

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 and Australia have responded with an array of policy and programs to enhance Indigenous involvement; however, balancing Indigenous and non-Indigenous priorities and preferred methods is a substantial challenge and much progress has been *ad hoc*. Using Australia as a case study, we argue that with more strategic direction to enhance the recognition of Indigenous People and their knowledge, ecosystem science and management could greatly benefit. Focussing on the terrestrial environment, this innovative review paper aims to increase broader uptake of Indigenous biocultural knowledge (IBK) by conducting a spatial, temporal and content analysis of publically available, documented IBK materials. A spatial analysis of the place-based resources identified Australian IBK hotspots, gaps and opportunities for further collaboration. A temporal analysis of IBK material showed exponential growth in documented IBK material since the 1970's. Indigenous authorship remained negligible until the 1990's. Working through Australia's ecosystem science priorities, we demonstrate how IBK has and can be used to inform research and management of fire, threatened species, invasive species, aquatic ecosystems and climate change. Lastly, we synthesise documented suggestions for overcoming cross-cultural awareness and communication challenges between Indigenous people and biologists, environmental managers and policy makers. Overcoming these challenges through development of inclusive strategies geared towards building socio-ecological resilience will guide more informed and sustainable management of global biocultural resources.

Keywords

Indigenous ecological knowledge; Traditional Knowledge; cross-cultural ecology; biocultural diversity; socio-ecological systems; sustainable development

1. Introduction

Indigenous knowledge systems contain a deep understanding of the forces that have shaped the diversity and condition of past and current environments (Gadgil et al. 1993; Berkes 1999; Drew and Henne 2006). The potential contribution of Indigenous knowledge to contemporary ecosystem science and management is irrefutable; the complex challenge we face worldwide, is how to mesh the knowledge, preferred methods and inclusion of Indigenous and non-Indigenous Peoples to reach local to international environmental and cultural conservation objectives. In recognition of this significant challenge, many international and national agencies and agreements focussing on environmental conservation, such as the *Convention on Biological Diversity*, the United States of America Environmental Protection Authority's Tribal Science Council (1999) and the Australian *Environmental Protection and Biodiversity Conservation Act 1999*, 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 Rhea 2005; Sachs et al. 2009). Notably, these authorities place much responsibility upon wider society to create inclusive approaches to biodiversity conservation and sustainable use of the world's resources. Biological diversity is increasingly being linked to cultural diversity, suggesting that combined biocultural resources are integral to the survival of life on Earth (Harmon 2007; Maffi and Woodley 2010; Hill et al. 2011a). Consideration of biocultural assets as well as biological assets will elevate the role of Indigenous Peoples in broader conservation agendas.

Globally, Indigenous Peoples are recognised as a disadvantaged group and they tend to disproportionately rely on direct access to natural resources for cultural maintenance and survival (Eversole et al 2005). Therefore, inclusion of Indigenous knowledge and People in environmental conservation pursuits must consider extant power imbalances as well as cultural differences in ways of knowing and doing. Discussions between Indigenous and non-Indigenous people about culturally specific and more holistic development aspirations in relation to the environment is required to devise approaches that meet local needs (endogenous development; see Rist et al. 2011) as well as national and international obligations.

Australia has made substantial progress in building Indigenous-focussed conservation initiatives from local to national scales that aim to serve both environmental and cultural objectives. Currently, about 30% of Australia is legally recognised as Indigenous owned land, with another approximately 45% under land claims, shared or co-management arrangements (Grech et al. in prep). The Australian Government has provided increasing support for Indigenous land and sea management through the Working on Country and Indigenous Protected Area (IPA) programs. The IPA program is based on voluntary declarations of Aboriginal owned land to the National Reserve System (NRS) where the land owners are remunerated for continued management of land according to IUCN guidelines (Szabo and Smyth 2003). To date, 52 IPAs have been declared in Australia, adding over 36 million hectares to the NRS which equates to 4.75% of the continent (Australian Government 2013).

Australia's national biodiversity conservation strategy is stratified and assessed through the NRS's Interim Biogeographic Regionalisation of Australia (IBRA) which was developed to ensure comprehensive, adequate and representative protection of the nation's biological resources. There are 89 IBRA regions, with conservation prioritised for IBRA regions that have less than 10% protected in reserves (including IPAs). Government obligations to meet the 10% target gave support to the IPA program as some bioregions are entirely owned by Aboriginal people (Langton and Ma Rhea. 2005). Therefore, IPA's offer local to international benefits by contributing to Australia's international conservation commitment (the *Convention on Biological Diversity*) and providing land management funding opportunity to Aboriginal People. At the local scale, hundreds of community-driven

Indigenous natural and cultural resource management (INCRM) enterprises have emerged over the last few decades as a result of increasing legislative support for Aboriginal land ownership and self-determination. INCRM has recently been described as the fastest growing sector of Australia's conservation effort (Hill et al. 2013).

Despite achievements in Australian INCRM, there are widespread cross-cultural tensions in the planning, governance and preferred types and methods of on-ground activity. These tensions are largely attributed to the lack of understanding of alternative Indigenous knowledge systems by mainstream society and the continual privileging of 'Western' scientific approaches (Langton and Ma Rhea 2005; Barbour and Schlesinger 2012; Hill et al. 2013). These tensions are correspondingly reflected in the disproportionately low funding and resourcing for INCRM (Hill et al. 2013). For example, the recent Australian Government funded Terrestrial Ecosystem Research Network, made of up Australia's most eminent ecologists, has largely ignored the large proportion of Indigenous land ownership and wealth of Indigenous knowledge in their development of a national long-term ecological research and management strategy (Ens et al. 2014). Lack of Indigenous involvement, and social dimensions more broadly, are also evident in other international Long Term Ecological Research Network's, such as in the United States of America and Europe (Ohl and Swinton 2010).

The challenge for contemporary Indigenous people is how to maintain biocultural knowledge, customary obligations and livelihoods in the future amidst increasing pressures from dominant society to conform to 'Western' modes of living and environmental conservation. Aboriginal elders recognise the challenge of maintaining their cultural identity in the face of these changes:

People. They can't listen for us. They just want money. Money. We want goose, we want fish. Other men want money. Him can make million dollars, but only last one year. Next year him want another million. Forever and ever him make million dollars. Him die.

Million no good for us. We need this earth to live because we'll be dead, we'll become earth. This ground and this earth, like brother and mother.

Trees and eagle. You know eagle? He can listen. Eagle our brother, like dingo our brother. We like this earth to stay, because he was staying for ever and ever. We don't want to lose him. We say 'Sacred, leave him.'

Bill Neidje, Bunitj clan (Neidje 2002)

A major challenge for the wider Australian population (and other nations) is to understand the crucial enabling factors that are required to facilitate self-determination and endogenous development - the development that is generated by the community for the community (Rist et al. 2011; Van der Ploeg and Long 1994). To achieve this, there needs to be greater recognition by non-Indigenous people of the value and diversity of non-scientific knowledge systems operating within society. Senior Custodians of Australian IBK emphasize this:

...we believe that our traditional knowledge has not been recognised. However we need to be engaged and take full control of our heritage. Goal is to protect our lore and custodial rights for the future generation, which has been passed down from ancestor's knowledge.

Tropical Indigenous Ethnobotany Centre Advisory Board (personal communication)

1.2 Indigenous biocultural knowledge and Western ecological knowledge

Indigenous biocultural knowledge (IBK) is a modified phrase for what is widely known as *Indigenous Ecological knowledge* or *Traditional Ecological Knowledge*, with an emphasis on the importance of cultural connections. Gerry Turpin, *Mbabaram* Traditional Owner, co-author of this

paper, describes Indigenous biocultural knowledge as ‘*knowledge that encompasses people, language and culture and their relationship to the environment*’.

Interconnectedness is also a feature of the ‘Western’ scientific discipline of ecology, which is defined as the study of the interactions within the environment, and includes sub-disciplines including human and fire ecology. Considering these overlapping areas of interest in holistic and interactive knowledge systems, it is surprising that integration of ‘Western’ ecology and IBK has not been more common (Bohensky and Maru 2011).

Worldwide, IBK (or its equivalent) has long been touted as valuable to conservation science, policy and management (Agrawal 1995; Berkes 1999; Gadgil et al. 1993; Huntington 2000). While IBK is an interconnection of bio-physical, social, spiritual and cosmological realms that are manifested through Country (for further information see Smyth 1994), ‘Western’ ecological knowledge is restricted to bio-physical entities and is rigorously bound by hypothetico-deductive methodological constraints (Agrawal 1995). The two forms of knowledge are distinct but not always mutually exclusive and they can complement each other if a diversity of knowledge systems and approaches are valued (Christie 2006; Clarke 2007; Ens 2012; Hill and Smyth 1999; Nakata 2007; Russell-Smith et al. 1997). It is also important to note that the distinctions between Indigenous and ‘Western’ science are not always clear. Neither knowledge system is static; both have been and will continue to be influenced by cultural, social, economic, political and environmental factors. The meanings of IBK and ‘Western’ science have been the subject of much debate (e. g. Agrawal 1995; Bohensky and Maru 2011; Drew and Henne 2006; Shackeroff and Campbell 2007; Wohling 2009) and will not be elaborated further here; although we acknowledge that use of these simplistic terms is not ideal but they are employed for concise delivery of our key messages.

Although IBK exists largely in oral forms held by Indigenous custodians, in many instances, this knowledge has been documented, often in collaboration with non-Indigenous researchers. This knowledge tends to be held in widely dispersed records such as private journals, linguistic dictionaries, unpublished reports, community publications, academic journal articles, books, databases, digital archives, photos and videos. Many records are not publically available or in accessible forms, and sometimes, Indigenous People themselves cannot access material about their own families due to author copyright or privacy laws. For more information about research, intellectual property issues and documentation of Indigenous knowledge’s see Nakata and Langton (2006) and Janke (2009). As a result of these complexities, this review presents a broad synthesis of publically available and accessible material intended to provide a platform to guide further respectful, collaborative documentation and use of IBK for the maintenance of biocultural resources.

Irreversible modification of the environment continues to occur at a rapid rate, with no definitive abatement afforded by ‘modern’ tools such as biological or chemical control of weeds. It is timely to review and respect Indigenous biocultural knowledge and methods that have shaped the landscape for millennia and offer highly valuable insight for more effective and sustainable management of Country (Altman et al. 2007; Howitt 2001; Howitt and Suchet-Pearson 2006).

To provide a foundation for further contributions of IBK to ecosystem science and management in Australia this paper presents:

1. Spatio-temporal syntheses of publically available Australian IBK projects involving Indigenous People;
2. A case study to demonstrate the extent to which IBK is ‘living’ and has not yet been documented;
3. An overview of how IBK has informed Australia’s ecosystem research and management priorities; and
4. A reflection on key principles for effective cross-cultural partnerships in ecosystem science and management.

2. Methodology

To be included in this review of IBK in Australia, material needed to directly address the relationship between Aboriginal people and the environment, and have involved Indigenous people. Therefore, for example, archaeological work conducted by non-Indigenous researchers alone was not included. To collect the material, author databases were searched, as well as Scott's (2004) bibliography of Indigenous Ecological Knowledge in Australia, CSIRO's Indigenous land and sea management database, Google searches (using terms: Australia and Indigenous/ Aborigin*/ or ethno) and a public call for contributions (via email). The list of references was separated into place-based material, reviews, methodology and related resources. Place-based materials that identified particular clans, tribes, regions, towns or homelands were attributed a 'place-name' and were geo-referenced (given a latitude/longitude) using the Australian Gazetteer (<http://www.ga.gov.au/place-name>). This enabled a spatial analysis and display of material using ArcGIS.

The following spatio-temporal analyses were conducted on the place-based literature:

- i) Spatial analysis of IBK materials in relation to the Indigenous estate;
- ii) Spatial analysis of IBK materials in relation to Australia's IBRA regions;
- iii) Spatial analysis of IBK hotspots and Australia's biodiversity hotspots;
- iv) Temporal analysis of IBK documentation;
- v) Temporal analysis of Indigenous authorship of IBK materials.

We also present a case study of living knowledge based on the current work of the Tropical Indigenous Ethnobotany Centre (TIEC) in Cairns, Australia. Lastly, we conducted a qualitative content review of all collated IBK materials in relation to Australia's ecosystem science priorities: fire, threatened species, biodiversity, aquatic species and climate change (NRMMC 2010). We assessed how these materials have informed or could inform Australia's research and management of these issues.

