



Towards a climate change adaptation strategy for national parks: Adaptive management pathways under dynamic risk

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ABSTRACT

Government seeks to manage public protected areas, such as national parks, to conserve high-quality wildlife habitats and provide essential ecosystems services at risk of permanent damage or extinction from climate change. The complexity of the organizational structure required to deliver this breadth of functions, coupled to uncertainty surrounding the onset and severity of climate impacts at local scale, impedes planning for climate change. This paper describes the development of an adaptation planning tool and its application in a pilot planning process for the National Parks and Wildlife Service, the agency of the New South Wales (NSW) Government (Australia) responsible for management of national parks and public conservation reserves. The process involved close engagement in knowledge co-production in participatory workshops, and employed two complementary techniques, adaptive pathways and risk assessment. It successfully elicited tacit knowledge of agency staff about the range of interventions available, the need for management practices to evolve, and of discontinuities in management pathways in a dynamic risk environment. Findings suggest that management effort across the NSW reserve system will increase as climate risk rises. Consequently, government will need to respond to increased demand for resources, for better targeting of those resources, and for management innovation in how resources are deployed to support adaptation that is both anticipatory and transformative.

1. Introduction

The effects of anthropogenic climate disruption are expected to be wide-scale and devastating for ecosystems and the services they provide to society (Parmesan and Yohe, 2003; Cardinale et al., 2012; Urban, 2015; Grimm et al., 2016). While evidence is mounting that ecosystems are already affected (e.g. Hughes, 2000; Pecl et al., 2017), there remains uncertainty about the onset and severity of some impacts, which is problematical for planning societal responses (for example sea level rise: Moser, 2005; Spirandelli et al., 2016).

Public protected areas, such as national parks, are specifically managed for biodiversity conservation of native species and their habitats. Typically, biodiversity conservation is seen as a public good that offers benefits at a range of temporal and spatial scales (Perrings and Gadgil, 2003), and therefore traditionally falls to government to service (Lockwood, 2010; Berkes, 2007). Public protected areas that contain high-quality wildlife habitats and provide essential ecosystems services at risk of permanent damage or extinction from climate change will require management intervention to maintain their biodiversity values

(Cimato and Mullan, 2010). Management that seeks to limit the future damage from climate impacts rather than mitigate the underlying causes of climate change (i.e. greenhouse gas emissions) is generally defined as anticipatory adaptation and is a distinct process from the autonomous adaptation that occurs in biological systems leading to ecosystem change (Fankhauser et al., 1999; Smit and Pilifosova, 2003). While the effects of climate-induced species changes do not necessarily involve a decline in ecosystem biodiversity (Vellend et al., 2017), the normative intent in national parks is to conserve the diversity of native species rather than of species diversity per se. The focus on native species has led recently to the development of approaches to conservation interventions that recognise the inevitability of ecosystem change under future climate (Dunlop et al., 2013; Jones et al., 2016). For ecosystems, dynamic approaches to intervention have been suggested that accommodate ecological change and biodiversity loss, that remain relevant and feasible under a range of future trajectories, and that seek to conserve multiple societal values (Cimato and Mullan, 2010; Dunlop et al., 2013).

In New South Wales (NSW) Australia, management of national

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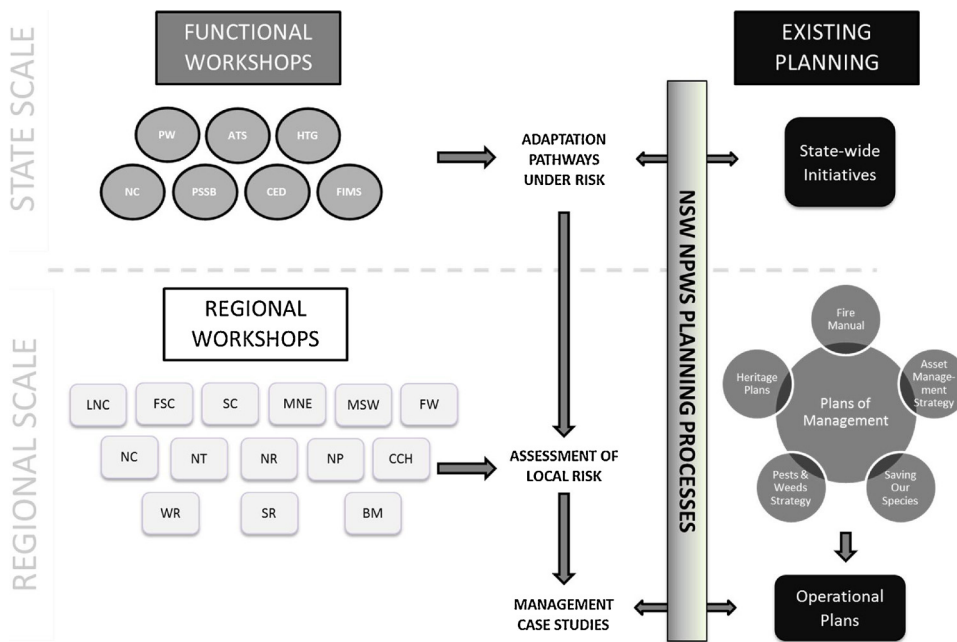


