



Australia Awards

RESEARCH TITLE:

Banteay Chhmar's Water Resources: Climate Change Impacts and Sustainable Management Strategies



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IMPLEMENTATION PERIOD:
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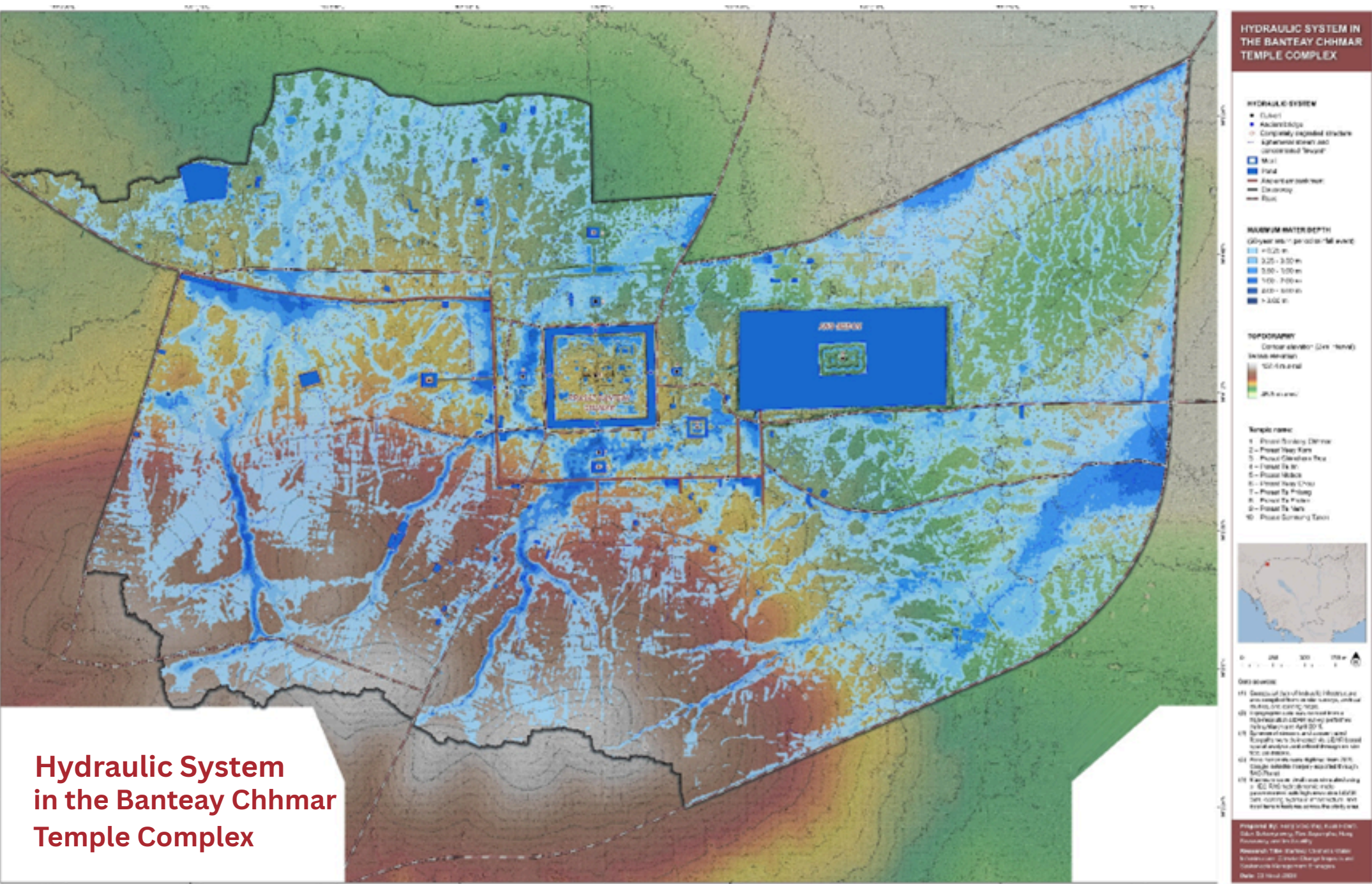
RESEARCH QUESTIONS

- Q1. What is the current status of water resources and water utilisation in the Banteay Chhmar’s Stung Teuk Chum Catchment?
- Q2. What are the hydraulic infrastructure bottlenecks that limit flood resilience within the Banteay Chhmar Temple Complex?
- Q3. How to merge the Integrated Water Resources Management (IWRM) framework with cultural heritage principles to transform Banteay Chhmar into a climate-resilient landscape?

RESEARCH METHODOLOGY

- Primary data collection via field surveys, authority consultations, and resident interviews
- Secondary data collection from authoritative institutional sources, including APSARA, MOWRAM, etc.
- Refinement of hydraulic connectivity and characterisation of flood inundation through advanced hydrodynamic modeling (HEC-RAS)
- Long-term climate change and drought assessment spanning historical baseline (1950–2024) and future projections (2025–2100) via ERA5 reanalysis data
- Quantification of catchment water availability using the HEC-HMS model

Mapping the depths: A **bathymetric survey** underway in the Banteay Chhmar temple moat using an **Acoustic Doppler Current Profiler** mounted on a small boat towed behind (28 October 2025)



RESEARCH KEY FINDINGS

Key finding #1: Water Insecurity & Imbalance

- High vulnerability:** About 70% of the population relies on unimproved, open-water sources, leaving them exposed to seasonal shortages and contamination.
- Massive deficit:** Annual irrigation demand (476 MCM) far exceeds the average annual catchment yield (140.4 MCM).
- Aquifer stress:** Groundwater storage is declining at a rate of–1.922 mm/month, indicating that extraction is outpacing natural recharge.

