H23X-1877: Practical Steps for Achieving Equity in Water Resources System Planning: Lesotho Irrigation Investment under Climate Change

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MOTIVATION

To achieve robust economic evaluation of water resources projects under climate change, without compromising on equity in the distribution of resources and risks.

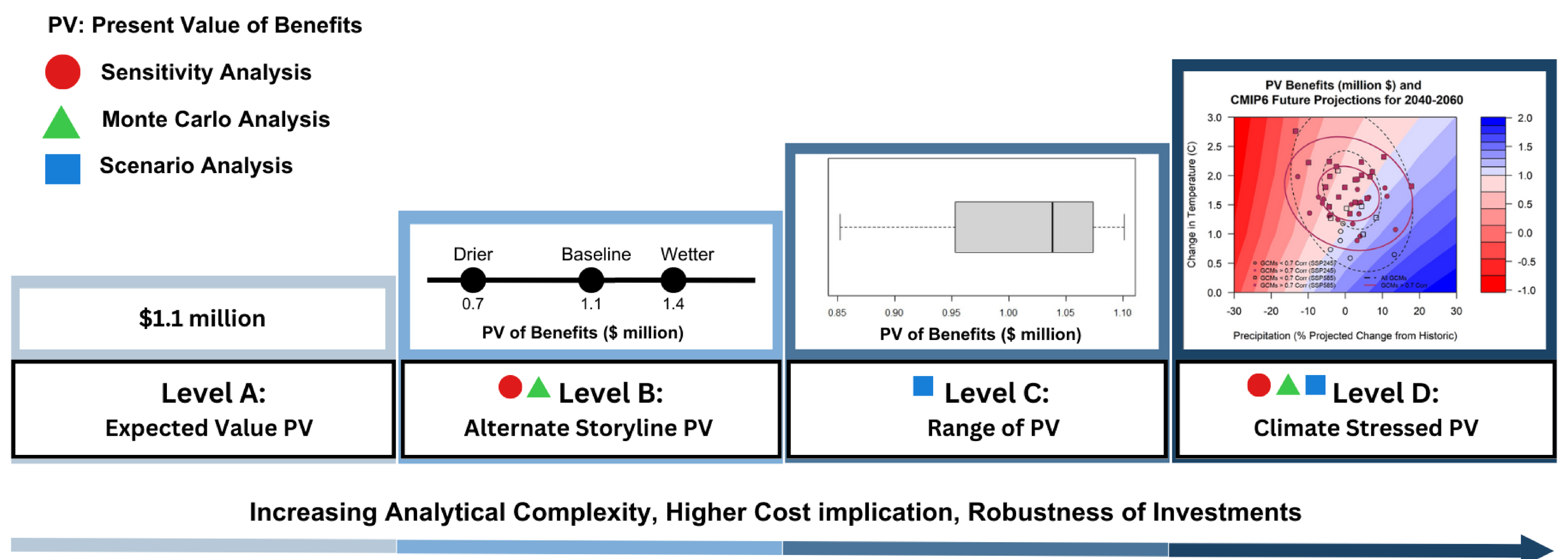

Figure 1: Towards Increasing Robustness of Economic Evaluation and Confident Investment Decisions