3. Results

Our desktop literature search resulted in a representative list of 1325 documents that contained information on Australian IBK. Of these references, 568 were 'place-based', 245 contained methodological or instructional content, 255 were review materials and 267 were related resources (not directly containing IBK material). These references are available on the ACEAS IBK website (www.aibk.info).

3.1 Spatio-temporal analyses of place-based literature

3.1.1. Spatial analysis of IBK in relation to the Indigenous estate

A spatial analysis of the place-based materials against Indigenous owned land (under Native Title determinations and the *Northern Territory Aboriginal Lands Rights Act 1976*) and declared IPA's is shown in Figure 1. We found that 40% of materials originated from within legally recognised areas of Aboriginal owned land and 19% from within areas declared as IPA's.

The year of IPA declaration was not related to the quantity of available materials. For example, we found the highest number of publically available IBK materials for the Djelk IPA that was declared in 2006, some 14 years after the first IPA, Nantawarrina, was declared (1992), for which we found no publically available IBK materials. Publication of materials appeared to be largely dependent upon partnerships between Indigenous and non-Indigenous people, especially researchers. The top two published IPA's, Djelk and Dhimurru, have long standing relationships with several Universities and government researchers (e. g. Altman 1982; Haynes 1985; Kennett et al. 1997; Griffiths et al. 2003; Smyth 2007; Hoffmann et al. 2012).

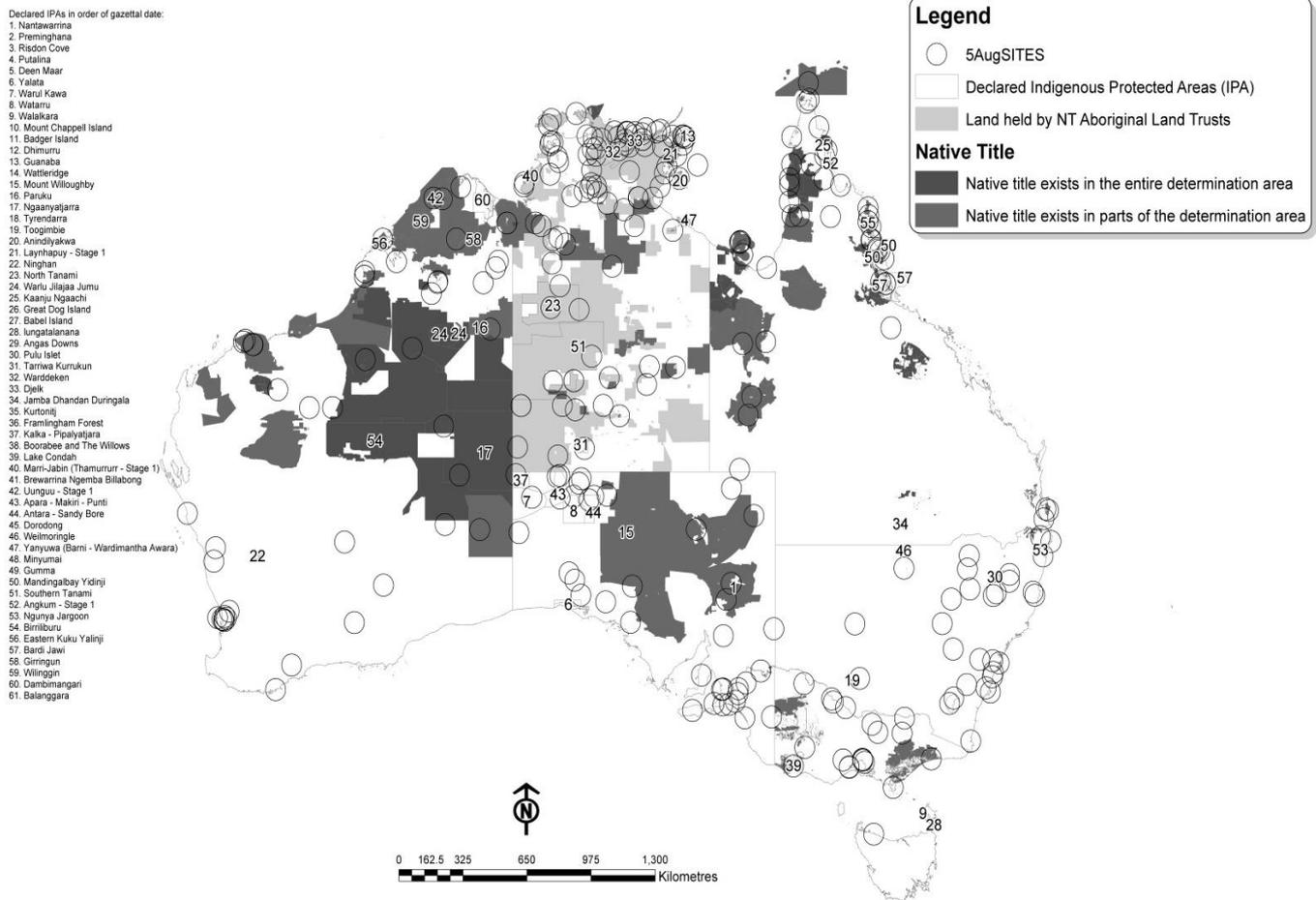


Figure 1: Map of place-based IBK material in Australia on the Indigenous and non-Indigenous estate Spatial analysis of IBK in relation to IBRA regions

We found that 69% of the IBRA regions had at least one publicly available piece of IBK material. The ‘richest’ biocultural regions (IBRA regions with the highest number of IBK materials) were the Arnhem Coast, Gulf Fall and Uplands, and Cape York Peninsula IBRA regions which are all in northern Australia (Figure 2). The bioregions which were not well represented in the publicly available IBK literature were mainly in Australia’s agricultural zones and Tasmania.

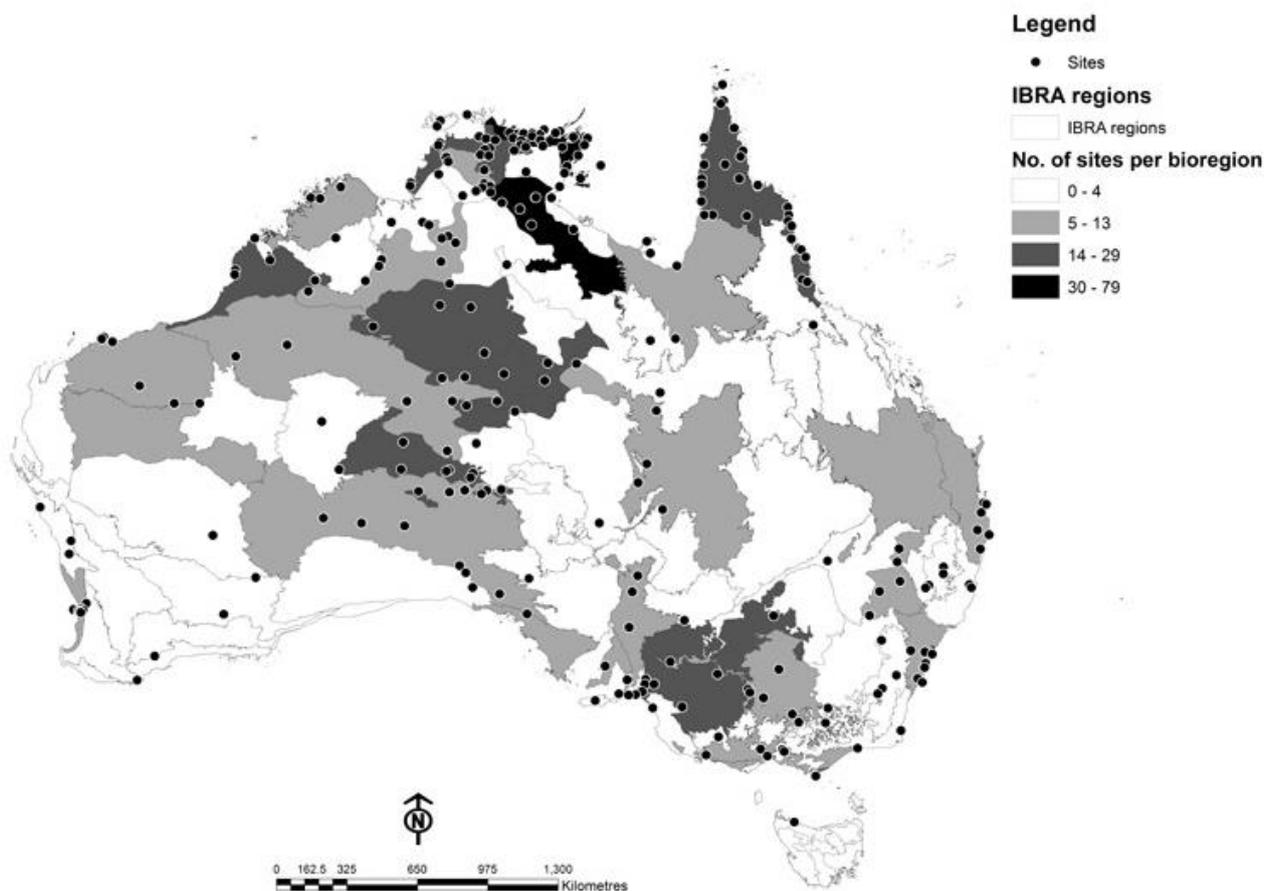


Figure 2: Density analysis of place-based IBK materials in IBRA regions, showing biocultural hotspots as darker areas

Table 1: The top 15 IBRA regions with the highest number of IBK materials and suggested as biocultural knowledge hotspots

IBRA name	Count of materials
Arnhem Coast	79
Gulf Fall and Uplands	47
Cape York Peninsula	29
Darwin Coastal	25
Murray Darling Depression	21
Wet Tropics	21
Central Ranges	20
Arnhem Plateau	18
Dampierland	18
Burt Plain	16
MacDonnell Ranges	16
Tanami	15

3.1.2. Spatial analysis of IBK material in relation to Australia's biodiversity hotspots

If we follow the biodiversity hotspot classification (Myers et al. 2000), which in Australia is based on the IBRA system, the top 15 *biocultural hotspots* (IBRA regions with the highest number of IBK materials) could be listed as priority regions for preserving biocultural richness (Table 1).

Comparison of these *biocultural hotspots* (Figure 2; Table 1) with Australia's 15 national biodiversity hotspots (Figure 3) showed that the two data sets or systems were mutually exclusive.

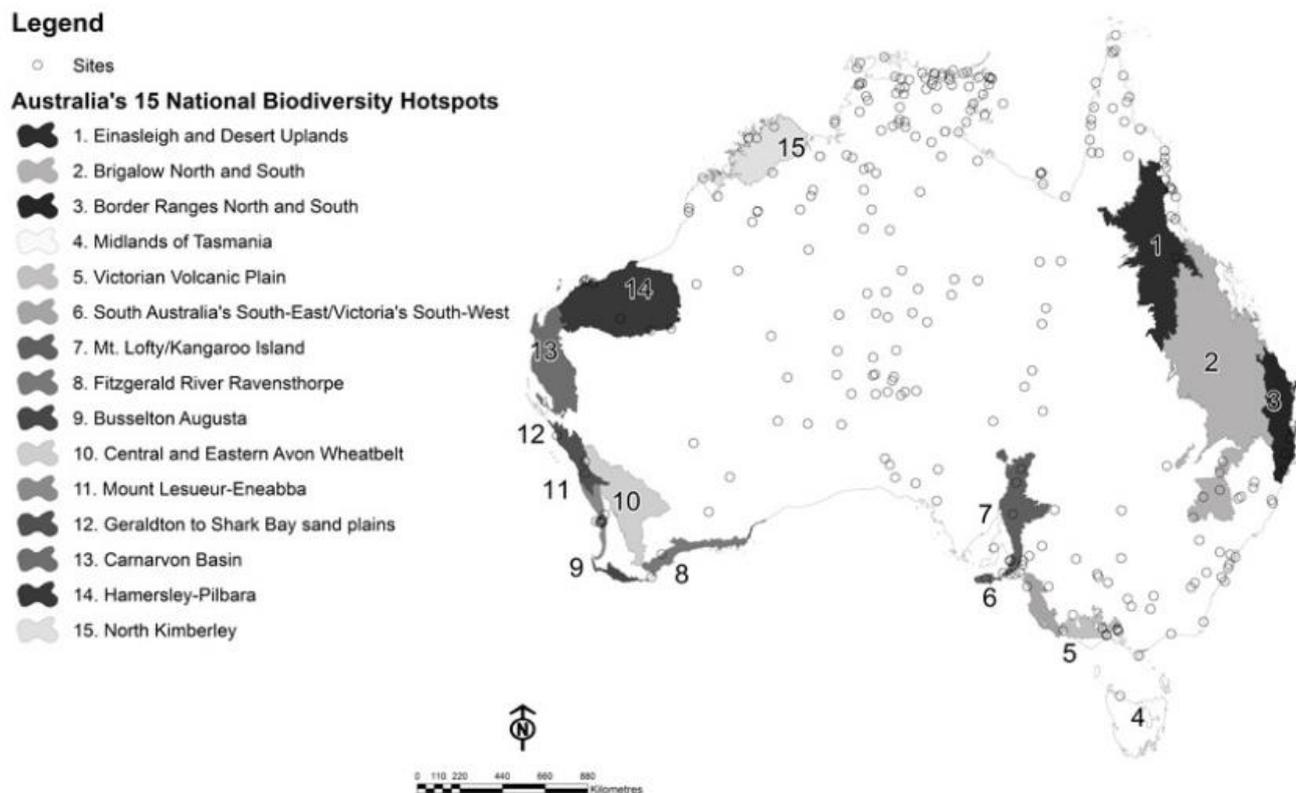


Figure 3: Place-based IBK materials (circles) over Australia's national biodiversity hotspot bioregions (shaded areas).

