GeoJournal
DOI 10.1007/s10708-009-9279-4

Desert knowledge: integrating knowledge and development in arid and semi-arid drylands

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Abstract Globalisation presents particular challenges for deserts given that their sparse populations, which are amongst the world's poorest in an absolute economic sense, tend to be remote from major markets and have only a distant, marginal voice in political and policy decision making. Here we are defining deserts as the arid and semi-arid drylands that encompass 70% of Australia and 25% of the world's land surfaces. The value of the knowledge that local traditions and science have generated about living sustainably in deserts is being promoted and extended through the 'desert knowledge' movement in Australia. The Australian research reported here, together with a contribution from Niger that offers a contrast and some lessons for Australia, is largely underpinned by a neopopulist paradigm of development stressing respect for local knowledge, participatory practice and empowerment. Research in partnership with desert Aboriginal groups is contributing to their engagement with new livelihood opportunities. The local knowledge of livestock graziers is also being engaged to support sustainable management of desert water sources and landscapes for multiple values. The research reported here also addresses opportunities and challenges for local norms, identities, knowledge systems, governance and livelihoods from broader scale processes and institutions. In doing so it contributes to a 'neo-ideographic approach' wherein desert people might better harness their locality, knowledge and diversity in adaptations that shape their encounters with globalisation. It also points to considerable scope to mature such an approach.

Keywords Desert · Rangeland · Neo-populism · Traditional knowledge · Local knowledge · Globalisation · Neo-ideographic · Poverty reduction · Multi-functionality · Australia · Niger · Aboriginal · Indigenous

The 'desert knowledge movement' in Australia is asserting and building the value of the knowledge that local traditions and science have generated about living sustainably in deserts—the arid and semi-arid drylands[1] that encompass 70% of Australia and 25% of the world's land surfaces. This special issue focuses mainly on research from that vibrant Australian movement. However, it opens with a contribution from Niger which offers a valuable contrast given the vast differences in institutions and other aspects of livelihood systems between sub-Saharan Africa and

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[1] Defined by the ratio of precipitation to evaporation being 0.20–0.50 for semi-arid areas and 0.05–0.20 for arid (less than 0.05 being hyper-arid, with no such areas in Australia). (Middleton and Thomas 1997, Safriel et al. 2005 in Stafford Smith 2008).

Published online: 21 March 2009

the remote[2] regions of a developed nation like Australia. The Niger experience of transforming livelihoods through innovative use of local assets and close attention to both governance and technical dimensions of production systems also offers lessons for practice in Australia and elsewhere.

The 'desert knowledge movement'

The stimulus in central Australia for the 'desert knowledge movement' (www.desertknowledge.com.au) was recognition amongst Aboriginal and non-Aboriginal leaders of the importance of asserting the value of knowledge of how to live well and sustainably in arid regions, and continuing to build that knowledge. Contemporary use of the term 'desert' to refer to Australia's arid regions harks to a long tradition notoriously established by Griffith Taylor, widely acknowledged as the founder of geography as a discipline in Australia (Powell 1999). In the early twentieth century, when fervently nationalistic politicians were proclaiming Australia's capacity to attract and sustain 100 million people, Taylor fearlessly labelled Australia's interior and her arid coasts as 'desert'. He compared their environment to the Sahara, showed that almost half of Australia had less than 10,000 settlers (together with an Aboriginal population that did not figure in any national census until 1969) and presciently (O'Connor and Lines 2008) forecast that the nation as a whole could not, on environmental grounds, sustain more than 20 million people (Powell 1992; Strange and Bashford 2008). He used 'desert' to simply mean 'a region where the average rainfall is below a certain figure' (Taylor 1924 in Strange and Bashford 2008, p. 126) notwithstanding populist protest that the term compromised the prospect of attracting more settlers and developing the new Australian nation.

Use of the term 'desert' in the contemporary 'desert knowledge' movement is on the one hand a recognition, like Griffith Taylor's, of the low, highly variable and uncertain rainfall in these regions and of the limits this places on human endeavour. However it also moves self-consciously beyond an environmental description. As an ideograph, 'desert' celebrates place, identity, adaptation and commitment to growing prosperity amongst the sparse populations of arid and semi-arid regions through knowhow, systems and technologies that are appropriate to and sustainable in these environments.

