carries pollutants into waterways, further degrading water quality. Conversely, prolonged droughts deplete reservoirs, reduce river flows, and severely impact agriculture, leading to crop failures and food insecurity. In many regions, water scarcity is already a significant problem, and climate change is exacerbating this issue, leading to conflicts over dwindling resources and displacement of populations. Glaciers and snowpack, crucial sources of freshwater for many communities, are melting at an alarming rate, exacerbating water scarcity in downstream areas and impacting seasonal water availability.

However, the consequences extend beyond the immediate effects on aquatic ecosystems and water availability.

Changes in water temperature and precipitation patterns significantly impact agriculture, a sector heavily reliant on consistent and reliable water supplies. Reduced water availability due to drought or saltwater intrusion in coastal areas decreases crop yields, threatening food security and livelihoods. Similarly, the tourism industry, particularly in coastal areas, is vulnerable to the impacts of climate change on water. Coral bleaching, beach erosion, and changes in water quality can deter tourists, impacting local economies. Furthermore, the increased frequency and intensity of extreme weather events, such as floods and droughts, cause significant economic damage and disruption, requiring substantial resources for disaster relief and recovery [4].

Water Resource Management and Climate Change

The management of water resources has far-reaching consequences, influencing various sectors of society and the economy. Water plays a critical role in food production and security, domestic water supply and sanitation, health, energy, tourism, industry, and the functioning of ecosystems. Currently, climate variability already poses significant water stress, particularly in developing countries. Historically, water management has involved adapting to natural fluctuations in water supply and balancing competing demands [5]. However, climate change is projected to

intensify this variability, leading to increased extreme weather events, greater uncertainty in water quantity and quality, and long-term impacts on water supply. This heightened uncertainty underscores the need for adaptive management strategies. Fortunately, adapting to current climate variability offers immediate benefits and prepares societies for future challenges.

By addressing present-day water management concerns, communities can build resilience and better navigate the complexities of climate change. Effective water resource management is crucial for mitigating the impacts of climate change and ensuring sustainable development. Climate change, alongside other factors, drives water resources management changes. According to research, many of these countries are experiencing high levels of water stress due to climate variability, exacerbated by factors such as population growth, unsustainable agricultural practices, and inefficient irrigation systems. The agricultural sector, a cornerstone of many developing economies, is acutely vulnerable to water scarcity. Irrigated agriculture consumes the largest share of global freshwater withdrawals, and in water-stressed regions, competition for this resource intensifies between agriculture, domestic use, and industry. Reduced water availability leads directly to lower crop yields, impacting food security and livelihoods [6].

Farmers often resort to unsustainable practices, such as over-extraction of groundwater, leading to aquifer depletion and land subsidence. The resulting decline in soil fertility further compromises agricultural productivity, creating a vicious cycle of degradation and poverty. Moreover, unpredictable rainfall patterns, a hallmark of climate variability, make it difficult for farmers to plan planting and harvesting schedules, increasing their vulnerability to crop failure and economic instability. Beyond agriculture, water scarcity significantly impacts public health. Lack of access to safe drinking water and sanitation contributes to the spread of waterborne diseases, such as cholera, typhoid, and diarrhea, particularly among vulnerable populations. These diseases disproportionately affect children, increasing mortality rates and hindering human development. Furthermore, water scarcity can lead to hygiene challenges, increasing the risk of other infectious diseases.

The lack of adequate sanitation infrastructure further exacerbates the problem, contaminating water sources and creating unsanitary living conditions [7]. The economic burden of treating waterborne illnesses places a considerable strain on already limited healthcare resources in developing countries. Also, the energy sector is also heavily reliant on water resources. Thermal power plants require large amounts of water for cooling, while hydroelectric power generation depends on consistent water flow in rivers and reservoirs. Water scarcity can lead to reduced energy production, impacting industrial activity and economic growth. This is particularly significant in developing countries where access to reliable energy is crucial for industrialization and poverty reduction. Competition for water resources between energy production and other sectors can create conflicts and exacerbate existing inequalities. Tourism, a vital source of revenue for many developing countries, is also vulnerable to water stress.