3.1.3. IBK temporal analysis

Temporal analysis of the documented materials showed a general trend for early documentation of IBK in eastern Australia moving towards central and Western Australia and more recently building in northern Australia (Figure 4). Many of the early documents contained the observations of explorers and much of this material covered vast areas and contained snippets of IBK (e.g. Eyre 1845; Leichhardt 1847; Orton 1836). The most detailed pre-1900 place-based documents on IBK came from New South Wales (Baylie 1843; Howitt and Fison 1880), Victoria (Beveridge 1889; Cary 1899; Curr 1883; Dawson 1881), South Australia (Cawthorne 1885) and northern Queensland (Palmer 1884; Roth 1897) corresponding to early settler regions.

Following the early period of colonial 'exploration' by non-Indigenous authors, there was a period of early ethnography and anthropology during the first of the 20th century where much more concerted efforts to better understand Aboriginal people, customs and culture were evident. Much of the published material in this period came from several key non-Indigenous researchers: the detailed and comprehensive ethnographic work of Roth in north Queensland (e. g. Roth 1897; Roth 1910); the collaborative work of Hale, Tindale, Cleland and Johnston in southern and central Australia (e. g. Cleland 1966; Cleland and Johnston 1937; Hale and Tindale 1925; Tindale 1974); and the work of Basedow, Thompson, Mountford and Specht in Arnhem Land (Basedow 1929; Specht and Mountford 1958; Thomson 1939).

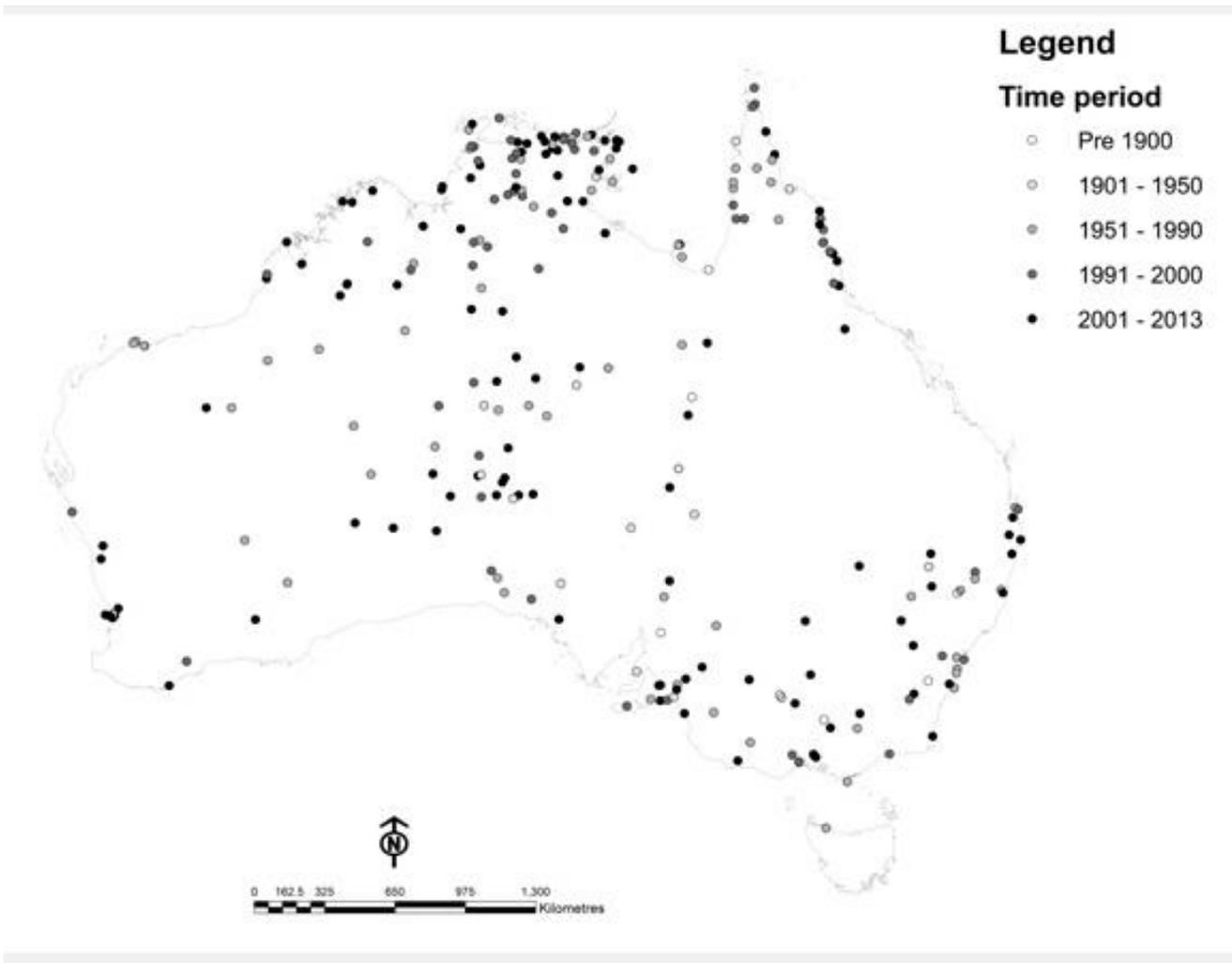


Figure 4: Map of documented place-based IBK material sorted by time period.

In the 1970's there was a dramatic increase in the number of IBK publications (Figure 5) which fanned out across Australia (Figure 4). The increase in publication rate appears to be the result of many new researchers entering the field. The exponential increase in publications continued to the present with an increase in obvious Indigenous authorship from the 1990's (Figure 5). Some notable prolific publishers dominate the IBK material of recent decades: Bradley and the Yanyuwa people (e. g. Bradley 1988; Bradley 2005; Yanyuwa families et al. 2013); Clarke (e. g. Clarke 1985; Clarke 2012); Wightman and northern Australia clans (e. g. Roberts et al. 2011; Wightman and Smith 1989); the Alice Springs CSIRO research group (e. g. Baker et al. 2001; Davies et al. 1999; Dobson 2007; Walsh and Douglas 2011; Walsh and Mitchell 2002; Young 1987); and the wet tropics research group (e. g. Smyth 1981; Hill and Smyth 1999; WTAPPT 2005; Hill et al. 2011b).

3.1.4. Temporal analysis of Indigenous authorship

Using our search methodology, the earliest material with clearly identified Aboriginal IBK custodians as authors were publications on bush medicines (Dhamarrandjai and Guyamirrilili 1979; Henshall et al. 1980; Nabarula et al. 1978). Although there was a clear shift in practice in the 1990's to acknowledge Indigenous co-authors, to date only 14% of papers containing IBK have identifiable Indigenous authors (Figure 5).

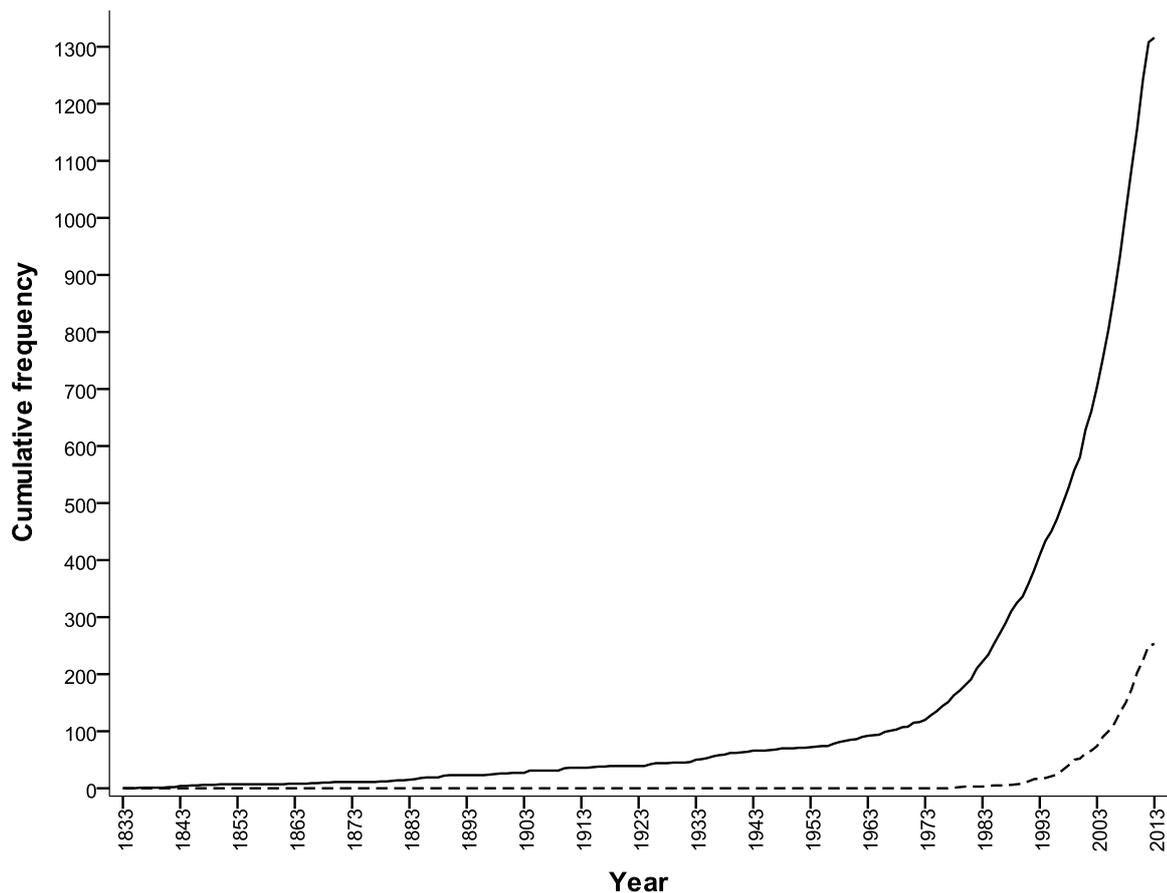


Figure 5: Cumulative frequency curve for all collated IBK materials (black line) and those with an identifiable Indigenous author/s (dashed line).

3.2. Living knowledge case study

The previous spatial analyses suggest that for many areas of Australia, IBK has not been documented, although it certainly is not absent. Indigenous knowledge is customarily transmitted orally and is still retained, modified and used by many Aboriginal people.

