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Editorial

Thinking globally, acting locally – conservation lessons from Oceania

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Abstract. Oceania is a diverse region encompassing Australia, Melanesia, Micronesia, New Zealand and Polynesia, with six of the world's 39 hotspots of diversity but a poor record for extinctions from widespread threats to biodiversity. The region is also culturally diverse, containing close to a quarter of the world's languages and some of the oldest cultures. This makes the region a priority for immediate and sustained conservation action. In this special issue we provide local conservation solutions in Oceania to global problems, capturing the diversity of nations, cultures and environments. The issue is organised by the major threats faced in the region: habitat loss, over exploitation and invasive species. Case studies, framed as coupled problem–solutions, include examples from Australia, New Zealand and the Pacific and contrast findings across regions and realms. There are successes and failures faced by conservation in this local region, and the analysis within this special issue offers lessons for conservation globally.

Additional keywords: Australia, conservation interventions, Fiji, habitat loss, invasive species, New Zealand, over exploitation, Papua New Guinea, pollution.

Introduction

We are experiencing a biodiversity crisis, with the Earth in the midst of its sixth mass extinction event (see Barnosky *et al.* 2011). Oceania is a highly diverse region that has lost thousands of species, many of them endemic and taxonomically unique (Duncan *et al.* 2013). Australia has the most mammalian extinctions of any continent, responsible for ~27% of the global total of extinct mammal species (Johnson 2006). The key threats to biodiversity within Oceania include habitat loss, over exploitation and invasive species (Kingsford *et al.* 2009). There is an increasing understanding that the loss of biodiversity impacts humanity through the loss of ecosystem services, with negative effects on livelihoods and economies (Costanza *et al.* 1997; Costanza *et al.* 2014).

There are many approaches for mapping and measuring global threats, such as habitat loss, declines in species, and natural processes (Vörösmarty *et al.* 2010), but the drivers of the threats are often highly idiosyncratic. Understanding the local drivers of threats allows conservation practitioners to design solutions that address these drivers to mitigate threats and restore ecosystems. Thus, conservation approaches can be highly varied and local in nature, building from local knowledge, stakeholder values and idiosyncrasies of natural systems. Solution-based science is essential for effective policy development, decision making and implementation of conservation actions. The papers in this special issue demonstrate the breadth of approaches available for describing local context, identifying threats and their drivers, and designing effective conservation approaches that account for this local knowledge (Table 1).

Habitat loss and associated impacts

In many nations there is competition for resources between industry and conservation. Often, immediate economic and political demands override conservation goals (Burkhard *et al.* 2012). Habitat loss is the most extreme scenario of this competition and the primary threat to biodiversity; in Oceania, it affects more than 80% of threatened species (Kingsford *et al.* 2009). Primary drivers of land clearing in Oceania include development activities such as mining, agriculture and forestry. For example: Queensland, Australia is experiencing high rates of clearing of forests related to agricultural expansion (Queensland Department of Science 2015; Evans 2016); Papua New Guinea continues to experience high rates of clearing due to forestry and mining (Bryan and Shearman 2015); and many Asian countries are experiencing extremely high rates of clearing for oil palm plantations for bio-fuels and food products (WWF 2014). Land clearing is often accompanied by increased water extraction to support intensified land uses. This development of water resources has severe negative impacts on downstream freshwater ecosystems, sometimes thousands of kilometres from the developments (Bino *et al.* 2016; Weeks *et al.* 2016).

Table 1. Lessons learnt from Oceania presented in this special issue. Approaches are categorised by threat type: habitat loss and degradation, over exploitation and invasive species. The conservation tool, spatial scale geographic location and effectiveness and transferability of the tool are described.