The attractiveness of tourist destinations often depends on the availability of clean water and healthy ecosystems. Water scarcity can damage ecosystems, reduce biodiversity and impact the aesthetic appeal of tourist sites. Shortages of water for hotels, restaurants, and other tourism-related businesses can negatively affect the quality of tourist experiences, potentially leading to a decline in tourism revenue. Industrial activities, crucial for economic development, are heavily reliant on water for various processes, including cleaning, cooling, and production. Water scarcity can lead to production disruptions, increased costs, and reduced competitiveness for industries located in water-stressed regions. This can hinder economic growth and exacerbate existing inequalities. The environmental consequences of water stress are equally profound. Reduced water availability can lead to ecosystem degradation, including the loss of biodiversity and the disruption of ecological processes [8].

Water scarcity can affect wetlands, rivers, and lakes, impacting aquatic life and the services these ecosystems provide, such as water purification and flood control. The depletion of groundwater aquifers can lead to land subsidence and saltwater intrusion in coastal areas, further compromising water quality and availability. However, improving water governance and management practices, promoting water conservation and efficiency, investing in water infrastructure, and developing drought-resistant crops are ways water can be well managed. Improved water governance requires transparent and participatory decision-making processes that ensure equitable access to water resources. Water conservation strategies, such as efficient irrigation techniques and rainwater harvesting, can reduce water consumption and improve water use efficiency. Investment in water infrastructure, including dams, reservoirs, and pipelines, is crucial for ensuring reliable water supply, especially in areas prone to drought.

Developing drought-resistant crops can help enhance food security in water-stressed regions. Furthermore, promoting water-efficient technologies in industry and agriculture, implementing stricter regulations on water pollution, and raising public awareness about the importance of water conservation are crucial steps towards sustainable water resource management. International cooperation and financial assistance are also essential to support developing countries in their efforts to address water stress. Sharing best practices and technologies, and providing financial and technical support for capacity building, can significantly enhance the ability of developing countries to manage their water resources sustainably. It is pertinent for decision-makers to adopt a holistic approach, recognizing water's vital role and considering its impact on their decisions. Amidst global challenges, integrated water management is critical. Country-specific solutions and new institutions are necessary to mitigate climate change impacts.

Urgent action is required to ensure progress toward sustainable development. To date, climate change policy has primarily focused on mitigation measures. While these efforts can slow climate change, they won't stop or reverse it [9]. Given the inevitable short- and medium-term effects, adaptation demands equal urgency. Effective adaptation, as outlined in the UNFCCC's Nairobi

Work Programme, requires a deeper understanding of climate change's impacts and informed decision-making. Integrated water management is crucial for climate change adaptation. This approach necessitates comprehensive and flexible planning and practices. When developing national climate change adaptation plans, water management must be prioritized. Effective climate change adaptation requires integrating adaptation requirements into climate risk management frameworks to ensure sustainable interventions. Water-related disaster risk reduction strategies should be leveraged as adaptation tools, with a focus on integrating water-related adaptation measures.

Long-term adaptation necessitates a holistic approach, incorporating infrastructure, policy, economic instruments, and behavioral changes into national development strategies. Adaptation programs should consider structural and non-structural measures, natural and physical infrastructure, soft programs (incentives, sanctions), ecosystem and human health impacts adaptation measures should be built on learning-by-doing principles, incorporating local and indigenous knowledge [10].

