



Addressing Environmental Justice Concerns in Water Pollution Management: Ways to Guarantee Fair Sharing of Resources

Alum Benedict Nnachi

Department of Publication and Extension Kampala International University, Uganda

Email: benedict.alum@kiu.ac.ug

ORCID: <https://orcid.org/my-orcid=0009-0005-1485-5776>

ABSTRACT

Water pollution is the state of contaminated water bodies caused by bacteria, chemicals, heavy metals, and nutrients. As a result, the water's quality deteriorates and becomes unsuitable for its intended use. Water pollution is a severe environmental issue that has a catastrophic impact on human health, ecosystems, and global economies. In addition to natural causes, improper waste disposal, urban living, agricultural runoff, and industrial activities can all produce waste pollutants. In addition to short-term environmental damage, water pollution has long-term effects on living systems, variety, and sustainability within the population. Businesses that depend on clean water for their operations are having difficulties, and local communities are losing money from tourism, fishing, and falling agricultural production. This assessment is thorough and explains the intricate nature of water contamination, its impacts, and the need for action and strategy development to address this important problem. Legislative tools, technological advancements, campaigns for public education, and equitable access to water and sanitation are all included in holistic approaches. During the evaluation process, scholarly papers as well as research articles, reports, and policy documents were utilized. High-quality publications were sourced from databases like Sage Journals, literature.com, and businessinsider.com. Therefore, the importance of water pollution as a conduit for the world's ecosystems, economy, and population as a whole cannot be understated. By preserving the quality of the water and investing their time in programs that improve it, the society can reduce the negative effects of pollution and preserve water resources for both current residents and future generations.

Keywords: Environmental Impact, Ecosystem Degradation, Biodiversity Loss, Mitigation Strategies, Human Health Risk and water pollution.

INTRODUCTION

Water supplies ecosystems, livelihoods, and our basic needs, including health and well-being, and is the cornerstone of our planet throughout its entire life cycle [1]. Air pollution, on the other hand, is a ubiquitous and sneaky enemy that threatens this priceless resource. Understanding the scope and significance of this environmental phenomenon is essential for understanding the various domains in which ecosystems, society, and the economy compete [2]. A variety of hazardous substances typify water pollution, posing a primary threat to our natural resources and the health of current and future generations [3]. Water pollution is actually rather varied in scope and complexity, involving a range of contaminants such as natural processes, urban sewage, agricultural runoff, and industrial effluents [4]. Industries release numerous pollutants into water bodies, including chemicals, poisons, and heavy metals, posing a threat to aquatic life and degrading the quality of the water. In the same way, these water bodies eventually become eutrophic and nutrient-enriched due to the runoff of fertilisers, pesticides, and animal waste from agricultural activities [5]. Due to improper waste management methods, storm water runoff, and sewage water discharges, urban areas operate as an extra agent that could negatively impact water quality. Because of this, the issue of water pollution affects not just the environment but also society's well-being and the economy [6]. Contaminated water sources are the primary source of waterborne illnesses, making clean drinking water unattainable, particularly in underprivileged areas [7]. In addition, water pollution poses a threat to aquatic ecosystems, and when this happens, it is certain that habitat degradation, biodiversity loss, and economic losses—primarily in the fishing and tourism industries—will occur [8]. Overall, there are significant financial repercussions from water contamination, including increased medical expenses, environmental cleanup expenses, and decreased production capability in important businesses [9]. We consulted a variety of trustworthy, peer-reviewed

publications for information, and procured this review using structured database data. Water pollution is a serious and urgent problem. A multi-level strategy including local, national, and international players is required to handle this issue. Policies, technological advancements, public awareness campaigns, and community involvement must all be essential components of a comprehensive plan to combat the causes of pollution and safeguard water resources [10]. On the other hand, prompt and urgent action is the only hope for averting irreversible environmental harm, closing socioeconomic disparities, and impeding efforts toward sustainable development. Therefore, there is an urgent need for a more comprehensive study of the causes, effects, and mitigation techniques of water contamination in this particular example [11]. We can unite all those who care about this issue and take a positive step towards a world with clean water and access to water for all through the study of water concerns.

