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Application of stakeholder-based and modelling approaches for supporting robust adaptation decision making under future climatic uncertainty and changing urban-agricultural water demand

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Deep uncertainty in future climate change and socio-economic conditions necessitates the use of assess-risk-of-policy approaches over predict-then-act approaches for adaptation decision making. Robust Decision Making (RDM) approaches embody this principle and help evaluate the ability of adaptation options to satisfy stakeholder preferences under wide-ranging future conditions.
This study involves the simultaneous application of two RDM approaches; qualitative and quantitative, in the Cauvery River Basin in Karnataka (population ∼23 million), India. The study aims to (a) determine robust water resources adaptation options for the 2030s and 2050s and (b) compare the usefulness of a qualitative stakeholder-driven approach with a quantitative modelling approach.
For developing a large set of future scenarios a combination of climate narratives and socio-economic narratives was used. Using structured expert elicitation with a group of climate experts in the Indian Summer Monsoon, climatic narratives were developed. Socio-economic narratives were developed to reflect potential future urban and agricultural water demand. In the qualitative RDM approach, a stakeholder workshop helped elicit key vulnerabilities, water resources adaptation options and performance criteria for evaluating options. During a second workshop, stakeholders discussed and evaluated adaptation options against the performance criteria for a large number of scenarios of climatic and socio-economic change in the basin. In the quantitative RDM approach, a Water Evaluation And Planning (WEAP) model was forced by precipitation and evapotranspiration data, coherent with the climatic narratives, together with water demand data based on socio-economic narratives.
We find that compared to business-as-usual conditions options addressing urban water demand satisfy performance criteria across scenarios and provide co-benefits like energy savings and reduction in groundwater depletion, while options reducing agricultural water demand significantly affect downstream water availability. Water demand options demonstrate potential to improve environmental flow conditions and satisfy legal water supply requirements for downstream riparian states. On the other hand, currently planned large scale infrastructural projects demonstrate reduced value in certain scenarios, illustrating the impacts of lock-in effects of large scale infrastructure.
From a methodological perspective, we find that while the stakeholder-driven approach revealed robust options in a resource-light manner and helped initiate much needed interaction amongst stakeholders, the modelling approach provides complementary quantitative information. The study reveals robust adaptation options for this important basin and provides a strong methodological basis for carrying out future studies that support adaptation decision making.