**VALUING WATER:
VARIABILITY AND THE LAKE EYRE BASIN,
CENTRAL AUSTRALIA**

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This thesis has not been submitted to any other university or institution for a higher degree. Except where otherwise acknowledged, this thesis and its photographic material comprise solely my own work.

A handwritten signature in black ink, reading "Leah M. Gibbs". The signature is written in a cursive style with a horizontal line underneath the name.

Leah M. Gibbs

Preface and Acknowledgements

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Abstract

Water has multiple forms and functions, meanings and values. In the context of growing awareness of environmental sustainability and social justice, natural resource management attempts to incorporate this multiplicity. This thesis is concerned with the ways value is attributed to water within natural resource management discourse and practice, and the extent to which such efforts capture the range of values associated with water. The research uses a case study of the arid and semi-arid Lake Eyre Basin in central Australia, a region whose waters are characterised by variability. A place-based study emphasises the significance of the specific place, and highlights the need to ensure that local, place-based values are not marginalised by the dominant universalising discourse and practice.

Colonial relationships with place and recent social change provide an historical context for the ways people live with Lake Eyre Basin water, and demonstrate changing meanings and values. Since the 1990s, there have been two major conflicts over water in the Basin: a campaign for World Heritage listing of parts of the Basin, and a proposal for a major cotton irrigation scheme on Cooper Creek. These two conflicts illuminate multiple and changing values, and reveal a multiplicity of constructions of nature. These events led directly to the region's first locally-driven catchment management process.

Within and beyond the Lake Eyre Basin, current approaches to valuing water within natural resource management rest heavily on the triple-bottom-line framework of economic, ecological and social sustainability, which separates values into discrete categories. Yet this research has found that values associated with water are not separable; rather, these established categories of value are interconnected.

Current approaches to valuing water are limited by reductionism, anthropocentrism, and cultural specificity. I propose a new framework for valuing water that emerges from place, overcomes these limitations, and captures the range of values associated with water. *Valuing variability* reflects two ways that value and variability are connected: water's variability is valued, and water's values are characterised by variability. This framework moves towards an understanding of water based on its interconnected, living and life-giving character. It recognises the interconnection of categories of value, and interconnections between water and the rest of the world. The framework draws on the discourse of social nature, the Australian Aboriginal concept of 'Country', and an ecosystem approach, to explore these qualities.

Valuing variability has implications for multiple scales of a nested hierarchy of discourse and practice. First, in the Lake Eyre Basin, it enables incorporation of diverse, changing and complex values, including those currently marginalised. Second, it presents possibilities for rethinking natural resource management elsewhere; by challenging universalisms, it offers hope for other places. Third, the framework builds on the discourse of social nature by critiquing connections between 'society' and 'nature' in the context of natural resource management in a specific place. Finally, *valuing variability* engages with ethics beyond the human world by prioritising place, and drawing on the interconnected, living and life-giving qualities of water.

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Wind pump and water tanks, Erudina Station, South Australia. April 2003.

CHAPTER 1

INTRODUCTION

1.1 Valuing water: a place-based approach

Current efforts to determine the value of water fail to capture the full significance of water's complexity. Within natural resource management, methods of valuing water are dominated by universalised values, yet people value particular water in specific places, and multiple values exist simultaneously. The aim of this thesis is to inform a more just and sustainable framework for valuing water that captures the diversity, complexity and changing nature of values associated with water.

In order to fulfil this aim I take a place-based approach. The study focuses on water and water places in the Lake Eyre Basin, central Australia (Figure 1.1). A place-based approach overcomes universalism by fostering understandings of a specific range of values associated with water in a particular place. An understanding of specificity enables a critique of the limited extent to which current approaches to 'valuing' water within the discourse and

practice of natural resource management capture a complex suite of dynamic and interconnecting values.

An analysis of the limitations of current methods for determining ‘the value of water’ complements the place-based approach to inform a new framework for valuing water. I argue that variability is a central characteristic of both water and value in the Lake Eyre Basin, and propose ‘valuing variability’ as a framework for capturing the diverse, complex, and changing values associated with water, and its interconnected, living and life-giving qualities.

In this chapter I introduce the key concepts of the thesis—water and value—and the place and scope of the study. I then discuss the literature forming the point of departure for the research, and for the methodology and methods employed. Following an account of the research methods, the chapter concludes with a detailed thesis outline explaining how each chapter contributes to the aim of the thesis.