Water Pollution Sources

Water pollution is a serious environmental issue that arises from a variety of causes, endangering human health, destroying habitats, and hurting economies all around the world [12]. The first step in creating effective and efficient pollution management strategies and methods for pollution management is raising awareness of the sources of water contamination [13]. This source immediately releases pollutants into water bodies, making the identification of the pollution source easy. Point sources are industrial discharges into water bodies via pipes or channels, such as chemicals, heavy metals, and organic compounds [14]. Such water pollution is undoubtedly caused in large part by mining operations, industries, and power plants. More specifically, pollutants can originate from sewage treatment plants that dump pathogen-contaminated effluents (sewage) into nearby water bodies; agricultural runoff, which includes pesticides, fertilisers, and animal waste washed into nearby water bodies and groundwater by rainfall; or from marine vessels that spill oil, illegally dumping chemical, oil, or garbage substances into non-point sources that are diffuse and hard to identify [15]. These are non-point sources of water pollution, such as soil erosion, fertiliser runoff, eutrophication, and algal blooms. High concentrations of fertilizers and pesticides are present in water bodies, causing sedimentation in lakes, rivers, and coastal areas due to deforestation [16]. Urban runoff sources include oils, heavy metals, litter, and sand in the water bodies. Sedimentation increases the risk of water bodies becoming extinct, destroys aquatic habitats, and discolors the water, leading to complex water chemistry [17]. Most airborne pollutants, including pesticides, heavy metals, and acid rain, either settle on the water's surface or enter water bodies through precipitation. Secondly, wet and dry deposition of contaminants onto distant or pristine mountains or lakes increases the susceptibility to water contamination even further away from direct sources of pollution [18]. Unmaintained septic systems, particularly in rural and suburban areas, can overflow or spiral out of control [19]. As a result, contaminants, fertilisers, and chemicals leak into surface and groundwater supplies, contaminating aquatic environments and human water sources. If the proper erosion and sediment management measures are not in place, construction sites may generate waste, pollutants, and sediment runoff that eventually finds its way into water bodies [20]. Runoff into water sources that is suggestive of saltiness can prevent aquatic growth and degrade the quality of such sources. Water pollution management necessitates multifaceted approaches that target both point and non-point sources of contamination [21]. These tactics can take many different forms, such as controlling emissions, enhancing wastewater treatment infrastructure, encouraging sustainable farming practices, improving urban storm water management, and increasing public awareness of the importance of water conservation and pollution avoidance [22]. To eradicate water pollution and save water resources for future generations, there will be a great deal of information exchange and cooperation between governments, businesses, communities, and individuals.

Environmental Justice of Water Pollution Management

In the management of water pollution, it is crucial to properly comprehend and interpret environmental justice concerns [23]. In the context of water pollution, environmental justice is the equitable distribution of environmental benefits and burdens (EJ) guarantees equal access to clean water for all communities, irrespective of their racial or socioeconomic background, and prevents them from suffering disproportionately from pollution [24]. Equity in water pollution is a crucial concern, encompassing the fair treatment of majority population communities severely affected by pollution. It refers to observing the intersections between political, economic, and social issues, as well as the question of equitable cost and benefit sharing within the community [25]. The differences in exposure are characterised by two factors: a lack of resources, such as clean drinking water and sanitary infrastructure, and a geographic component, such as industrial sites and garbage disposal in low-income neighbourhoods and communities of colour [26]. Chronic illnesses, waterborne infections, and the particular risk that older persons and children face are among the possible lengths of health issues [27]. Historical settings were responsible for things like colonialism and discriminatory laws, which have a negative correlation with water pollution. The statutes that address these matters are the Environmental Justice Executive Order and the Clean Water Act [28]. However, these obstacles could not be as strong, particularly if environmental controls are not implemented enough or if regulatory rollbacks impact them. Community operations, individual science, green technology, and community-modified processes are examples of people's engagement and solutions [29]. By acknowledging the interdependence of social, economic, and environmental elements, decision-makers, communities, and interested parties can

collaborate to guarantee universal access to potable water and lessen the unequal impacts of pollution on the disadvantaged [30].

Innovation and Technological Solutions

One of the biggest issues facing the world is water resource pollution, which has an impact on all aspects of nature, the economy, and the health of its population. We are using technology to innovate and find solutions to this issue, combining things like improved filtration systems and monitoring tools [31]. Some of the techniques being employed to improve the water quality include membrane filtration technologies, sophisticated oxidation processes, smart monitoring systems, bioremediation and biofiltration, nanotechnology applications, emerging technologies, artificial intelligence (AI), and machine learning [32]. While modern oxidation techniques chemically change organic pollutants to remove things like pesticides, medicines, and industrial chemicals, membrane filtration technologies take advantage of their filtering properties to remove heavy metals, bacteria, viruses, and microplastics [33]. The use of remote sensing and sensor technology makes advanced monitoring systems feasible, enabling prompt management and avoidance. Nanotechnology applications include filters and nanozymes, which are based on nanomaterials and offer quick pollutant removal [34]. Artificial intelligence, enhanced electrochemical processes, and decentralized STPs (refer to STPs) are a few examples of upcoming technologies. Water quality innovations then include developing strategies for achieving integrated water resource management (IWRM) and implementing trade programmes for water quality [35]. These technological advancements are the driving force behind the campaign against water pollution and the development of environmentally friendly water management techniques.

