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Natural Hazards Ahead: Navigating Uncertainty with Stakeholder-Led Scenarios

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Abstract:

Urban planning decisions have long-term consequences and determine the number people and assets exposed to climate related risks. Given that the future is uncertain, these urban planning decisions need to be robust under many different outcomes. Planning and decision makers often interact with uncertainty at a global level, such as with climate change scenarios, but not at a local level, where single "best-guess" or "intended" projections are frequently used for population, land use, infrastructure development, economics, and conservation. While regional urban planning strategies often have clear objectives and goals, without explicit incorporation of future uncertainty, they may not be resilient when facing a wide range of plausible future conditions.

Reducing the risk of natural hazards is an important planning consideration that needs to encapsulate potential changes to hazard, vulnerability, and exposure, due to both global uncertainty in climate and local uncertainty in socio-economic factors. By planning with explicit consideration of uncertainty, the effectiveness of risk reduction across different future scenarios options can be quantified, and decisions can be designed to be resilient across these multiple futures, not just single projections of an unknown future. Strategic foresight techniques, to elicit stakeholder opinions of critical uncertainties within their local regions, can be used to generate possible future socio-economic conditions under which the risk reduction options can be tested. Stakeholders can assist in developing plausible future worlds for different elements of uncertainty, informed by global megatrends, which form the basis of narrative scenarios, and subsequently, quantified model inputs.

In order to use local socio-economic scenarios to inform risk assessments and to assess the effectiveness of different risk reduction strategies, they need to be used to augment inputs into quantitative risk models, especially in relation to modelling plausible changes in exposure and vulnerability. However, the translation of qualitative scenarios to quantitative model inputs remains challenging. Consequently, this presentation will focus on the process for achieving this translation, where the Unified Natural Hazard Risk Mitigation Exploratory Decision Support System (UNHaRMED) process was used to illustrate how narrative scenarios that capture a range of plausible futures can help structure model outputs under uncertainty. UNHaRMED uses spatial-temporal modelling of land use and hazards to support decision making of mitigation strategies under socioeconomic and climate scenarios. The process is being applied to a project with the Western Australian Government's Department of Planning, Lands and Heritage, focusing on case studies within South Metro Peel and Bunbury-Geographe, regions that face risks predominantly due to bushfire and coastal inundation hazards.

Within each of the case studies a participatory process with government stakeholders was used to develop narrative scenarios that frame UNHaRMED model outputs. First, stakeholders identified key drivers of change for case study regions (such as population and demographics, environment and biodiversity, services, housing and transport), which were then drawn out into how these may manifest as future changes up to 2050 and 2070. Combinations of these individual changes were produced to form future scenarios in these time periods. This allowed stakeholders to add local context and contribute regarding specific dynamics and interplays between changes. Next, post processing of results, and quantification of key model parameters from these scenario descriptions will be completed, with continual review from stakeholders. Quantitative risk modelling will be undertaken in UNHaRMED for subsequent participatory workshops, and final risk reduction strategies, will then be framed under each of these scenarios, allowing for an explicit incorporation of various dimensions of uncertainty into natural hazard risk reduction decision making. Broader adoption of a stakeholder led, scenario focused approach to incorporating uncertainty in decision support systems will inform decisions that are more resilient, liveable, and sustainable.

Keywords: *Natural Hazards, Decision Support Systems, Strategic Foresight, Scenarios, Stakeholder Engagement*

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