

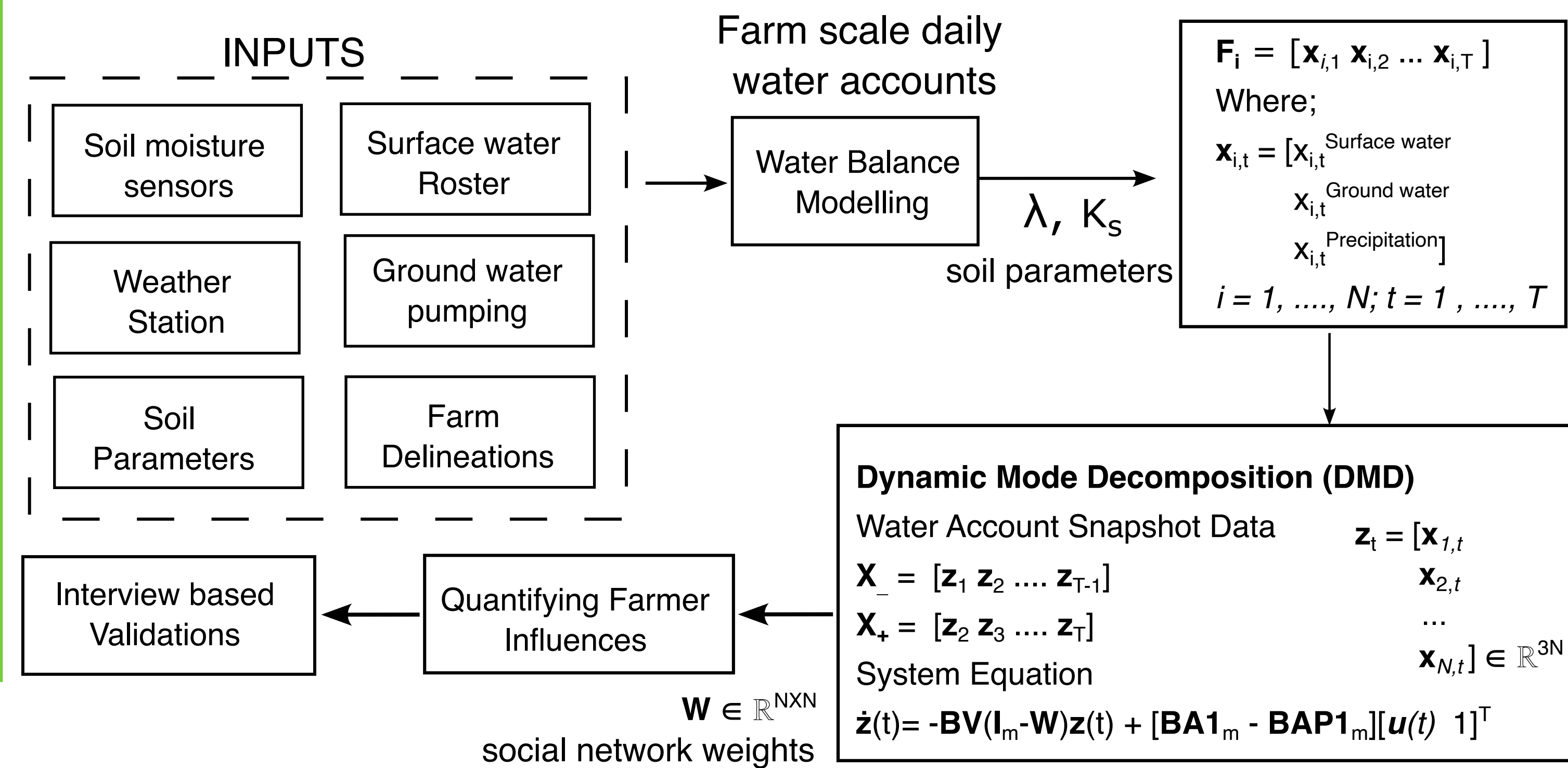
Inferring Socio-ecological Influences on Smallholder Conjunctive Irrigation Patterns