METHODOLOGY

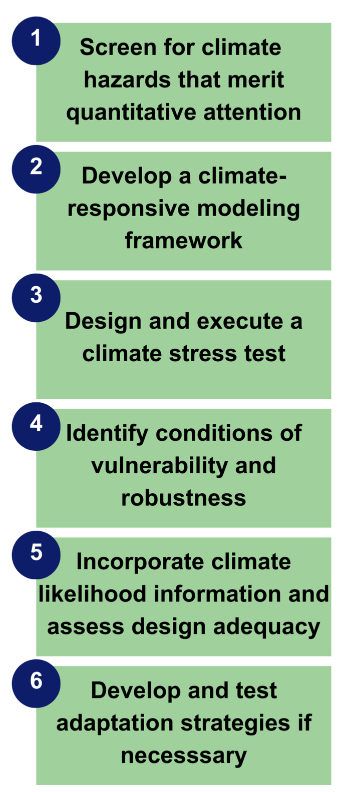

Figure 2: Methodology

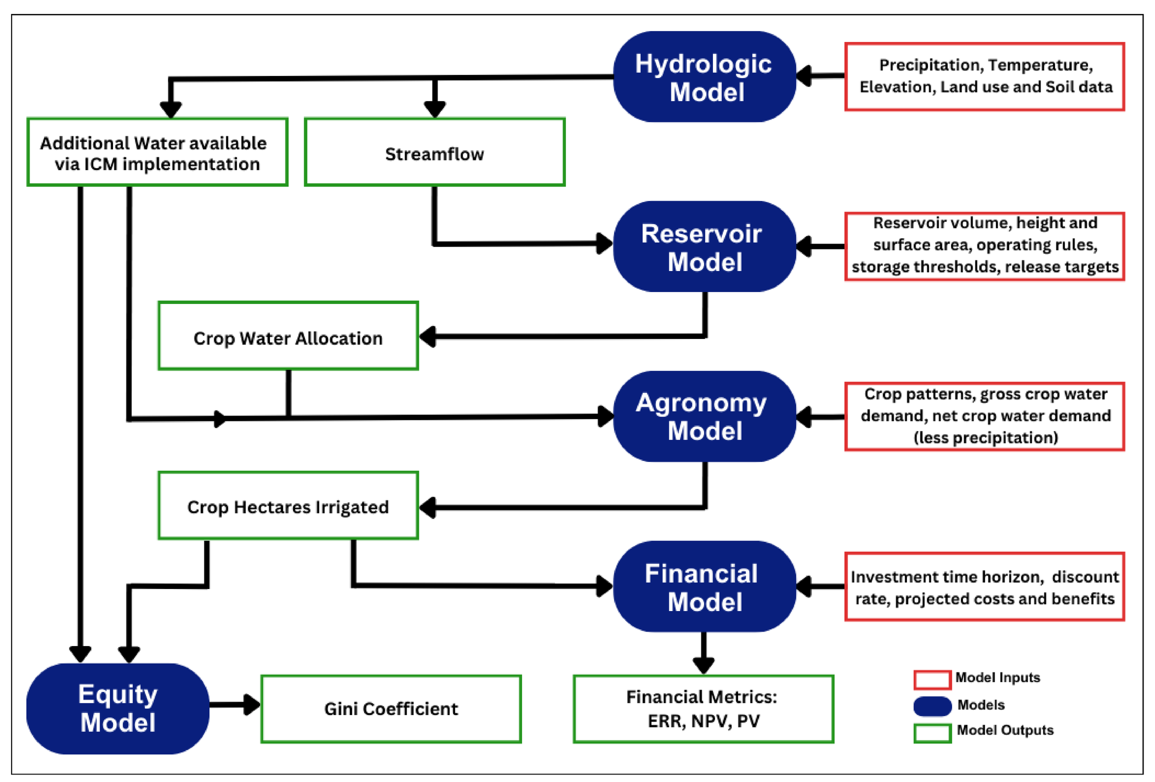

Figure 3: Climate-responsive Modelling Framework

STUDY AREA

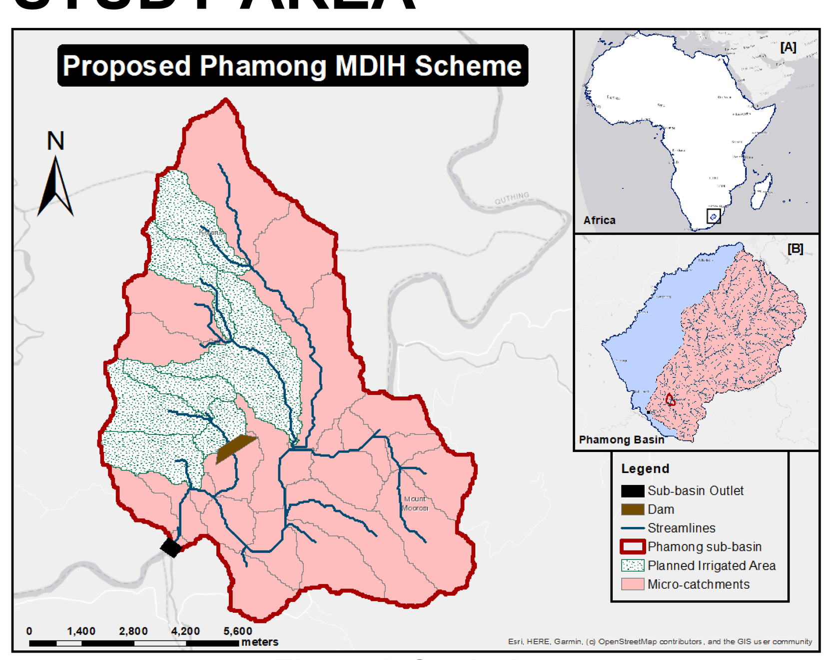

Figure 4: Study Area

Phamong, in the Lesotho Lowlands, is one of the areas shortlisted for MDIH (Market Driven Irrigation Horticulture). The key infrastructure is an irrigation dam designed to supply water to demarcated cultivated areas. Integrated catchment management (ICM) interventions like check dams have been