The Tropical Indigenous Ethnobotany Centre (TIEC) was established in 2011 as a unique Indigenous-driven initiative established to engage, support, and build the capacity of Traditional land owner groups to maintain IBK, mainly in tropical Queensland (Hill et al. 2011b). The Centre is managed by Gerry Turpin (Mbabaram clan) and an Indigenous Cultural Advisors Working Group consisting of five members from various clans in northern Queensland (who are co-authors of this paper). The main aim of the TIEC is to record and utilise Indigenous ethno-biological and ethno-ecological knowledge for cultural use on Country. Projects include: an electronic ethno-botanical database; and seasonal indicator species information for a climate change eco-tourism enterprise. To date, the TIEC has engaged with 11 Indigenous communities through 27 established or emerging projects (Figure 6). If we consider these ‘living projects’ alongside the documented IBK material, the contribution of this small centre in only a couple of years is manifold, especially for the bioregion around the TIEC (Wet Tropics) and the pastoral lease regions of the Mount Isa Inlier and Einasleigh Uplands (Figure 7).

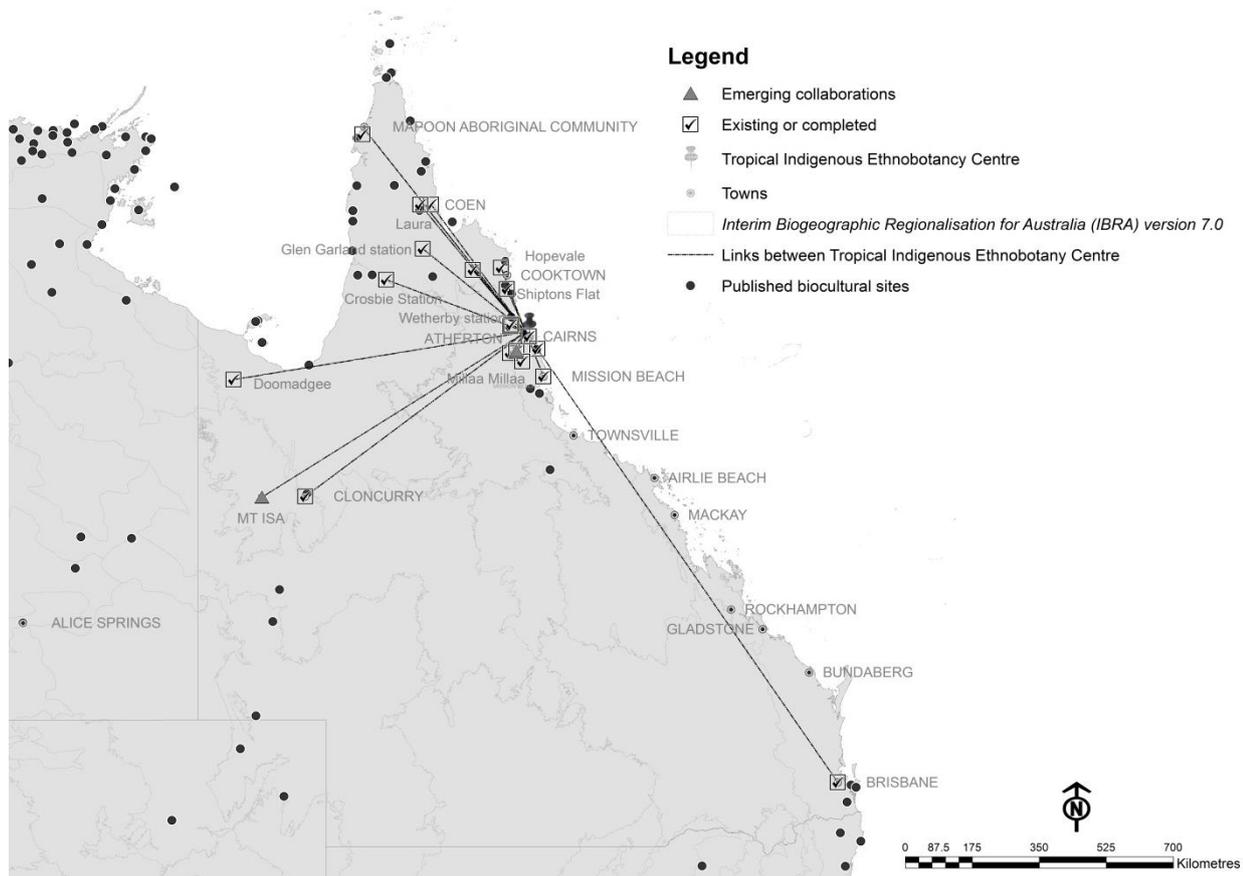


Figure 6: Living knowledge projects of the TIEC in relation to documented publicly available literature (1: Mt Isa Inlier region; 2: Einasleigh Uplands region).

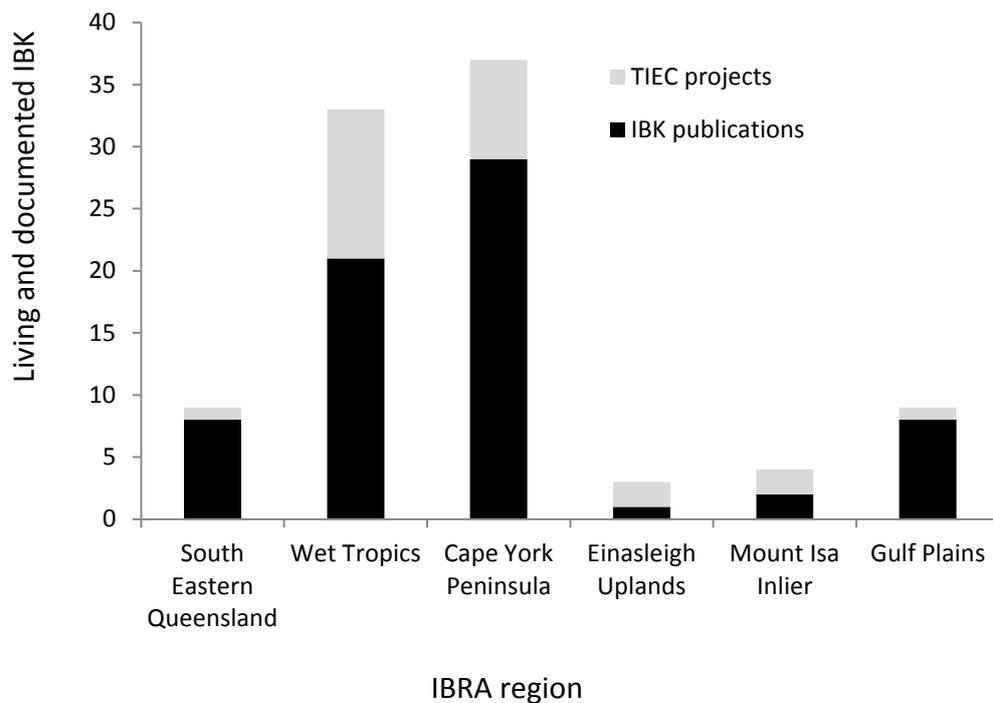


Figure 7: Number of TIEC Living knowledge projects and documented IBK materials for Queensland IBRA regions.

3.3. Contributions of IBK to Australia's national ecosystem science and management priorities

Australia's ecosystem science and management priorities were broadly identified in Australia's Biodiversity Conservation Strategy 2010-2030 (NRMMC 2010) as fire, threatened species, biodiversity, aquatic ecosystems, invasive species and climate change. The following section reviews how IBK has and could contribute to these contemporary environmental issues.

3.3.1. Fire management

The IBK of fire is an outstanding example of how IBK has informed fire management in Australia (e. g. Jones, 1969; Gill and Groves 1981), particularly in northern Australia over the last few decades (e. g. Haynes 1985; Yibarbuk et al. 2001; Hill et al. 2004; Russell-Smith et al. 2009). Thirteen percent of the collated IBK material in this review directly related to fire. One of the earliest and most influential examples of IBK use in fire management is the innovative Western Arnhem Land Fire Abatement (WALFA) project in northern Australia. For over 20 years Northern Territory Government scientists and bushfire staff, the Northern Australian Indigenous Land and Sea Management Alliance (NAILSMA) and Indigenous land and sea management (Ranger) groups have collaborated to promote early-dry season burns to prevent destructive late-dry season fires, protect fire sensitive species, community infrastructure and concurrently abate carbon emissions (Russell-Smith et al. 2009). This project hinges on recreating customary mosaic burning practices which have been shared with scientists by Senior Knowledge Custodians of the region (e. g. Garde et al. 2009). The collaboration inherent to this project was recognised with a prestigious national Banksia Award in 2011 and was the basis for the first formal carbon-offset agreement in Australia (Russell-Smith et al. 2009).

There has also been a wealth of collaborative research and application of Indigenous fire management practices in the wet tropics region of northern Queensland (e. g. Hill et al. 1999; Hill et al. 2004). Here, Senior Knowledge Custodians have worked with Indigenous Rangers and researchers to record Indigenous burning practices using audio-visual technologies and multi-disciplinary techniques to promote the benefits of customary Indigenous fire management. Participatory action research has been a key feature of this work which aims to build the capacity of Indigenous and non-Indigenous participants to better understand and manage fire using both knowledge systems. A key product of this work is 'Yalanji-Warranga Kaban: Yalanji people of the rainforest fire management book' (Hill et al. 2004). Following from the successes of these projects, many other Indigenous groups across Australia aspire to initiate collaborative cross-cultural fire management projects.

3.3.2. Threatened fauna

There have been some significant, albeit few, long-term documented partnerships where Aboriginal people have worked with Western scientists to better understand the distribution, ecology and status of threatened species. However, there are likely to be many more undocumented examples considering the well-known animal tracking skills of Indigenous People (e. g. Southgate and Moseby 2008).

One of the first and most publicised collaborative studies between Aboriginal people and 'Western' scientists was that of the declining mammals of the central Australian deserts (Burbidge et al. 1988). Aboriginal people were shown museum skins and provided information about local names, the biology and ecology and the current and past status of the animals. During this research new data were collected on the distribution, biology and ecology of many species. Recently, Ziembicki and others (2013) replicated this method and supplemented it with on-Country trips and mammal trapping with Aboriginal people in northern Australia to expand the knowledge of declining species. This 'expert knowledge' research has been used to inform collaborative management and planning in the region, especially for fire and feral animals.

Some linguists have also conducted research into threatened fauna when building Aboriginal language dictionaries. For example, when compiling a dictionary for the Adnyamathanha People of the Flinders Ranges, Tunbridge became interested in Indigenous knowledge of the mammal fauna which had largely disappeared following European settlement in the late 1800's. Tunbridge's book 'The story of the Flinders Ranges mammals' (1992) records detailed information on the habit, diet and behaviour of 58 species. In a review of this book in *Australian Mammalogy*, Burbidge (1992) commented on the significant range extensions of many species as well as the 'amazing ability of Aborigines to identify mammals from skins, and to relate information about animals and places that they have never seen but which had been passed onto them by earlier generations.' He concluded the review by stating that he hoped the book 'would encourage others to record Aboriginal knowledge in other parts of the country, particularly knowledge of extinct and threatened species of mammals, before it is too late.' Twenty years on there has been some continuation of this work; however, such collaborations are far from reaching their potential with progress warranting even more urgency as the threats of feral animals, altered fire regimes, disease and habitat destruction continue to decimate Australia's small mammals and reptiles (e. g. Woinarski et al. 2007).

In terms of pro-active management of threatened species, the Anangu People of the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands offer an outstanding example as they have shared knowledge and developed management approaches for the threatened Black-footed Rock Wallaby (*warru*, *Petrogale lateralis*) with scientists since the first biological survey in the region in 1985 (Muhic et al. 2012; Read and Ward 2011). When a rapid decline was detected in populations from 1999, *Anangu* have worked alongside scientists to try and protect this species. In 2007, the Anangu Warru Recovery Team was established as part of the Threatened Species Recovery Plan for the *warru*. The team, including Anangu Warru Rangers, established a breeding colony at the Monarto Zoo in southern South Australia and have recently translocated joeys back to the APY Lands into large feral animal exclosures. The Warru Rangers monitor the fence, conduct traditional burning, predator baiting and monitor *warru* populations. In 2011, the *warru* team won the National Aborigines and Islanders Day Observance Committee (NAIDOC) Caring for Country Award for their work on this threatened species. *Anangu* have played critical roles in this project through their use of traditional knowledge of *warru* behaviour, preferred habitat and spiritual connections and practices (including song) to facilitate project success (Muhic et al. 2012).

