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# Informing climate adaptation pathways in multi-use woodland landscapes using the values-rules-knowledge framework

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ABSTRACT

An emerging planning framework for climate adaptation focuses on interactions among societal *values*, institutional *rules* and scientific and experiential *knowledge* about biophysical impacts of climate change and adaptation options. These interactions shape the decision context that can enable or constrain effective adaptation. To illustrate the operationalisation of this 'values-rules-knowledge' (VRK) framework we developed biophysical adaptation pathways for agricultural landscapes of south-eastern Australia, which are expected to become warmer and drier under climate change. We used the VRK framework to identify potential constraints to implementing the pathways. Drawing on expert knowledge, published literature, biodiversity modelling and stakeholder workshops we identified potential adaptation pathways for (1) the production matrix, (2) high conservation value remnant eucalypt woodlands, and (3) woodland trees. Adaptation options included shifts from mixed cropping-grazing to rangeland grazing or biomass enterprises; promoting re-assembly of native ecological communities; and maintaining ecosystem services and habitat that trees provide. Across all pathways, applying the VRK framework elucidated fifteen key implementation constraints, including limits to farm viability, decreasing effectiveness of environmental legislation and conflicting values about exotic plants. Most of the constraints involved interactions among VRK; 13 involved rules, eight involved values, and seven involved knowledge. Value constraints appeared most difficult to address, whereas those based on rules or knowledge were more tangible. The lower number of knowledge constraints may reflect the scale of our analysis (which focused on decision points in pre-defined pathways); new knowledge and participatory approaches would likely yield a richer set of scenarios. We conclude that the VRK framework helps connect the biophysical knowledge-based view of adaptation with a perspective on the need for changes in social systems, enabling targeting of constraints to adaptation. Our focus on pathways and decision points in different sectors of the multi-use landscape highlighted the importance of group and higher level planning and policy for balancing the collective outcomes of multiple decisions by many land managers.



## 1. Introduction

Climate change is one of the greatest incipient threats to the Earth's social-ecological systems. Irrespective of efforts to mitigate greenhouse gas emissions, global mean surface temperatures are

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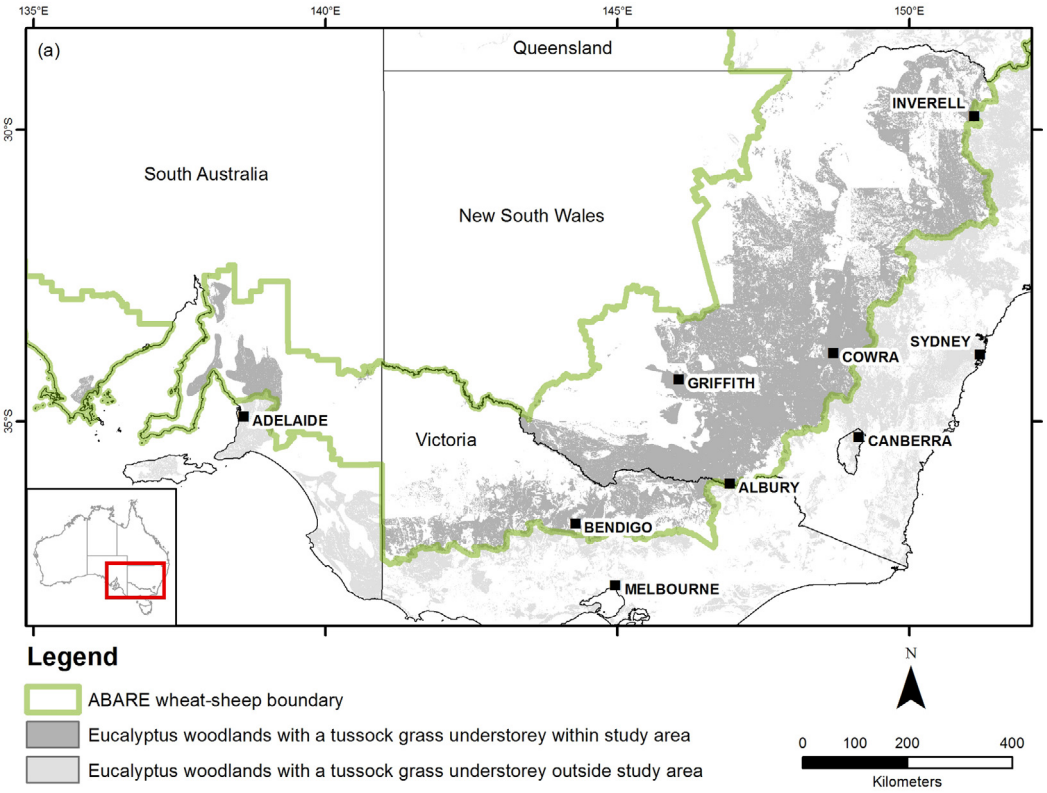
expected to continue rising into the next century, and extreme weather events are expected to become more frequent and severe (IPCC, 2013). Policy makers and natural resource managers face the complex task of managing the ensuing pressures on societies, ecosystems and biodiversity, commensurate with likely transformations in their structure, function and composition (Wise et al., 2014). However, pro-active approaches to ensure the development and adoption of best practices in climate adaptation management are still in their infancy.