Education and Awareness Campaigns Adopted against Water Pollution

Water pollution, one of the most significant environmental issues, has a negative impact on economies, human health, and ecosystems worldwide. It is crucial to educate the public, communities, and the general public in order to raise awareness, mobilise support, and shape behavioural changes that will reduce human effects on the environment to the absolute minimum [36]. To effectively combat water pollution, public awareness campaigns should identify the causes, effects, and sources of the problem in a way that is simple to comprehend through the use of graphics, plain language, and careful consideration of actual cases [11]. We can promote the initiatives through a variety of platforms such as social media, print media, radio, television, and community events. They ought to present some potential remedies, such as reducing the amount of plastic and other garbage produced, using less water, and suggesting policy changes and changes in how people use technology [11]. It is imperative to craft messages that are pertinent to the targeted demographic groupings and individuals in the community. Participation from the community is essential to these programmes' success. Despite the availability of information through the internet, mobile devices, and social media, technology has the potential to increase the frequency of such campaigns [37]. Thus, a crucial element in guaranteeing sustainable development and environmental preservation is long-term commitment.

Collaboration and Combined Efforts among Partners and Stakeholders

Stakeholder agreements and cooperative partnerships are essential pieces of the puzzle in the water contamination case, a complicated matter involving officials, corporate executives, individuals, and non-governmental organisations [38, 39]. These partnerships involve using the processes of enlisting key stakeholders, setting up channels of communication, deciding on a shared objective, drafting agreements with stakeholders, implementing best practices and technologies, advocating for policy endorsements, raising public awareness, tracking and evaluating the collaborative work, and adjusting to new environments. Public authorities, businesses, community organisations, academic institutions, environmental non-governmental organisations, and individuals can all be considered stakeholders [40]. Since effective communication serves as a bridge between two or more people, it is essential for fostering collaboration and trust. Common goals include reducing substrate discharge, enhancing water quality, safeguarding aquatic environments, and maintaining public safety [41]. The stakeholder agreements outline each party's duties, responsibilities, obligations, and expectations in resolving the water pollution issue [42]. The aforementioned partnerships aim to raise public awareness and engagement to preserve and manage our water resources for the benefit of both present and future generations.

CONCLUSION

Community water pollution is a serious issue since it has an impact on social justice, ecological health, and human health. Seagoing vessels destroy the aquatic environment, pollute drinking water supplies, and result in employment losses. We need to address both climate change and water pollution together, given their particular relationship. These worldwide goals—a fair environment, sustainable development, and an analytical approach to the ecosystem—have great expectations for their accomplishment in the fight against water pollution. Enforcing the rules, investing in pollution control, promoting environmentally friendly land and water management methods, and raising public awareness accomplish this. Water bodies link people's lives globally, making international cooperation essential. Careful maintenance and restoration of water quality will eventually lessen the effects of pollution, guarantee water security, and create a safer and better environment for current and future generations.