1.2 Water

Water is central to life. It forms and transforms landscapes; is an agent of creation and change. Water has multiple forms and functions, meanings and values, which exist simultaneously. In its multiple forms it strongly influences interactions between living and non-living things, between people, the non-human world and place. Meanings of water and ‘water places’—the places where water lies, emerges from, passes through, or leaves its traces—overlay one another in space and time, building complex places.

Figure 1.1 The Lake Eyre Basin.

Meanings of water and water places change over time. For humans, water has been a vital tool of colonisation and development. Among its many historical roles water has provided a means of navigation and transportation, power generation, irrigation, settlement, drainage, and waste disposal. Since the popularisation of the ethic of ecological or environmental conservation from the 1970s, human focus on water has broadened from a perspective of water as a tool of development, to include more holistic understandings of water and its role in ecosystems and in the lives of humans and others. Yet, the importance of the 'services' provided by water remains crucial to human survival, and are a priority in development and natural resource management.

At a global scale, a growing water crisis is becoming widely recognised. Demands on water resources continue to increase, and conflict over water is becoming more common. Surface and ground waters are increasingly subject to over-use, pollution and diversion. River catchments are not confined to national borders. Demands on water cross jurisdictions and scales and local demands are affected by the decisions of state governments (Cocklin & Blundin 1998; Donahue & Johnston 1998; Kingsford 2000; Lemly *et al.* 2000; Wishart *et al.* 2000; McCully 2001; World Commission on Dams 2001; Dimitrov 2002; L. Harris 2002; Barlow & Clarke 2002; Shiva 2002; Sneddon *et al.* 2002 *inter alia*).

Evidence of an emerging international awareness of water crisis takes the form of initiatives including the United Nations' 'Water for Life, International Decade for Action 2005-2015' (United Nations 2005). The priorities and approach of the Water for Life Decade draw strong connections between social, cultural, environmental and economic imperatives—concerns often treated separately in natural resource management strategies. The campaign was launched on 22nd March 2005 by United National Secretary-General Kofi Annan with the aim 'to promote efforts to fulfil international commitments made on water and water-related issues by 2015'. These commitments include: the Millennium Development Goals to reduce by half the proportion of people without access to safe drinking water by 2015 and to stop unsustainable exploitation of water resources; and, as adopted at the World Summit in Johannesburg in 2002, to halve by 2015 the proportion of people who do not have access to basic sanitation. Water for Life has a particular focus on poor people as they comprise the majority currently without basic access to water and the services provided by it, and on women in recognition of the central role they play in water provision and management. In his address, Kofi Annan stated: 'This is an urgent matter of human development, and human dignity' (United Nations 2005).

The effects of water crises are particularly acute in arid and semi-arid regions of the world where the presence of water is tenuous. The draining of the Mesopotamian Marshes in Iraq is arguably one of the most significant and dramatic water-based tragedies the world has faced. The Mesopotamian Marshes—often referred to as ‘the cradle of western civilization’ (Richardson *et al.* 2005: 1307)—are fed by the Tigris and Euphrates Rivers. The rivers have their headwaters in the mountains of eastern Turkey, and their combined catchments incorporate parts of Turkey, Syria, Saudi Arabia, Iran and Iraq. In the 1950s governments of those nations began building dams on the rivers, but the most devastating change took place as a result of extensive irrigation and intentional drainage during Saddam Hussein’s regime, particularly between 1985 and 2000 (Lawler 2005: 1186; Richardson *et al.* 2005: 1308). During this time the Marshes, which covered some 15 000km², were reduced to less than 10% of that size (Richardson *et al.* 2005: 1307-1308).

The draining of the marshes has resulted in the displacement and dispossession of the Indigenous Ma’dan people, commonly known as the Marsh Arabs, who have lived in the Mesopotamian Marshlands for 5 000 years. Destruction of the wetlands has led to loss of habitat for an extensive and diverse range of birds and aquatic life, and loss of a significant staging area for migratory birds between Siberia and Africa. Impacts reach further as saline and polluted waters, no longer cleansed by the wetlands, enter the Persian Gulf and affect marine life and the fishing industry (Lawler 2005; Richardson *et al.* 2005). This case illustrates the complex and interconnected implications of human decision-making and action with respect to water, and the ways in which water connects human and non-human life with place.

