

Topic Concept Note

Thematic Process, 11th World Water Forum

Theme Number: 5

Theme Title: Innovation for Water Management

Topic Number: 5D

Topic Title: Engaging Citizen Science and Community-Based Knowledge

Topic Coordinator: Climate and Water Initiative (Dr. Lama Elhatow)

I. Topic Overview

Rationale and Context

Achieving the targets of SDG 6 requires a significant acceleration in how water data are generated, shared, and used for decision-making. Persistent gaps in hydrological monitoring, water quality data, ecosystem assessment, and risk preparedness—particularly in low- and middle-income countries—continue to constrain effective water management. Conventional monitoring systems alone are often insufficient due to financial, technical, institutional, or geographic limitations.

Citizen science and community-based knowledge offer innovative and complementary approaches to addressing these gaps. By actively engaging communities, water users, youth, and women in data collection, observation, and interpretation, citizen science enhances data availability while fostering water literacy, local ownership, and long-term behavioral change. These approaches are increasingly recognized for their contributions to water quality monitoring, water-use efficiency, pollution tracking, ecosystem protection, and flood and drought preparedness, particularly in data-scarce and climate-vulnerable contexts.

Evidence from global and regional initiatives—including programs such as Colorado River Watch (USA), UNESCO RiverWatch, and emerging experiences in the MENA region (e.g. Lebanon and Tunisia)—demonstrates that citizen-generated data can meaningfully support water monitoring and governance when supported by appropriate methodologies, quality assurance mechanisms, and institutional partnerships.

Beyond SDG 6, this topic contributes to SDG 2 (sustainable agricultural water use), SDG 11 (urban water resilience), SDG 13 (climate adaptation and risk preparedness), SDGs 14 and 15 (aquatic and terrestrial ecosystem monitoring), and SDG 17 (partnerships). It integrates key cross-cutting dimensions by promoting climate resilience through locally relevant

monitoring, strengthening gender and youth inclusion by recognizing their central roles in water stewardship, leveraging digital innovation for real-time data collection and visualization, fostering multi-stakeholder partnerships, and exploring sustainable financing mechanisms to support long-term citizen science initiatives.

Objectives of the Topic

The objective of this topic is to advance action-oriented and initiative-driven outcomes that strengthen water management by systematically integrating citizen science and community-based knowledge into water governance, monitoring, and decision-making processes.

Specifically, the topic aims to:

- **Strengthen technical capacity and credibility** by providing project initiators (including NGOs, governments, and academic institutions) with methodological guidance, appropriate tools and equipment, and quality assurance mechanisms to enhance the reliability and usability of community-generated data.
- **Promote policy and institutional integration** by exploring pathways to mainstream citizen science within national and local water monitoring frameworks, SDG 6 reporting, and inter-institutional collaboration between governments, academia, civil society, and the private sector.
- **Enhance water literacy and inclusive participation** by assessing knowledge gaps across societal groups and building the capacities of communities, youth, and women to actively participate in data collection, interpretation, and water-related decision-making.

II. Key Issues, Opportunities, and Scope

Key Challenges

Engaging citizen science and community-based knowledge at scale faces several interrelated challenges:

- Language
 - Language barriers include translating technical terminology to local language (i.e. English to Arabic, Swahili, etc.)
- Cultural sensitivities

- Contextualizing how climate and water issues are communicated to local people in a simplistic form that matches the cultural nuances and sensitivities that exist in that community.
- Partnerships
 - Entering into new communities requires partnerships with NGOs/local groups/ dedicated sectoral networks (e.g gender, youth networks) to be able to tap into community intelligence and outreach in that community for awareness and dissemination.
 - Partnering with other entities regionally and globally with similar interests for knowledge sharing and lessons learned.
- Financing
 - Being able to deploy citizen science into communities requires funding for organizations to be able to do so, as well as for research.
 - Accessibility of financing for local communities becomes problematic due to insufficient financial literacy and know-how
- Capacity building
 - Important to raise the capacity of local communities to be able to engage in citizen science
 - Awareness raising of various target groups becomes important
 - Could be done through institutions such as academia, research institutions, etc.
- Outreach
 - Reaching different target groups (youth, women, children, policymakers, etc.), requires different strategies. How do you facilitate outreach to ensure that the target group that you're reaching can be done efficiently (i.e. social media, tv, adverts, local billboards, focus groups, etc.)
- Regional and transboundary context
 - Many West African water systems are transboundary basins (e.g. Senegal, Niger, Volta Rivers), making it difficult to coordinate citizen science initiatives across borders and to harmonize community-generated data between countries.
- Integration of community-based knowledge
 - Traditional and local water management knowledge (flood management, groundwater use, pastoral practices) is often not formally recognized or integrated into national water planning and decision-making processes.
 - A gap persists between formal institutional frameworks and community-level water practices, limiting the uptake of locally generated knowledge.
- Climate variability and local preparedness