The papers in this special issue present applied research and several are authored or co-authored by practitioners. As this indicates, efforts to inform policy and practice, including by directly engaging government and practitioners in research, have been integral in the growth of the 'desert knowledge movement'. The work of Desert Knowledge Cooperative Research Centre (DKCRC) has also been central. DKCRC is an unincorporated joint venture whose initial term runs from 2003 to 2010 with the goal of enhancing knowledge for sustainable livelihoods, stronger remote settlements, thriving regional economies and increased human and social capital in arid and semi-arid Australia. It is supported by resources from more than 20 partner organisations and from the Australian Government's Cooperative Research Centre programme. All but two of the papers in this special issue derive from DKCRC research projects. Other authors (Tougiani et al. 2009; Clark and Brake 2009) are linked less formally to the expansive desert knowledge network. Most of the papers were developed from presentations made at a desert knowledge session of the International Geographical Union Regional Conference, Brisbane, July 2006 or at the 2nd Desert Knowledge Symposium, Alice Springs, November 2006.

The papers approach knowledge, and its application in development, within a neopopulist paradigm (Blaikie et al. 1997; De Haan 2000), emphasising respect for local knowledge, participatory practice and empowerment. Here we introduce the papers in two broad themes. Four of the Australian papers (Cunningham et al. 2009; Evans et al. 2009; Moran and Elvin 2009; Singleton et al. 2009) together with Tougiani et al.'s paper from Niger are concerned with efforts to reduce poverty and disadvantage by engaging local knowledge and resources equitably,

[2] Unless otherwise specified, we use 'remote' to encompass both the 'remote' and 'very remote' categories that are identified in the Accessibility/Remoteness Index of Australia (ARIA) (ABS 2006). ARIA provides the standard geographical classification for remoteness in Australia based primarily on accessibility to services. The vast proportion of Australia's arid zone is classed as 'very remote' by ARIA, whereas land in the vicinity of the larger arid zone towns, and much of the land in semi-arid Australia, is classed as 'remote'.

and by promoting institutional change. The other group of four papers are concerned with understanding the diverse knowledge systems of desert people (Clark and Brake 2009; Maclean 2009; Vaarzon-Morel and Gabrys 2009), or tourists (Hueneke and Baker 2009), in order to promote collaborative management of the multi-functional desert landscapes of Australia.

The settings for many of the papers are 'glocalised' (Robertson 1995 in De Haan 2000, p. 365): researchers are collaborating with local people to harness distinctive elements of their knowledge of, and relationships with, desert environments and thereby supporting them to shape their encounters with extra-local, if not globalised, drivers and opportunities. As such the research reported here contributes to the kind of 'neo-ideographic' approach that De Haan (2000, p. 367) compellingly argues is urgently needed in this era of globalisation. However, that contribution often remains latent and embryonic, presenting significant opportunity for maturing such an approach.

The context of Australian deserts

Deserts are home to 18.5% of the world's population (Safriel et al. 2005). Stafford Smith (2008) builds from Reynolds et al. (2007) and synthetic research on the 'science of desert living' (Stafford Smith et al. 2008a) to argue that the remoteness of desert people from political centres and major markets makes them vulnerable not only to climatic variability and uncertainty, but also to institutional changes over which they can exercise little influence. The potential is for a self-perpetuating cycle, where sparse populations are trapped in poverty by decisions at larger scales that ignore local specificities (Stafford Smith 2008). Arguably this potential is already realised in that desert populations are the world's poorest, in an absolute economic sense, with the worst indicators for human well-being and development of any of the world's biomes (MEA 2005). As De Haan and Zoomers (2003, p. 359) put it: "the majority of the poor are located in the wrong place" to get livelihood benefits from globalisation. Instead, they are "in marginal and isolated areas that lack resources and infrastructure" (De Haan and Zoomers 2003, p. 359). Many such regions are deserts. In Australian deserts, poverty is particularly problematic amongst Aboriginal people, though it is not necessarily restricted to them. Indeed Australian rangelands, which include desert regions as well as the wet dry tropical savannas, are distinguished from non-rangeland areas by socioeconomic disadvantage (Bastin and ACRIS Management Committee 2008).