3.3.3. Biodiversity

Biodiversity surveys that targeted species significant to Indigenous people (those used for material culture, bush tucker and bush medicine), were the earliest IBK documents produced by Indigenous authors (Nabarula et al. 1978; Dhamarrandjai and Guyamirrilili 1979) and have become more common (e. g. Latz 1995; Packer et al. 2011); although, are still considered vastly under-prescribed considering that about 250 Indigenous language groups occur across Australia (McConvell and Thieberger 2006). Such studies are often described as ethno-biological, ethno-ecological or ethno-pharmacological studies. A rare example of documented detailed collaborative ethno-biological research was published by Telfer and Garde (2006) who conducted one of the most comprehensive reviews of Indigenous knowledge of several species - rock kangaroos in western Arnhem Land. This work greatly expanded the ecological literature for several species of conservation interest, including information on diet, habitat use, distribution, behaviour and predation. A feature of this work was that it involved a linguist who ensured that the nuances of local Indigenous knowledge were correctly documented. Notably, there has been a concentration of ethno-biological research in the Top End of northern Australia, largely driven by collaborations involving the Northern Territory Herbarium (e.g. Wightman and Smith 1989; Roberts et al. 2011). Much of this knowledge would have been lost as elders passed away if these records were not produced (Horstman and Wightman 2001). Surprisingly, in Australia, ethno-biological research has not featured prominently in any other State or Territory Government institution until very recently, through the TIEC (Hill et al 2011b) and Macquarie University (eg Packer et al. 2011; Gaikwad 2011; Gaikwad et al. 2011).

The prevalence of cross-cultural systematic biological surveys has increased around Australia, especially since the advent of the Indigenous Protected Area and Working on Country programs. Biological surveys range from inventories to inclusion of distributional and ecological information. For example, recently, a group of Western Australian Government biologists conducted a series of biodiversity surveys with the *Pila Nguru* (Spinifex people) of the Great Victoria Desert, which greatly contributed to the documented biodiversity knowledge of the region, including several new species to science and of conservation interest (Brennan et al. 2012). Notably, these authors reiterated that such projects can be more productive when both Indigenous and ‘Western’ knowledge and survey methods are employed and drew attention to the paucity of publically available documentation on this type of research. Clearly there are vast opportunities for more collaborative biodiversity surveys across Australia, where multiple benefits for conservation, cultural maintenance and socio-economic outcomes are possible (Moritz et al. in press).

3.3.4. Aquatic ecosystems

Aboriginal people have long had a spiritual and life-sustaining connection to aquatic ecosystems (Bayly 1999; Humphries 2007; Clarke 2009a), which according to Humphries (2007), is not well understood and appreciated by mainstream aquatic ecologists. An outstanding example of IBK contribution to aquatic ecosystem research and policy in Australia is the demonstration of Aboriginal occupation, understanding and use of the land and waters in the Murray-Darling Basin (e. g. Weir 2009; Clarke 2009a; Birckhead et al. 2011). This work has resulted in landmark contributions of Indigenous perspectives in large-scale water management strategies (Birckhead et al. 2011), such as the National Water Initiative (Jackson and Morrison 2007); although controversy and calls for greater Indigenous involvement continue (Weir 2009; Birckhead et al. 2011; Bark et al. 2012).

Similarly, Indigenous and non-Indigenous stakeholders have made substantial headway into promoting Indigenous water rights and customary water uses in northern Australia (e. g. Jackson et al. 2005; Altman et al. 2009; Kennett et al. 2010). Socio-economic studies on the contributions of freshwater resources to the Indigenous customary economy (e. g. Jackson 2004; Barber and Jackson 2011; Woodward et al. 2012) provide substantial evidence for the imperative to honour Indigenous people’s rights to use their ancestral Country to support wellbeing and livelihoods, especially in the absence of adequate essential service delivery to Indigenous communities by governments.

Based on the present collation of IBK materials, the majority of Indigenous contributions to aquatic ecosystem research management primarily centred on Indigenous water rights. However, by international standards, recognition of Indigenous water rights in Australia is considered poor (Durette 2008; Bark et al. 2012). Therefore, there is substantial potential to further document and expand public awareness of IBK of aquatic environments, which would certainly have positive implications for more holistic management of aquatic natural and cultural resources as well as Indigenous-driven socio-economic development opportunities related to the customary economy and eco-tourism (Altman et al. 2007).

3.3.5. Invasive species

There was scant publically available IBK material related to invasive species, despite great potential for Indigenous insight into their historical distributions, impacts and ecology, particularly where Indigenous people have had enduring connection to Country. The relatively limited documented IBK about invasive species primarily focused on large exotic animals (e. g. camel, buffalo and pig) and comparisons of perceptions and preferred management approaches by Indigenous and non-Indigenous stakeholders (Rose 1995; Robinson et al. 2005; Edwards et al. 2008; Trigger 2008). These studies clearly demonstrated differences in world views and are very useful for building cross-cultural awareness. Few publicly available documents went on to offer practical suggestions or guidelines for working with these differences, which are particularly necessary for co-managed areas and Indigenous land for which management is often funded by non-Indigenous agencies. A rare example was detected in Edwards et al. (2008) on extensive collaborative research in central

Australia where a structured study into management options and stakeholder perceptions of feral camels were used in decision making tools that defined a range of management suitability areas.

For invasive plants there was far less documented material incorporating IBK, and for microbial invaders, we found nothing. Of the few documented materials relating to IBK and invasive plants most related to management and preferred eradication of invasive plants (Storrs et al. 1996; CSIRO 2012; Grice et al. 2012). Several materials contained information on the positive values and uses of plants by Aboriginal people, species that ‘Western’ science call invasive or pests (e.g. Wightman et al. 1994; Smith 2000; Packer et al. 2011; Clarke 2012). Again, there is ample opportunity to expand our understanding of different world views in relation to invasive species and development of preferred management approaches that serve these alternate views.

3.3.6. Climate change

Climate change is expected to have significant social, economic and environmental impacts, particularly for Indigenous communities who are least resourced to adapt (Green et al. 2009). The predicted effects of rising sea levels and changing seasonality include: a loss of community and environmental assets, loss of cultural heritage sites, a significant downturn in the human quality of life, and the establishment of potential favourable conditions for the spread of invasive plant diseases, weeds and pests (Green et al. 2009).

There is a growing body of published literature discussing the importance of IBK and worldviews in the climate change debate (e. g. Green and Raygorodetsky 2010; Petheram et al. 2010; Alexander et al. 2011; Leonard et al. 2013), although there has been limited documented use of IBK by Australian climate scientists. Indigenous communities have long observed and recorded the phenology of flora and the seasonal behaviour of fauna through biocultural knowledge systems. Recently, many Indigenous groups across Australia have begun to document their seasonal knowledge (e. g. Hoogenraad and Robertson 1997; Clarke 2009b; Green et al. 2010; Woodward et al. 2012). IBK paradigms, as described earlier in this paper, have high levels of socio-ecological complexity that help explain the changing relationships between cycles of inter-annual weather patterns, water availability and the subsequent response of flora and fauna in the landscape. The use of seasonal calendars has the potential to highlight the Indigenous identified bio-temporal indicators of landscape response to climatic change and provide a basis for developing detailed climatic monitoring and evaluation programs (eg Leonard et al. 2013), particularly for the growing extent of Aboriginal owned and managed lands.

4. Discussion

Langton and Ma Rhea (2005) assert that ‘the documentation of traditional or Indigenous knowledge is fundamental to the capacity of traditional knowledge holders to promote, protect and facilitate the proper use of their knowledge’. For this to occur, IBK custodians and their communities must see the value in documenting inherited and new knowledge, understand the variety of forms that this can take as well as incumbent Intellectual Property issues (see Janke and Frankel 1998; Janke 2009). To facilitate the funding and support for IBK documentation, arguably a greater impediment is the attitude of dominant non-Indigenous society and the resultant values and priorities of funding bodies. Therefore, a shift in society’s values towards more inclusive, diverse and equitable approaches is required (Barbour and Schlesinger 2012; Ens et al. 2014). In ecosystem science and management this will require strengthening the understanding and acceptance of different knowledge systems, values and priorities to facilitate greater cross-cultural or two-way learning approaches (Marika et al. 2009; Yunupingu and Muller 2009; LaFlamme 2011; Ens et al. 2012).

The review of Australian IBK material presented in this paper is not reflective of the entire body of IBK in Australia as much knowledge has not been documented. It is also likely that the methodology deployed here did not capture all documented IBK works as many may not be publically available for

good reason relating to information sensitivities and property rights. However, an examination of publically available IBK material is beneficial as this is what is likely to shape broader community perceptions about IBK, unless people have closer connections to Indigenous people and communities. Despite these limitations, this review clearly demonstrates that IBK has and can continue to make substantial contributions to the understanding and implementation of Australia's national ecosystem science and management priorities. The large spatial gaps in IBK documentation detected in this study illustrate vast opportunities to expand cross-cultural research, management and awareness of Australia's unique assets to deliver environmental, cultural and socio-economic outcomes. Of particular note are the IBK material gaps in agricultural areas and Tasmania which are areas where Indigenous people suffered great disruption following colonisation.

We found that Indigenous land ownership clearly offers a stable platform for enhanced collaboration and mobilisation of IBK resources; however, has not prohibited the documentation of IBK on other land tenures (where 60% of IBK materials originated). For example, the TIEC works with many Indigenous groups in Queensland where vast tracts of land are currently held under pastoral leases and private non-Indigenous ownership. In some cases there has been great incentive to maintain and document Indigenous knowledge for the Native Title process where Indigenous ownership of Country is granted following demonstration of continuous occupation. There are also benefits to raising public awareness of the biocultural value of Indigenous owned land (including government supported IPAs) as a perceived higher value by the public and funding bodies can leverage greater investment. In support of this supposition, a recent study by Hill et al. (2013) showed that between 2002 and 2012 the Dhimurru and Djelk IPAs received the highest income of all IPA's which corresponds with our finding that these two IPAs also had two of the highest numbers of publically available IBK materials, and therefore public awareness and arguably perceived value. This correlation between IBK material availability and income may not be causal; nevertheless, it is an interesting coincidence when considering the aspirations for culturally meaningful development of many Indigenous communities.

If we are to move beyond simple biodiversity conservation by incorporating socio-ecological systems thinking (e. g. Sachs et al. 2009) that serves to promote more inclusive conservation practice, conservation priorities could adopt our biocultural hotspot concept. Broadening the biological hotspot targets to include culture is one way of enhancing the role of Indigenous people, knowledge and land into national conservation priorities. Therefore, following the logic of Myers et al (2000) the most bioculturally *and* biologically rich areas 'undergoing exceptional threats' could be targeted for conservation. Alternatively, the gaps in IBK documentation could be considered a priority for funding and work as in these areas, IBK may be critically endangered. Decision making about biocultural asset maintenance is similar to the debates about biodiversity and threatened species conservation – do we conserve the richest 'intact' areas, try and maintain or increase richness in less 'intact' areas, or adopt a blend of approaches (Kareiva and Marvier 2003)? We acknowledge again that the 'gaps' identified in this study may simply be an artefact of the methodology as we only used publically available and accessible IBK materials; however this foundational work raises the question about what should or could be supported to maximise return on investment. Considering the increasing interest in Australian IBK documentation shown in Figure 6, it is timely to assess the content and geographic spread of the baseline data and look to develop a more strategic approach to managing Australia's biocultural resources, importantly, in collaboration with Indigenous people. To do this, there needs to be greater awareness of the value of Indigenous knowledge and a willingness to accept differing knowledge systems by broader society.

4.1. Breaking down intellectual and institutional barriers

Globally, the value of 'cultural brokers' for negotiating divergent knowledge systems and understanding has been recognised when working in complex cross-cultural or cross-disciplinary spaces (Guston 2001). Use of cultural brokers is of particular relevance for work on Indigenous land, with Indigenous people or when using IBK (Maru and Davies 2011; Robinson and Wallington 2012).

Drawing on ‘champions’ that may be individuals or larger groups or agencies who have the power to drive institutional change may also strengthen efforts to raise awareness of the value of IBK in national conservation decision-making. The conglomerate of leading ecologists which make up Australia’s Terrestrial Ecosystem Research Network (TERN) could play a leading role in driving change and reaching out to mainstream society, in line with Australia’s Biodiversity Conservation Strategy Priority 1 – Engaging all Australians. Of all the 12 long-term ecological research projects under the banner of TERN, only one project (the Tropical Savanna project) has formally engaged Indigenous stakeholders (Ens et al. 2014). While internationally, initiatives to incorporate long-term socio-ecological research into national ecology networks like TERN are gaining momentum (e. g. Ohl and Swinton 2010).