Australia is the continent with the smallest area of wetlands in the world (Lindenmayer & Burger 2005: 1). As a nation, we have much to learn from the salient example of the

Mesopotamian Marshes about the far-reaching implications of water decision-making. In Australia—a country characterised by aridity and variability—water is particularly important. While the nation has not yet faced water crises on the scale of the Mesopotamian Marshes, past and ongoing attitudes to land and water have had major impacts on water and water places, and promise to continue to affect negative change. Decisions of the past—including the massive diversion and extraction from the Murray River, the drilling of free-flowing bores of the Great Artesian Basin, the damming of the Gordon below Franklin—sit uneasily in the Australian consciousness and conscience. Careful thinking about water management is required for more just and sustainable ‘ways of living with water’.

1.3 Value

The term ‘value’ is increasingly appearing in natural resource management strategies and discourse. With the development and popularisation of the ‘triple-bottom-line’ management framework of economic, environmental and social sustainability (Elkington 1998), the ‘social’ and ‘cultural’ are gaining recognition in management decisions. Yet, the *concept* of value is presently framed within largely economic terms. Current methods employed within natural resource management for valuing water—and more inclusively ‘nature’—rely on a limited definition of value, and as such fail to capture the full significance of water to humans and the non-human world.

In 1949, Aldo Leopold wrote:

It is inconceivable to me that an ethical relation to land can exist without love, respect, and admiration for land, and a high regard for its value. By value, I of

course mean something far broader than mere economic value; I mean value in the philosophical sense (Leopold 1989 [1949]: 223).

With these words, Leopold raised a vital question about value and nature. In referring to ‘something far broader’ he opened our minds to possibilities for thinking about value beyond the confines of a natural resource management framed by economic motivation.

Today, efforts to ‘value nature’ remain limited by a narrow framing. Some approaches attempt to incorporate non-economic values, or those values not readily recognised within market economics. Most notable among them is ‘ecosystem service valuation’, which focuses on ‘societal dependence on natural ecosystems’ (Daily 1997a). Ecosystem service valuation attempts to place a value on the goods, services and functions provided by ecosystems and biodiversity. Many of the services are framed in terms of human dependence or utility. This approach ostensibly considers social and cultural values, yet values are measured within a largely economic framework.

People, non-human life, and landscapes are directly affected by management decisions. Yet, value remains narrowly defined within natural resource management discourse. Decisions about water and how people *live with* water must be informed by a more nuanced understanding of the multiple, coexisting values associated with water.

1.4 Research scope: the Lake Eyre Basin and interdisciplinarity

A place-based approach moves beyond generic notions of water and value. It allows an analysis of specificity and complexity, captured by the concepts ‘hybridity’ and ‘interconnection’. A place-based approach highlights the need to ensure that local, place-

based values are not marginalised by the dominant universalising discourse and practice of natural resource management.

The place upon which this research focuses is the Lake Eyre Basin, in arid and semi-arid central Australia. Arid and semi-arid environments—often collectively referred to as ‘deserts’—cover approximately 20% of Earth’s land surface; in Australia they cover 70%. Worldwide, deserts are home to some 313 million people—13% of the world’s human population (Smith & Hesse 2005a). Yet in Australia less than 3% of the total population make their home in the arid and semi-arid zones (Taylor 2003: 357). Arid and semi-arid regions contain fragile ecosystems that are easily affected by human decisions and actions, yet these environments are currently poorly understood and under-studied in comparison with temperate regions of the world (Kingsford 2000; Sheldon *et al.* 2002).

The Lake Eyre Basin provides a distinctive and topical local Australian case study. Typical of arid environments around the world, the Lake Eyre Basin receives less research attention than temperate regions. The predominant focus of water research in Australia is on the Murray-Darling Basin, Australia’s most important agricultural and economic region, accounting for over 40% of the nation’s gross agricultural production. While a comparable size (1.06 million km² compared to the 1.14 million km² Lake Eyre Basin), a far greater proportion of the population, agricultural industry and water extraction are focused on the Murray-Darling. Seventy percent of all irrigated crop and pasture lands in Australia lie in the Murray-Darling, and 70% of all water used for agriculture in Australia is used in Murray-Darling Basin irrigation (Murray Darling Basin Commission 2005). Water development is intensive, the most notable example being the Snowy River Hydroelectric Scheme (discussed in chapter 3, section 3.2.2).