Only about 3% of Australia's 21 million people (in 2008) live in the 70% of Australia that is desert (Brown et al. 2008). Population densities are very low, averaging 0.05 persons/km^2 in arid regions and 0.23 in semi-arid. About half of the population of the arid regions lives in five regional service and mining centres with populations of 10,000–30,000 each. Aboriginal people, of diverse language groups, comprise a higher proportion of the population in deserts than in more densely settled parts of Australia, being more than 20% of the population in arid regions and up to 12% in semi-arid regions (and 2.5% of the total Australian population). In arid regions they comprise the vast majority of the population outside major towns. However these Aboriginal populations are not large: 38,000 Aboriginal people live in arid Australia, and 55,000 in semi-arid regions. Aboriginal populations tend to be growing and non-Aboriginal populations tend to be declining although there are considerable differences between regions in the trends (Brown et al. 2008).

Different parts of the Australian desert show a different mix of commodity or amenity orientations according to their pastoral productivity, mining activity, and accessibility to urban populations and tourists (Holmes 1997, 2002, 2008). Some 30%[3] of Australia is now recognised as being owned by Aboriginal and Torres Strait Islander peoples. Almost all (>98%) of that land is in the remoter parts of the nation and about 80% of it is in arid regions (SCRGSP 2007). Generally, as Holmes (2002) has noted, there is an inverse relationship between productivity of arid lands for livestock industries and recognition of Aboriginal property rights.

[3] The figure includes 8.2% of Australia (11.1% of 'very remote' Australia (sensu ABS 2006) where native title has been determined to exist in full or part, and over 15% of Australia (and 21.5% of 'very remote' Australia) which is owned and controlled by Aboriginal or Torres Strait Islander corporations or trusts, or is held by governments on behalf of Aboriginal people (and in most cases leased to Aboriginal corporations) (SCRGSP 2007, pp. 11.29–11.33).

The United Nations Environment Program (2006) has concluded that the Australian arid regions have by far the lowest human footprint of any in the world. Australia's deserts are characterised by diverse shrublands, savannas and ephemeral or saline wetlands. In this special issue, the contrast in landscape functionality and biodiversity between Australia, the Sahel and western China can be glimpsed through Tougiani et al.'s paper from Niger and the review by Davies (2009) of Ding's monograph from a photovoice project in Inner Mongolia. Nevertheless, a considerable loss of biodiversity has occurred in Australia's deserts, particularly amongst the fauna (Morton 1990). This is continuing (Woinarski and Fisher 2003; Bastin and ACRIS Management Committee 2008). Although there is economic and ecological advantage in retaining the comparatively intact condition of these regions, doing so is a major challenge (Foran 2007). Aboriginal languages and culture are also under threat. Of more than 250 Australian languages originally spoken, only 18 are still being routinely transmitted between generations. All of these are in remote Australia, half in desert Australia (AIATSIS and FATSIL 2005; Stafford Smith 2008), and some are declining and at risk of becoming endangered (AIATSIS and FATSIL 2005).

Poverty reduction in Australia and Niger

The context of many of the papers in this special issue is the effort of non-local actors to enhance and apply knowledge in order to reduce poverty. In Australia, overcoming Aboriginal and Torres Strait Islander people's disadvantage, or 'closing the gap' with the rest of the Australian population in factors such as life expectancy, income and education (SCRGSP 2007), is widely recognised as a national priority. Aboriginal people do not share in Australia's overall status as the third highest ranked nation on the UN's Human Development Index (UNDP 2007). For example, age specific death rates for Aboriginal people under 65 years old are twice those of other Australians and infant mortality is three times that of the general population (ABS and AIHW 2008). In Niger poverty reduction is not only a national issue but part of a globally recognised priority, given that Niger is amongst the lowest ranked nations in terms of human development (UNDP 2007). The challenges for poverty reduction in both remote Aboriginal Australia and Niger involve not only technical knowledge appropriate to local contexts, but also knowledge of how effective institutions might be established given political contest about their design. Papers in this special issue address aspects of both these dimensions, as outlined below.

