



Review

Indigenous biocultural knowledge in ecosystem science and management: Review and insight from Australia



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ABSTRACT

Worldwide, environmental conservation directives are mandating greater inclusion of Indigenous people and their knowledge in the management of global ecosystems. Colonised countries such as the United States of America, New Zealand and Australia have responded with an array of policy and programs to enhance Indigenous involvement; however, balancing Indigenous and non-Indigenous priorities and preferred management methods is a substantial challenge. Using Australia as a case study, we investigate past documentation and use of Indigenous biocultural knowledge (IBK) and assess the main contributions to ecosystem science and management. Focussing on the terrestrial environment, this innovative paper presents an integrated review of IBK documentation (IBKD) by conducting a spatial, temporal and content analysis of the publically available literature. A spatial analysis of the place-based documents identified Australian IBKD hotspots, gaps and opportunities for further collaboration. Sixty percent of IBKD has occurred off the Indigenous estate with only 19% of the total coinciding with current Indigenous Protected Areas. We also found that IBKD hotspots were different to Australia's biodiversity hotspots suggesting opportunity for development of integrated biological and cultural hotspots. A temporal analysis of IBKD showed exponential growth since the 1970s and typical involvement of non-Indigenous researchers. Indigenous authorship remained negligible until the 1990s when there was an obvious increase, although only 14% of IBKD to date has acknowledged Indigenous authorship. Working through Australia's broad biological conservation priorities, we demonstrate how IBK has and can be used to inform research and management of biodiversity, threatened species, aquatic ecosystems, fire, invasive species, and climate change. We also synthesise documented suggestions for overcoming cross-cultural awareness and communication challenges between Indigenous people and biologists, environmental managers and policy makers. Lastly, we suggest that inclusion of both tangible and philosophical engagement of Indigenous people in national conservation agendas may promote more holistic socio-ecological systems thinking and facilitate greater progress towards addressing the Indigenous engagement directive of international conservation agreements.

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1. Introduction

Indigenous knowledge systems contain detailed representations of the forces that have shaped the diversity and condition of past and current environments (Gadgil et al., 1993; Drew and Henne, 2006; Berkes, 2012). The potential contribution of Indigenous knowledge to contemporary ecosystem science and management is irrefutable; the complex challenge we face worldwide, is how to integrate the knowledge, preferred management methods and inclusion of Indigenous and non-Indigenous peoples to reach local to international biological and cultural conservation objectives (ICSU, 2002). In recognition of this significant challenge, many international and national agencies and agreements focusing on environmental conservation, such as the 1992 *Convention on Biological Diversity*, UNESCO's 1999 *Declaration on Science and the Use of Scientific Knowledge*, the United States of America Environmental Protection Authority's Tribal Science Council (1999), the Australian *Environmental Protection and Biodiversity Conservation Act 1999* and the New Zealand *Biodiversity Strategy 2000*, similarly advocate for enhanced engagement of Indigenous societies in respect of their rich environmental knowledge, land ethic and the need for more equitable benefit sharing (Langton and Ma Rhea, 2005; Sachs et al., 2009). Notably, these authorities place much responsibility upon wider society, including scientists, to create inclusive approaches to biodiversity conservation and sustainable use of the world's resources. There are calls for a new "social contract" for science (Lubchenco, 1998; Gallopín et al., 2001) to encourage a shift towards more applied and holistic socio-ecological systems thinking, also described as sustainability science (Kates et al., 2001; Cash et al., 2003).

Biological diversity is increasingly being linked to cultural diversity suggesting that combined *biocultural* resources are integral to the survival of life on Earth (Maffi, 2001, 2007; Loh and Harmon, 2005; Maffi and Woodley, 2010; Hill et al., 2011a; Gorenflo et al., 2012). For example, the Australian Government reports on the state of Indigenous knowledge in Australia to the

International Convention on Biological Diversity (Langton et al., 2003). Deeper consideration of biocultural diversity and knowledge as a mechanism for enhanced understandings of diverse human perceptions and values of biodiversity, ecosystem dynamics and natural resource use, offers a constructive approach for greater inclusion of Indigenous people (and other local knowledge holders) in conservation pursuits. Indigenous and local knowledge of a particular place, especially when it has been accumulated, tested and adapted over generations, can make great contributions to ecosystem understanding and management particularly at the local level (ICSU, 2002; Raymond et al., 2010).

However, Nadasdy (1999) and Agrawal (2002) caution that well-intentioned advocates of broader uptake and use of Indigenous biocultural knowledge must be careful to avoid "scientising" or "distilling" Indigenous knowledge into static, transferrable and non-contextual forms which remove the localised essence of Indigenous knowledge as "a way of life", thereby arguably rendering it as non-Indigenous knowledge. Similar sentiments are asserted by Hemming et al. (2007, 2010) and Smith (2012) who discuss the need to develop de-colonising methodologies and promote Indigenous ways of knowing and doing rather than continually trying to structure Indigenous knowledge around 'Western' pedagogical and research frameworks. Although Agrawal (2002) notes that there are benefits from databasing and making generalisations about Indigenous knowledge to enhance recognition by dominant society. However, he also argues that there are substantial ethical problems associated with such syntheses, for example possible lost opportunities for people whose knowledge has not been documented but still exists in living forms and therefore may not gain equitable recognition. He suggests that these issues should be counteracted by active lobbying for enhanced Indigenous rights and involvement in ecosystem science, management and decision-making at local to global levels, as well as lobbying for a greater awareness of different knowledge systems other than those of dominant Newtonian and Popperian 'Western' science. This is the goal of this paper.

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