The Convergence of Right to Life and Policy

Life is sacred and priceless; as a result, nations placed much emphasis and priority on the subject. The forceful taking away of an individual life would lead to culpable homicide, punishable under the law. The right to life also extends to animals and any living thing. One of the basic needs of man is water; without it, survival is hell on Earth, increasing the mortality rate. Water is divinely given to all living organisms. Climate change has become a threat posed to life, depriving water from man, causing drought, famine, floods, flood and so on. Furthermore, as equivalent to the right to life, it requires protection of the law; that is, a mechanism is to be put in place. One of them is the Paris Agreement of 2015, recognizing the importance of water management in adapting to climate change. The arms of government must be functioning properly in order to promote a climate water adaptation strategy whereby such policy is enacted, implemented, and executed.

Where these are not properly put in place, by 2030, various nations would experience massive drought, making water scarcer to see. As said earlier, the evil is out of Pandora; adequate policy is our hope to promote adaptation strategy. Effective adaptation policy of water resources hinges on two fundamental principles: efficiency and equity. Efficiency focuses on maximizing welfare by allocating water to its most valuable economic use, while equity ensures fair distribution across the population. In the face of uncertainty and risk, adaptive efficiency emerges as a critical consideration, enabling the long-term maximization of social welfare despite complexity, unpredictability, and path dependencies. This research will explore the nuances of adaptive efficiency in water resource management, examining its practical application, the challenges it presents, and the potential pathways towards its successful implementation.

The traditional approach to water resource management often prioritizes static efficiency, aiming to optimize allocation under a set of assumed conditions. However, the reality of water management is far from static. Climate change, population growth,

technological advancements, and evolving societal values introduce significant uncertainty and risk, rendering static efficiency models inadequate. Adaptive efficiency, in contrast, recognizes this inherent unpredictability and emphasizes flexibility, learning, and adjustment over time. It acknowledges that optimal allocation today may not be optimal tomorrow, and therefore, strategies must be designed to adapt to changing circumstances. This necessitates a shift from a deterministic, optimization-focused approach to a more probabilistic and iterative one. A crucial element of adaptive efficiency is the incorporation of robust decision-making frameworks. These frameworks should explicitly account for uncertainty and risk, using tools such as scenario planning, Bayesian analysis, and Monte Carlo simulations [11].

Scenario planning, for instance, allows policymakers to explore a range of plausible future conditions, identifying potential vulnerabilities and developing contingency plans. Bayesian analysis facilitates the updating of beliefs and predictions as new information becomes available, allowing for a continuous learning process. Monte Carlo simulations help quantify the uncertainty associated with different management strategies, providing a more comprehensive understanding of the potential risks and benefits. The application of adaptive efficiency requires a multi-faceted approach involving various stakeholders. Effective communication and collaboration are paramount. This includes engaging with diverse communities, incorporating local knowledge and perspectives, and fostering transparency in decision-making processes. Participatory approaches, such as community-based water management initiatives, can enhance both efficiency and equity by ensuring that water allocation decisions reflect the needs.

The integration of traditional ecological knowledge (TEK) with scientific data can provide a more holistic and comprehensive understanding of water systems and their resilience to change. However, the implementation of adaptive efficiency is faced with challenges. One major hurdle is the inherent complexity of water systems. Water resources are interconnected across geographical boundaries and various sectors, making it difficult to predict the cascading effects of management interventions. Furthermore, the long-term nature of water management decisions necessitates a long-term perspective that often clashes with short-term political and economic priorities. Political will and institutional capacity are crucial for successful implementation, requiring coordinated efforts across multiple levels of government and organizations. Another significant challenge relates to data availability and quality. Adaptive management relies on continuous monitoring and evaluation, requiring robust data collection and analysis systems.

In many regions, particularly in developing countries, data scarcity limits the ability to accurately assess the effectiveness of adaptation strategies and make informed decisions. Investing in data infrastructure and capacity building is therefore critical for the successful implementation of adaptive efficiency. Furthermore, the equitable distribution of water resources remains a central challenge. Adaptive efficiency should not only maximize welfare but also ensure a fair and just distribution of water benefits across different social groups. This requires addressing historical

inequalities and power imbalances, ensuring that marginalized communities have a voice in decision-making processes and have equitable access to water resources. Mechanisms such as water rights allocation, pricing policies, and social safety nets can be instrumental in achieving this goal. However, economic instruments play a vital role in achieving efficiency, equity, and adaptive efficiency.