Fig. 1. Interrelationships among type of workshop (functional area and regional), scale (state, regional and park) and existing policy and planning processes (e.g. Plans of Management (POMS)) in the pilot of a climate adaptation planning process for NSW NPWS. Letters within symbols designate a functional area or region for seven functional areas or 14 regions respectively. Functional areas were Pests and weeds (PW), Nature conservation (NC), Strategy and services (ATS), Park assets management (PSSB), Heritage (HTG), Customer experience (CED) and Fire and incident management (FIMS). Regional locations were Lower North Coast (LNC), North Coast (NC), Western Region (WR), Far South Coast (FSC), Northern Tablelands (NT), South Coast (SC), Northern Rivers (NR), Southern Ranges (SR), Metropolitan North East (MNE), Metropolitan South West (MSW), Northern Plains (NP), Far West (FW), Central Coast Hunter (CCH), and Blue Mountains (BM).

parcs and public conservation reserves is performed by the NSW National Parks and Wildlife Service (NPWS) (New South Wales Government, 2016). Government has a distinct role in climate adaptation, which includes adaptation of its own operations and creation of conditions that encourage adaptive action in the community (Brooks and Adger, 2005). Management of contemporary public protected areas performs a range of functions, in addition to conservation of native biodiversity (Ayles, 2016). The functions of the NPWS range from fire and incident management (often as a statutory fire authority), pest and weed control and maintenance of built assets (tourist centres, roads and fire trails, signage) to provision of tourism and public amenity (recreation and nature experiences) and protection of cultural heritage assets (historic buildings and sites, Aboriginal sites of significance). Some of these functions may be only indirectly related to conservation of native species. In addition to coping with climate impacts across a range of NSW climatic zones and landscapes (Jacobs et al., 2016; New South Wales Government, 2015a,b), NPWS has to plan adaptive actions for these multiple functions that will be variously affected by changing climate.

Government agencies, in common with other types of organisations, are subject to a range of barriers that restrict the planning, implementation and options for adaptation actions (Moser and Ekstrom, 2010). These barriers include conflicting timescales; substantive, strategic and institutional uncertainty; institutional crowdedness and institutional void; institutional fragmentation; lack of awareness and communication, motives and willingness to act; and, lack of resources (Biesbroek et al., 2013). Barriers can also form complex interdependencies that stymie organizational change (Eisenack et al., 2014). An assessment of the barriers to adaptation for NPWS is beyond the scope of this paper. However, while recognizing that significant planning has occurred within specific functional areas (e.g. fire and incident management), it is likely that the complexity of NPWS's organizational structure and the breadth of its functions coupled to uncertainty surrounding the onset and severity of climate impacts across operational geographies have impeded whole-of-agency strategic planning for climate change. These issues often elicit a collective view that the task is 'too big to tackle' (Moser, 2014; Pidgeon and Fischhoff, 2011). Under such conditions innovative approaches are needed that implicitly recognise uncertainty through the integration of adaptive planning and climate risk management (Lawrence and Haasnoot, 2017; Woodruff, 2016; Walker et al., 2013). Jones and Preston (2011) mapped the range

of approaches to adaptation planning in two dimensions according to their style of engagement with stakeholders (top down versus bottom up) and how they deal with time (predictive versus diagnostic). However, they suggest approaches that combine these orientations and incorporate multiple perspectives as offering greater flexibility in complex situations.

In addition to the generic characteristics of assessments, a number of specific techniques have been suggested as useful additions to adaptation planning and assessment approaches to ensure uncertainty is explicitly considered. These techniques include robust decision making (Lempert et al., 2006), real options analysis (Dobes, 2008), and dynamic adaptive policy pathways (Haasnoot et al., 2013). In complex 'real world' situations, such as adaptation planning for a multi-functional government agency, selection of techniques must be made pragmatically, often requiring blending of theory and practice in bespoke, contextual processes that account for wide variations in available data, staff knowledge and business systems, and that simultaneously seek to build organizational adaptive capacity (e.g. Jacobs et al., 2014, 2015).

This paper describes the development of an adaptation planning tool and its application in a pilot climate adaptation planning process for the NSW NPWS. The tool and process aimed to address the complex operational realities of the organisation, incorporate uncertainty into the assessment process, engage participants (NPWS staff) to help overcome barriers to adoption, and build capacity to use outputs in existing agency planning processes.

2. Methods

Two series of workshops were conducted consecutively with participants drawn from a broad range of policy, planning and operations tasks across NSW NPWS (Fig. 1).

2.1. Functional area workshops

The first series consisted of seven workshops with 'functional areas' of the agency. These functional areas are tasked with centralised policy and planning at state and regional scale. The purpose of these workshops was to elicit information on the broad suite of management options available to each functional area in response to the major impacts of a changing climate. This information would then be synthesised into

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