



NOAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY

Noakhali - 3814, Bangladesh.

SDG PROGRESS REPORT 2024

6 CLEAN WATER AND SANITATION



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Comprehensive Report: SDG 6 - Clean Water and Sanitation

Noakhali Science and Technology University

December 2024

Introduction

Noakhali Science and Technology University (NSTU) recognizes that clean water and sanitation are the bedrock of public health, environmental stability, and sustainable development. We are profoundly committed to Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Our 2024 contribution demonstrates this commitment through a two-pillar strategy:

1. **Research and Innovation:** A high-impact 2024 research portfolio (38 publications) tackling water challenges from the molecular level to the ecosystem-wide.
2. **Operations and Community Engagement:** A responsible approach to on-campus water management and active knowledge-sharing with the local community.

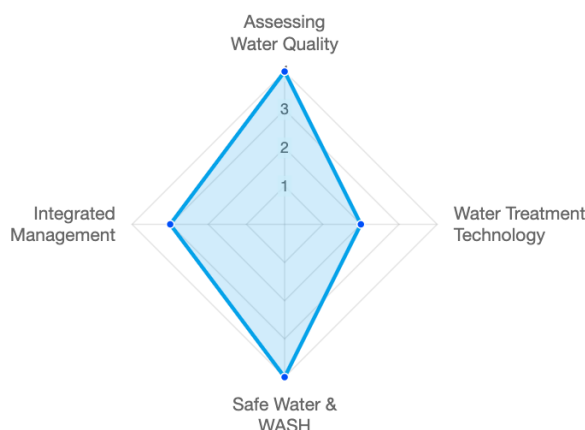
This report details our 2024 accomplishments across these critical pillars.

Pillar 1: Progress through Research and Innovation

Our 2024 research portfolio, featuring 38 distinct publications, demonstrates a large-scale engagement with this goal, organized around four key pillars.

Pillar 1: A 360-Degree Research Strategy (2024)

Focus Areas of 2024 Research



Section 1.1: Assessing and Protecting Water Quality (Targets 6.3, 6.6)

A primary focus of our research is to identify and understand the threats to our water bodies.

- **Microplastic Contamination:** We are at the forefront of tracking this emergent threat, with studies identifying microplastic contamination in urban tap water (Belal Hossain, M.B. et al.), groundwater-sourced drinking water (Paray, B.A. et al.), and surface water (Riya, K.K. et al.).

- **Heavy Metal and Chemical Pollution:** Our researchers conducted extensive risk assessments of toxic metals and arsenic in shallow and urban groundwater (Tajwar, M. et al.) and surface water (Rahman, M. et al.). We also reviewed the systemic threat of heavy metal contamination in aquatic food webs (Rakib, M.R.J. et al.).
- **Arsenic Monitoring:** We produced globally significant research on chronic arsenic exposure in children (Hu, K.Y. et al.) and its mobility in riverbanks (Kwak, K. et al.).
- **Biological & Ecosystem Threats:** Our work also identified biological threats, such as pathogenic bacteria in aquaculture (Tawhid, M. et al.).

Section 1.2: Innovating in Water Treatment and Technology (Targets 6.1, 6.3)

Our institution is actively developing the novel technologies required to treat polluted water.

- **Nanotechnology for Purification:** We have a strong focus on using nanomaterials to remove pollutants, including the green synthesis of nano-ZnO for photocatalytic degradation (Tamanna, N.J. et al.), using nanocellulose from waste to adsorb dyes (Tuntun, S.M. et al.), and developing reusable nanoadsorbents from e-waste to remove pharmaceuticals (Mojumder, F. et al.).
- **Advanced Membrane-Based Treatment:** Our researchers are innovating in membrane science, including nanomaterial-embedded polymer membranes (Nath, M.R. et al.), polysulfone microfiltration membranes (Nur-E-Alam, M. et al.), and advanced membranes for desalination and electrodialysis (Das, A. et al.; Kabir, M.M. et al.).

Section 1.3: Ensuring Safe Water, Sanitation, and Hygiene (WASH) (Targets 6.1, 6.2)

We conduct critical, on-the-ground research to assess WASH needs and their direct link to human health.

- **Linking WASH to Health:** Our studies provide clear evidence linking sanitation access to childhood malnutrition (Mondal, S. et al.) and analyzing the impact of WASH factors on diarrhea prevalence (Abera, M.G. et al.).
- **Safe Water Access & Solutions:** We are assessing practical solutions, including pond sand filters (Khan, M.S. et al.), developing "safe water atlases" (Jakariya, M. et al.), and promoting rainwater harvesting (Nipun, M.W.H. et al.).
- **Sanitation Systems:** Our research provides blueprints for systemic improvements, such as the case study on holistic, citywide sanitation for Noakhali Pourashava (Karim, F.S. et al.).
- **Wastewater Surveillance:** We are innovating in the use of wastewater as a public health tool, pioneering surveillance methods for early detection of viral outbreaks like Mpox (Islam, M.A. et al.).

Section 1.4: Integrated Water Resource & Ecosystem Management (Targets 6.4, 6.5, 6.6)

Our research provides the high-level data and models needed for sustainable, long-term water management.

