



Strengthening and Localising Data for Inclusive and Climate-Resilient Water Management: Lessons from Boeng Sneh Lake, Cambodia

Ang Raksmeay

Research fellow
Centre for Natural Resources and Environment, CDRI

Sao Davy

Visiting fellow
Centre for Natural Resources and Environment, CDRI

Mak Sithirith

Scientist and director
Centre for Natural Resources and Environment, CDRI

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KEY MESSAGES

- Boeng Sneh Lake is a crucial freshwater ecosystem supporting rice farming, fisheries, water supply, and climate resilience for nearby communities. Its sustainability is threatened by rising water demand, climate- and human-driven hydrological changes, and competing sector needs.
- The District Technical Working Group (DTWG), a multi-sectoral, ecosystem-based governance model for water management, was piloted to coordinate water users around the lake; however, effective water management is hindered, among other factors, by limited locally accessible data.
- Existing water datasets are often available at central levels but are fragmented, poorly disaggregated, and rarely integrated into operational tools used by local authorities. The priority is therefore not simply more data collection, but rather improving local access, integration, and decision-making empowerment.
- Dedicated budget allocations for water-related data collection, monitoring and management should be incorporated into decentralised planning, including commune development and investment plans. Without reliable data, lake water management remains reactive, fragmented, and vulnerable to conflicting sectoral demands.
- This shows that operational hydrological information enables local institutions to manage shared water resources effectively, providing strong evidence for the government to expand the pilot DTWG's data-driven community water management across Cambodia.

INTRODUCTION

Freshwater wetlands and small lake systems are vital to Cambodia's rural economy and food security, providing water for rice cultivation and crops, supporting inland fisheries, and serving as a primary source of domestic water for many communities (WWT 2023). In the context of climate change, these water bodies also act as natural buffers against droughts and floods, playing an essential role in the country's adaptation strategies (Sithirith et al. 2023). For instance, Boeng Sneh Lake in Prey Veng

Province is one of the most important wetland systems in Cambodia's Lower Mekong region (CGIAR 2026). The lake sustains thousands of households through irrigation, fishing, and domestic use while preserving ecological functions. However, agricultural intensification, population growth, and climate change strain water resources, leading to more frequent seasonal shortages and increased competition among users (CGIAR 2026).

Cambodia's water governance faces multiple challenges, including centralised sectoral

influences, top-down strategies, ineffective inter-agency coordination, and limited local community engagement (Sithirith et al. 2024). In response, the country has adopted decentralised approaches, such as Farmer Water User Communities (FWUCs), Community Fisheries (CFis), and Community Fish Refuges (CFRs) (CEDAC 2009). While FWUCs focus on supply-side irrigation management for rice farming, CFis and CFRs depend on water for sustainable fisheries. However, decentralisation is complicated by centralised control: FWUCs are overseen by the Ministry of Water Resources and Meteorology (MOWRAM), while CFis and CFRs fall under the Ministry of Agriculture, Forestry, and Fisheries (MAFF). MOWRAM prioritises irrigation management, whereas MAFF integrates water into rice production planning. Overlapping and fragmented mandates weaken coordination and limit the effectiveness of decentralised governance structures (CDRI 2026). Climate change further exacerbates these challenges by threatening water availability. In 2024, to address the complexity of natural resource challenges, WorldFish and the International Water Management Institute (IWMI) partnered with the Inland Fisheries Research and Development Institute (IFReDI) to pilot the District Technical Working Group (DTWG) to manage water resources at Boeng Sneh Lake in Prey Veng province. These multi-stakeholder platforms, which bring together local authorities and decentralised, community-based organisations, have begun to transform how local institutions coordinate, plan, and respond to natural resource challenges (CGIAR 2025). As an ecosystem-based governance approach, the DTWG enables water management beyond administrative boundaries. In the case of Boeng Sneh Lake, whose lake system spans three districts, the DTWG manages water resources by considering the ecosystem as a whole rather than fragmenting efforts along district boundary lines.

Although Cambodia has made significant progress in formulating national policies on water resource management, decentralisation, and climate adaptation, there remains a gap between national data systems and local decision-making processes (UNDP 2020). Most hydrological and agricultural data are produced and stored at the central or provincial levels, often in technical formats that are not localised, making them not readily accessible or usable by commune councils, FWUCs, CFis, or CFRs. Similarly, the

pilot DTWG lacks sufficient evidence-based hydrological data to support planning and decision-making for effective water management (Sithirith et al. 2026).

