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Social-ecological resilience to changes in moisture recycling

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Scientists from the biophysical and social sciences often define resilience substantially different. Biophysical scientists primarily use resilience to understand how a system can return to an equilibrium following a perturbation, and social scientists use resilience to understand what enables, or disable, human development. In the Anthropocene, where social changes are causing both linear and nonlinear biophysical changes, with local or distant feedbacks on society, it is important to develop integrated definitions and analytical methods to analyze combined social-ecological interactions. There has been a growing amount of research in this field over the last decade, but with a primary focus on relatively small-scale regions or specific ecosystems.

In this paper we review literature dealing with interdisciplinary aspects of resilience to global change and develop a conceptual framework for analyzing social-ecological resilience in relation to moisture recycling (i.e. where evaporation from land returns as precipitation on land). We first identify current social drivers of changes in evaporation (including e.g. large scale land and water acquisitions, and REDD+ programs). We then identify geographic regions where the effects of altered evaporation on moisture recycling can risk a) causing thresholds in specific biomes (such as between forests and savannas), or b) shifts in social systems (such as collapse of rainfed farming systems). We also identify institutional structures that enhance the capacity to enhance resilience through either dealing directly with drivers, or building adaptive capacity to changes in moisture recycling. We particularly stress the difference between regional feedbacks (where the consequences are felt in the same regions where decisions are made), and teleconnections, i.e. where local decision in one place is altering important drivers for distant social-ecological systems.

Through this review we identify the characteristics of interlinked biophysical and social systems that enhance or undermine resilience as related to moisture recycling. We use these characteristics to identify critical geographic regions globally where social-ecological resilience to moisture recycling is low, currently being undermined, or where there might be large risks in the future. We illustrate that some of these regions are well-studied, while others have been neglected in previous research. We end with a list of research priorities for understanding implication land-atmosphere interactions for resilience of interlinked social-biophysical in the Anthropocene.