- **Resource Monitoring and Forecasting:** We provide essential data for national planning, including groundwater vulnerability mapping (Iqbal, M.A. et al.), trend analysis of

evapotranspiration (Dia, R.B. et al.), and advanced AI models for rainfall forecasting (Ali, M.E. et al.).

- **Ecosystem Protection:** Our research assesses the impact of human interventions and land use on water-related ecosystems (Jannah, M.R. et al.; Haque, M.R. et al.; Roy, S.K. et al.).
- **Water-Use Efficiency:** We are developing tools for more efficient water use in agriculture through IoT-enabled sustainable irrigation (Rana, M.Z. et al.) and by identifying climate-adaptive strategies for farmers (Al Mamun, M.A. et al.).

Pillar 2: Progress through University Operations and Community Engagement

NSTU's operational strategy focuses on responsible water stewardship on campus and active engagement with the wider community on water security.

Section 2.1: On-Campus Water Management and Infrastructure

NSTU actively measures the total volume of water used for our campus population of 11,800.

- **Sustainable Extraction:** We utilize sustainable water extraction technologies, drawing from on-campus lakes and groundwater. Rainwater is also captured in the large campus lake to reduce reliance on groundwater.
- **Free Drinking Water:** In accordance with the NSTU Citizen Charter, we provide free and safe drinking water to all students, staff, and visitors in every campus building.
- **Water-Saving Infrastructure:** All new university buildings are designed and constructed in compliance with the Bangladesh National Building Code (BNBC) 2020 to minimize water use.
- **Ecological Landscaping:** Our campus landscaping, which includes species like *Mangifera indica* and *Cocos nucifera*, is designed primarily to enhance ecological diversity and support local wildlife.



Section 2.2: Wastewater and Water Reuse

As part of our commitment to continuous improvement, we have identified key areas for future development. The university does not currently have a centralized wastewater treatment process, processes to prevent accidental water pollution, or a formal policy to maximize water reuse. These areas are a focus for future planning.

Section 2.3: Community Engagement and Water Conservation

NSTU actively promotes conscious water use and conservation both on campus and in the wider community.

- **Public Education:** We provide educational opportunities for local communities, such as the "special model exhibition on water management" organized by the Department of Environmental Science and Disaster Management (ESDM) (images attached on the previous page).
- **Community Workshops:** We support water conservation off-campus by organizing public workshops on topics like rainwater harvesting.
- **Multi-Level Collaboration:** Our community-facing water security initiatives are conducted in cooperation with local, regional, and national partners, including the Bangladesh University Grants Commission (UGC), WaterAid Bangladesh, Coastal Environment Network (COEN), Choumuhani Municipality, and Noakhali Municipality.

Pillar 2: Operations – Stewardship & Community

We practice responsible water management for our 11,800 campus members and actively engage our local community.



On-Campus Water Supply

We provide free drinking water for all students, staff, and visitors. Water is sustainably extracted from on-campus lakes and groundwater, supplemented by rainwater capture. All new construction adheres to BNBC 2020 water-saving codes.



Community Engagement

We run free educational workshops on rainwater harvesting and water management for the public, collaborating with partners like the UGC, WaterAid, and local municipalities to promote water security in the region.



Areas for Future Development

As part of our commitment to continuous improvement, we have identified key areas for future planning, including the development of centralized wastewater treatment processes and a formal water reuse policy.

Conclusion

Noakhali Science and Technology University's 2024 contribution to SDG 6 is both extensive and holistic. Our 38 publications cover the full life cycle of water, from identifying molecular pollutants to innovating purification technologies and providing integrated management models. Operationally, we practice responsible water stewardship by providing free drinking water, utilizing sustainable extraction methods, and actively promoting water conservation in our community through education and multi-stakeholder collaboration.

Appendix: SDG 6 Targeting 2024 Publications Referenced

1. Riya, K.K., Anisuzzaman, M., Samad Azad, M.A., Yu, J.J., Hossain, M.B. (2024). Characteristics, Contamination Levels, and Ecosystem Risk Assessment of Microplastics in Surface Water of a Highly Urbanized River from a Developing Country. *ACS Omega*.