Yet the Lake Eyre Basin has played—and continues to play—a crucial role in the development of Australia and the Australian imagination. This is the subject of chapter 2. In comparison to the highly regulated Murray, Lake Eyre Basin rivers have undergone relatively little water development, providing a case study of living with relatively unregulated water. For most of their length, rivers in the Lake Eyre Basin still display their variable flow regimes. As is the case in deserts around the world (Smith & Hesse 2005b), spatial and temporal variability of rainfall and river flow is central to the Lake Eyre Basin.

In the past decade significant events and community processes focused on water have taken place in the Lake Eyre Basin. Two major conflicts—the first over a proposal for World Heritage listing of parts of the Basin, and the second over a cotton irrigation development—stimulated the first locally driven catchment management process. In this research I focus on the south-eastern portion of the Basin, where these two conflicts were centred. The south-east is also the most arid and most variable part of the Basin. Regulation and development has historically characterised natural resource management; variability therefore poses a significant challenge to contemporary management discourse and practice.

In this thesis I take an interdisciplinary approach to valuing water. Such an approach is suited to the multiple facets of natural resource management. My background in Human Geography, Resource and Environmental Management, and Aboriginal Studies forms a point of departure for my theoretical approach; the concepts of place, multiplicity and interconnection are central to my thesis. During the research project, working within an interdisciplinary research centre has presented opportunities for further developing my understanding of interdisciplinary research.

Geographer and social theorist Lesley Instone considers the role of interdisciplinarity in cultural geographies of nature:

If connectivity is at the heart of modern methodologies, cultural geographers of nature also need to stretch their thinking to cross and befuddle boundaries both within our field and beyond. I can see strong resonance between doing cultural geographies of nature and efforts within environmental science and management to find effective tools for dealing with uncertainty, incomplete information and constant change (2004: 136).

In addition to human geography I draw on several domains concerned with place, value, water and nature. These include physical geography, in which water is recognised as an agent of landscape change, and ecology, which considers water as part of an interconnected world. History provides tools for understanding complex change over time, sources of meanings, social practices and norms, and contributes to an understanding of the context of this research project; anthropology presents insights into connections between humans and the non-human world; and economics dominates current concepts and approaches to managing water. Bringing this literature into conversation provides theoretical and methodological tools for understanding complex place-based questions. Two bodies of literature form points of departure for this thesis. I refer to them as 'rethinking water resource management' and 'social nature', and discuss their contribution to my research question below. Other literature is reviewed in the course of the arguments presented in other chapters of the thesis.

1.5 Rethinking water resource management

As discussed above, water has many meanings that exist simultaneously. Water resource management does not capture the complex range of values people associate with water, nor reflect fully how people live with water. 'Management' of water as a 'resource' is not the dominant way in which people interact with water. Yet, practices and discourses of water resource management—and natural resource management more broadly—have inordinate powers to affect physical environments, people's lives and non-human others.

Despite changes in natural resource management worldwide over the past three decades, current dominant approaches are limited by the construction of water as a *resource* to be *managed*. This construction presents a range of dilemmas. The construction of water as a resource is limited by its own framework; 'resources' exist only within the capitalist construction of nature as a commodity (Sachs 1992; Shiva 1992; Howitt 2001). Chris Sneddon asserts: 'the mosaic of ecological systems constituting river basins, which "act" according to their own logics, pays little attention to how "resources" are construed and categorized by human environmental managers' (2002: 727). Human geographer Richie Howitt (2001) calls for 'rethinking resource management'. Howitt suggests that resources should be defined through relationships rather than existing as 'things'. He suggests that resources 'do not exist outside the complex relationships between societies, technologies, cultures, economics and environments in some preordained form, waiting to be discovered. They are created by these relationships' (Howitt 2001: 4). Howitt refers to Zimmerman's salient 1933 definition:

The word 'resource' *does not refer to a thing nor a substance but to a function which a thing or a substance may perform or to an operation in which it may take part*, namely, the function or operation of attaining a given end such as satisfying a want. In other words, the

word 'resource' is an abstraction reflecting human appraisal and relating to a function or operation (Zimmerman, cited in Howitt 2001: 4, emphasis in original).

