

Ramsar wetland climate adaptation: lessons learnt from a participatory process

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Abstract: Models don't make decisions—people do. There has been significant progress in complex systems modelling over the last few decades, but if these models don't serve the humans making real-world decisions, they will have little impact. Four key challenges are often cited as limiting the use of quantitative models in ecological climate adaptation (i) scale and data mismatches between model outputs and the information required to guide transformation management, (ii) the broad complexity and uncertainty spectrum associated with climate metrics, impact pathways and biological responses of ecological assets, (iii) reductionist approaches that miss holistic system values prioritised by many participants and most critically (iv) the lack of clear future state targets and vision of the changed ecological character.

This study developed climate vulnerability assessments and adaptation roadmaps for three Ramsar wetlands in the Murray–Darling Basin. We used both quantitative and qualitative methods through a participatory process involving over 160 water and landscape managers. Ramsar wetlands play a crucial role within the broader landscape in maintaining biodiversity, improving water quality, controlling floods, and providing other critical ecosystem services. Their importance extends beyond environmental benefits, supporting local economies and holding cultural significance. The impacts of climate change on Ramsar-listed wetlands in the Murray–Darling Basin are likely to be significant and compounded by already altered flow regimes from historical river management. This creates complex, interconnected challenges that are particularly difficult to anticipate and address.

Our approach integrated local knowledge and values, including Indigenous cultural values with downscaled climate projections and outputs from hydrological models. Future hydroclimate metrics, including temperatures, rainfall, river flows, and wetland inundation dynamics, and ecological thresholds and responses provided scientific evidence to underpin the participatory process. Core site values and features were co-developed with local managers, and vulnerability assessments provided qualitative and quantitative analysis of wetland thresholds and climate responses, developing visions for the future, changed site using climate analogues and hydrological projections. Adaptation pathways were co-developed to guide management through climate-ready objectives that acknowledge the site values and features that are expected to persist, while accounting for significant ecosystem changes.

This method of complementing modelling with workshop-based deliberation fills a gap in broader adaptation research for complex systems, particularly for riparian wetlands in a highly regulated catchment. Co-production with participants was critical for shaping the models, metrics and assessments used, and local experiential knowledge bridged the gap between the information needs of human decision makers and the limits of quantitative approaches. It demonstrated that effective adaptation requires matching assessment methods to problem complexity, blending scientific information and human insights, rather than always defaulting to more sophisticated numerical modelling.

Keywords: Ramsar, climate adaptation, participatory approach, complexity, climate modelling