2. Jannah, M.R., Saha, D., Bappy, M.M.M., Arai, T., Belal Hossain, M.B. (2024). Macrobenthos community responses to tidal barrier in a sub-tropical river estuary: Insights for coastal management. *Regional Studies in Marine Science*.
3. Tajwar, M., Rahman, M., Shreya, S.S., Alam, M.M.T., Zahid, A. (2024). Pollution evaluation and health risks assessment of naturally occurring toxic metals in shallow groundwater: A study in southwestern tidal delta of Bangladesh. *Journal of Trace Elements and Minerals*.
4. Rakib, M.R.J., Sarker, A., Nahida, Z.T., Kumar, R., Malafaia, G. (2024). A critical review on heavy metal contamination in aquatic food webs by edible fish species: a special case concerning Bangladesh. *Environmental Monitoring and Assessment*.
5. Mondal, S., Wangdi, K., Gray, D.J., Kelly, M.J., Sarma, H. (2024). Associations between childhood malnutrition, socioeconomic inequalities and sanitation in the coastal regions of Bangladesh. *Discover Public Health*.
6. Iqbal, M.A., Salam, M.A., Nur-E-Alam, M., Rahaman, H., Uddin, M.F. (2024). Monitoring groundwater vulnerability for sustainable water resource management: A DRASTIC-based comparative assessment in a newly township area of Bangladesh. *Groundwater for Sustainable Development*.
7. Khudri, M.M., Chowdhury, P.B., Hossain, S.M.R., Ahsan, K.Z. (2024). Explaining the role of socioeconomic, healthcare access and infrastructural shifts in nutritional transition among women in Bangladesh between 2004 and 2018. *Public Health*.
8. Tamanna, N.J., Sahadat Hossain, M., Tabassum, S., Bahadur, N.M., Ahmed, S. (2024). Easy and green synthesis of nano-ZnO and nano-TiO₂ for efficient photocatalytic degradation of organic pollutants. *Heliyon*.
9. Kwak, K., Varner, T.S., Saha, S., Datta, S., Knappett, P.S.K. (2024). Impact of surficial lithology on arsenic mobility in riverbanks of tidally fluctuating rivers: The Hooghly River, West Bengal, India. *Journal of Hydrology*.
10. Khan, M.S., Paul, S.K. (2024). Quality and efficiency assessment, health issues and management practices of pond sand filter water in coastal Bangladesh. *International Journal of Energy and Water Resources*.
11. Tuntun, S.M., Sahadat Hossain, M., Akter, S., Alam, M.S., Ahmed, S. (2024). Synthesis of nano crystallite cellulose and chitosan from waste natural source for the adsorption of cationic and anionic dyes in aqueous medium. *Hybrid Advances*.
12. Karim, F.S., Mohinuzzaman, M., Rafa, N., Hosen, R., Ahmed, S. (2024). Holistic citywide sanitation for an urban area in the Global South: A case study of the Noakhali Pourashava of Bangladesh. *Journal of Water Sanitation and Hygiene for Development*.
13. Abera, M.G., Werkneh, A.A., Welde, R.S., Islam, M.A., Redae, G.H. (2024). Diarrhea prevalence and water, sanitation, and hygiene (WASH) factors among internally displaced children under-five in Mekelle city, Northern Ethiopia. *Clinical Epidemiology and Global Health*.

14. Dia, R.B., Mallick, J., Aziz, T., Chu, R., ISLAM, A.R.M.T. (2024). Comparative Trend Variability Analysis of Reference Evapotranspiration in Bangladesh Using Multiple Trend Detection Approaches. *Theoretical and Applied Climatology*.
15. Das, A., Im, K., Kabir, M.M., Shon, H., Nam, S.Y. (2024). Polybenzimidazole (PBI)-based membranes for fuel cell, water electrolysis and desalination. *Desalination*.
16. Rahman, M., Chaity, I.J., Hossain, M.I.S., Siddique, M.A.M. (2024). Surface water pollution by some heavy metals in a remote island, Hatiya, northern Bay of Bengal. *Journal of Trace Elements and Minerals*.
17. Nath, M.R., Pal, K., Imran, A.B., Chowdhury, A.N. (2024). Innovations in nanomaterial-embedded polymer membranes for water and wastewater treatment: a comprehensive review. *Nano Express*.
18. Al Mamun, M.A., Li, J., Cui, A., Chowdhury, R., Hossain, M.L. (2024). Climate-adaptive strategies for enhancing agricultural resilience in southeastern coastal Bangladesh: Insights from farmers and stakeholders. *Plos One*.
19. Hu, K.Y., Islam, M.A., Parvez, F., Bhattacharya, P., Khan, K.M. (2024). Chronic exposure of arsenic among children in Asia: A current opinion based on epidemiological evidence. *Current Opinion in Environmental Science and Health*.
20. Islam, M.A., Kumar, R., Sharma, P., Bhattacharya, P., Tiwari, A. (2024). Wastewater-Based Surveillance of Mpox (Monkeypox): An Early Surveillance Tool for Detecting Hotspots. *Current Pollution Reports*.
21. Mojumder, F., Yasmin, S., Ali Shaikh, M.A., Chowdhury, P., Kabir, M.H. (2024). Synthesis of reusable graphene oxide based nickel-iron superparamagnetic nanoadsorbent from electronic waste for the removal of doxycycline in aqueous media. *Journal of Hazardous Materials Advances*.
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29. Haque, M.R., Tusar, M.K., Mou, M.A., Rahaman, M.S. (2024). Assessment of LULC change and its impact on Surface Runoff using SCS-CN method for Noakhali Region, Bangladesh. *Present Environment and Sustainable Development*.
30. Belal Hossain, M.B., Yu, J.J., Sarker, P.K., Paray, B.A., Arai, T. (2024). Microplastic accumulation, morpho-polymer characterization, and dietary exposure in urban tap water of a developing nation. *Frontiers in Sustainable Food Systems*.
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