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Making time for space: The critical role of spatial planning in adapting natural resource management to climate change

V.M. Adams[a,*], J.G. Álvarez-Romero[b], S.J. Capon[c], G.M. Crowley[d], A.P. Dale[d], M.J. Kennard[c], M.M. Douglas[e], R.L. Pressey[b]

[a] School of Biological Sciences, University of Queensland, Brisbane, Queensland 4072, Australia
[b] ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Queensland 4810, Australia
[c] Australian Rivers Institute, Griffith University, Nathan, Queensland 4111, Australia
[d] The Cairns Institute, James Cook University, Cairns, Queensland 4870, Australia
[e] School of Earth and Environment, University of Western Australia, Perth, Western Australia 6009, Australia

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ABSTRACT

Climate change is driving shifts in social-ecological systems globally. In response, humans must adapt to altered climatic and environmental conditions. While climate change adaptation is a pressing issue in many sectors and regions, the adaptation of environmental management strategies is particularly urgent because of the severity and extent of risks associated with projected impacts. Robust adaptation of environmental management requires effective spatial and temporal implementation of interventions, with explicit consideration of trade-offs between different socio-economic and environmental objectives. We investigate the critical interface between regional governance systems and spatial planning for climate adaptation by exploring the case of Australia's Natural Resource Management (NRM) bodies. Australia's NRM bodies provide an ideal case study for two reasons. First, Australia faces significant threats from current and future climate changes. Second, Australian NRM bodies have recently undertaken a major program of spatial planning and research to explicitly address the need for climate adaptation. We explore the interface between regional governance systems and spatial planning by: 1) reviewing the historical development of institutional arrangements in relation to spatial planning by Australia's regional NRM bodies; 2) documenting current planning processes with regard to climate adaptation and more generally; and 3) identifying strengths and weaknesses of the existing governance system at various scales with respect to its ability to foster effective spatial planning. We find that the institutional and resource capacity of the Australian regional NRM bodies is currently being eroded and that the national governance system is broadly failing to deliver on the intended outcomes of climate-ready NRM plans. We make recommendations for governance reform and institutional adaptation to improve spatial planning for climate adaptation in Australia and discuss the broader implications of our findings.

1. Introduction

Climate change is driving shifts in ecological systems globally (Bellard et al., 2012; Brook et al., 2008). As a result, humans are faced with the challenge of adapting to altered environmental conditions and an increasingly uncertain future (Ford et al., 2011; Watson, 2014). Responses to climate change require understanding complex social-ecological systems and their capacity to respond and adapt to the diverse social, economic, and ecological effects of changing climates (Chapman et al., 2014; Cross et al., 2012; Meyer et al., 2016).

Adaptation strategies that have been commonly proposed for managing natural ecosystems in a changing climate include those which: 1) promote ecological resistance (e.g. by protecting climate refugia), 2) build ecological resilience (e.g. by mitigating local threats that exacerbate those from changing climates) or 3) facilitate ecological change or transformation (e.g. provision of corridors for species migration) (Hansen et al., 2003; Lawler, 2009). Recommendations for adaptation strategies in human-dominated and social systems are aligned with these broad approaches of promoting and building social resilience or facilitating transformation (e.g. enhancing social resilience through social networks or facilitating transformation through adjusted political regimes) (Adger et al., 2005; Pelling, 2011).

Designing and implementing adaptation strategies to changing climates requires an understanding of the spatial distribution of

* Corresponding author.
E-mail address: v.adams@uq.edu.au (V.M. Adams).

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environmental and socio-economic values (e.g. priority areas for conservation of threatened species and ecosystems, sites of cultural significance, areas of high agricultural value) and the processes threatening their persistence now and under future climates (Lawler et al., 2015). Given the inherently spatial nature of climate adaptation and the significant investment required to support successful implementation, spatial planning approaches are necessary to support the three broad strategies outlined above (Groves et al., 2012; Heller and Zavaleta, 2009).

Spatial planning, in which spatial priorities for action are identified, is a subset of wider planning processes used to guide the allocation of management actions and resources to: (a) achieve explicit environmental and socio-economic objectives, and (b) evaluate potential trade-offs among competing objectives (Álvarez-Romero et al., 2015; Morán-Ordóñez et al., 2017; Pressey et al., 2007). Common approaches to spatial planning aiming to optimize the allocation of actions and land uses to achieve environmental and socio-economic objectives include systematic conservation planning (e.g., Adams et al., 2016), integrated landscape planning (e.g., Bohnet et al., 2011), and ranking of management actions and environmental values, e.g. threatened species, invasive species (e.g., Joseph et al., 2009). While these approaches differ in the management problems being addressed (e.g. where to locate reserves or which actions to prioritize for threatened species conservation) and therefore the methods and decision support tools used, they share four broad steps: 1. Set objectives, 2. Collect data, 3. Identify conservation actions, and 4. Set spatial priorities (including implementation timeframes) (Wilson et al., 2009). These various approaches also highlight that well-designed and well-populated decision support tools are a necessary component of spatial planning as they can integrate complex information about social-ecological systems and their responses to climate change (Adger et al., 2005; Jones et al., 2016).