These policy tools harness market signals to influence behavior, rather than relying on explicit regulation. Water charges, pricing, and trading, for instance, reduce baseline stress on water systems, fostering resilience against future climate change impacts. By promoting efficient water use, allocating water to high-value uses, and identifying low-cost options, these instruments optimize resource utilization. Moreover, economic instruments facilitate adaptive efficiency, enabling dynamic, decentralized, and flexible responses to changing circumstances. Water pricing and trading provide flexibility, minimize timing errors in adaptation actions, and signal scarcity, informing optimal investment timing in supply augmentation. Adequate water pricing encourages the development of alternative water supplies, ensuring diversification and reliability. By integrating economic instruments into water management, policymakers can strike a balance between efficiency, equity, and adaptive efficiency, ultimately enhancing the resilience and sustainability of water resources.

Discussion

The right to life is a fundamental human right, enshrined in international law. Climate change poses a significant threat to this right, as it exacerbates existing environmental, social, and economic vulnerabilities. Rising temperatures, more frequent natural disasters, and disrupted ecosystems undermine access to basic necessities like clean water, food, and healthcare. This disproportionately affects vulnerable populations, including the poor, elderly, and indigenous communities. Effective policy responses are critical to mitigating climate change's impacts on the right to life. Governments must adopt measures to reduce greenhouse gas emissions, adapt to climate consequences, and protect human rights. The Impact of Climate Change on the Right to Life in Tuvalu as a Case Study. Tuvalu, a small Pacific Island nation, faces existential threats from climate change. Rising sea levels, increased storm frequency, and saltwater intrusion into freshwater sources jeopardize the population's survival. In 2018, Tuvalu's government launched the Tuvalu National Adaptation Programmes of Action (NAPA), focusing on climate resilience, disaster risk reduction, and human rights protection. Key initiatives include:

- a) Relocation planning for at-risk communities.
- b) Climate-resilient infrastructure development.
- c) Improved early warning systems for extreme weather events.

However, these measures, while crucial, grapple with the fundamental challenge of safeguarding the Tuvaluan people's right to life, a right intrinsically linked to their homeland and cultural identity. This essay will explore the multifaceted impact of climate

change on this fundamental human right, analyzing the challenges faced by Tuvalu and examining the legal and ethical implications of a potential loss of territory.

The most immediate and devastating impact of climate change on the right to life in Tuvalu is the threat of inundation. Rising sea levels, driven by global warming, are steadily encroaching on the already low-lying islands. King tides and storm surges, amplified by climate change, regularly inundate homes and agricultural lands, causing displacement, damage to infrastructure, and contamination of freshwater sources. This constant threat creates a state of perpetual insecurity, undermining the psychological well-being of the population and impacting their ability to lead normal lives.

The very foundation of their existence – their land – is slowly being eroded, directly threatening their right to life, as defined by international human rights law. The right to life, as enshrined in Article 6 of the International Covenant on Civil and Political Rights (ICCPR), is not merely the right to be free from arbitrary killing; it encompasses the right to a life with dignity, including the right to an adequate standard of living, access to clean water and sanitation, and the right to health. Climate change actively undermines all these aspects in Tuvalu. The relocation of communities, while presented as a solution by some, raises significant ethical and legal challenges. Relocation implies the loss of land, culture, and identity, which are intrinsically linked to the Tuvaluan people's right to life. Forced displacement violates international human rights law, unless it is carried out in accordance with strict legal requirements, including the provision of adequate compensation, consultation with affected communities, and ensuring the preservation of their cultural heritage [12].