REFERENCES

1. Water is central in achieving all 17 SDGs. But how?, <https://siwi.org/latest/water-is-central-in-achieving-all-17-sdgs-but-how/>
2. Taxmann: Understand Environmental Studies – Scope, Importance, Sustainability, and History, <https://www.taxmann.com/post/blog/understand-environmental-studies-scope-importance-sustainability-history/>
3. Water pollution | Definition, Causes, Effects, Solutions, Examples, Types, & Facts | Britannica, <https://www.britannica.com/science/water-pollution>
4. Water quality in rivers - Environmental Audit Committee, <https://publications.parliament.uk/pa/cm5802/cmselect/cmenvaud/74/report.html>
5. M. Nasir Khan: Eutrophication: Challenges and Solutions. (2014). <https://doi.org/10.13140/2.1.3673.8884>
6. A, I.A., O, A.B., AbimbolaP, O., A, A.-A.T., O, D.A., ToyinA, O., A, I.A., O, A.B., AbimbolaP, O., A, A.-A.T., O, D.A., ToyinA, O.: Water Pollution: Effects, Prevention, and Climatic Impact. In: Water Challenges of an Urbanizing World. IntechOpen (2018)
7. Bazaanah, P., Mothapo, R.A.: Sustainability of drinking water and sanitation delivery systems in rural communities of the Lepelle Nkumpi Local Municipality, South Africa. *Environ Dev Sustain.* (2023). <https://doi.org/10.1007/s10668-023-03190-4>
8. Bashir, I., Lone, F.A., Bhat, R.A., Mir, S.A., Dar, Z.A., Dar, S.A.: Concerns and Threats of Contamination on Aquatic Ecosystems. *Bioremediation and Biotechnology.* 1–26 (2020). https://doi.org/10.1007/978-3-030-35691-0_1
9. Hutton, G., Chase, C.: Water Supply, Sanitation, and Hygiene. In: Mock, C.N., Nugent, R., Kobusingye, O., and Smith, K.R. (eds.) *Injury Prevention and Environmental Health. The International Bank for Reconstruction and Development / The World Bank, Washington (DC)* (2017)
10. Nti, E.K., Cobbina, S.J., Attafuaah, E.E., Senanu, L.D., Amenyeku, G., Gyan, M.A., Forson, D., Safo, A.-R.: Water pollution control and revitalization using advanced technologies: Uncovering artificial intelligence options towards environmental health protection, sustainability and water security. *Heliyon.* 9, e18170 (2023). <https://doi.org/10.1016/j.heliyon.2023.e18170>
11. Water Pollution & its Control - Causes, Effects & Control Measures, <https://byjus.com/biology/water-pollution-control/>
12. How does water pollution affect us?, <https://www.activesustainability.com/water/causes-consequences-water-pollution/>
13. Liu, J., Hu, Z., Du, F., Tang, W., Zheng, S., Lu, S., An, L., Ding, J.: Environment education: A first step in solving plastic pollution. *Front. Environ. Sci.* 11, (2023). <https://doi.org/10.3389/fenvs.2023.1130463>
14. US Department of Commerce, N.O. and A.A.: Nonpoint Source Pollution, NOS Education Offering, https://oceanservice.noaa.gov/education/tutorial_pollution/03pointsource.html
15. Source, N.: What is Nonpoint Source Pollution, <https://www.in.gov/idem/nps/what-is-nonpoint-source-pollution/>
16. Khan, M., Mobin, M., Zahid, A., Alamri, S.: Fertilizers and Their Contaminants in Soils, Surface and Groundwater. Presented at the October 8 (2020)
17. The Impacts of Sedimentation | VERTEX, <https://vertexeng.com/insights/the-impacts-of-sedimentation/>
18. Xing, J.W., Song, J.M., Yuan, H.M., Li, X.G., Li, N., Duan, L.Q., Qu, B.X., Kang, X.M.: [Atmospheric depositions of biogenic elements and their ecological effects on marine ecosystem of Jiaozhou Bay: A review]. *Ying Yong Sheng Tai Xue Bao.* 28, 353–366 (2017). <https://doi.org/10.13287/j.1001-9332.201701.006>
19. Signs of Septic System Failure | Washington State Department of Health, <https://doh.wa.gov/community-and-environment/wastewater-management/septic-system/signs-failure>
20. Müller, A., Österlund, H., Marsalek, J., Viklander, M.: The pollution conveyed by urban runoff: A review of sources. *Science of The Total Environment.* 709, 136125 (2020). <https://doi.org/10.1016/j.scitotenv.2019.136125>
21. Point Source and Nonpoint Sources of Pollution, <https://education.nationalgeographic.org/resource/point-source-and-nonpoint-sources-pollution>
22. Lako, A., Çomo, E.: Sustainable Water Management: An Integrated Approach to Solving the Problems of Wastewater Treatment. *QAJ.* 4, 91–100 (2024). <https://doi.org/10.58429/qaj.v4n1a267>
23. Karasaki, S., Goddard, J., Cohen, A., Ray, I.: Environmental justice and drinking water: A critical review of primary data studies. *Wiley Interdisciplinary Reviews: Water.* 10, (2023). <https://doi.org/10.1002/wat2.1653>
24. Environmental Justice | Definition, Principles & Examples - Lesson, <https://study.com/academy/lesson/what-is-environmental-justice-definition-principles-examples-issues.html>
25. 15.3 The Environment | Social Problems, <https://courses.lumenlearning.com/suny-socialproblems/chapter/15-3-the-environment/>