It is clear that we need to move beyond participation to more active engagement of Indigenous people, knowledge and Country in environmental conservation initiatives (Colechester 1996; Hill et al. 2012; Walsh and Mitchell 2002). There are many examples of tokenistic and limited collaborations between Indigenous people and environmental scientists and managers. Generally, in Australia and likely in other colonised countries, the reasons for limited Indigenous involvement can be distilled down to a poor understanding of Indigenous history and culture by the wider populous and a general failure to appreciate alternate knowledge systems as a result of Eurocentric education systems. The result of dominant colonial histories has been the development of rigid environmental project and funding frameworks that tend to work against Indigenous involvement.

In Australia, key principles for effective collaboration between Indigenous and non-Indigenous people have been widely documented (e. g. Janke and Frankel 1998; Davies 2007; Desert Knowledge Cooperative Research Centre 2008; Marika et al. 2009; Davies et al. 2011; Ens et al. 2012; Hoffmann et al. 2012). In summary they are:

1. Cross-cultural awareness and sensitivity;
2. Respectful consultation and partnerships from project conception to completion and communication;
3. Enough time and adequate resources to discuss, consult and conduct the work;
4. Legal advice on Intellectual Property rights;
5. Prior informed consent of all people involved;
6. Equitable remuneration and acknowledgement of collaborator’s time and knowledge; and
7. That the principles of the UN Declaration of the Rights of Indigenous Peoples and the Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS) guidelines for research with Indigenous People’s be followed.

Indigenous land and sea management corporations are increasingly seeking collaboration with non-Indigenous scientists, managers and policy makers to fulfil their own research questions and organisational needs (Hoffmann et al. 2012; Marika and Roeger 2012). As Hemming et al. (2007) comment, government programs and support institutions come and go which ‘...means that universities are even more important as partner organisations for capacity building, knowledge development and knowledge exchange for Indigenous communities seeking social transformation.’ Development of respectful partnerships with long-term commitment has proven to deliver mutual, nationally significant and transformative benefits for ecosystem science and management, such as the *warru* and Western Arnhem Land Fire Abatement projects previously described.

5. Conclusions

Over the last two centuries, there have been large shifts in the way non-Indigenous people have engaged with Indigenous people, land and biocultural knowledge towards much more inclusive and respectful interaction, although inequitable benefit sharing remains. Many Aboriginal people still refer to Indigenous knowledge systems and Law when trying to making sense of environmental

change, despite the impacts of European colonisation. There are clear hotspots of documented IBK in Australia that have greatly enhanced the broader understanding and management of coupled natural and cultural systems. We have shown that all of Australia's conservation priorities could be greatly informed by IBK, although the existing opportunities far outweigh the advances made to date. Threats to global environments are increasing, so it is timely to rethink our ecological knowledge base and develop more holistic and inclusive research, management and funding options for the future. Enhanced cross-cultural and cross-disciplinary engagement has great potential to strengthen global capacity to build socio-ecological resilience for more holistic, inclusive and sustainable environmental management strategies.

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Literature cited

- Agrawal, A. 1995. Dismantling the Divide Between Indigenous and Scientific Knowledge. *Dev Change*. 26, 413-439.
- Alexander, C., Bynum, N., Johnson, E., King, U., Mustonen, T., Neofotis, P., Oettle, N., Rosenzweig, C., Sakakibara, C., Shadrin, V., Vicarelli, M., Waterhouse, J., Weeks, B., 2011. Linking Indigenous and Scientific Knowledge of Climate Change. *Bioscience*. 61, 477-484.
- Altman, J., Buchanan, G., Larsen, L., 2007. The environmental significance of the Indigenous estate: natural resource management as economic development in remote Australia. Centre for Aboriginal Economic Policy Research, ANU, Canberra.
- Altman, J., Jordan, K., Kerins, S., Buchanan, G., Biddle, N., Ens, E., May, K., 2009. Indigenous Interests in Land and Water. In: Stone, P. (ed). *Northern Australia Land and Water Science Review 2009*. Northern Australia Land and Water Taskforce, Canberra.
- Altman, J. C. 1982. Hunting buffalo in north-central Arnhem Land: a case of rapid adaptation among Aborigines. *Oceania*. 52, 274-285.
- Australian Government. 2013. <http://www.environment.gov.au/topics/land/nrs/about-nrs/ownership> Website accessed 9 December 2013.
- Baker, R., Davies, J., Young, E., 2001. *Working on Country Contemporary Indigenous Management of Australia's Lands and Coastal Regions*. Oxford University Press, Melbourne.
- Barber, M., Jackson, S., 2011. Aboriginal water values and resource development pressures in the Pilbara region of north-west Australia. *Aust Ab Stud*. 32-49.
- Barbour, W., Schlesinger, C., 2012. Who's the boss? Post-colonialism, ecological research and conservation management on Australian Indigenous lands. *Ecol Manage Rest*. 13, 36-41.
- Bark, R., Garrick, D., Robinson, C. J., Jackson, S., 2012. Adaptive basin governance and the prospects for meeting Indigenous water claims. *Environ Sci Pol*. 19-20,169-177.
- Basedow, H., 1929. Notes on the Aborigines and on the Geology of Arnhem Land. *Geogr J*. 74, 572-573.
- Baylie, W. H., 1843. On the Aborigines of the Goulburn district. *Port Phillip Mag*. 1, 89-91.
- Bayly, I. A. E., 1999. Review of how indigenous people managed for water in desert regions of Australia. *J Royal Soc West Australia*. 82, 17-25.

- Berkes, F., 1999. *Sacred Ecology: Traditional ecological knowledge and resource management*. Taylor and Francis, Philadelphia.
- Beveridge, P., 1889. *The Aborigines of Victoria and Riverina*. ML Hutchinson.
- Birckhead, J., Greiner, R., Hemming, S., Rigney, D., Rigney, M., Trevorrow, G., Trevorrow, T., 2011. *Economic and Cultural Values of Water to the Ngarrindjeri People of the Lower Lakes, Coorong and Murray Mouth*. River Consulting and CSIRO, Townsville.
- Bohensky, E. L., Maru, Y., 2011. *Indigenous Knowledge, Science, and Resilience: What Have We Learned from a Decade of International Literature on 'Integration'*. *Ecol Soc.* 16, Article 6.
- Bradley, J., 1988. *Yanyuwa country: the Yanyuwa people of Borroloola tell the history of their land*. Greenhouse.
- Bradley, J. J., 2005. 'Same time poison, same time good tucker': The cycad palm in the south west gulf of Carpentaria. *J Aust Stud.* 29, 119-133.
- Brennan, K. E. C., Twigg, P. J., Watson, A., Pennington, A., Sumner, J., Davis, R., Jackson, J., Brooks, B., Grant, F., Underwood, R., 2012. *Cross-cultural systematic biological surveys in Australia's Western Desert*. *Ecol Manage Rest.* 13, 72-80.
- Burbidge, A. A., 1992. *Book Review: Dorothy Tunbridge 1992. The story of the Flinders Ranges mammals*. *Aust Mam.* 15, 179-180.
- Burbidge, A. A., Johnson, K. A., Fuller, P. J., Southgate, R. I., 1988. *Aboriginal knowledge of the mammals of the central deserts of Australia*. *Wildlife Res.* 15, 9-39.
- Cary, J. J., 1899. *Vocabularies of the Geelong and Colac Tribes, Collected in 1840*. Australasian Association for the Advancement of Science.
- Cawthorne, W., 1885. *Sketch of the Aborigines of South Australia: their manners, customs, ceremonies, etc., with thirty illustrations taken upon the spot*. Mitchell Library Ms A 1447.
- Christie, M., 2006. *Transdisciplinary research and Aboriginal knowledge*. *The Australian J Indig Ed.* 35, 78-98.
- Christie, M., 2009. *Engaging with Australian Indigenous knowledge systems: Charles Darwin University and the Yolngu of northeast Arnhem Land*. *Learning Communities: Int J Learn Soc Contexts* 23-35.
- Clarke, P. A., 1985. *Fruits and seeds as food for southern South Australian Aborigines*. *J Anthropol Soc South Australia* 23:9-22.
- Clarke, P. A., 2007. *Aboriginal people and their plants*. Rosenberg Publishing, New South Wales.
- Clarke, P. A., 2009a. *Aboriginal culture and the Riverine environment*. In: Jennings, J. T. (Ed). *The Natural History of the Riverland and Murraylands*. Royal Soc South Australia, Adelaide.
- Clarke, P. A., 2009b. *Australian Aboriginal ethnometeorology and seasonal calendars*. *Hist Anthropol.* 20, 79-106.
- Clarke, P. A., 2012. *Australian plants and Aboriginal tools*. Rosenberg Publishing, New South Wales.
- Cleland, J., 1966. *The ecology of the Aboriginal in south and central Australia*. In: Cotton, B. C. (Ed). *Aboriginal Man in South and Central Australia*. Government Printer, Adelaide, pp. 111-158.
- Cleland, J. B., Johnston, T. H., 1937. *Notes on native names and uses of plants in the Musgrave Ranges region*. *Oceania.* 8, 208-215.
- Colchester, M., 1996. *Beyond "participation": Indigenous peoples, biological diversity conservation and protected area management*. UNASYLVA-FAO, pp. 33-39.
- Concerned Australians, 2011. *Walk with us: Aboriginal Elders call out to Australian people to walk with them in their quest for justice*. Concerned Australians, East Melbourne.
- CSIRO, 2012. *Unwelcome Strangers: Weeds on Aboriginal Country*. Film, 14mins, David Batty and Jeni McMahon, Reel Films.
- Curr, E. M., 1883. *Recollections of Squatting in Victoria, then called the Port Phillip District (from 1841 to 1851)*. Robertson.
- Davies, J., 2007. *Walking together, working together: Aboriginal research partnerships*. Desert Knowledge CRC, Alice Springs.

- Davies, J., Campbell, D., Campbell, M., Douglas, J., Hueneke, H., LaFlamme, M., Pearson, D., Preuss, K., Walker, J., Walsh, F., 2011. Attention to four key principles can promote health outcomes from desert Aboriginal land management. *Rangeland J.* 33, 17-431.
- Davies, J., Higginbottom, K., Noack, D., Ross, H., Young, E., 1999. *Sustaining Eden: Indigenous community based wildlife management in Australia.* International Institute for Environment and Development, London.
- Dawson, J., 1881. *Australian Aborigines: the languages and customs of several tribes of Aborigines in the Western District of Victoria, Australia.* G. Robertson.
- Desert Knowledge Cooperative Research Centre, 2008. *Protocol for Aboriginal Knowledge and Intellectual Property.* DKCRC, Alice Springs.
- Dhamarrandjai, D., Guyamirrilili, Y., 1979. Medicinal plants on Elcho Island. *Ab Islander Health Worker J.* pp. 3:50.
- Dobson, V., 2007. *Arelhe-kenhe Merrethene: Arrernte traditional healing.* IAD Press, Alice Springs.
- Drew, J. A., Henne, A. P., 2006. Conservation biology and traditional ecological knowledge: integrating academic disciplines for better conservation practice. *Ecol Soc.* 11, Article 34.
- Durette, M., 2008. *Indigenous Legal Rights in Freshwater: Australia in the International Context.* CAEPR WORKING PAPER No. 42/2008, Australian National University, Canberra.
- Edwards, G. P., Zeng, B., Saalfeld, W. K., Vaarzon-Morel, P., McGregor, M., 2008. *Managing the impacts of feral camels in Australia: a new way of doing business.* Desert Knowledge Cooperative Research Centre, Alice Springs.
- Ens, E., 2012. Conducting two-way ecological research. In: Altman, J., Kerins, S. (Eds). *People on Country, Vital landscapes, Indigenous futures.* Federation Press, Sydney, pp. 45-64.
- Ens, E. J., Burns, E., Russell-Smith, J., Sparrow, B., Wardle, G. M., 2014. The cultural imperative: Broadening the vision of long-term monitoring to enhance environmental policy and management outcomes. In: Lindenmeyer, D., Burns, E., Thurgate, N., Lowe, A. J. (Eds). *Biodiversity and Environmental Change: Monitoring, Challenges and Direction.* CSIRO Publishing, Collingwood.
- Ens, E. J., Finlayson, C. M., Preuss, K., Jackson, S., Holcombe, S., 2012. Australian approaches for managing 'country' using Indigenous and non-Indigenous knowledge. *Ecol Manage Rest.* 13, 100-107.
- Eyre, E. J., 1845. *Journals of expeditions of discovery into central Australia, and overland from Adelaide to King George's Sound, in the years 1840-1.* T. and W. Boone.
- Eversole, R., McNeish, J. A., Cimadamore, A. D., 2005. *Indigenous Peoples and poverty: An international perspective.* Zed Books, London.
- Gadgil, M., Berkes, F., Folke, C., 1993. Indigenous knowledge for biodiversity conservation. *Ambio.* 22, 151-156.
- Gaikwad, J. 2011. *Digitisation and analysis of customary medicinal plant knowledge using biodiversity informatics.* PhD. Thesis. Macquarie University: Sydney, Australia.
- Gaikwad, J., Wilson, P. D., Ranganathan, S. 2011. Ecological niche modelling of customary medicinal plant species used by Australian aborigines to identify species-rich and culturally valuable areas for conservation. - *Ecol. Modelling* 222: 3437-3443
- Garde, M., Nadjamerrek, B. L., Kolkiwarra, M., Kalarriya, J., Djandjomerr, J., Birriyabirriya, B., Bilindja, R., Kubarku, M., Biless, P., 2009. The language of fire: seasonality, resources and landscape burning on the Arnhem Plateau. In: Russell-Smith, J., Whitehead, P., Cooke, P. (Eds), *Culture, Ecology and Economy of Fire Management in North Australian Savannas.* CSIRO Publishing, Collingwood, pp. 85-164.
- Gill, A. M., Groves, R. H., 1981. *Fire and the Australian Biota.* Australian Academy of Science, Canberra.
- Grech, A., Pressey, R., Marsh, H., Ens, E., In prep. Conservation planning and the maintenance of cultural and natural heritage: An Australian case study.
- Green, D., Billy, J., Tapim, A., 2010. Indigenous Australians' knowledge of weather and climate. *Climatic Change.* 100, 337-354.