- West Africa faces high climate variability, including recurrent droughts and sudden floods, while community-based early warning and monitoring systems remain limited.
 - Citizen science initiatives are often not sufficiently linked to local climate adaptation and risk management mechanisms.
- Security and fragile contexts
 - In parts of the Sahel and border regions, security challenges and population displacement restrict access to communities and disrupt long-term citizen science and monitoring activities.
 - Ongoing conflicts and political instability across parts of the MENA region (e.g. Sudan, Gaza) disrupt community structures, limit access to affected populations, and constrain sustained citizen science and community-based monitoring efforts.
- Displacement
 - Displacement weakened institutions, and humanitarian priorities often shift attention away from long-term water governance, knowledge generation, and participatory approaches, despite increasing water scarcity and climate vulnerability.
- Gender-specific constraints
 - Despite their central role in water use and management, women remain underrepresented in local water governance structures, and their knowledge is often insufficiently captured in citizen science initiatives due to social and cultural barriers.
- Sustainability of initiatives
 - Citizen science initiatives in West Africa are often project-based and donor-dependent, with limited national or local financing mechanisms to ensure long-term sustainability and scaling-up.
- Education in Water Sector
 - Enhancing education toward water issues.
 - There is significant expansion in academic disciplines and universities. However, there are no undergraduate programs or specialties focused on water (like RO major, waste water major, etc.), nor are there dedicated research programs addressing water-related challenges for academy, master's and PhD students and researchers.

Opportunities and Strategic Importance

Despite these challenges, significant opportunities exist to scale and institutionalize citizen science approaches:

- Growing recognition of citizen science as a **complementary mechanism** to conventional water monitoring, particularly in data-scarce and climate-vulnerable contexts.
- Opportunities to build **structured partnerships** between communities, academia, government agencies, NGOs, and the private sector to co-design and implement citizen science initiatives.
- Potential to **integrate citizen science into national monitoring systems**, SDG 6 reporting, and basin-level governance frameworks.
- Increasing demand for **water literacy assessments and targeted capacity-building strategies** across all societal groups, from schools and universities to farmers, water utilities, and policymakers.

Proposed Priorities of the Topic / Guiding Questions

- What is the effective scope of citizen science in the water sector, and what are its limitations?
- Where do key knowledge gaps exist at community, institutional, and policy levels, and how can citizen science help address them?
- How can citizen-generated data be validated, trusted, and effectively used in public decision-making?
- Which geographic hotspots and water challenges would benefit most from citizen science approaches?
- How can traditional and community-based knowledge be better integrated into climate-resilient water management strategies?

Proposed Sessions of the Topic

Sessions will be organized around the following thematic clusters:

1. **From Community Data to Public Decision: Making Citizen Science Count in Water Governance:** This session explores how community-generated data can become a credible and influential driver of water policy, planning, and accountability.

This discussion will examine the core challenges that shape the effectiveness and inclusivity of citizen science, including barriers faced by Indigenous communities, who often possess deep environmental knowledge yet encounter linguistic, cultural, and institutional obstacles that hinder their participation. It will highlight how citizen science can strengthen holistic water advocacy and public awareness, demonstrating its potential to mobilize societal engagement and reshape narratives about water risks and responsibilities. By exploring links to Water-Energy-Food (WEF) security, the session will show how community data can illuminate interconnected pressures on water systems and guide integrated resource planning. It will also delve into the central question of how to transform local observations into actionable insights for public decision-making, identifying mechanisms for validation, trust-building, and interface with formal governance structures. The role of traditional and community-based knowledge will be emphasized as a critical component of climate-resilient water management, especially in contexts where formal data systems remain limited. Finally, the session will address the long-term sustainability of citizen science initiatives, including financing challenges, institutional ownership, and strategies for maintaining engagement beyond short-term project cycles. Together, these perspectives underscore that citizen science, when inclusive and well supported, has the power to bridge community realities with public policy, improving equity, responsiveness, and resilience in water governance.