This study conducted a systematic review of core thematic areas, including hydrology, ecosystem health and biodiversity, water resource utilisation, and institutional governance. It combined technical hydrological analysis with primary fieldwork at Boeng Sneh Lake, employing Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with community members, local authorities, and pilot DTWG members. Findings from field research, stakeholder consultations, and community engagement highlight the importance of accessing data for water management. Drawing on this analysis, the policy brief defines data requirements and institutional constraints. It proposes policy interventions to enhance local, data-driven water management and to promote a decentralised governance model for inclusive, climate-resilient water management.

KEY FINDINGS

Boeng Sneh: A lake under pressure

Boeng Sneh is a vital ecological system comprising water bodies, river networks, fisheries, rice fields, irrigation, and communities. Water connects the upstream and downstream regions, supporting aquatic life and livelihoods. As a key freshwater lake in Prey Veng, it provides water, fish, and agricultural products essential to the community (Sithirith et al. 2026). Water supports irrigation, and fisheries provide protein crucial for food security. Ecosystem services, such as water purification, habitat provision, and flood control, maintain ecological balance and livelihoods. Lakes also supply food to markets, thereby strengthening the economy.

Pressures on the lake's water resources are escalating due to intensifying agriculture, population growth, and climate change. Competition among agriculture, fisheries, livestock, Private Water Operators (PWOs), and households has intensified amid climate variability, altered hydrological regimes, and expanding irrigation. Consequently, these dynamics have led to wetland degradation, loss of fish habitats, soil depletion, diminished water quality, and a decline in ecological resilience (Sithirith et al. 2026). The pilot DTWG's effectiveness is constrained by several interrelated factors, including limited hydrological data, insufficient

financial resources, evolving institutional arrangements, and the need for coordinated decision-making processes. While other factors remain critical to the DTWG's effectiveness, improved hydrological data and information play an important role in planning and decision-making for resource management and effective allocation of lake water. If local institutions have access to timely, decision-ready data, they can integrate it into operational planning, thereby improving water management, reducing competition among sectoral interests, and sustaining lake ecosystems.

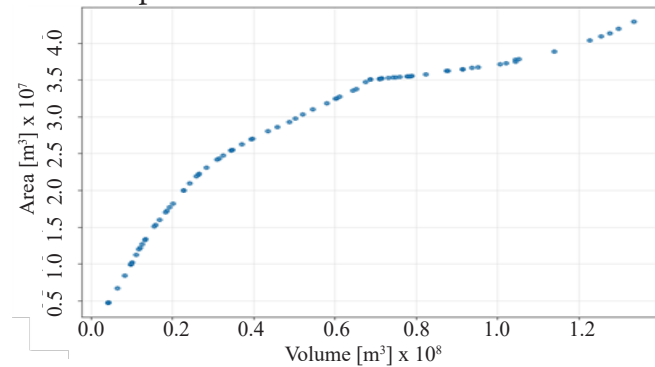
The hydrological characteristics and data scarcity

Boeng Sneh Lake was managed with limited decision-ready information. The main issue was not merely missing data but also fragmented, limited, and poorly integrated information. Basic meteorological data were incomplete, and the absence of a bathymetric map further constrained local institutions' ability to define safe management thresholds. Communities observed worsening dry seasons, but there was no quantitative evidence to support these observations, and they were not fully integrated into decision-making. A participatory field survey conducted during the study period, 21–24 October 2025, collected 121 depth measurements with communities, producing the first high-resolution Digital Elevation Model (DEM) of the lakebed.

The survey recorded a maximum depth of 5.10 m and an average depth of 2.33 m, with nine deep pools ranging from 3.80 to 5.95 m each, covering 4–7 ha, and serving as vital dry-season refugia for aquatic fauna. Most notably, the data showed a non-linear relationship between surface area and volume (Figure 1) at lower volumes, modest increases in volume significantly increase surface area; however, when the volume exceeds 80 million m³, water spills into floodplains, saturating the surface and limiting further expansion of the surface area.