Conservation issue	Conservation tool	Spatial scale (location)	Effectiveness and transferability of tool	Reference
		Habitat loss and degradation		
Habitat cleared for oil palm plantations	Community empowerment to make conscious decisions and influence the supply chain (clear labelling of Certified Sustainable Palm Oil (CSPO) products and consumer shift to CSPO products)	Multi-national (Australia and New Zealand labelling for palm oil from Asia)	Identifying pivot points in a supply chain, engaging communities to change behaviour and facilitating improved alternatives	Dunstan *et al.* (2016)
Habitat loss and degradation, pollution of coastal ecosystems	Alignment of regulatory frameworks across local, state and federal levels. Policy needs to account for interactions between key ecosystems – marine, freshwater and terrestrial – as well as additive interactions among threats	Local (Sydney Harbour, Australia)	Marine spatial planning can help identify priorities for action. Policy responses remain a primary tool for regulating threats to biodiversity in countries with strong regulatory system (e.g. Australia and New Zealand), but require realignment and strong enforcement	Banks *et al.* (2016)
Habitat loss and degradation, pollution of freshwater ecosystems	Review policy framework to ensure sufficient protection of native species from over exploitation, habitat degradation and pollution	National (New Zealand)	Tools to improve assessment of threats to biodiversity, consistent policy responses to multiple threats and wide application of monitoring methods, where regulatory systems are a primary tool for addressing threats to biodiversity	Weeks *et al.* (2016)
Habitat loss and degradation, pollution of freshwater ecosystems	Identify spatial conservation priorities	National (Australia)	Identifying spatial conservation priorities can help guide policy responses and resourcing. Policy responses remain a primary tool for regulating threats to biodiversity in countries with strong regulatory system (e.g. Australia and New Zealand)	Bino *et al.* (2016)
Habitat loss and degradation through land clearing of native vegetation and forest cover	Assessment of the efficacy of policies with respect to their ability to protect native vegetation, reduce clearing and develop policies that work at different levels, are enforceable, mutually supportive and monitored long-term	National (Australia)	A broad assessment of innovative schemes in our region may provide more data to determine elements of effective policy in relation to curbing deforestation across states and nations in our region	Evans (2016)
		Over exploitation		
Over exploitation and habitat change affecting marine biodiversity	Marine spatial planning to identify priorities for biodiversity conservation (e.g. Marine Protected Areas (MPAs))	Local (Hauraki Gulf, New Zealand)	Marine protected areas, and no-take zones in particular, remain a primary tool for conserving biodiversity threatened by over-harvesting. Spatial planning (and tools such as Zonation) has wide applicability globally for designing MPAs that meet conservation targets.	Jackson and Lundquist (2016)
Over exploitation and habitat change affecting marine biodiversity	Marine spatial planning to identify priorities for biodiversity conservation (e.g. MPAs)	Local (Kadavu, Fiji)	This provides an example of how a global approach, such as spatial planning (using Marxan), can be made relevant to local contexts in Oceania, using stakeholder engagement and planning products as tools to support local decision making for designing MPAs and locally-managed marine areas	Wendt *et al.* (2016)
Over harvesting of Admiralty cuscus (Phalangeridae: *Spilocuscus kraemeri*)	Traditional *tambu* approach to limit harvesting of Admiralty cuscus	Local (community based in Manus Island, PNG)	Use and adaptation of pre-existing tools within Indigenous communities for resource management has wide applicability in the Pacific Islands where there are many cultural traditions such as periodic *tambu* areas, aligned with conservation objectives	Whitmore *et al.* (2016)
		Invasive species		
Biosecurity	Biocontrol approaches	National and multi-national (Australia)	Integrated biosecurity with improved coordination across scales (e.g. state and national governments and supranational bodies), allowing the region to manage shared threat of invasive species more effectively	Lott and Rose (2016)
Invasive plants	Invasive plant risk management approaches that account for multiple (social, economic, environmental) values	Regional (northern Australia)	Presents risk management approaches such as prioritisation tools that can be adapted to data limited environments. These tools are highly relevant to Oceania where there is often a limited understanding of the species requiring immediate management	Adams and Setterfield (2016)