2. **Youth and Women as Data Stewards: Building Inclusive Citizen Science Networks:** This session highlights the transformative potential of groups who are often closest to water challenges yet underrepresented in formal monitoring and decision-making. Youth bring digital fluency, creativity, and the ability to rapidly adopt new technologies, making them powerful drivers of innovative data-collection methods and community outreach. Women, meanwhile, hold deep, place-based knowledge due to their central roles in household water management, agriculture, and community caregiving—knowledge that remains vastly under-utilized in conventional water governance systems. By positioning youth and women as credible data stewards, this session fosters more inclusive, trusted, and socially grounded citizen science networks. It also strengthens local ownership, improves data relevance and reliability, and ensures that water solutions reflect the realities and priorities of entire communities rather than a limited subset of stakeholders. Ultimately, this session helps build equitable, resilient, and people-centered water monitoring systems that support long-term governance transformation.

3. **Case Studies: Citizen Science Projects — Success Stories from Science-Driven to Policy Outcomes:** This session will demonstrate how community-generated data can meaningfully influence real-world water governance across diverse contexts. Examples from West Africa, the Middle East, and East Africa highlight how citizen science strengthens both local stewardship and higher-level decision-making. In West Africa, citizen-led monitoring initiatives support transboundary water cooperation, showing how communities can contribute data that informs basin-level dialogue and harmonized management across borders, particularly in regions facing climate variability and shared river systems. On Heissa Island in Aswan, Egypt, citizen science has been instrumental in ecological restoration and water management, where community members actively participate in monitoring water quality, protecting local ecosystems, and guiding restoration strategies grounded in lived knowledge. In East Africa, youth-driven sanitation monitoring initiatives demonstrate how young people can collect meaningful data on water and sanitation conditions, driving behavioral change, informing local authorities, and improving service provision in underserved settlements. Together, these case studies illustrate the power of citizen science to bridge science and policy, showcasing how context-specific, community-generated data can shape governance outcomes, strengthen equity, and catalyze more resilient and inclusive water management systems.
4. **Technology, AI, and Digital Tools for Scaling Citizen Science:** This session explores how emerging technologies have the power to dramatically expand the reach, accuracy, and impact of community-generated water data. Digital tools—such as mobile applications, low-cost sensors, drones, cloud-based dashboards, and open-source mapping platforms—enable communities to collect and share real-time information with unprecedented ease. Artificial intelligence further enhances this ecosystem by improving data validation, automating pattern detection, and transforming raw observations into actionable insights for policymakers and water managers. These innovations lower barriers to participation, allowing even remote or underserved communities to contribute meaningfully to water monitoring and climate resilience efforts. By showcasing practical applications and ethical considerations, this session will demonstrate how technology can help scale citizen science from scattered local initiatives into coordinated, reliable, and influential systems that strengthen water governance at all levels. This session could also cross-pollinate with theme 6, as well as 5A and 5C.

III. Expected Outcomes and Deliverables

Policy and Strategic Outcomes

- Recognition of citizen science and community-based knowledge as formal complements to conventional water monitoring and governance.
- Policy-oriented recommendations defining roles and responsibilities of public institutions, academia, civil society, the private sector, and communities.
- Strategic guidance and roadmaps for institutionalizing citizen science within ministries, water agencies, and basin organizations.

Technical and Knowledge Deliverables

- Synthesis of lessons learned and best practices from citizen science applications across water quality, quantity, sanitation, ecosystems, and climate resilience.
- Standardized protocols, methodological guidelines, and training materials to improve data quality and comparability.
- Open or interoperable digital platforms for collecting, visualizing, and sharing citizen-generated water data.
- Analytical reports identifying water literacy and capacity gaps to inform targeted education and awareness strategies.

Partnerships and Financing Outcomes

- Strengthened partnerships among governments, academia, NGOs, communities, and the private sector.
- Identification of sustainable financing models, including blended finance and results-based mechanisms, to support long-term citizen science initiatives.

Actions and Initiatives for Implementation

- Launch of pilot citizen science projects in data-scarce and climate-vulnerable regions.
- Development of citizen science networks and communities of practice.
- Open calls for simple, low-cost data collection kits.
- Water literacy assessment projects and capacity-building programs for communities, educators, and local authorities.
- Establishment of youth-led community water observatories.

Communication and Visibility

- Showcasing success stories through Forum sessions, side events, and exhibitions.
- Youth-driven communication initiatives, including a social-media-based competition to amplify water awareness and Forum outcomes.