The context and inherent challenges for poverty reduction in the two nations are quite different. The population of the Maradi region of Niger, where Tougiani et al.'s paper (2009) is located, are dominantly dryland farmers. On the other hand Aboriginal people in Australia were hunter gatherers. They had no strong tradition of agriculture, notwithstanding analyses of plant husbandry practices inherent in their management of land, particularly through use of fire (Jones 1969; Bird et al. 2008; Vaarzon-Morel and Gabrys 2009, and see Walsh's (2009) review of Gerritsen). In contrast to Niger, colonisation in Australia resulted in Aboriginal economic systems becoming progressively decoupled from natural resources, even in remote desert regions (Young 1981). In Australia, unlike in Niger, government social security payments now provide a 'safety net' of a low though relatively reliable cash income to all citizens. Over half of the contemporary Aboriginal population receives most of its cash income from such government pensions and allowances (SCRGSP 2007). Notwithstanding these differences, in both desert Australia and Niger poverty is experienced as dependency, lack of opportunity and an overall diminished capability or substantive freedom for people to "lead lives they have reason to value and enhance the substantive choices they have" (Sen 1997, p. 1959).

Regional change in Niger

Tougiani et al. (2009) describe a regional scale livelihood transformation in southern Niger, generated through synchronous NGO-led reforms in the valuation and management of indigenous plant resources and the introduction of new governance structures. The changes required not only technical innovation and inclusive mechanisms for making decisions beyond the household scale, but courage amongst the early adopters to overcome ridicule of their changed farming practices. In Niger, colonisation by France and post colonial experiences of development had encouraged 'modernisation' of agriculture, including

removal of coppicing tree stumps to allow more efficient ploughing. Tougiani et al. attribute desertification and frequent famine at least in part to that practice. They chart the widespread failure, for technical and institutional reasons, of projects that have aimed to address desertification through tree planting. The alternative, locally contextualised, agroforestry systems that they describe use coppicing indigenous trees as a resource and introduce enrichment plantings of other species including edible-seeded Australian acacias. An integrated approach to technical and institutional issues has generated local food and fuelwood security, new markets, increased livestock production and improved soil fertility.

Australian contrasts

Australia offers multiple examples at local scales of positive outcomes and practices addressing Aboriginal disadvantage (SCRGSP 2007). There are also some recent successes in increased employment and in enterprise growth, particularly in the economically significant minerals sector (ATSISJC 2007; Brereton and Parmenter 2008). However the Australian desert has no examples of enduring reduction in the poverty of Aboriginal people at a regional scale such as Tougini et al. describe from Niger. Perhaps the contrast in outcomes between Niger and Australia serves to illustrate Yaqub's argument (in Hulme and Shepherd 2003, p. 405) that "chronic relative poverty (i.e. always being in the bottom quintile of a country's income distribution) may be as hard or even harder to escape than chronic absolute poverty." The substantially higher average income levels of desert Aboriginal people compared to those in Niger (see Cunningham et al. 2009) means it is difficult to assert that they experience absolute poverty by global standards. Nevertheless, their poverty relative to other Australians continues to be chronic and entrenched.

Institutional tensions and mismatches encountered in remote Aboriginal development have led to the charge that Australian government presents in this context as a 'failed state' (Dillon and Westbury 2007, see the book review by Tedmanson 2009). The charge is contested, as are explanations of why Aboriginal disadvantage persists and recommendations for appropriate policy responses (e.g. Dillon and Westbury 2007; Hughes 2007). 'Passive welfare' is widely blamed for sapping the motivation and self-reliance of many Aboriginal people. And a number of commentators call for a stronger focus on evidence and more clarity about concepts (e.g. Altman 2006; Morphy 2008; Stafford Smith et al. 2008b). Some analyses have found significant under-expenditure by Australian governments on services for remote Aboriginal people relative to other Australians (particularly Taylor and Stanley 2005). Nevertheless, when the Australian situation is compared to Niger, it is clear that more effective investment is required in Australia, rather than simply more money. Lessons offered from the Niger experience include establishment of new and inclusive governance structures as well as appropriate technical solutions and local responsibility. Long time frames with continuity of support, particularly to local people who are changing their practices, and a commitment to experimentation and feedback on outcomes are also identified as important. The attention to such lessons in DKCRC research is apparent in papers in the special desert knowledge issue of *The Rangeland Journal* (Vol. 30(1) 2008) and in the four papers introduced below.