Key finding #2: Climate Change & Environmental Shifts

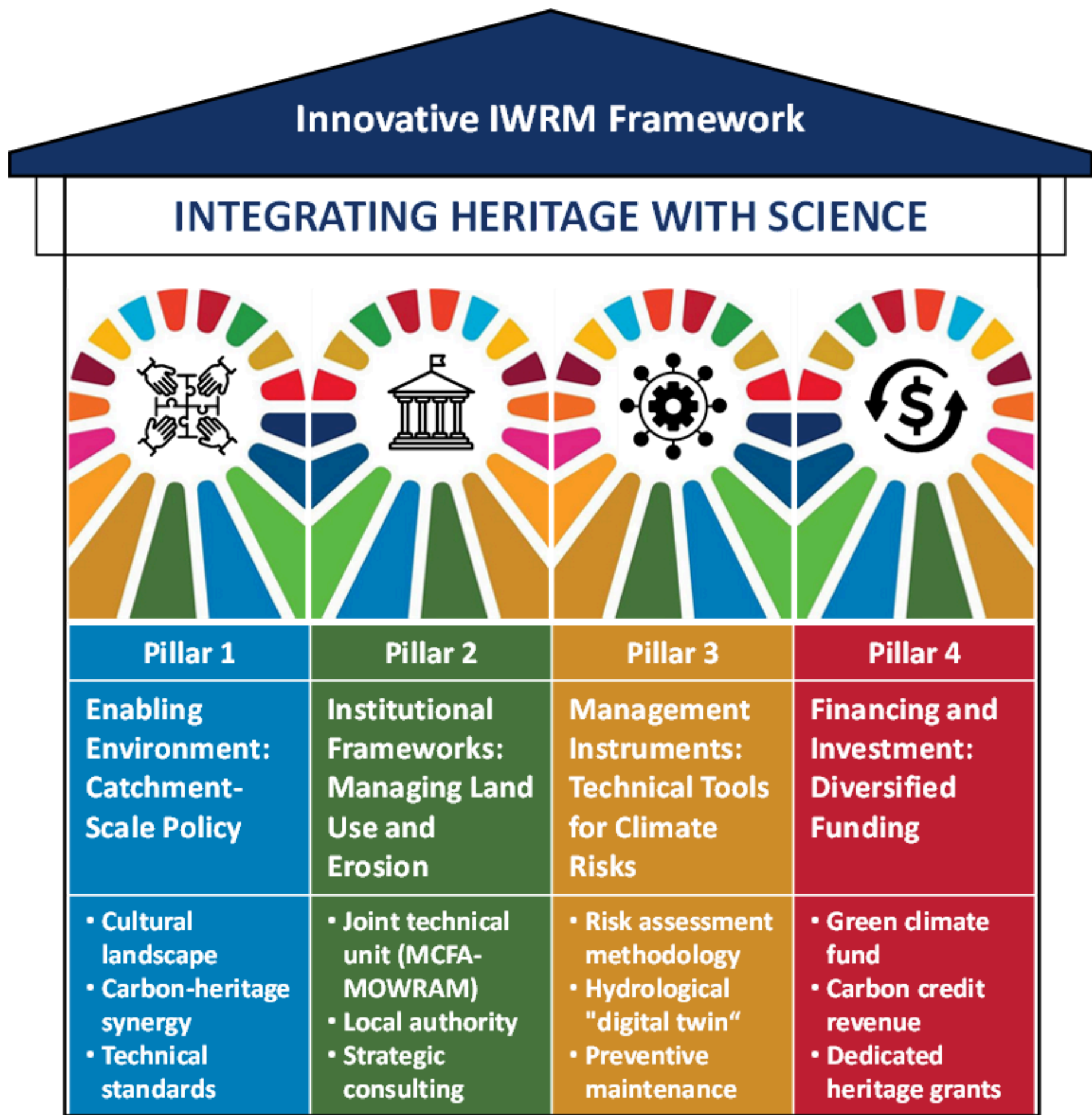
- Temperature rise:** The region has warmed by +1.22°C since 1950, with future projections suggesting intensified heat and "flash drought" risks.
- Deforestation:** Forest cover plummeted from 47%(2000) to 7% (2023), accelerating soil erosion and siltation of ancient water structures.

Key finding #3: Hydraulic System Deficiency

- Overflow and embankment failure:** Flash flooding (up to 2 hours) occurs due to hydraulic bottlenecks at undersized or missing culverts and compromised sections of the embankment.
- Operational constraints (lack of control structures):** All current hydraulic elements are ungated, restricting active flow regulation and emergency isolation during extreme events.

STRATEGIC RECOMMENDATIONS

To address these systemic challenges, this research proposes an innovative framework of Integrated Water Resources Management (IWRM) that synthesizes heritage conservation with hydrological science. **A primary recommendation** is the establishment of a dedicated authority for Banteay Chhmar to manage the entire catchment as a "Cultural Landscape". This strategy involves upgrading hydraulic infrastructure with flow-control gates, implementing reforestation-based carbon credit programs to mitigate soil erosion, and formalizing a joint technical partnership between the Ministry of Water Resources and Meteorology and the Ministry of Culture and Fine Arts. Such a collaboration aims to align the national river basin management plan with the long-term preservation of heritage assets in the region.



Sustainable approach: Integrating the Global Water Partnership’s IWRM principles with cultural heritage guidelines of the UNESCO, ICCROM, and ICOMOS