While water exists in and of itself, water *as a resource* is a social construct.

The construction of water as a resource is established and reaffirmed by the discourses of resource and environmental management and sustainable development, and the notion that '“We” have responsibility for managing the human use of planet earth' (Escobar 1996: 50).

According to Escobar 'By adopting the concept of “sustainable development”, two old enemies, growth and the environment, are reconciled ... unfolding a new field of social intervention and control' (1996: 52).

In his analysis of sustainable development and resource management discourse, Escobar draws attention to the new concept of 'environment', 'the importance of which has grown steadily in the post-Second World War ecological discourse':

The development of ecological consciousness accompanying the rapid growth of industrial civilisation also effected the transformation of 'nature' into 'environment' ... No longer does nature denote an entity with its own agency, a source of life and discourse, as was the case in many traditional societies, and with European Romantic literature and art of the nineteenth century. For those committed to the world as a resource, the 'environment' becomes an indispensable construct (1996: 52).

In Escobar's contemplation of nature and the environment, human agency becomes the active principle, 'while nature is confined to an ever more passive role. ... What circulates are raw materials, industrial products, toxic wastes, “resources”; nature is reduced to stasis, a mere appendage to the environment'. In this conceptualisation of nature and

environment, water is removed from its position as an active part of nature, with its own agency, representing a diversity of meanings, and is envisioned as a commodity, devoid of agency and detached from meanings and the ontologies that inform them.

The dominance of this conceptualisation of water excludes (which I discuss with specific reference to Australia and the Lake Eyre Basin in chapter 3), makes invisible or de-values other meanings and values of water. When constructed as a resource, water cannot take on meanings that lie outside this framework. People and other living and non-living entities for whom water is significant in different ways are excluded from decision-making processes that may affect them. In turn, constructing water as a resource limits possibilities for learning from and being challenged by different meanings, values and ways of knowing. Ollman discusses the limitations to what can be learned from a single 'vantage point' (1993: 70). Ollman's 'vantage point' refers to the way in which 'the same relation is being viewed from different sides, or the same process from its different moments':

A vantage point sets up a perspective that colors everything which falls into it, establishing order, hierarchy, and priorities, distributing values, meanings, and degrees of relevance, and asserting a distinctive coherence between the parts. Within a given perspective, some processes and connections will appear large, some obvious, some important; others will appear small, insignificant, and irrelevant; and some will even be invisible (1993: 68).

Hegemonic water resource management frameworks do not nourish diverse understandings of water. As such, they limit possibilities for learning from diverse ways of knowing. In the Lake Eyre Basin, Arabanna man and Marree resident Reg Dodd discusses the narrow perspective of water resource management:

Water is a cultural asset. You can't separate water, it's all interconnected. ... whether it's surface or GAB [Great Artesian Basin] water, people have a connection to water. Waterholes, camping. It connects you to that area. It gives you identity; sense of belonging. It can't be separated. Government and developers think of water as a resource, without thought of other meanings and values held by other people (field notes, Dodd 5.03).

Finding ways of listening to and learning from multiple ontologies presents new opportunities for developing understandings of water.

Natural resource management is highly culturally specific, as geographers Howitt and Suchet-Pearson argue:

The 'epistemological transformation' ... that occurs when nature, wildlife and 'wild humans' are constructed as *resources*, legitimates the assertion and imposition of Eurocentric practices of management—intervening, taming, domesticating, controlling, subduing and dominating the wild-wildlife-wilderness. Managerial intervention, however, is not how all people interact with worlds (2003: 563).

According to anthropologist Deborah Bird Rose (1988), non-intervention is frequently considered as a virtue by Ngarinman and Ngaliwurru of the Victoria River District in northern Australia. In the Lake Eyre Basin, Wangkangurru man Jimmy Crombie says that one of his greatest concerns about water in his Country on the Diamantina River is the possibility of people changing the course of the river, altering the waterway, interfering with the natural path of flow (field notes, J. Crombie 5.03); precisely the activities that occupy water resource managers. Cultural specificity refers not only to the marginalisation of Indigenous cultures, but to numerous local cultures and other ways of knowing and being that are not consistent with Western managerialism.