proposed for implementation upstream of the dam to reduce sedimentation, thereby preserving live dam storage volume for irrigation purposes. Targeted benefit stream for this investment is revenue from the hectares cultivated each month.

Clear connections between equity and standard water project planning frameworks are required

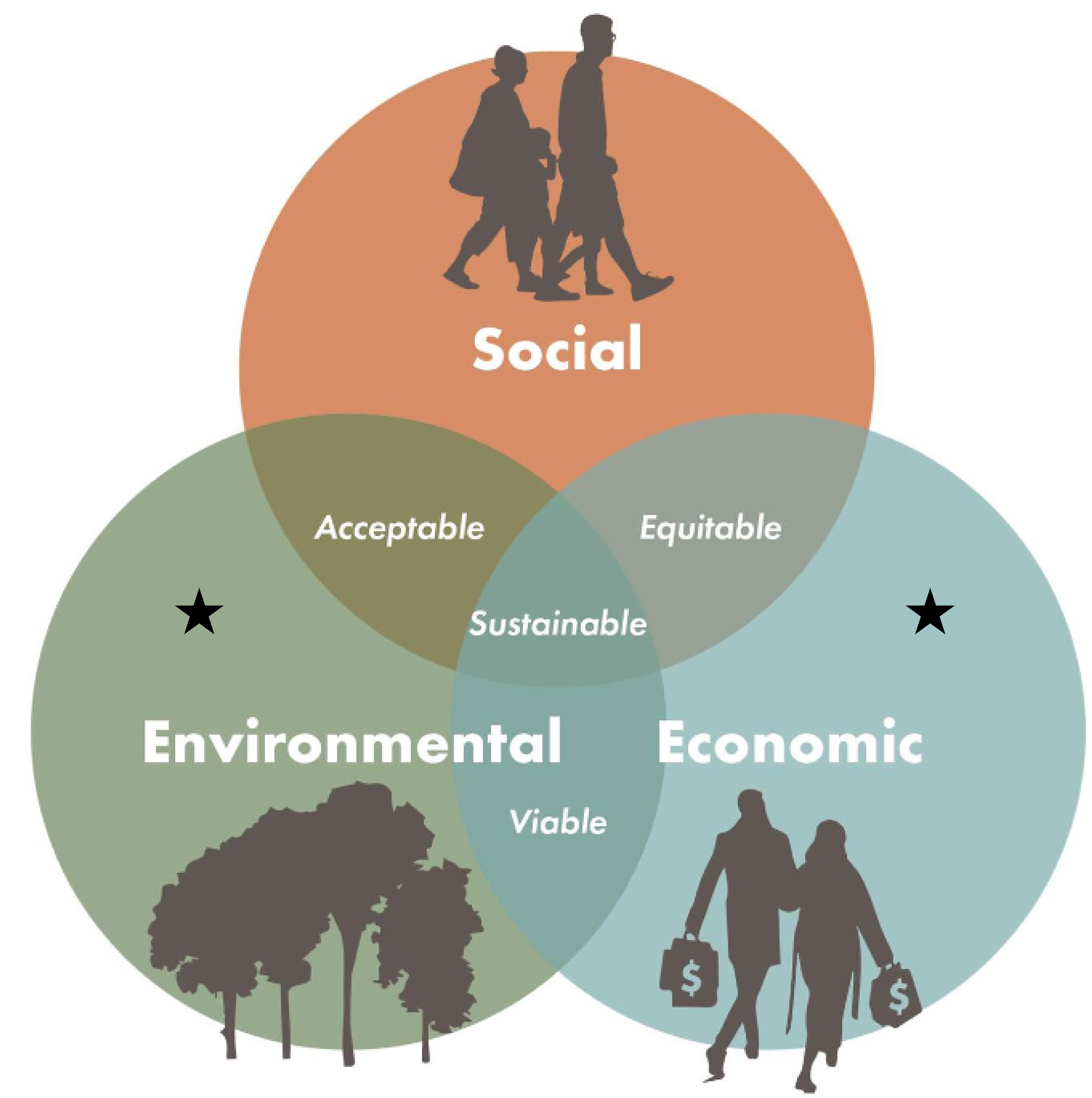

Figure 5: Triple-win Outcomes achieved through Engineering With Nature - EWN (larger text) and associated additional benefits (smaller text) (Source: USACE, 2018)