MOTIVATION

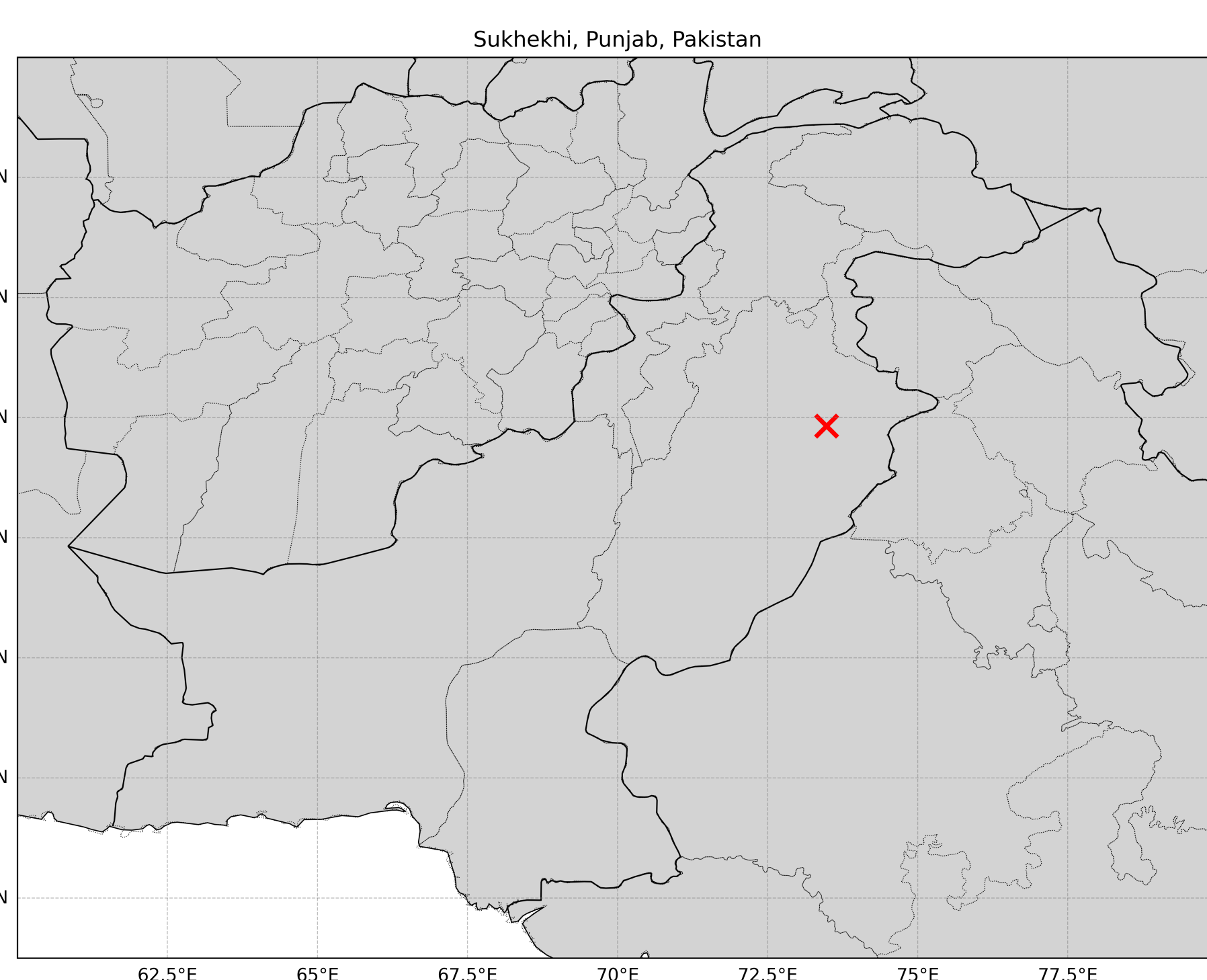
Water scarcity is a pressing global challenge, with agriculture accounting for the largest share of freshwater use. In Punjab, Pakistan, where smallholder farming is integral to regional food production, limited and unreliable canal supplies drive groundwater abstraction to meet crop water requirements. Within shared irrigation watercourses, farmers' irrigation decisions are embedded in institutional allocation arrangements, common resource dependencies, and social networks. Understanding these decisions requires examining both the hydrological conditions governing irrigation demand and the social interactions shaping water-use practices.