The 'values-rules-knowledge' (VRK) framework (Gorddard et al., 2016) is an emerging framework to facilitate planning for climate adaptation, which focuses on addressing the social context in which adaptation decisions are made. It emphasises that effective decisions and actions are enabled or constrained by the 'decision context', defined as the interactions among societal *values* (e.g. outlooks and goals shaped by basic human values and preferences, O'Brien and Wolf, 2010; Schwartz, 2012), societal *rules*, including rules-in-use (e.g. social norms, practices and heuristics) and rules-in-form (laws, regulations and governance structures; Ostrom, 2011), and the body of *knowledge* (scientific information and lived experience leading to beliefs about the world) regarding possible biophysical impacts and adaptation options (Colloff et al., 2017; Gorddard et al., 2016; Pelling, 2011; Wise et al., 2014). For example, transformative adaptation in land management is likely to require shifts in values and aspirations, which in turn may facilitate shifts in industry practice and government regulations (e.g. Pelling, 2011). While offering fresh perspectives on climate adaptation planning, ways of operationalising the VRK framework are yet to be established.



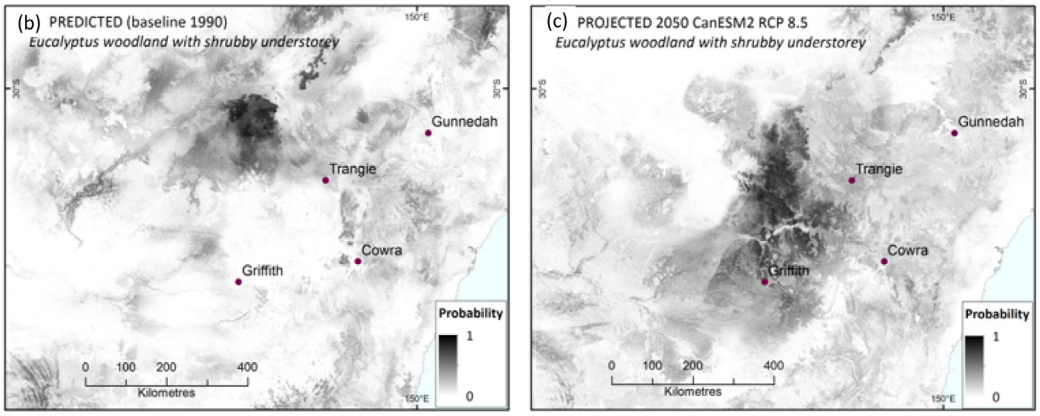




**Fig. 1.** (a) The study area (dark grey) as defined by the intersect of 'Eucalyptus woodlands with a tussock grass understorey' (light and dark grey, Department of the Environment, 2012) in NSW, Victoria and South Australia; and the wheat-sheep belt (as mapped by ABARE, Australian Bureau of Agricultural and Resource Economics and Sciences). (b and c) Projected shifts in the spatial locations of environments currently supporting shrubby eucalypt woodlands for central NSW (indicating probability of occurrence; Department of the Environment, 2012, Major Vegetation Subgroups) under the CanESM2, RCP 8.5 climate scenario (derived from Prober et al., 2015a).