(★ Sectors addressed in the study)

PRELIMINARY RESULTS

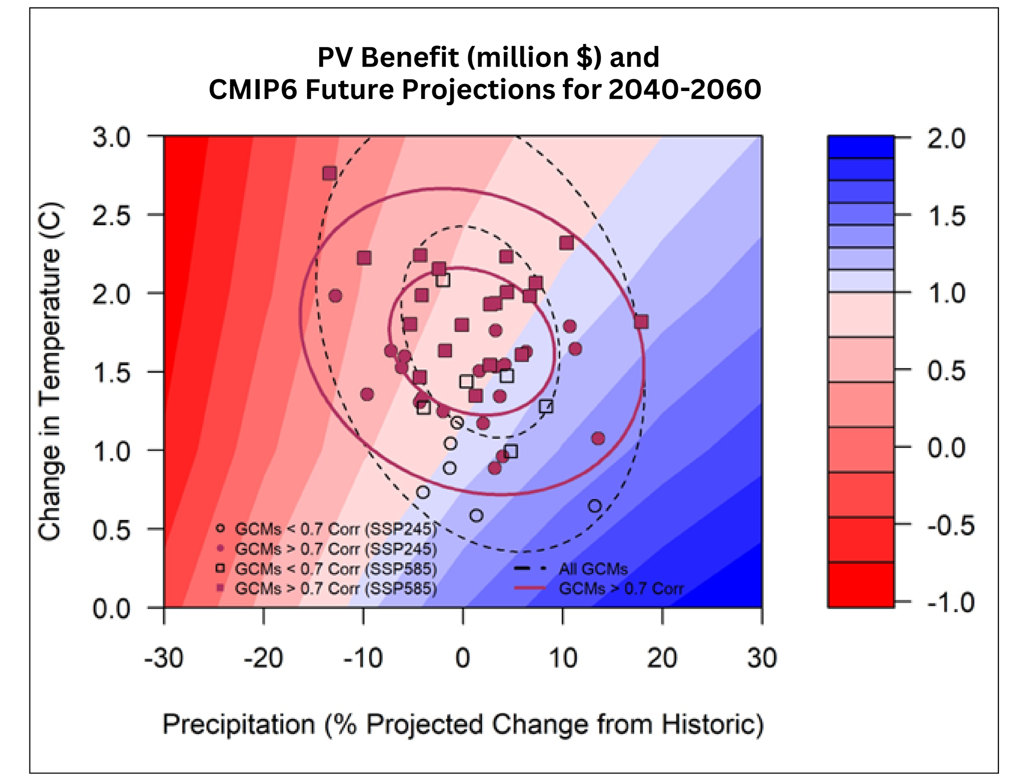

Figure 6: Response of PV to Climate Change

Key Findings

- Decision making using a **single Present Value (PV)** may be less cumbersome analytically, but it is risky because the metric gives no information on the investment's robustness to (climate) uncertainty.
- Simple sensitivity analysis that adopted **few (7) climate scenarios** only presented partial information on the investment's robustness (Robustness Index, RI = 57%)
- The **Stress Test** approach led to RI ≈ 31%, indicating that the proposed investment is about 26% less robust than analysis of few climate scenarios indicated.

