How Methods for Navigating Uncertainty Connect Science and Policy at the Water-Energy-Food Nexus

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Abstract

As the water-energy-food (WEF) nexus becomes an increasingly common framework for bridging science and policy, there is a growing need to unpack and make explicit many of the methods and assumptions being used to operationalize the nexus. In this paper, we focus on two common approaches to nexus research, quantitative modeling and futures thinking, and the ways that each set of methodological tools address uncertainty. We first review the underlying assumptions of each approach with a focus on sources of and ability to measure uncertainty, and potential complementarities. Quantitative modeling takes a probabilistic approach to predicting the likelihood of a specific outcome or future state based on estimates of current system dynamics. In contrast, futures thinking approaches, such as scenario processes, explore novel changes that cannot be fully predicted or even anticipated based on current understandings of the nexus. We then examine a set of applied nexus projects that bridge science and policy-making contexts to better understand practitioner experiences with different methodological tools and how they are utilized to navigate uncertainty. We explore one nexus case study, LIVES Cambodia, in-depth, to better understand the opportunities and challenges associated with participatory modeling and stakeholder engagement with uncertainty in a policy-making context. Across the cases, practitioners identify the complementarity between modeling and futures thinking approaches, and those projects that integrated both into the planning process experienced benefits from having multiple angles on uncertainty within the nexus. In particular, stakeholder engagement provided critical opportunities to address some types of uncertainties (e.g., data gaps) through the use of local knowledge. Explicit discussions of model uncertainty and use of scenario processes also enabled stakeholders to deepen their understandings of uncertainties and envision policy pathways that would be robust to uncertainty. In many senses, models became boundary objects that encouraged critical thinking and questioning of assumptions across diverse stakeholders. And, for some nexus projects, confronting uncertainty in explicit and transparent ways build capacity for policy flexibility and adaptiveness. We conclude with a discussion of when and how these benefits can be fully realized through the strategic use of appropriate approaches to characterizing and navigating nexus uncertainty.

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