IV. Monitoring and Post-Forum Action

The outcomes of this topic will be consolidated into policy briefs, methodological toolkits, and case study syntheses that will contribute to the long-term legacy of the World Water Forum and guide continued collaboration toward the 12th World Water Forum. A structured monitoring framework will track progress using measurable indicators, including the degree to which citizen science approaches are formally adopted in national and local water policies, the increased participation and leadership of women and youth in monitoring and governance, and the integration of citizen-generated data into official water information systems. These indicators will help assess both institutional uptake and community-level impact over time. The results will also feed into broader global agendas, strengthening contributions to SDG reporting, informing climate negotiation processes, and supporting basin-level cooperation where shared datasets and participatory monitoring are essential for joint decision-making. By sustaining momentum beyond the Forum, this topic will reinforce multi-stakeholder partnerships, advance inclusive knowledge-sharing mechanisms, and ensure that citizen-driven insights continue to shape adaptive and resilient water governance.

V. Proposed Cross-Process Dialogue Areas

5D–4E: Citizen Science as a Platform for Engaging Unheard and Vulnerable Voices

This dialogue will explore how citizen science can serve as an inclusive platform to amplify the perspectives of groups that are often underrepresented in water governance—such as Indigenous peoples, rural women, youth, migrants, and communities living in informal or marginalized settings. It will examine how participatory monitoring and community-based data collection can elevate their lived experiences into formal decision-making processes, strengthen social equity, and build trust between institutions and communities. The dialogue will also highlight methods for overcoming cultural, linguistic, and technological barriers that may restrict participation, ensuring that vulnerable voices contribute meaningfully to shaping water policies and interventions.

5D–5E: Scaling Water Innovation through Citizen Science and Open Data

This dialogue focuses on how citizen science can complement broader innovation ecosystems by contributing high-resolution, localized data to open-data platforms and digital knowledge systems. It will discuss approaches to integrating citizen-generated datasets with institutional monitoring networks, enabling more adaptive, data-driven management of water resources. The conversation will also address governance issues such as data quality, interoperability, ethics, and long-term maintenance of open-data systems, ensuring that innovations scale beyond pilot projects to become embedded in national and regional monitoring frameworks.

5D–4E–6D: Citizen Science for Water Valuation, Footprinting, and Public Awareness

This dialogue will explore how citizen-generated data can inform water valuation, water-footprinting initiatives, and public awareness campaigns. It will highlight how participatory monitoring can reveal the true social, environmental, and economic value of water—particularly in regions facing scarcity, pollution pressure, or climate risks. The session will showcase examples of how communities contribute to understanding water footprints, pollution sources, ecosystem impacts, and consumption patterns, helping translate complex scientific concepts into accessible narratives that promote behavioral change and advocacy at the household, community, and national levels.

5C–5D–5E: AI for Sustainable Water Monitoring and Participatory Decision Support

This dialogue brings together AI, digital innovation, and citizen science to examine how advanced technologies can enhance the accuracy, efficiency, and usefulness of community-generated data. It will focus on how AI and machine-learning tools can support data validation, automate classification and pattern detection, improve early-warning systems, and generate decision-support products that are accessible to both policymakers and communities. The discussion will also reflect on ethical considerations such as data privacy, algorithmic bias, and equitable access to digital tools, ensuring that technology strengthens—not replaces—local knowledge and community agency.

Priority Regions

The topic will prioritize engagement in Sub-Saharan Africa, the MENA region, South Asia, and Latin America, where citizen science holds high potential to address structural gaps in water monitoring and governance. These regions face acute pressures such as rapid population growth, climate-induced water variability, aging or limited hydrological infrastructure, and persistent inequities in access to safe water and sanitation. Strengthening citizen-driven

monitoring in these areas can improve visibility of localized challenges, empower communities to contribute to formal decision-making, and support cross-border cooperation in shared basins.

Focus Areas

Special attention will be given to data-scarce watersheds, informal urban settlements, pollution hotspots, climate-sensitive zones, and disaster-risk-prone regions, where traditional monitoring systems are limited or absent. In these contexts, citizen science can fill critical information gaps by providing real-time observations, documenting environmental and health risks, and contributing early-warning data for floods, droughts, and contamination events. Enhancing monitoring in these areas not only improves local resource management but also strengthens national datasets that inform resilience planning, infrastructure investments, and climate adaptation strategies.