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Geomorphic and hydrogeologic controls on wetland distribution in the New South Wales Southern Highlands, south east Australia: prioritising natural resource management investment.

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Strategic investment of public funds in wetland conservation on the New South Wales (NSW) Southern Tablelands, in south east Australia, is impeded by poor understanding of the distribution of wetlands and their geomorphic and hydrogeologic setting. Appropriate investment and management is also unclear in the face of climate change. This research detailed: the spatial configuration, the hydrogeological setting, and intrinsic ecological value of the wetlands. Using this modelling, potential impact of climate change on wetlands was examined. Previous work developed a draft typology for Southern Tablelands wetlands, expanded techniques for representing spatial variability in wetland biodiversity (using generalised dissimilarity models) and explored methods of modelling wetland location through integration of hydrology, terrain and geological features.

This new work integrated the mapping of the spatial distribution of a range of wetland types with a hydrogeological landscape (HGL) framework in order to better understand the movement of water through wetland landscapes. The process of HGL determination relies on the integration of a number of factors including: geology, soils, slope, regolith thickness, vegetation and climate. If the distribution of regolith materials, fractured rock and barriers to flow are characterised, an understanding of surface and sub-surface fluid pathways can be established. Contextualising a study of wetlands in an HGL framework is useful because it provides information about the biophysical controls that influence why wetlands occur in some parts of the landscape and not others. Each HGL unit spatially defines areas with similar controls on movement of water and hence similar patterns of surface and groundwater connectivity.

The NSW Southern Highland landscape was divided into 34 HGL units, based on derived spatial information and field observations. Each HGL unit had an associated conceptual model, identifying potential surface water and groundwater pathways. These models were then field tested by collating and interpreting the widest possible range of biophysical parameters, in order to enhance the rigour of the models. In parallel, wetland mapping identified 4 main wetland types: upland hanging swamps, upland bogs or fens, upland freshwater lakes and riverine wetlands. The wetland types were linked with their contemporary geomorphic setting and then integrated with the HGL framework enabling identification of the wetland 'plumbing' context. These integrated wetland HGL units were evaluated with respect to the NSW Climate Impact Profile for the south east NSW region (min. T increase 1-3°C; max T. increase 2-3°C; rainfall 20-50% summer increase, 20-50% winter decrease; 10-20% evaporation increase). This scenario-based modelling provides an accurate measure of sensitivity of the wetlands to change and allows evaluation of the capacity for a wetland to adapt to change. If landscape variation, the biophysical character of wetlands, the hydrogeological context, and hence the influences of surface and groundwater systems are understood, then we can identify NRM hazards and prioritise wetland management. The premise is that if we understand the natural processes that result in particular outcomes in a landscape, then strategic decisions about whether to intervene, how to intervene, or whether it is worth doing so, can be made.