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## Theoretical frameworks for understanding and predicting changes in hydrology and society

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Coupled human water systems (CWHS) are distinctive in their diversity. Humans both affect and are affected by water across multiple, and sometimes interacting spatial, temporal, management and governance scales. These relationships pertain to multiple characteristics of both the human (e.g., culture, institutions, historical processes, power relations, and economic incentives) and water (e.g., abundance, scarcity, quality) components of CWHS. Changes in any of these characteristics might ripple through CWHSs to affect key societal outcomes, such as the distribution of hydrological risk and access to water and sanitation. The complexity of understanding and predicting hydrological and social changes lies in the fact that there are multiple, interwoven CHWS, each of which has been examined through a variety of disciplinary and theoretical perspectives.

This chapter synthesizes existing CHWS frameworks across the social, environmental and engineering sciences. We first propose a typology for the CHWS themselves by identifying both their defining and differentiating characteristics. We then develop a typology for the frameworks used to study them, based on philosophical perspectives and methodological approaches. We then identify promising approaches (what “worked”) and outstanding gaps for future work on CHWS. Finally, we leverage the two previously defined typologies to propose a general structure around which to synthesize knowledge in the subsequent topical chapters of the book.