The concept of "climate refugees" is still largely undefined in international law, creating a legal vacuum that needs to be addressed. Tuvalu's fight for survival therefore requires a proactive approach to international law development to address the specific challenges posed by climate-induced displacement. Furthermore, the responsibility for addressing the climate crisis and its impact on Tuvalu lies squarely with the developed nations, who are primarily responsible for the greenhouse gas emissions causing climate change. The principle of "common but differentiated responsibilities" enshrined in the United Nations Framework Convention on Climate Change (UNFCCC) dictates that developed countries have a greater responsibility to reduce emissions and provide financial and technological assistance to developing nations like Tuvalu to adapt to the impacts of climate change. Failure to meet these obligations constitutes a breach of international law and a violation of Tuvalu's right to a healthy environment, which is increasingly recognized as a fundamental human right.

In conclusion, climate change poses an existential threat to the right to life in Tuvalu. The rising sea levels, saltwater intrusion, and increased frequency of extreme weather events directly undermine the Tuvaluan people's ability to live with dignity and security. While adaptation measures are crucial, they are insufficient to address the fundamental challenge of protecting the right to life in the face of a climate crisis largely caused by external actors. International

cooperation, financial assistance, and a robust legal framework are essential to ensure that the Tuvaluan people's right to life, including their right to their land and culture, is protected and upheld. The case of Tuvalu serves as a stark warning of the devastating consequences of climate change and underscores the urgent need for global action to mitigate emissions and support vulnerable communities.

Recommendation

The first strategy, integrating human rights considerations into climate change adaptation and mitigation strategies, requires a fundamental shift in how climate policies are designed and implemented. Rather than relying solely on technical or scientific frameworks, climate action must be guided by a human rights-based approach. This means thoroughly assessing how proposed climate policies affect human rights—both positively and negatively. For instance, while large-scale renewable energy projects are essential for reducing emissions, they can inadvertently cause land grabs or displace local populations, infringing on rights to housing and an adequate standard of living. Similarly, poorly designed adaptation strategies may worsen existing social inequalities. A human rights-based approach demands free, prior, and informed consent from affected communities, meaningful participation in decision-making processes, and mechanisms for addressing potential harms.

To support this, legal frameworks must explicitly recognize the human rights implications of climate action and provide avenues for redress and accountability. International human rights instruments, such as the Universal Declaration of Human Rights and the International Covenant on Economic, Social and Cultural Rights, offer a robust foundation for integrating these principles into climate governance. The second critical strategy, prioritizing vulnerable populations' needs in climate policy and planning, responds to the reality that climate change does not affect everyone equally. Marginalized groups—including women, children, indigenous peoples, persons with disabilities, and low-income communities—often face the greatest risks while having the fewest resources to adapt. These vulnerabilities are compounded by systemic inequalities like poverty, discrimination, and inadequate access to services. Addressing this requires targeted measures to overcome these structural barriers.

Examples include ensuring equitable access to climate-resilient infrastructure, clean water, quality healthcare, and education. Climate policy must also promote the inclusion and leadership of vulnerable populations in decision-making processes. This involves not just consultation but genuine participation, where diverse voices shape the planning, implementation, and evaluation of climate actions. Disaggregated data by gender, age, disability, and ethnicity is essential to identify specific needs and inform tailored, effective interventions that promote equity and resilience. The third strategy, ensuring climate resilience and disaster risk reduction measures are community-led and participatory, emphasizes the vital role of local communities in creating effective, sustainable responses. Communities often hold valuable traditional knowledge and a nuanced understanding of their own environmental risks

and coping mechanisms. Empowering them to lead adaptation and risk reduction efforts fosters ownership, relevance, and long-term sustainability.