New livelihood strategies in Australia

Two of the Australian papers in this issue (Evans et al. 2009; Singleton et al. 2009) derive from DKCRC projects whose main emphasis has been to understand how best to support enterprise development amongst Aboriginal people and more effective engagement with markets. The projects have looked for the commercial advantage that Aboriginal people may have from factors such as their remote location, ecological knowledge and distinctive cultures. Partnerships between local people and researchers that have contributed to the application of traditional knowledge and new technologies are reflected in the co-authorship of both papers by local Aboriginal leaders. Extending collaborations such as these to publication has helped to validate and apply the knowledge being generated in desert knowledge research, further strengthening partnerships.

Considerable tension commonly emerges in Australia, as it has elsewhere (e.g. Posey and Duffield 1996; Shiva 1997; Hansen and Van Fleet 2003), about initiatives that apply traditional knowledge in commercial enterprise or that seek to develop new

markets for natural resources that have long standing traditions of use and management. At its establishment in 2003 DKCRC adopted an intellectual property protocol, since updated and revised (DKCRC 2008), to govern these kinds of initiatives and ensure that they return benefit to desert Aboriginal people. It has also promoted research that has independently addressed questions about the rights of Aboriginal people to determine how such knowledge and resources are used, and Aboriginal benefit from any such use (e.g. Smallacombe et al. 2007). Evans et al. (2009) engaged with such questions early in the implementation of a project initiated by Titjikala community elders. That project aimed to document elders' traditional knowledge about food and medicinal plants and conduct laboratory analysis of the bioactive ingredients of selected species.

Evans et al. (2009) describe the development of the research agreement that established the benefit sharing regime and that forms a contract between the research organisations and an organisation representing the community. Such processes need to be central in neo-populist approaches to development if these are to achieve respect for local agendas and address the unequal power relations that typically characterise community-researcher relationships (Blaikie et al. 1997; Blaikie 1998). Nevertheless, as Evans et al. describe, they have high transaction costs even when they can build on a family-based relationship of trust between key parties, as in this case. The broader scale impact of work such as this is to contribute to collective knowhow of ethical use and management of Aboriginal traditional knowledge, and to more efficient and effective agreement making in future such projects.

Singleton et al.'s (2009) paper focuses on the use of information and communication technologies (ICTs) in empowering Aboriginal youth in a small desert town. The local Walkatjurra Cultural Centre had developed an ICT initiative aimed at re-engaging young Aboriginal people in their culture in ways that would encourage them to contribute actively to the centre's development goals. By their own criteria, community elders found that the ICT initiative, and the partnership with university researchers that developed to support it, empowered the young people involved. This was achieved particularly by promoting young people's appreciation of the contemporary value of maintaining cultural knowledge and practice.

These two papers illustrate new economic couplings between Aboriginal people, the natural and cultural resources of their desert environments, and opportunities emergent through globalisation. Both examples are from localities where livestock grazing is the dominant extensive land use and Aboriginal people have had only very limited formal recognition from governments or industry of their customary rights to use and manage land. Hence neither livestock grazing (Gill 2005b) nor involvement in the emerging Aboriginal natural and cultural resource management industry sector (Putnis et al. 2007) are readily accessible to them as livelihood strategies. Both papers provide glimpses to diverse and dynamic alternate livelihood pathways that these local groups are pursuing. These include arts and crafts, cross cultural education and tourism, and the very partnerships with researchers that formed these papers. The adaptiveness and multi-dimensionality involved, and their extra-local dimensions, can easily be rendered invisible in approaches to development that focus on the goals or opportunities in a single service sector or industry.

Agendas for institutional change in Australia

The opportunities available to local people are invariably shaped by institutions (rules, norms and strategies) operating at other levels, beyond the local (Ostrom 2005). This points to inherent limitations in research on sustainable livelihoods if it only considers the local scale (De Haan and Zoomers 2003; Davies et al. 2008). Further, one of the generalised consequences of the existence of a 'desert syndrome', as hypothesised by Stafford Smith (2008), is that desert people almost inevitably comprise sparse populations who have only a distant voice in political processes and who commonly have different cultural characteristics and norms to those in more populated regions. As a consequence desert people face relatively greater challenges in influencing institutions that are constructed at national scale, or by majority populations whose mental models are drawn from more humid, resource rich and less inherently variable environments. Lack of attention in institutional design to the social and environmental characteristics of remote desert regions is almost certainly a factor in poor socio-economic outcomes for people of those regions. Amiran (1973, p. 29) summed up the situation succinctly in saying: "In short, one should

treat deserts as deserts and not try to apply non-arid standards to their development except under very specific circumstances."

