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The use of impact chains and Bayesian Network Analysis to assess flood risk dynamics in the Lower Mono River Basin, Benin

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River floods are a common and often devastating environmental hazard causing severe damages, loss of lives and livelihoods, notably for the most vulnerable. Understanding the root causes, drivers, patterns and dynamics of flood risks and associated uncertainties is important to inform adequate risk management. Yet, a lack of understanding the highly dynamic processes, interactions, uncertainties, and the inclusion of participatory methods and transdisciplinary approaches in risk assessments remains a limiting factor. In many flood-prone regions of the world, data scarcity poses another serious challenge for risk assessments. Addressing the above, we developed an impact chain via desk study and expert consultation to reveal key drivers of flood risk for agricultural livelihoods in the Lower Mono River Basin of Benin and their interlinkages – a region that is both highly prone to flooding and can be considered data-scarce. Particularly, the dynamic formation of vulnerability and its interplay with hazard and exposure components is highlighted.

Based on a simplified version of the impact chain which was validated in a participatory manner during a virtual expert workshop, an alpha-level Bayesian Network was created to further explore these interactions. The model was applied to an exemplary what-if scenario for the study area in Benin. Based on the above, this study critically evaluates the benefits and limitations of integrating the two methodological approaches to better understand and simulate risk dynamics in data scarce environments. The study finds that impact chains are a useful approach to conceptualize interactions of risk drivers. Particularly in combination with a Bayesian Network approach the method enables an improved understanding of how different risk drivers interact within the system and allows for dynamic assessments of what-if scenarios, for example, to inform resilience building strategies.