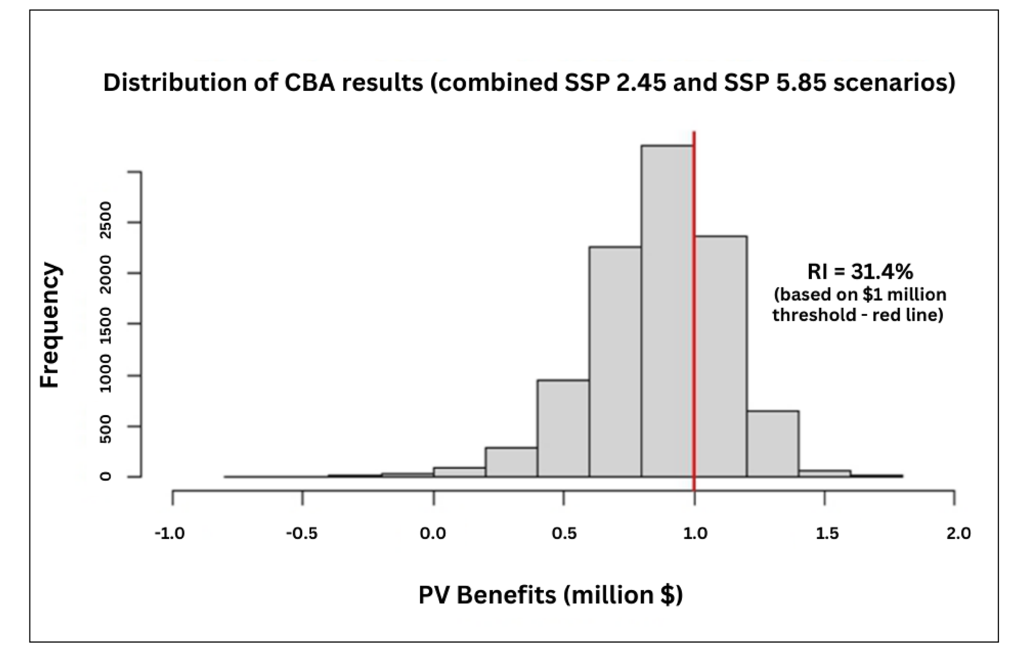

Figure 7: Robustness of PV under Climate Change

Practical Implications

If a RI benchmark of 50% is chosen for decision-making, and a climate stress test is not performed, the need to invest in adaptations like ICM measures and safeguard the investment's robustness could be overlooked. However, since RI < 50% after conducting the stress test, the study is able to propose the adoption of adaptation measures (Step 6 in Figure 2) to improve the robustness of the MDIH scheme.

FUTURE WORK

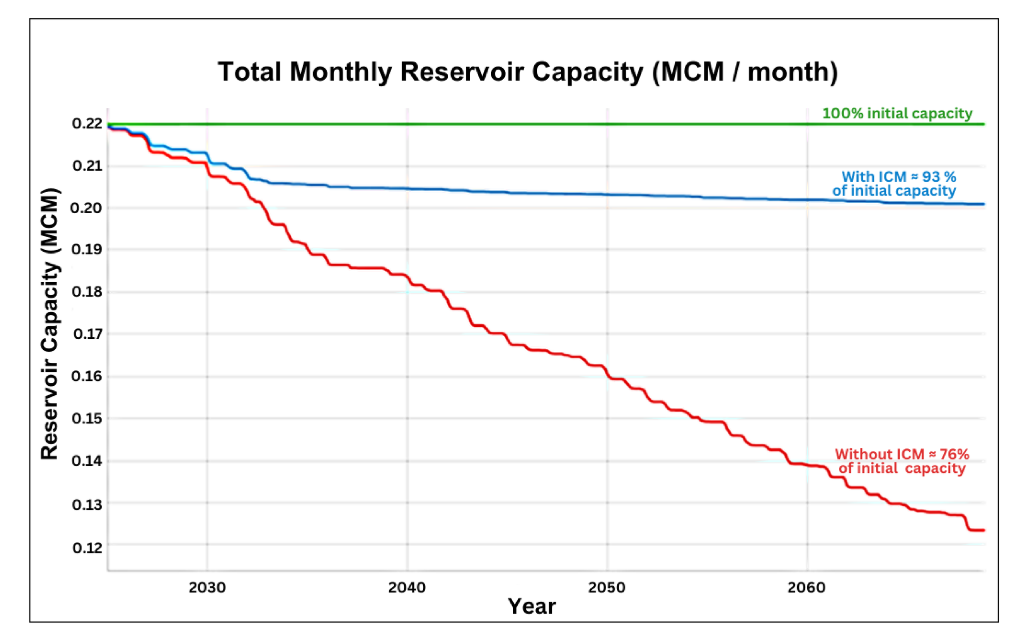

Figure 8: Potential Benefit of ICM in preserving Dam Storage Volume over a period of 44 years

Exploring the potential of ICM as an adaptation measure to improve the investment's robustness under climate change, following the framework presented in Figure 2. Aspects of distributional equity would also be considered using a decentralized configuration of the MDIH scheme shown in Figure 4. Furthermore, the effect of equitable distribution on financial evaluation metrics, robustness of investments and improved decision-making would be examined.

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