Understanding of non-equilibrium processes and their application in the governance of social-ecological systems offers significant insight to the need for diversified decision making structures linked horizontally and across levels of organisation and spatial scale (Berkes et al. 2003; Reynolds et al. 2007; Marshall 2008). Tougiani et al. (2009) argue that a key to the effectiveness of the agro-forestry projects they describe from Niger has been the development of new governance institutions at village level that are inclusive of both genders and different ethnic groups. These have an inbuilt capacity for monitoring and enforcement of the operational rules they establish for resource use, while cross-scale linkages have been strengthened through establishment of higher level committees representing several villages. One outcome is a nested governance structure (Ostrom 2005) that can address problems that are common to a district. In contrast, recent institutional change effected through Australia's national policies on Aboriginal and Torres Strait Islander affairs have tended to re-centralise decision making and apply a 'command and control' approach to addressing social and economic issues (Cunningham and Baeza 2005; ATSISJC 2008; NTRERB 2008).

Moran and Elvin (2009) take up these themes in this issue. They apply a lens of complex adaptive systems theory to argue that excessive attention to detailed design of governance and government service delivery in remote Aboriginal settlements, with excessive top-down control, precludes adaptive processes of social learning and curtails the capacity of local people to self-organise. They argue that attention to three interconnected principles of subsidiarity, connectivity amongst agents in the system, and a multi-dimensional construction of accountability will promote governance that is adaptive to feedback from local knowledge and practice.

Cunningham et al. (2009) take up different agendas for institutional change. They are concerned about how desert Aboriginal people might engage more with markets and realise greater economic value from their traditions of harvesting plant food resources from naturally vegetated lands. The desert 'bush foods' industry is small, fragmented, emergent and experiencing increased market demand for some of its products. A key concern for DKCRC has been the participation and equity position of Aboriginal people in native plants industries (Cleary et al. 2008). Such concern stimulated DKCRC support for the research in which Evans et al. (2009) developed their benefit sharing agreement. Cunningham et al. join other commentators internationally in calling for a 'reality-check' on the prospects for non-timber forest products such as desert bush foods to deliver significant improvement in desert Aboriginal people's livelihoods. Their review highlights that considerable concerted action is required at all scales to maintain and develop benefit for remote Aboriginal people from one of the few new natural resource based commercial opportunities available to them.

Knowledge in multi-functional Australian desert landscapes

The shift from productivism to multi-functionality in Australian desert landscapes, as charted by Holmes (1997, 2002, 2008), is leading to new articulations of knowledge for environmental management. It highlights contrasts amongst the values of local and extra-local communities and amongst the meta-narratives in which these values are embedded. At a more localised scale, it points to the importance of cross tenure and cross cultural approaches to land use and management. These issues are considered in four papers in this special issue. As a group these papers point to opportunities and challenges for empowering local knowledge systems in negotiations, decisions and actions on natural and cultural resource management.

Local knowledge and amenity values of pastoral lands

Pastoral leasehold tenures in the Flinders Ranges of South Australia are the setting for Clark and Brake's paper (2009) on knowledge collaborations in water resource management. The paper illustrates how regional organisations charged with fostering sustainable natural resource management are engaging local knowledge for political as well as pragmatic reasons. Commodity values of food, fibre and minerals that once dominated the economic and social fabric of the Flinders Ranges, and the expectations of regional and extra-local communities for the region's

management, are now being succeeded, to a significant extent, by amenity values of tourism, recreation and conservation. This multi-functionality, together with the impact of variable rainfall on livestock management, means that pastoral lease holders in such regions have been particularly vulnerable to the strong neoliberalism driving Australian agricultural policy, with its emphasis on globally competitive production and decoupling of agricultural, environment and socio-cultural outcomes from farming (Potter and Tilzey 2007). Faced with pressures to maintain their economic viability, regional populations also face significant challenges associated with guiding and fostering amenity land uses, and the expectations of and accountabilities to regional and national constituencies associated with them, while retaining social cohesion (Holmes 1997, 2002).