- Green, D., King, U., Morrison, J., 2009. Disproportionate burdens: the multidimensional impacts of climate change on the health of Indigenous Australians. *Med J Aust.* 190, 4-5.
- Green, D., Raygorodetsky, G., 2010. Indigenous knowledge of a changing climate. *Climatic Change.* 100, 239-242.
- Grice, A. C., Cassady, J., Nicholas, D. M., 2012. Indigenous and non-Indigenous knowledge and values combine to support management of Nywaigi lands in the Queensland coastal tropics. *Ecol Manage Rest.* 13, 93-97.
- Griffiths, A. D., Philips, A., Godjuwa, C., 2003. Harvest of *Bombax ceiba* for the Aboriginal arts industry, central Arnhem Land, Australia. *Biol Conserv.* 113, 295-305.
- Guston, D. H., 2001. Boundary organizations in environmental policy and science: an introduction. *Sci Technol Hum Val.* 26, 399-408.
- Hale, H. M., Tindale, N. B., 1925. *Observations on Aborigines of the Flinders Ranges and Records of Rock Carvings and Painting.* Hassell Press, Adelaide.
- Harmon, D., 2007. A Bridge over the Chasm: Finding Ways to Achieve Integrated Natural and Cultural Heritage Conservation. *Int J Heritage Stud.* 13, 80 - 392.
- Haynes, C. D., 1985. The pattern and ecology of munwag: traditional Aboriginal fire regimes in north-central Arnhem Land. *Proc Ecol Soc Aust,* pp. 203-214.
- Hemming, S., Rigney, D., Wallis, L., Trevorrow, T., Rigney, M., Trevorrow, G., 2007. Caring for Ngarindjeri country: Collaborative research, community development and social justice. *Indig Law Bull.* 6, 6-8.
- Henshall, T., Jambijinpa, D., Kelly, F., Bartlett, P., Granites, L., Price, J., Coulshed, E., Robertson, G., 1980. *Ngurrju Maninja Kurlangu. Yapa Nyurnu Kurlangu. Bush Medicine.* Warlpiri Literature Production Centre, Yuendumu, NT.
- Hill, R., Baird, A., Buchanan, D., Denman, C., Fischer, P., Gibson, K., Johnson, J., Kerry, A., Kulka, G., Madsen, E., 2004. *Yalanji-Warranga Kaban: Yalanji people of the rainforest fire management book.* Little Ramsay Press.
- Hill, R., Buchanan, D., Baird, A., 1999. Aborigines & Fires in the Wet Tropics of Queensland, Australia: Ecosystem Management Across Cultures. *Soc Natur Resour.* 12, 205-223.
- Hill, R., Cullen-Unsworth, L. C., Talbot, L. D., McIntyre, S., 2011a. Empowering Indigenous peoples' biocultural diversity through world heritage cultural landscapes: A case study from the Australian tropical forests. *Int J Heritage Stud.* 17, 571-590.
- Hill, R., Grant, C., George, M., Robinson, C. J., Jackson, S., Abel, N., 2012. A typology of Indigenous engagement in Australian environmental management: Implications for knowledge integration and social-ecological system sustainability. *Ecol Soc.* 17, Article 23.
- Hill, R., Pert, P. L., Davies, J., Robinson, C. J., Walsh, F., Falco-Mammone, F., 2013. Indigenous Land Management in Australia: Extent, scope, diversity, barriers and success factors. *CSIRO Ecosystem Services,* Cairns.
- Hill, R., Smyth, D., 1999. Collaborative environmental research with Kuku–Yalanji people in the wet tropics of Queensland World Heritage Area, Australia. In: Posey, D. (Ed), *Cultural and Spiritual Values of Biodiversity.* United Nations Environment Programme, Intermediate Technology Publications, London, pp. 227-232.
- Hill, R., Turpin, G., Canendo, W., Standley, P-M., Crayn, D., Warne, S-J., Keith, K., Addicott, E., Zich, F., 2011b. Indigenous-driven tropical ethnobotany. *Australasian Plant Conserv.* 19, 24-25.
- Hoffmann, B. D., Roeger, S., Wise, P., Dermer, J., Yunupingu, B., Lacey, D., Yunupingu, D., Marika, B., Marika, M., Panton, B., 2012. Achieving highly successful multiple agency collaborations in a cross-cultural environment: Experiences and lessons from Dhimurru Aboriginal Corporation and partners. *Ecol Manage Rest.* 13, 42-50.
- Hoogenraad, R., Robertson, G. J., 1997. Seasonal calendars from central Australia. *Windows on Meteorology. Australian Perspective,* pp. 34-41.
- Horstman, M., Wightman, G., 2001. *Karparti* ecology: Recognition of Aboriginal ecological knowledge and its application to management in north-western Australia. *Ecol Manage Rest.* 2, 99-109.

- Howitt, A. W., Fison, L., 1880. Kamilaroi and Kurnai. Robertson, Melbourne.
- Howitt, R. 2001. Rethinking resource management: Justice, sustainability and indigenous peoples. Routledge.
- Howitt, R., Suchet-Pearson, S., 2006. Rethinking the building blocks: Ontological pluralism and the idea of management. *Geogr Ann B.* 88, 323-335.
- Humphries, P., 2007. Historical Indigenous use of aquatic resources in Australia's Murray-Darling Basin, and its implications for river management. *Ecol Manage Rest.* 8, 106-113.
- Huntington, H. P., 2000. Using traditional ecological knowledge in science: Methods and applications. *Ecol Appl.* 10, 1270-1274.
- Jackson, S., 2004. Preliminary report on Aboriginal perspectives on land-use and water management in the Daly River region, Northern Territory. CSIRO.
- Jackson, S., Morrison, J., 2007. Indigenous perspectives in water management, reforms and implementation. In: Hussey, K., Dovers, S. (Eds), *Managing water for Australia: the social and institutional challenges.* CSIRO Publishing, Collingwood, pp. 22-41.
- Jackson, S., Storrs, M., Morrison, J., 2005. Recognition of Aboriginal rights, interests and values in river research and management: perspectives from northern Australia. *Ecol Manage Rest.* 6, 107-110.
- Janke, T., 2009. Report on the Current Status of Indigenous Intellectual Property. Terri Janke and Company Pty Ltd, National Centre for Indigenous Studies Australian National University and Jumbunna Indigenous House of Learning University of Technology Sydney, Canberra.
- Janke, T., Frankel, M., 1998. Our culture our future: report on Australian indigenous cultural and intellectual property rights. Michael Frankel, Sydney.
- Jones, R., 1969. Fire-stick farming. *Aust Natur History.* 16, 224-228.
- Kareiva, P., Marvier, M., 2003. Conserving Biodiversity Coldspots: Recent calls to direct conservation funding to the world's biodiversity hotspots may be bad investment advice. *Am Sci* 91: 344-351.
- Kennett, R., M. Jackson, J. Morrison, and J. Kitchens. 2010. Indigenous rights and obligations to management traditional land and sea estates in north Australia: the role of Indigenous rangers and the I-tracker project. *Policy Matters* 17:135-142.
- Kennett, R., Yunupingu, D., Wunungmurra, B., Mununguritj, N., Marika, R., 1997. *Nhaltjan Nguli Miwatj Yolngu Djaka Miyapunuwu: Sea Turtle conservation and the Yolngu People of North East Arnhem Land, Australia.* Sinauer Assoc. Inc., Massachusetts
- LaFlamme, M., 2011. A framework for sustainable rangeland livelihoods. *Rangeland J.* 33, 339-351.
- Langton, M., Rhea, Z. M., 2005. Traditional Indigenous Biodiversity-related Knowledge. *Aust Academic & Research Libraries.* 36, 45-69.
- Latz, P. K., Green, J., 1995. *Bushfires and bushtucker: Aboriginal plant use in central Australia.* IAD Press, Alice Springs.
- Leichhardt, L., 1847. *Journal of an overland expedition in Australia, from Moreton Bay to Port Essington, a distance of upward of 3000 miles, during the years 1844-1845.* T. & W. Boone, London (reprinted 2000, Adelaide, Corkwood Press).
- Leonard, S., Parsons, M., Olawsky, K., Kofod, K., 2013. The role of culture and traditional knowledge in climate change adaptation: Insights from East Kimberley, Australia. *Global Environ Chang.* 23, 623-632.
- Maffi, L., Woodley, E., 2010. *Biocultural diversity conservation: A global sourcebook.* Earthscan/James & James.
- Marika, M., Roeger, S., 2012. Dhimurru wind bringing change. In: Altman, J., Kerins, S. (Eds), *People on Country, Vital landscapes, Indigenous futures.* Federation Press, Sydney, pp. 119-131.
- Marika, R., Yunupingu, Y., Marika-Munungiritj, R., Muller, S., 2009. Leaching the poison - The importance of process and partnership in working with Yolngu. *J Rural Stud.* 25, 404-413.
- Maru, Y., Davies, J., 2011. Supporting cross-cultural brokers is essential for employment among Aboriginal people in remote Australia. *Rangeland J.* 33, 327-338.