We quantify this sociological network through a framework linking hydrological modelling and quantitative interaction analysis with planned qualitative inquiry: estimating how strongly farmers' irrigation practices influence one another and exploring the social processes behind these relationships.

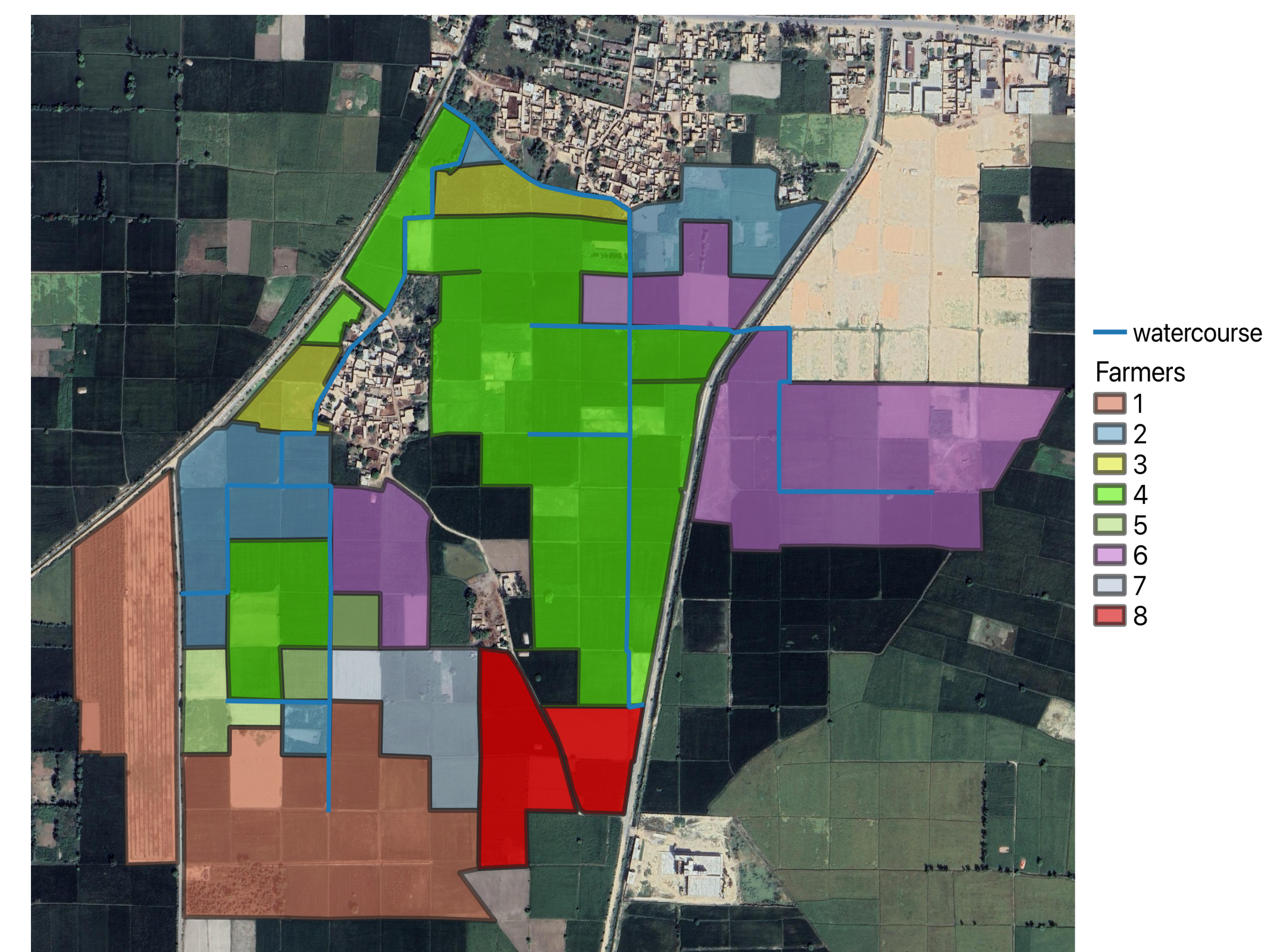
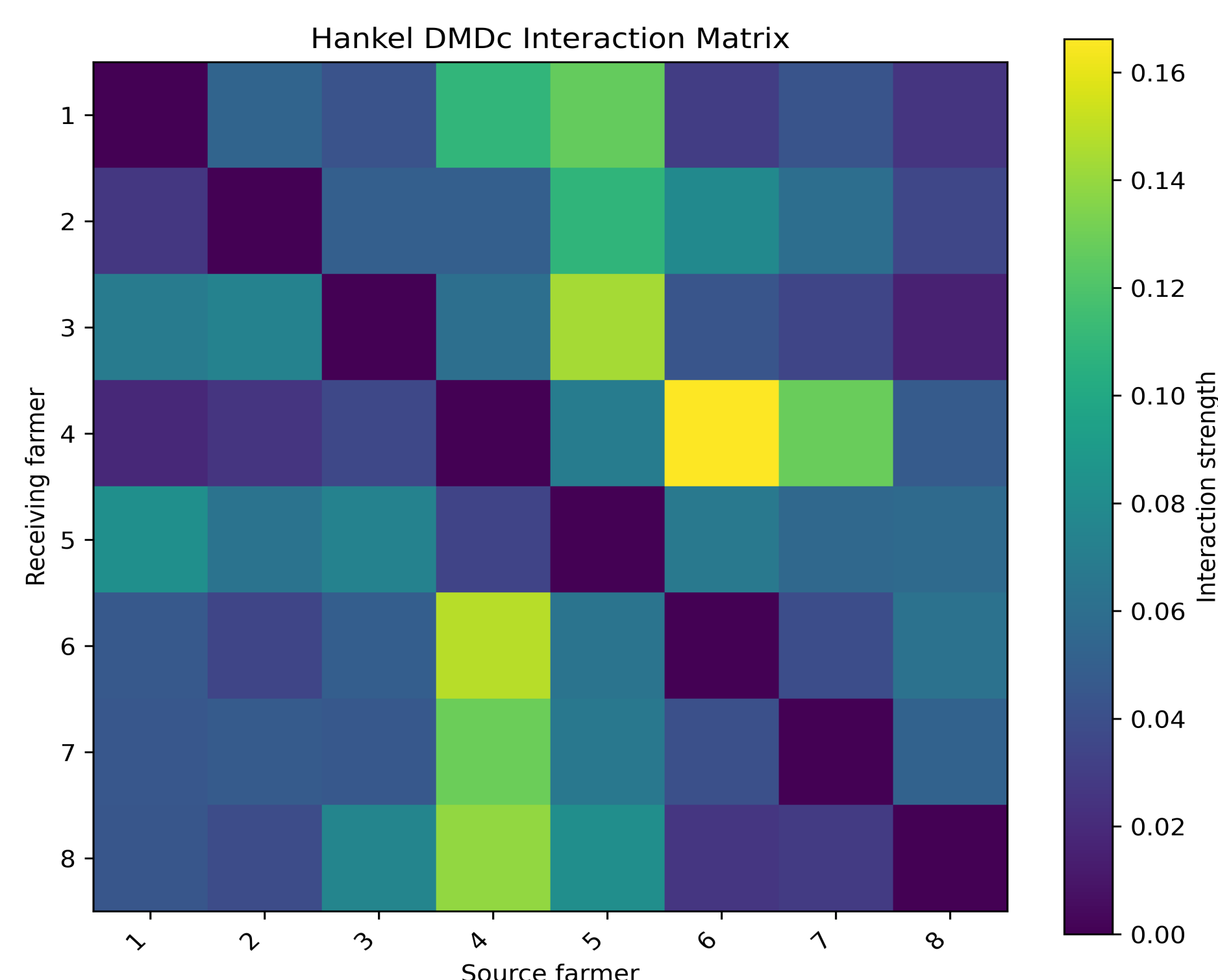
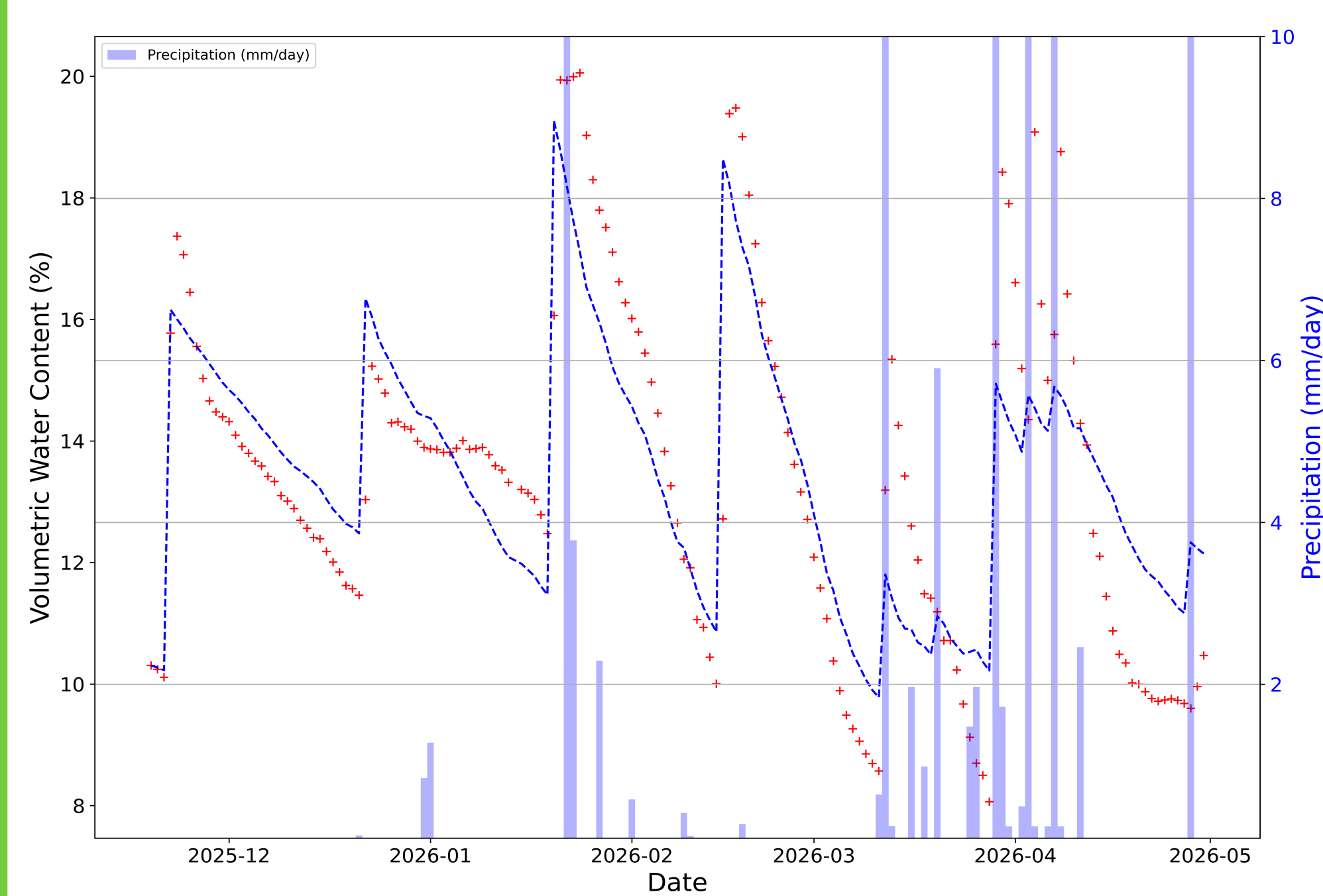
METHODOLOGY



STUDY AREA AND INTERVENTIONS



RESULTS AND INSIGHTS



OUR CONTRIBUTIONS

Socio-hydrological framework: Integrate hydrological modelling and quantitative interaction analysis with planned qualitative inquiry to investigate the strength and social basis of inter-farmer influences.

Network characterisation: Estimate the strength and direction of relationships among farmers' irrigation patterns, providing a quantitative basis for subsequent social investigation.

FUTURE WORK

- Investigate the social basis of inferred interactions through farmer interviews and participatory network mapping.
- Assess whether inferred relationships reflect social influence or shared hydrological and allocation conditions.
- Validate irrigation estimates against delivery and pumping records, and assess sensitivity to model assumptions.
- Evaluate network dynamics across seasons and crops to inform irrigation advice and collective water management.

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