ABSTRACT

Climate change impact on water resources makes adaptation crucial. Locally relevant adaptation options which address biophysical and socio-ecological adaptation requirements have to be determined and evaluated using an integrated approach. In this study, such an approach has been applied in the Kangsabati reservoir catchment and command areas, located in West Bengal, India. Through a participatory approach involving 14 multi-level stakeholder workshops, locally relevant adaptation options are determined using a problem web-solution web method and prioritized using Multi-Criteria Analysis. Then, a validated Water Evaluation And Planning (WEAP) model is used for hydrological assessment of effectiveness of five prioritized adaptation options in addressing adaptation requirements. The prioritized options include check dams and increasing forest cover in the Kangsabati reservoir catchment and, changing cropping pattern, traditional ponds and waste water reuse in the command areas. Stakeholder prioritized criteria which correspond to adaptation requirements are increasing local water availability, runoff reduction and crop diversification. High resolution (~25km) climatic projections from four Regional Climate Model (RCM) simulations and their ensemble for the mid-21st century SRES A1B scenario are used to force the WEAP model. Ensemble projections for 2050 for temperature show an increase of 1.3 °C and a reduction of ~6.6% for precipitation. Future increase in evapotranspiration is expected to increase future irrigation water demand, while rising population is expected to increase urban water demand. Cropping pattern change reduces water demand for both Kharif and Rabi seasons compared to the business as usual scenario, with peak unmet demand reducing from ~ 0.78 x 10^9 m^3 to ~0.42 x 10^9 m^3. Traditional ponds reduce unmet demand by ~4.5 x 10^9 m^3 and reduce peak demand from ~0.78 x 10^9 m^3 to ~ 0.7 x 10^9 m^3. Increasing forest cover reduces runoff by ~1000 times more than check dams and reduces runoff during monsoon season. Waste water reuse in three towns reduces water demand and increases streamflow downstream. WEAP future simulations demonstrate that magnitude of impact of adaptation options depends on RCM simulation. There is uncertainty in the magnitude of change of streamflow due to the effect of adaptation options, but there is greater certainty in the sign of change. Increasing forest cover is a more suitable option than check dams while command area options address different adaptation requirements and therefore have complementary benefits.

Keywords*: climate change adaptation, RCMs, WEAP modelling, participatory approach*