- McConvell, P., Thieberger, N., 2001. State of Indigenous languages in Australia—2001. Environment Australia. Canberra: Department of the Environment and Heritage.
- McConvell, P., Thieberger, N., 2006. Keeping track of Indigenous language endangerment in Australia. In: Cunningham, D., Ingram, D. E., Sumbuk, K. (Eds), Language diversity in the Pacific: Endangerment and survival. Multilingual Matters, Clevedon, UK.
- Moritz, C., Ens, E., Potter, S., Catullo, R., In press. The Australian monsoonal tropics: A unique opportunity to secure biodiversity benefits and secure benefits for Aboriginal communities. *Pac Conserv Biol*.
- Muhic, J., Abbott, E., Ward, M. J., 2012. The warru (*Petrogale lateralis* MacDonnell Ranges Race) reintroduction project on the Anangu Pitjantjatjara Yankunytjatjara Lands, South Australia. *Ecol Manage Rest*. 13, 89-92.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., Kent, J., 2000. Biodiversity hotspots for conservation priorities. *Nature*. 403, 853-858.
- Nabarula, A. D., Nabarnardi, C. F., Nambijimba, E. R., Nungari, S. P., 1978. Bush Medicines Used at Warrabri. *Ab Islander Health Worker J*. 2, 12.
- Nakata, M., Langton, M., 2006. Australian Indigenous Knowledge and Libraries. UTSePress, Sydney.
- Nakata, M., Byrne, A., Nakata, V., Gardiner, G., 2006. Indigenous Knowledge, the Library and Information Service Sector, and Protocols. In: Nakata, M., Langton, M., (Eds), Australian Indigenous Knowledge and Libraries. UTSePress, Sydney, pp. 7-20.
- Nakata, M. N., 2007. Disciplining the savages, savaging the disciplines. Aboriginal Studies Press, Canberra.
- Natural Resource Management Ministerial Council (NRMMC), 2010. Australia's Biodiversity Conservation Strategy 2010-2030. Australian Government, Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Neidjie, B., 2002. Gagadju Man: Kakadu National Park, Northern Territory, Australia. JB Books. South Australia.
- Ohl, C., Swinton, S. M., 2010. Integrating Social Sciences into Long-Term Ecological Research. In: Müller, F., Baessler, C., Schubert, H., Klotz, S. (Eds), Long-term ecological research: Between theory and application. Springer, Netherlands, pp. 399-410.
- Orton, J., 1836. The Aborigines of Australia. Thomas, London.
- Packer, J., Brouwer, N., Harrington, D., Gaikwad, J., Jamie, J., Vemulpad, S., Yaegl Community Elders, 2011. Yaegl medicinal and plant resources handbook. Macquarie Lighthouse Press, North Ryde.
- Palmer, E., 1884. On Plants Used by the Natives of North Queensland, Flinders and Mitchell Rivers, for Food, Medicine, Etc. Government Printer, South Africa.
- Petheram, L., Zander, K. K., Campbell, B. M., High, C., Stacey, N., 2010. 'Strange changes': Indigenous perspectives of climate change and adaptation in NE Arnhem Land (Australia). *Global Environ Chang*. 20, 681-692.
- Rands, M. R. W., Adams, W. M., Bennun, L., Butchart, S. H. M., Clements, A., Coomes, D., Entwistle, A., Hodge, I., Kapos, V., Scharlemann, J. P. W., Sutherland, W. J., Bhaskar, V., 2010. Biodiversity Conservation: Challenges Beyond 2010. *Science*. 329, 1298-1303.
- Read, J. L., Ward, M. J., 2011. Bringing back warru: initiation and implementation of the South Australian Warru Recovery Plan. *Aust. Mam*. 33, 214-220.
- Rist, S., Boillat, S., Gerritsen, P. R. W., Schneider, F., Mathez-Stiefel, S. L., Tapia, N. 2011. Endogenous knowledge: Implications for sustainable development. In: Wiesmann, U., Hurni, H. (Eds), Research for Sustainable Development: Foundations, Experiences, and Perspectives. Perspectives of the Swiss National Centre of Competence in Research (NCCR) North-South. University of Bern, Bern, Switzerland, pp. 119-146.
- Roberts, G. J., Conway, S. Y., Morgan, R., Dirn.gayg, A., Harris, S., Farrar, E. B., Roberts, F. B., Merlan, F., Collyer, E., Calnan, T., Wightman, G., 2011. Mangarrayi and Yangman Plants and Animals: Aboriginal biocultural knowledge from Elsey and the Roper River, north

- Australia. Department of Natural Resources, Environment, the Arts and Sport, Diwurruwurru-Jaru Aboriginal Corporation and Mimi Aboriginal Art and Craft, Darwin.
- Roberts, R. G., Jones, R., Spooner, N. A., Head, M. J., Murray, A. S., Smith, M. A., 1994. The human colonisation of Australia: optical dates of 53,000 and 60,000 years bracket human arrival at Deaf Adder Gorge, Northern Territory. *Quaternary Sci Rev.* 13, 575-583.
- Robinson, C., J., Wallington, T., 2012. Boundary Work: Engaging Knowledge Systems in Co-management of Feral Animals on Indigenous Lands. *Ecol Soc.* 17, Article 2.
- Robinson, C. J., Smyth, D., Whitehead, P. J., 2005. Bush Tucker, Bush Pets, and Bush Threats: Cooperative Management of Feral Animals in Australia's Kakadu National Park. *Conserv Biol.* 19, 1385-1391.
- Rose, B., 1995. Land management issues: attitudes and perceptions amongst Aboriginal people of central Australia. Central Land Council, Alice Springs.
- Rose, D., Clarke, A., 1997. Tracking knowledge in Northern Australian landscapes: studies in indigenous and settler ecological knowledge systems. Australian National University, Northern Australian Research Unit, Darwin.
- Rose, D. B., 2000. Dingo makes us human: life and land in an Australian Aboriginal culture. Cambridge University Press.
- Ross, M. C., 1986. Australian Aboriginal oral traditions. *Oral Tradition* 1:231-271.
- Roth, W. E., 1897. *Ethnological Studies among the North-West-Central Queensland Aborigines.* Brisbane and London.
- Roth, W. E., 1910. North Queensland Ethnography. Bulletin No. 16. Huts and shelters. *Records of the Aust Museum.* 8, 55.
- Russell-Smith, J., Lucas, D., Gapindi, M., Gunbunuka, B., Kapirogi, N., Namingum, G., Lucas, K., Giuliani, P., Chaloupka, G., 1997. Aboriginal resource utilisation and fire management practice in western Arnhem Land, monsoonal northern Australia: notes for prehistory, lessons for the future. *Hum Ecol.* 25, 159-195.
- Russell-Smith, J., Whitehead, P. J., Cooke, P., 2009. Culture, ecology and economy of fire management in northern Australian savannas: Rekindling the Wurrk tradition. CSIRO Publishing, Collingwood.
- Sachs, J. D., Baillie, J. E. M., Sutherland, W. J., Armsworth, P. R., Ash, N., Beddington, J., Blackburn, T. M., Collen, B., Gardiner, B., Gaston, K. J., Godfray, H. C. J., Green, R. E., Harvey, P. H., House, B., Knapp, S., Kampel, N. F., Macdonald, D. W., Mace, G. M., Mallet, J., Matthews, A., May, R. M., Petchey, O., Purvis, A., Roe, D., Safi, K., Turner, K., Walpole, M., Watson, R., Jones, K. E., 2009. Biodiversity Conservation and the Millennium Development Goals. *Science.* 325, 1502-1503.
- Scott, G., 2004. *A bibliography of Indigenous Ecological Knowledge in northern Australia.* Charles Darwin University, Darwin.
- Shackeroff, J. M., Campbell, L. M., 2007. Traditional Ecological Knowledge in Conservation Research: Problems and Prospects for their Constructive Engagement. *Conserv Soc.* 5, 343-360.
- Smith, N., 2000. Not from here: Plant invasions on Aboriginal lands of the Top End. Tropical Savannas CRC, Darwin.
- Smyth, D., 1981. Aboriginal Occupation of Inland Cape York Peninsula. Australian Institute of Aboriginal Studies Newsletter.
- Smyth, D., 1994. Understanding Country. The Importance of Land and Sea in Aboriginal and Torres Strait Islander Societies. Council for Aboriginal Reconciliation Key Issues Paper No. 1. Australian Government Publishing Service, Canberra.
- Smyth, D., 2007. Dhimurru Indigenous Protected Area: sole management with partners. In: Bauman, T., Smyth, D. (Eds), *Indigenous partnerships in protected area management in Australia: Three case studies* Australian Institute of Aboriginal and Torres Strait Islander Studies in association with the Australian Collaboration and the Poola Foundation (Tom Kantor Fund), Canberra, pp. 100-126.

- Southgate, R. I., Moseby, K., 2008. Track-based monitoring for the deserts and rangelands of Australia. Threatened Species Network, WWF-Australia.
- Specht, R. L., Mountford, C. P., 1958. Records of the American-Australian Expedition into Arnhem Land, Vol 3: Botany and Plant Ecology. Melbourne University Press, Melbourne.
- Storrs, M. J., Kenyon, A., Lonsdale, W. M., 1996. Strategic weed management for the Aboriginal Lands of the Top End. Eleventh Australian Weeds Conference Proceedings. Weed Science Society of Victoria, Melbourne, pp. 402-407.
- Szabo, S., Smyth, D., 2003. Indigenous Protected Areas in Australia: incorporating indigenous owned land into Australia's national system of protected areas. In: Jaireth, H., Smyth, D. (Eds). Innovative governance: Indigenous peoples, local communities and protected areas. Ane Books, New Delhi, pp. 145-164.
- Telfer, W. R., Garde, M. J., 2006. Indigenous knowledge of rock kangaroo ecology in western Arnhem Land, Australia. *Human Ecol.* 34, 379-406
- Thomson, D. F., 1939. The seasonal factor in human culture: illustrated from the life of a contemporary nomadic group.
- Tindale, N. E., 1974. Tribal boundaries in Aboriginal Australia. [Catalogue to Map] Aboriginal tribes of Australia, their terrain, environmental controls, distribution, limits and proper names. South Australian Museum.
- Trigger, D. S., 2008. Indigeneity, ferality, and what 'belongs' in the Australian bush: Aboriginal responses to 'introduced' animals and plants in a settler-descendant society. *J Royal Anthropol Inst.* 14, 628-646.
- Tunbridge, D., 1992. The story of the Flinders Ranges mammals. Kangaroo Press, Sydney.
- Turner, M. K., McDonald, B., 2010. Iwenhe Tyerrtye - what it means to be an Aboriginal person. IAD Press, Alice Springs.
- Van der Ploeg, J. D., Long, A., 1994. Born from within: practice and perspectives of endogenous rural development. Van Gorcum Publishers, Assen, The Netherlands.
- Walsh, F., Douglas, J., 2011. No bush foods without people: the essential human dimension to the sustainability of trade in native plant products from desert Australia. *Rangeland J.* 33, 395-416.
- Walsh, F., Mitchell, P., 2002. Planning for country: cross-cultural approaches to decision making on Aboriginal lands. Jukurrpa Books/IAD Press, Alice Springs.
- Weir, J. K., 2009. Murray River Country An ecological dialogue with traditional owners. Aboriginal Studies Press, Canberra, Australia.
- Wightman, G. M., Brown, J., Conservation Commission of the Northern Territory, Jawoyn Association, 1994. Jawoyn plant identikit: common useful plants in the Katherine area of Northern Australia. Conservation Commission of the Northern Territory, Darwin.
- Wightman, G. M., Smith, N. M., 1989. Ethnobotany, vegetation and floristics of Milingimbi, Northern Australia. Darwin.
- Wohling, M., 2009. The problem of scale in Indigenous knowledge: A perspective from northern Australia. *Ecology and Society* 14:Article 1.
- Woinarski, J. C. Z., Pavey, C., Kerrigan, R., Cowie, I., Ward, S., 2007. Lost from our landscape: Threatened species of the Northern Territory. Northern Territory Government, Palmerston, Northern Territory.
- Woodward, E., Jackson, S., Finn, M., McTaggart, P. M., 2012. Utilising Indigenous seasonal knowledge to understand aquatic resource use and inform water resource management in northern Australia. *Ecol Manage Rest.* 13, 58-64.
- WTAPPT, 2005. Caring for Country and Culture - The Wet Tropics Aboriginal Cultural and Natural Resource Management Plan. Wet Tropics Aboriginal Plan Project Team, Rainforest CRC and FNQ NRM Ltd., Cairns.
- Yibarbuk, D., Whitehead, P. J., Russell-Smith, J., Jackson, D., Godjuwa, C., Fisher, A., Cooke, P., Choquenot, D., Bowman, D. M. J. S., 2001. Fire ecology and Aboriginal land management in central Arnhem Land, northern Australia: a tradition of ecosystem management. *J Biogeog.* 28, 325-343.

- Yanyuwa families, Bradley, J., Kirton, J., MacDonald, E., 2013. Wuka nya-nganunga li-Yanyuwa li-Anthawirriyarra: Language for us, the Yanyuwa Saltwater People. A Yanyuwa Encyclopaedic Dictionary. Australia Scholarly Publishing, Melbourne.
- Young, E., 1987. Resettlement and caring for the country: the Anmatyerre experience. *Ab History* 11:156-170.
- Yunupingu, D., Muller, S., 2009. Cross-cultural challenges for Indigenous sea country management in Australia. *Australasian J Environ Manage* 16, 158-167.
- Ziembicki, M., Woinarski, J., Mackey, B., 2013. Evaluating the status of species using Indigenous knowledge: Novel evidence for major native mammal declines in northern Australia. *Biol Conserv.* 157, 78-92.