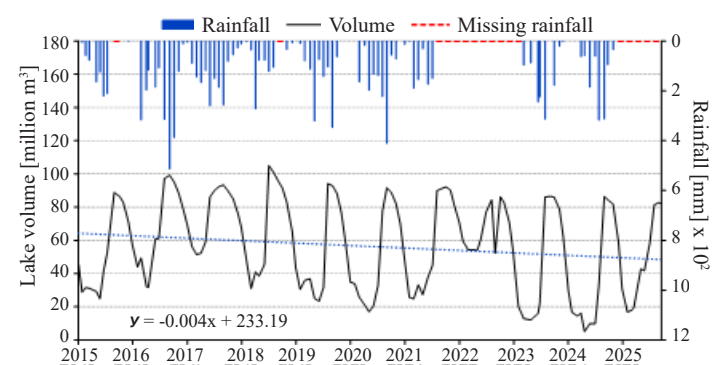
Figure 2 shows that Boeng Sneh Lake's volume peaks at 80–100 million m³ from September to November, driven by rainfall, then drops sharply during the dry season. In 2023 and 2024, it fell to critically low levels of 5–15 million m³, well below the historical minimum of 20–35

Figure 1: Lake surface area and volume changes and relationship



Source: Authors

Figure 2: Monthly lake storage volume changes against rainfall from 2015 to 2025



Source: Authors

million m³. Additionally, a decreasing trend in lake volume was observed, possibly due to hydrological disconnection (e.g., the absence of Mekong River overflow), climate variability, and increased human pressure (e.g., water allocation among sectors).

Data-enabled identification of a critical management threshold

Following consultations with the Provincial Department of Water Resources and Meteorology (PDWRAM) and local stakeholders, a minimum ecological and domestic threshold of 27 million m³ was identified. Below this volume:

- Ecological integrity deteriorates as deep pools lose their dissolved oxygen and thermal stability, both of which are essential for fish survival, thereby threatening four CFIs and lake biodiversity.
- Domestic water supply faces significant challenges; PWOs are unable to meet withdrawal demands, which can reach up to 46,627 m³ per month during the dry season, thereby risking the water needs of over 4,000 households.

- Conflicts over irrigation are escalating, with intensified competition among the six FWUCs, leaving downstream users without access to water.

Critically, during the recent dry season (2023–2024), volumes fell sharply to 5–15 million m³ (below the established threshold), confirming that the system is operating at its maximum physical capacity. This evidence provided the DTWG with a clear, scientifically substantiated reference point for management decisions. When the 27 million m³ threshold is reached, trade-offs should be negotiated through the DTWG, using this shared evidence base to sustainably manage the lake.

Data-driven governance: The DTWG's trigger-based management framework

With reliable data, the DTWG could shift from reactive crisis management to proactive, evidence-based water allocation. The assessment laid the

groundwork for a trigger-based management framework (Table 1) and a conceptual lake water balance (Figure 3) that links specific actions to real-time lake volume.

This framework enables the DTWG to serve as an operational water-allocation authority by establishing explicit, data-informed protocols. It enables local governments to make challenging decisions transparently, thereby alleviating the political pressure associated with ad hoc allocations. The pilot DTWG has no legal authority to override mandates and relies on consensus, transparency, and voluntary alignment among agencies. To implement the trigger-based framework, a formal pathway (e.g., a provincial directive) is required to delegate allocation authority.