This shift requires moving away from top-down policymaking toward decentralized, inclusive processes. Support for community-based organizations, equitable access to resources, and strong partnerships between governments, civil society, and local actors are all essential. Participation strengthens the legitimacy of climate policies, aligning them with real needs and lived experiences. To ensure success, robust participatory monitoring and evaluation systems should be established to assess the effectiveness of community-led initiatives, share learnings, and continuously improve resilience strategies. Providing sustained financial and technical support to vulnerable countries like Tuvalu is essential in the global response to climate change. These nations, especially small island developing states, face severe climate impacts despite minimal emissions contributions. Support through mechanisms like the Green Climate Fund helps build resilience, implement adaptation strategies, and pursue low-carbon development.

This aid must be predictable, accessible, and tailored to their needs. In conclusion, combating climate change demands a human rights-based approach that centers vulnerable populations, promotes justice, and ensures a sustainable future. International cooperation is not optional—it is a moral duty to protect lives and uphold equity.

Conclusion

This commentary explores how climate justice can be advanced through adaptation strategies aimed at mitigating the impacts of climate change on water quality. It critiques the current overreliance on reactive measures and advocates for a shift toward proactive, equitable, and transformative strategies. A key emphasis is placed on the role of judicial activism in driving this transition and ensuring just outcomes, particularly for vulnerable and marginalized communities. Currently, adaptation responses to climate-induced water quality issues are dominated by reactive strategies. These include short-term fixes such as adjusting water withdrawal levels during heatwaves, emergency water rationing in response to droughts, and remediation of polluted water sources after climate events like flooding. While these actions may provide temporary relief, they fail to address the root causes of vulnerability and often result in unsustainable solutions.

Moreover, such reactive strategies disproportionately affect marginalized communities, who typically lack the resources to recover from or adapt to water-related challenges. These populations frequently suffer the most from water pollution, scarcity, and poor infrastructure, exacerbating existing social and economic inequalities. In contrast, proactive adaptation strategies are forward-looking and preventative. They focus on anticipating climate threats and building resilience before disaster strikes. Examples include investing in early warning systems for floods and droughts, upgrading wastewater treatment systems to withstand extreme weather, and adopting nature-based solutions like wetland restoration to enhance natural water filtration. These strategies

are more cost-effective and sustainable in the long term. However, despite their potential, they remain underutilized due to several key barriers. One of the most significant barriers to proactive adaptation is a lack of sufficient funding and political will.

Many governments prioritize short-term economic goals and hesitate to commit to long-term investments with benefits that may not be immediately visible. Climate adaptation is often underfunded, particularly in low-income regions that are most vulnerable to climate impacts. Additionally, political cycles and changing leadership can disrupt continuity in adaptation planning and implementation. Another major challenge is weak governance and poor coordination across agencies and stakeholders. Water management typically involves multiple actors at local, national, and international levels, leading to fragmented responsibilities and conflicting interests. In transboundary water systems, the need for cooperation between countries further complicates governance. Without clear leadership and accountability, adaptation strategies risk becoming ineffective or failing altogether. Furthermore, adaptation efforts are hindered by structural inequities embedded in existing systems.

Vulnerable communities—such as low-income groups, Indigenous populations, and rural residents—often lack access to political influence, financial support, and information necessary to participate in decision-making processes. As a result, adaptation policies may overlook their specific needs or even exacerbate their vulnerability. To address these injustices, the commentary highlights the importance of judicial activism as a mechanism for accountability and reform. Through strategic litigation, communities can challenge inadequate environmental protections, demand stronger regulatory frameworks, and push for equitable access to water resources. Courts can compel governments to invest in climate-resilient infrastructure, recognize the human right to water, and enforce environmental laws more effectively. Judicial activism also plays a critical role in shaping public policy and setting legal precedents that uphold environmental and human rights. Legal cases focused on climate-related water issues are

gaining momentum globally, providing a pathway for communities to seek redress and compel institutional change. This legal avenue is especially vital in contexts where political or bureaucratic systems fail to prioritize the needs of the most affected populations.

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