In the research process described by Clark and Brake (2009), landholders and scientists generated knowledge of water resources collaboratively. The collaboration increased landholders' commitment and capacity to act in ways that support the sustainable management of water resources and their landscape settings, for multiple values. As such, the research has helped to facilitate the kind of gradual transformations amongst local actors' goals and ideologies that Wilson (2001) has noted are required if a transition from productivist landscapes is to be more than rhetoric.

Environmental management across tenures

Pastoral, Aboriginal and conservation tenures are closely juxtaposed in some Australian desert regions, such as the southern Tanami which lies north west of the central Australian regional centre of Alice Springs. Very large intense wildfires occurred across central Australia in 2000–2002 generating considerable conflict amongst landowners about appropriate management strategies (Edwards et al. 2008). Subsequent action to establish a cross tenure fire management strategy provides the setting for the research reported in this issue in papers by Maclean (2009), and by Vaarzon-Morel and Gabrys (2009).

Maclean (2009) points out that while colonialism is widely recognised as having romanticised Aboriginal culture and silenced Aboriginal voices, it also mythologised and homogenised the culture of Australia's outback graziers. Arguably, colonialism has also silenced the significant role that anthropogenic fire has long played in the landscapes of the Australian arid zone. This includes fragmenting continuous and highly flammable fuel loads, thereby reducing the risk of very large intense wildfires. Climatic variability conspires in this silencing as the risk of such wildfires, which are associated with large pulses of rain over a two to three year period, occurs infrequently. Long term local knowledge becomes important if people are to learn from and plan for such events. However, as Stafford Smith et al. (2007) illustrate, it may not be enough in itself. Rather such knowledge needs to be part of a broader regional system for adaptive management.

Maclean notes that there are few examples of successful fire management strategies on single land tenures in central Australia, let alone where complex land tenures meet, as they do in the southern Tanami. Different actors—graziers, Aboriginal people and scientifically trained land managers—bring different goals, knowledge and knowledge limitations to discussions about fire management. Maclean argues that acknowledging the sometimes conflicting interpretations and management approaches that she describes in her paper creates the potential for dialogue and discussion. As such it is a first step in working towards the process of cultural hybridity—a nuanced and sophisticated intercultural approach to management—that is necessary for equitable and sustainable environmental governance.

Vaarzon-Morel and Gabrys (2009) focus on the fire management knowledge and practices of Warlpiri Aboriginal people. Warlpiri use of fire was constrained when cattle stations were established in the first half of the twentieth century since their non-Aboriginal owners/managers were typically anti-fire. It was re-established when progressive recognition of land rights from the 1970s allowed Warlpiri people more freedom to implement their own land management practices. Customary burning practices and complex cultural protocols about who burns, when and where, remain strong in the region. In spite of a significant shift that has occurred in the Warlpiri subsistence economy, away from dependence on hunting and gathering, burning is central to the relationship between Warlpiri people and their biophysical and spiritual landscape. Like Maclean, Vaarzon-Morel and Gabrys turn to the need for a cross-cultural dialogue to manage conflicts over fire and its management across tenures and value systems.

They suggest that regional scale fire management is not likely to be effective unless Warlpiri institutions for the governance of fire—their customary authority structures and protocols—are acknowledged and observed. They also point to the risk that Warlpiri understandings of fire will be over-simplified in such processes.

Meta-narratives of the 'outback'

Australia's deserts, often referred to colloquially as the 'outback', have a powerful place in the national psyche and in imagery used to promote and explain Australia internationally. Nation-building discourses of the twentieth century established the importance of settling the 'empty heart' of the continent and rugged survival against harsh climate, distance from family and improvident, sometimes hostile, Aboriginal people. A competing outback eco-mythology emerged from the 1980s when the urban based voluntary conservation movement began to take some interest in desert landscapes, noted ecological degradation and ascribed blame to livestock grazing and its management (Gill 2005a). More recently, national agendas for Aboriginal reconciliation have gained momentum (Elder et al. 2006) and increasingly impact on beliefs and expectations about the authenticity of 'outback' knowledge and experience. Such meta-narratives are highlighted in this issue by Hueneke and Baker.