Technology as a decision-support tool for local government

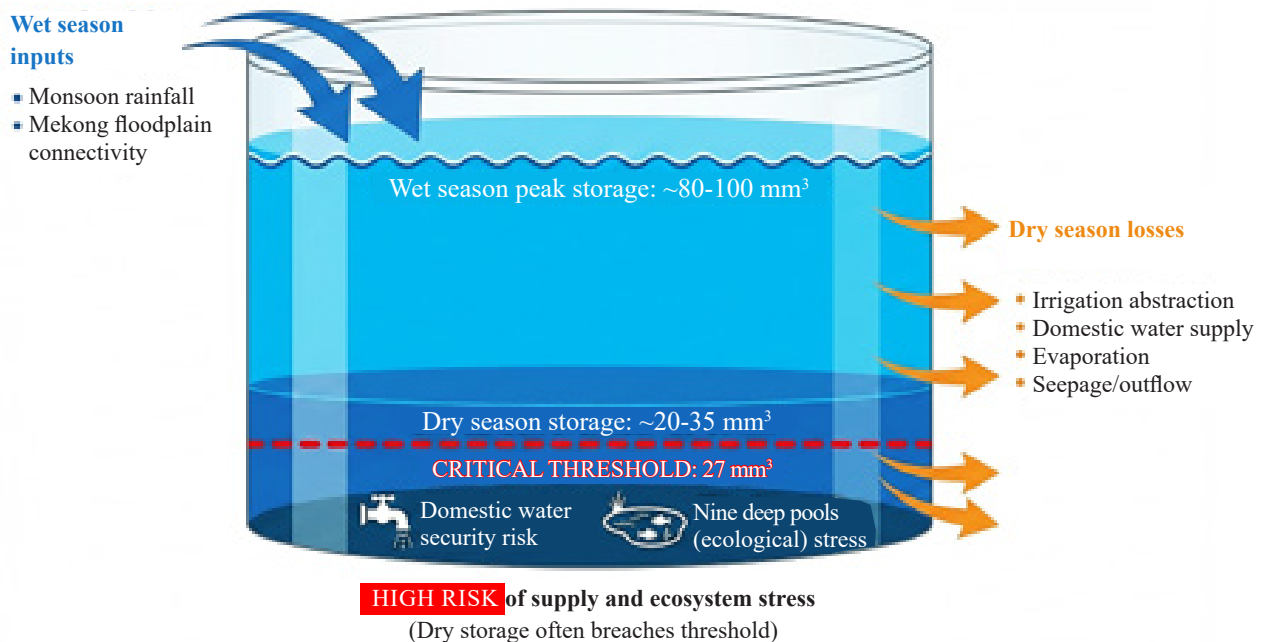
Improved data access via a digital support tool, particularly an extended Google Earth Engine (GEE) Web App used as a pilot (Figure 4),

Table 1: Trigger-based management framework for Boeng Sneh Lake

Phase	Volume threshold (million cubic metres)	Management actions
Normal	>35	Normal abstraction permitted; promote efficiency measures (Alternate wetting and drying, canal maintenance).
Moderate	27–35	Cap irrigation withdrawals; advise planting delays; prioritise domestic intakes.
Critical	<27	Suspend non-essential irrigation; protect deep pools; allocate emergency domestic water; support ecological sustainability.