<https://rijournals.com/current-issues-in-arts-and-management/>

26. Grobler, L., Schenck, R., Chitaka, T.: Waste Management, Littering and Illegal Dumping: A Literature Review. (2022)
27. 7 Most Common Waterborne Diseases (and How to Prevent Them) - Lifewater International, <https://lifewater.org/blog/7-most-common-waterborne-diseases-and-how-to-prevent-them/>
28. House, T.W.: Executive Order on Revitalizing Our Nation's Commitment to Environmental Justice for All, <https://www.whitehouse.gov/briefing-room/presidential-actions/2023/04/21/executive-order-on-revitalizing-our-nations-commitment-to-environmental-justice-for-all/>
29. (PDF) Opportunities & Challenges for Green Technology in 21st Century, https://www.researchgate.net/publication/307967579_Opportunities_Challenges_for_Green_Technology_in_21st_Century
30. Melo, V.: Collaborative Efforts for Sustainable Development: Surveying the Literature on Multi-Stakeholder Initiatives to Realize the Sustainable Development Goals. (2018)
31. Innovations in Advanced Filtration Systems • Fluid Handling Pro, <https://fluidhandlingpro.com/fluid-filtration-systems/innovations-in-advanced-filtration-systems/>
32. Alprol, A., Mansour, A., Ibrahim, M., Ashour, M.: Artificial Intelligence Technologies Revolutionizing Wastewater Treatment: Current Trends and Future Prospective. *Water*. 16, 314 (2024). <https://doi.org/10.3390/w16020314>
33. Mustapha, M.A.: Advanced Membrane Technologies for Water Purification. (2024)
34. Pathakoti, K., Manjunath, M., Hwang, H.-M.: Nanotechnology Applications for Environmental Industry. Presented at the July 27 (2018)
35. Dirwai, T.L., Kanda, E., Senzanje, A., Busari, T.: Water resource management: IWRM strategies for improved water management. A systematic review of case studies of East, West and Southern Africa. *PLOS ONE*. 16, e0236903 (2021). <https://doi.org/10.1371/journal.pone.0236903>
36. Kola-Olusanya, A., Oyeyemi, E., Adewale, P.S., Omobuwa, O.: Role of environmental education in water pollution prevention and conservation in Nigeria. *Water Supply*. 24, 361–370 (2023). <https://doi.org/10.2166/ws.2023.337>
37. Dwivedi, Y.K., Hughes, L., Kar, A.K., Baabdullah, A.M., Grover, P., Abbas, R., Andreini, D., Abumoghli, I., Barlette, Y., Bunker, D., Chandra Kruse, L., Constantiou, I., Davison, R.M., De', R., Dubey, R., Fenby-Taylor, H., Gupta, B., He, W., Kodama, M., Mäntymäki, M., Metri, B., Michael, K., Olaisen, J., Panteli, N., Pekkola, S., Nishant, R., Raman, R., Rana, N.P., Rowe, F., Sarker, S., Scholtz, B., Sein, M., Shah, J.D., Teo, T.S.H., Tiwari, M.K., Vendelø, M.T., Wade, M.: Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action. *International Journal of Information Management*. 63, 102456 (2022). <https://doi.org/10.1016/j.ijinfomgt.2021.102456>
38. Stakeholders' Perception of the Relevance of Water and Sediment Connectivity in Water and Land Management | Request PDF, https://www.researchgate.net/publication/324005019_Stakeholders'_Perception_of_the_Relevance_of_Water_and_Sediment_Connectivity_in_Water_and_Land_Management
39. Pulling Together: A Guide to Building Collaboration at Hazardous Waste Sites - NACCHO, <https://www.naccho.org/programs/environmental-health/hazards/pulling-together>
40. What Are Stakeholders: Definition, Types, and Examples, <https://www.investopedia.com/terms/s/stakeholder.asp>
41. Hajam, Y.A., Kumar, R., Kumar, A.: Environmental waste management strategies and vermi transformation for sustainable development. *Environmental Challenges*. 13, 100747 (2023). <https://doi.org/10.1016/j.envc.2023.100747>
42. More than a resource: Water, Business and Human Rights.

CITE AS: Alum Benedict Nnachi (2024). Addressing Environmental Justice Concerns in Water Pollution Management: Ways to Guarantee Fair Sharing of Resources. RESEARCH INVENTION JOURNAL OF CURRENT ISSUES IN ARTS AND MANAGEMENT 3(2):65-69.