Hueneke and Baker (2009) researched the responses of Australian and international visitors to Uluru-Kata Tjuta National Park to the request made by the park's Aboriginal owners to respect their culture by not climbing its central landscape feature, Uluru. They found that visitors justified their decisions about whether or not to climb Uluru by drawing from a broad pantheon of meta-narratives. For Australian visitors these typically concerned settler-Aboriginal relationships and competing rights. However, Hueneke and Baker conclude that the actual decisions of the many visitors who do climb Uluru are influenced at least as much by subtle signals from the landscape itself. Infrastructure for tourist access to, and activities around, the base of Uluru that largely pre-dates recognition of Aboriginal ownership of the park has particularly powerful impact in directing visitors towards the climb. Improved knowledge from this research of how landscape and meta-narrative interact in tourists' decisions points to possibilities that changes to park infrastructure might reduce the climbing rate. In turn this will discursively influence which competing meta-narratives Uluru and its outback setting will empower in future.

Maturing a neo-ideographic approach

By rarely taking account of key characteristics of desert social-ecological systems, such as low and variable rainfall, sparse populations, cultural diversity and remoteness from decision makers (Stafford Smith 2008), decisions made in markets and policy forums can readily entrench poverty and restrict capability amongst desert people. The 'desert knowledge movement' and the Desert Knowledge Cooperative Research Centre are in many ways charged with empowering the voices of desert people to influence, challenge or counter such impacts. A neo-populist paradigm of development, expressed in socially inclusive and locally meaningful research, is well suited to that agenda.

However, the focus on the local that is promoted through a neo-populist paradigm does carry a risk of myopia. Practitioners and researchers may be blind to lessons from other places and from theory, to intersections between the local and broader scale institutions and trends, or to direct engagements with global opportunities and drivers that subvert notions of hierarchical scale. The papers in this issue do have a general concern with how local actors may pursue their interests in ways that take account of extra-local, if not global, drivers and opportunities. Most overtly, Singleton et al. (2009) chart the process whereby young people from a local Aboriginal group draw on customary knowledge to establish their identity on a global stage. Evans et al. (2009) negotiate novel institutions for local Aboriginal benefit from potential uses of plant species in global markets. Cunningham et al., in charting the broader challenges for realising such local benefits from Australian plant products, draw solid attention to their globalised institutional settings. Other papers (Clarke and Brake 2009; Maclean 2009; Vaarzon-Morel and Gabrys 2009; and Tougiani et al. 2009) present situations where extra-local actors have engaged with local knowledge and action to promote ways to address extra-local agendas collaboratively. Finally, both the papers by Moran and Elvin (2009) and by Hueneke and Baker

(2009), in very different settings, show that feedback from people's experiences of local places and how these are impacted by broader institutions is necessary for management systems to adapt and evolve.

Nevertheless, explicit analysis of such multi-faceted intersections between local and extra-local actors, institutions and drivers is often latent or embryonic in the papers in this special issue, compared to the prominence given to the local. Neither do the papers pay much attention to explicitly considering what characteristics of desert human-environment relationships might be shaping such intersections. Desert characteristics of variable rainfall, low and patchy productivity, sparse populations, and cultural diversity (Stafford Smith 2008) are often seen as aberrant, if not negative, features in comparison to more humid environments. However these characteristics suggest potential strengths that are important to planetary populations facing the need to shape how social-ecological systems adapt to change. Human capacities that may be fostered by desert environments include close observation, multi-skilling, self-reliance, patience, negotiation skills and a pragmatic readiness to turn opportunity into advantage. We see considerable opportunity for future desert knowledge research to contribute to maturing a 'neo-ideographic approach' (De Haan 2000) that elucidates the nature of such capacities and their consequences for knowledge systems, and that addresses how they might be most effectively engaged in development.

Acknowledgments We acknowledge the assistance of reviewers of all the papers in this special issue and of Craig James and Murray McGregor of Desert Knowledge Cooperative Research Centre. We thank two colleagues at CSIRO Sustainable Ecosystems: Tom Measham for comments that have helped to improve a draft of this article, and Mark Stafford Smith for generous advice on this article and guidance throughout the compilation of this special issue. Further inspiration and insight has come from conversations with central Australian historian Megg Kelham. Development of this paper and our editorial work on this special issue was supported by funding from the Australian Government Cooperative Research Centres Programme through the Desert Knowledge CRC; the views expressed in this paper do not necessarily represent the views of Desert Knowledge CRC or its Participants.

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