In addition to the direct loss of habitat from clearing and water extraction, associated impacts of clearing such as increased run off, sedimentation, and intensity of human use (e.g. from recreation) have far reaching impacts for species. For example, land conversion for agriculture and urbanisation has limited habitat suitability for native species in freshwater habitats of New Zealand, causing widespread decline (Weeks *et al.* 2016). Acidification and increased frequencies of natural cyanobacterial blooms represent further symptoms of habitat loss and degradation (Bino *et al.* 2016). In Sydney Harbour, complex interactions among local human activities, agricultural intensification, urbanisation and development have increased pollutants, with negative impacts on biodiversity (Banks *et al.* 2016).

Policy and regulatory approaches still play a major role in achieving conservation goals. If regulatory approaches are to achieve conservation goals, solutions need to account for the complex biophysical, financial, socio-political and regulatory levers. Several papers in this special issue emphasise the complex interactions between aspects of social–ecological systems and regulation. For example, Weeks *et al.* (2016) described the cumulative and synergistic effect of multiple threats to freshwater ecosystems in New Zealand including: local scale human activities, pollution from urbanisation, industry and sedimentation, harvesting of native species, introduction of invasive species and climate change. These threats must be managed together to develop effective integrated management and regulatory instruments (Weeks *et al.* 2016). Similarly, Banks *et al.* (2016) recommended that regulations focused on delivering coastal conservation outcomes must account for threats across interconnected habitats (land, freshwater and marine). In the context of Sydney Harbour, Banks *et al.* (2016) also discussed the need for regulatory frameworks and legislative tools integrated across jurisdictional scales of local, state and federal governments.

Regulatory approaches address the supply side of over extraction of resources such as clearing forests for intensive land use and appropriation of water resources for development (Bino *et al.* 2016; Evans 2016). However, effective conservation policy approaches require monitoring, evaluation and enforcement. Key regulatory and policy recommendations emerging from case studies in this special issue are: (1) increased capacity to monitor and evaluate policies (such as native vegetation policies in Australia) to ensure more effective, efficient and equitable delivery of outcomes (Evans 2016); (2) reductions in demand for water resources with changes to legislation that improve measurement of the long-term costs and benefits of water resource development of freshwater ecosystems (Bino *et al.* 2016; Weeks *et al.* 2016); and (3) identification of high conservation value sites for immediate action and investment in restoration of ecosystems and protection of free-flowing rivers wherever possible (Bino *et al.* 2016).

Successful policy implementation fundamentally relies on effective communication to target audiences. This includes both enforcement and regulation of suppliers and engaging consumers of resources to change demand for sustainable products (Dunstan *et al.* 2016). For example, Australian and New Zealand zoos have run a consumer facing campaign to increase awareness of the threat of rainforest clearing for oil palm plantations to wildlife throughout Asia. Concurrent to the public campaign, pressure was exerted on the palm oil industry and regulators to provide and certify sustainable products for consumers to choose. The power of consumer numbers backing the lobby group Roundtable on Responsible Palm Oil has led to a significant increase in the production of Certified Sustainable Palm Oil (CSPO; harvested only from land already designated for agriculture) (Dunstan *et al.* 2016). This case study demonstrates that clear and consistent consumer messages coordinated with the development and regulation of sustainable alternatives are essential for driving gains for biodiversity through consumer choice (Dunstan *et al.* 2016).

Over exploitation

Over exploitation of wildlife and marine resources can negatively impact native species, causing extinction of local biodiversity in terrestrial (Vié *et al.* 2009) and marine (Caddy and Garibaldi 2000) environments. In Oceania, Pacific Island nations are reliant on marine resources for subsistence and commercial purposes but overharvesting is a major threat to fisheries and the viability of marine populations. This is primarily managed with protection measures that restrict human access and extraction of resources. However, approaches to restricting access can range from top-down regulation through to use of local knowledge and traditional tools through community-based management of marine resources.