Extending spatial planning approaches to consider climate change requires expanding objectives to explicitly consider climate change implications, integrating models of future climates, and accounting for associated uncertainties (Álvarez-Romero et al., 2015). Advances in spatial planning processes relevant to climate adaptation include considerations of dynamic processes that incorporate a temporal dimension (Alagador et al., 2014), such as scheduling of actions in relation to the occurrence of threats (Visconti et al., 2010), anticipating climate change effects and making adaptation decisions (Waterhouse et al., 2016), or enabling flexible management responses (Rayfield et al., 2008) to deal with incomplete or new information. These advances require increasingly complex approaches to spatial planning; thus, while they provide decision makers with climate adaptation solutions that consider changes in climate and associated impacts on the environment, they require a high level of technical capacity to implement.

Planning for (and implementing) responses to climate change is needed at all scales and levels of organization from global to local (Adger et al., 2005). However, planning at regional scales allows integrating higher-level climate adaptation policies with on-ground or local actions (e.g., Weeks et al., 2014; Wyborn and Bixler, 2013). We define 'regional-scale planning' as any spatial planning process undertaken at a spatial extent that provides broad socio-economic and ecological perspective for local management decisions (Pressey et al., 2013). In the conservation and natural resource management (NRM) contexts, regional-scale planning allows considering the links between local-scale on-ground efforts (bottom-up processes) and broader-scale (state, national or global) policies and funding opportunities (Fig. 1). Regional-scale planning that recognizes such multi-level and cross-scale links (Cash et al., 2006; Scholes et al., 2013) allows for the broader spatial context of actions to be considered, such as ecological processes that transcend local management scales and jurisdictional boundaries (Pressey et al., 2013), while still engaging with stakeholders at a scale that is meaningful for guiding on-ground action. As a consequence, regional-scale planning can act as a bridge between local actions and state, national, or global scale policies, which is critical for successful climate adaptation (Heller and Zavaleta, 2009).

Spatial planning is embedded within the broader socio-ecological context. Moving from spatial planning to implementation requires appropriate processes that reflect this context, such as capacity building, knowledge, and funding transfer (Guerrero and Wilson, 2016; Pressey et al., 2013). These non-spatial aspects of planning are often described as key requirements in the implementation of regional-scale planning which require integrating policies across scales (Moser and Ekstrom, 2010; Pressey et al., 2013; Scholes et al., 2013). The need for cross-scale integration is demonstrated by, for example, a lack of local or regional capacity and resources to implement high-level policy, and a disregard for local needs and preferences in higher-level decision making (Cash and Moser, 2000; Gibbs, 2000; Saleth and Dinar, 2000). These barriers are likely to significantly constrain spatial planning for climate adaptation, and therefore deserve further investigation. Of particular importance is the extent to which governance systems can bridge these gaps to support successful spatial climate adaptation planning.

In keeping with the trend for devolving responsibility for NRM to regional organizations (Lockwood et al., 2009; Schreiner and Van Koppen, 2002; Shackleton et al., 2002; Wester et al., 2011), much of the responsibility for on-ground climate change action is falling to regional organizations (Agarwal et al., 2012). This is the case in Australia, where, in recognition of the urgent need to design and implement adaptation strategies to address climate change (CSIRO and Bureau of Meteorology, 2015), the Australian Government dedicated $AUD 42.53 million for NRM bodies to undertake planning for climate change adaptation (Australian Government, 2012). Australian NRM bodies are community-based organizations operating at a regional scale that represent their community's NRM perspectives and priorities. They act as strategy-building and funding-delivery agents for NRM projects under Federal funding programs. We chose Australian NRM bodies as our case study because these organizations have been undertaking regional-scale planning over the last 10–15 years, and their current planning processes must address climate adaptation strategies. Australian NRM bodies thus present a unique opportunity for exploring how governance systems can facilitate or constrain regional-scale planning for climate adaptation.

In this paper, we investigate the critical interface between regional governance systems and spatial planning for climate adaptation by exploring the case of Australia's Natural Resource Management (NRM) bodies. In particular, we address the question of how Australian NRM bodies are approaching regional-scale planning, the types of tools they are using, whether their approaches are appropriately aligned with planning for climate adaptation, and the extent to which the existing governance system is facilitating this planning. We begin by reviewing the historical context of NRM planning in Australia, documenting the current NRM planning process with regard to climate adaptation, and exploring the structure and function of NRM governance. We then go on to discuss barriers to and opportunities for current and future spatial planning for climate adaption, including: the ability of overarching governance systems to deliver on intended outcomes; the importance of foundational investment to support technical capacity; and, the need for a system that supports the legacy of planning.

2. Methods

2.1. General approach and case study

We used multiple data collection methods in order to develop an in-depth understanding of the interface between NRM governance systems and regional-scale planning for climate adaptation. We used historical analysis along with semi-structured interviews to develop an understanding of how governance systems have influenced, by both support-