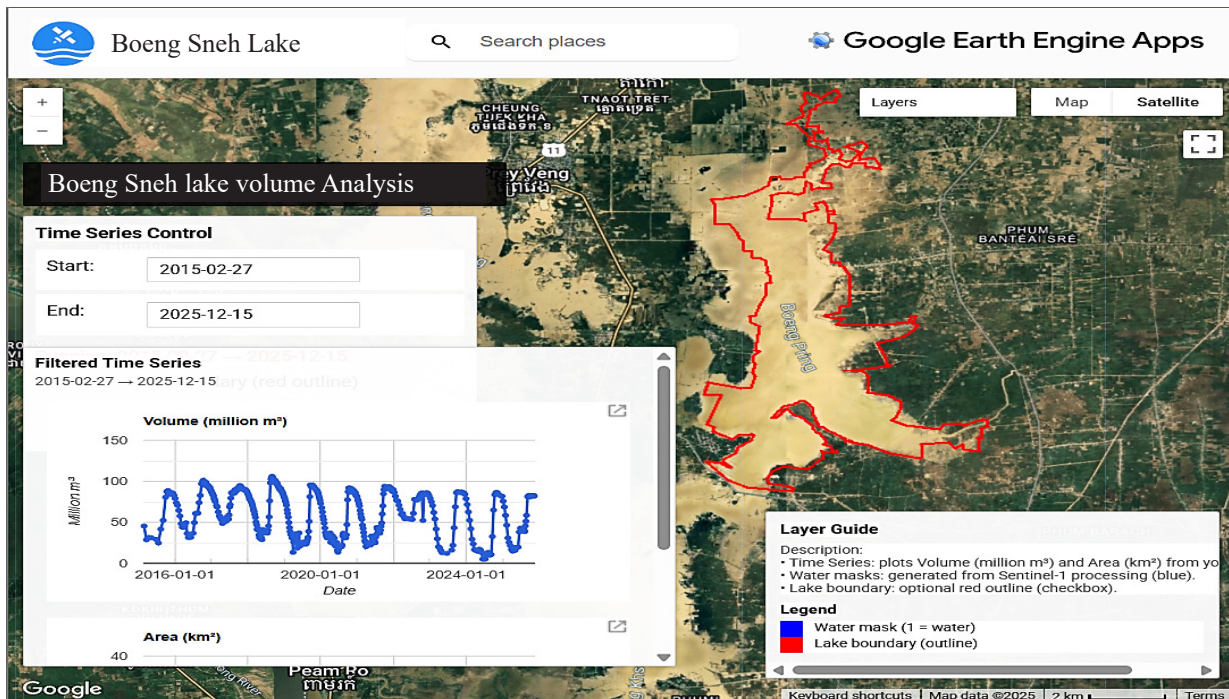
Source: Authors

Figure 3: Conceptual diagram of lake water balance



Source: Authors

Figure 4: Interface of the GEE web app for the Boeng Sneh Lake area and volume analysis



Source: Authors

presents an opportunity to strengthen evidence-based insights. Key features include the integration of DEMs with satellite imagery, which automatically calculates the current lake volume every 10–14 days, and threshold visualisation, which alerts users when the volume approaches the critical 27 million m³. This tool operationalises decades of hydrological data into an active decision-support platform, enabling near-real-time monitoring without the need for physical gauges or advanced technical expertise. This pilot testing tool requires further development. It demonstrates how digital support can assist local planning; however, true localisation requires capacity building and a transition plan from research to authorities. Without these, it remains a research product rather than an operational tool for practitioners.

Local perspectives: Fostering trust through data and mitigating conflict

FGDs and KIIs with FWUC leaders, CF members, and PWOs revealed that limited shared access to data had eroded trust and hindered coordination. Farmers, fishers, and community leaders report that traditional water management systems are failing under the pressure of expanding triple-cropping of rice. Community-operated sluices and the lake's nine deep-pool fish sanctuaries are increasingly over-exploited as pumping intensifies. This implies that basic water-level data in these deep pools are not collected for water-

gate operation, leaving gate operators without evidence-based triggers to restrict pumping or prioritise ecological refugia.

Their observations of worsening dry-season shortages, with canals running dry by April or May, align with the collected data showing that lake storage collapsed to just 5–15 million m³ in 2023–2024, far below the 27 million m³ threshold. Farmers have individually adapted by planting drought-tolerant rice, switching to short-cycle crops, or leaving fields fallow. However, local authorities emphasise that without systemic monitoring, these individual efforts cannot resolve the growing conflict between irrigation and fisheries. Communities urgently demand regular water-level records and meteorological data to enable transparent planning and equitable water allocation.

POLICY RECOMMENDATIONS

In light of these findings, this study suggests the following interventions to strengthen local data systems and scale this approach to enhance climate resilience and effective water management at Boeng Sneh Lake and beyond.

- **Institutionalise data-driven decision-making:** Adopt the data management approach as an authoritative monitoring instrument for Boeng Sneh Lake, with the DTWG responsible for overseeing and updating the data management system. Fill

foundational data gaps (e.g., bathymetry, water-level records) while embedding these data in operational tools, local governance, and mandated decision-making.

- **Enhance local capacity for data utilisation and ownership:** Provide DTWG members with training in interpreting and applying water data, and in integrating it into planning and water management. Additionally, simplified guidance materials, such as posters and voice-message updates, should be developed for dissemination at the community level.
- **Recognise and support the DTWG:** Formally recognise the DTWG as an ecosystem-based governance structure for holistic water resource management, aligning institutional coordination with ecological realities rather than with jurisdictional boundaries. In addition, dedicated budget lines for DTWG operations, including monitoring infrastructure and capacity building, should be integrated into decentralised planning and financing frameworks.
- **Invest in scaling the ecosystem-based governance model:** Document and disseminate the Boeng Sneh Lake methodology as a national good practice for participatory and inclusive water management. Replicate the DTWG's data-driven community water management model across other water-stressed wetlands in Cambodia, adapting it to local contexts.
- **Align localised data systems with national climate and water policies:** Integrate localised monitoring into national climate adaptation and water strategies. This alignment ensures policy coherence and enables scaling.

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