

Fariba Babaeian, Majid Delavar, Saeed Morid and Shervin Jamshidi, 2023, Designing climate change dynamic adaptive policy pathways for agricultural water management using a socio-hydrological modeling approach, *Journal of Hydrology*, Volume 627, Part A, December 2023, 130398.

## Highlights

- Deep climate uncertainties pose a challenge for long-term water resources planning.
- Dynamic Adaptive Policy Pathways is linked to socio-hydrological modeling (SWAT-ABM).
- SWAT-ABM covers hydrological aspect and farmer agents' preferences and behaviors.
- Robust adaptable plans are designed and evaluated under deep climate uncertainties.
- Farmers' cooperative adaptation actions are the most robust adaptable plans.

**Abstract** Deep climate uncertainties create challenges to long-term planning in the management of complicated water resources and agricultural systems. The use of an innovative decision-making approach under deep climate uncertainties is helpful to deal with these challenges in such systems. The research aims to develop an appropriate methodology for designing and evaluating robust adaptable plans in the agricultural sector in the face of deep climate uncertainties which covers hydrological aspects and stakeholders' preferences and behaviors. For this purpose, Dynamic Adaptive Policy Pathways (DAPP) approach in conjunction with socio-hydrological modeling is utilized to design and evaluate comprehensive robust adaptable plans under future climate uncertainties in the Hablehroud River Basin, Iran. In this context, an agent-based modeling (ABM) approach is linked to the Soil and Water Assessment Tool (SWAT) model to account for the social behavior of various stakeholders as well as the impact of climate change on water resources and agricultural systems and their interactions. The results indicated that encouraging farmers to cooperate in changing cropping patterns and deficit irrigation should be proposed as a main plan in both short- and long-term planning. If the implementation issues are also considered, penalty-based adaptation actions (robustness range of 56–72%) can be prioritized in the early years to gradually educate farmers about the benefits of cooperative behavior. Therefore, taking into account all issues: 1) sustainability of water resources, 2) agricultural income, 3) climate change impacts, and 4) implementation plans in the time period, it is suggested to impose a penalty on deficit irrigation (56–76% of robustness) during the early time periods and then shift to changes in cropping patterns through training of farmers (76–82%). Considering limits to allowable water withdrawal through penalties (56–72%) can be implemented as another suggested alternative in the early time

periods, but imposing penalties on deficit irrigation (62–68%) should be implemented in the long-term.

... The information gap decision theory (IGDT) (Ben-Haim, 2006) is applied to determine robust adaptation actions and their tipping points.