In this special issue we explore a range of examples from national to local scales including systematic conservation planning approaches for designing protected areas (e.g. use of Zonation in New Zealand, Jackson and Lundquist 2016) to community-based management through local adaptation of traditional approaches to achieve biodiversity conservation goals (*tambu* areas in PNG, Whitmore *et al.* 2016). Classic identification and restriction of access to resources remains a key tool in developed countries with strong rule of law, often applied at large scales, but they may require adaptation in other contexts. At a local scale, traditional resource management options can be particularly powerful. Wendt *et al.* (2016) and Whitmore *et al.* (2016) exemplify two innovative approaches adapting mainstream conservation approaches restricting human access to priority areas using locally relevant processes and tools. Wendt *et al.* (2016) adapt globally recognised conservation planning tools (Marxan) to the local context of Kadavu, Fiji, integrating planning outputs with local stakeholder participation. Whitmore *et al.* (2016) test how the traditional resource management tool of *tambu* areas, which close and open a resource for harvest, affect conservation of Admiralty cuscus. Understanding how populations of key resources (e.g. Admiralty cuscus) respond to exploitation is critical to determining sustainability of harvest practices on resources with multiple values (e.g. cultural, conservation and economic).

Invasive species

Invasive vertebrates and vascular plants have devastated terrestrial biodiversity of the Pacific Islands, particularly invasive mammals and plants in Australia and the Pacific (Kingsford *et al.* 2009). Extinctions of Pacific Island birds due to invasive

animals are notorious (Duncan *et al.* 2013). All ecosystems in the Pacific continue to be damaged by established and new invasive species and diseases. For example amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) has caused extinctions of at least four frog species in Australia (Berger and Skeratt 2012). Growing global trade, agriculture and urban expansion, and climate change are increasing the likelihood of new invasive species becoming established (e.g. Australia, Lott and Rose 2016).

Responses to invasive species and organisms range from biosecurity responses which focus on borders and ensuring organisms are stopped at the border, or are rapidly detected and controlled once established (Stohlgren and Schnase 2006). Lott and Rose (2016) review the role of biosecurity in protecting wildlife from invasive organisms, highlighting the importance of coordinated approaches at the multi-national level in Oceania, given the high trade connectivity of countries. Management of established invasive species (e.g. in Australia's invaded plant communities, van Klinken *et al.* 2015), requires prioritisation of risk, focusing on the most effective methods and species for management. Adams and Setterfield (2016) review risk management approaches, highlighting innovative tools developed in northern Australia, applicable in other data-limited regions, such as the Pacific Islands, where knowledge of invasive species is highly limited. Managing risks associated with invaders into the Pacific is imperative to avoid increasingly large damage costs, including impacts on biodiversity.

Conclusions

Effective conservation of biodiversity emphasises the intrinsic importance of nature over its resources for humans (Soulé 2013). However, in the struggle for resources, this argument often does not compete with immediate economic and political priorities. There is increasing evidence that the loss of ecosystem services is significant, and the costs of recovery daunting. Governments, communities and conservation scientists must design conservation strategies that account for the multiple values associated with ecosystems (e.g. economic, social and cultural).

To effectively protect biodiversity, a range of solutions are needed to address the many threats to biodiversity (Salafsky *et al.* 2008). While there is a growing conservation toolbox, application of these tools remains context dependent, requiring local adaptation. This special issue makes a critical contribution to this gap for Oceania. The 10 papers highlight how global solutions, such as regulation, spatial planning and biocontrol, can be locally adapted and informed to make them effective. Importantly, this issue also emphasises that conservation actions must be coupled with appropriate monitoring, evaluation and enforcement to achieve their intended goals.

Oceania represents a microcosm, albeit a big one, of the planet's challenges. The region is affected by the same ubiquitous threats driving the world's biodiversity into decline. There are the same challenges of lack of understanding often associated with poor political will in the face of deleterious developments. These case studies illustrate some progress towards conservation in different areas of Oceania: lessons in thinking globally but acting locally.

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