To Howitt and Suchet-Pearson's list of Eurocentric management practices I add the terms 'harnessing' and 'capturing', frequently used in water resource management, but seldom examined critically. Like the other words on Howitt and Suchet-Pearson's list, these terms—and the practices they describe—are closely associated with control, domination and colonialism. Control and domination of water—through engineering projects such as irrigation, diversion and damming—has long been a core process in the colonial project (Reisner 1986; Powell 1989, 2000; Worster 1992).

The link between water control and colonisation begs the question: is it possible to move towards decolonising in an era of regulation? Even in institutions that aim to address colonial legacies, it is possible for their practices to reinscribe colonial effects. Rose uses the term 'deep colonizing' to refer to this reinscription and suggests 'colonizing practices embedded within decolonizing institutions must not be understood simply as negligible side effects of essentially benign endeavours. This embeddedness may conceal, naturalize, or marginalize continuing colonizing practices' (1999: 182). By acknowledging multiple vantage points, engaging with multiple ontologies and expanding understandings of water, current hegemonic resource management systems that maintain, reinforce and renew processes of colonisation may be challenged (Gibbs 2003: 26).

1.6 Social nature

In 1984 human geographer Neil Smith claimed that 'nature is nothing if not social' (1984: 30). Since that time, the interconnections between 'society' and 'nature', or 'nature' and 'culture', have increasingly become the subject of research and analysis in human geography and numerous other disciplines. The concept of *social nature* provides valuable insights into

rethinking water and water resource management in ways that foster understandings of water and lead to more just and sustainable ways of living with water.

‘Social nature’ refers to efforts by geographers and others to examine the relationships and interconnections between society and nature (Braun & Castree 1998; Head 2000a; Castree & Braun 2001; Braun 2002; Whatmore 2002; Instone 2004 *inter alia*). Where Modernism asserted binaries such as ‘nature/culture’, ‘man/woman’, ‘black/white’, ‘mind/body’, ‘active/ passive’, and Postmodernism sought to investigate ways those categories could be deconstructed, the discourse of social nature contributes to a movement to reconnect these ‘categories’; to investigate the ways established categories are co-constituted. Social nature examines the multiple and complex interconnections between ‘nature’ and ‘culture’.

This thesis is concerned with investigating the interconnections between nature and culture by looking closely at relationships between people, water and the non-human world, in a particular place. I consider the diverse, changing and complex ways people interact with water and water places; the ways that water is socially constructed; places are given significance and value with respect to water; and water is valued.

While geographers have sought to describe and explain the society-nature interface for over a century (Castree 2001), the emerging discourse of social nature seeks to challenge the established nature/culture dichotomy. In this *social approach* to the society-nature nexus, ‘the social and natural are seen to intertwine in ways that make their separation—in either thought or practice—impossible’. This approach argues that ‘nature is defined, delimited, and even physically reconstituted by different societies, often in order to serve specific, and usually dominant, social interests’ (Castree 2001: 3). According to Castree the social

approach to society-nature interactions is less a unified worldview, and more a plurality of related positions.

In Australia, the particular historical and contemporary political context of colonialism plays a significant role in local discourse of social nature. In her review of Australian cultural geographies of nature, Lesley Instone contends that there is a 'significant trend that places postcolonial insights and decolonising strategies at the heart of an historicized Australian geography' (2004: 135). Australian geographers analyse settler relationships with Australian places (Gelder & Jacobs 1998; Gill & Anderson 2005; Head 2000a, 2000b *inter alia*). Lesley Head (2000b) explores the implications of Australia as an Aboriginal landscape. For Head (2000b), and for Gelder and Jacobs (1998), discomfort and unsettlement are important themes in relations between humans and the non-human world:

Culturally and scientifically, we are part-way through a process of profound reorientation in our understanding of the Australian environment and of the human role in its creation; but still there is a persistent reluctance to articulate ... the discomforts and ambiguities that process brings to the surface (Head 2000b: 6).

For Gill & Anderson (2005) an ontological distinction between human and non-human transforms nature into an object for 'improvement'—human intervention in and alteration of landscape.

A significant number of Australian geographers engage in conversations with Aboriginal people and Indigenous ways of knowing (Jacobs 1989, 1994; Jackson 1995, 2004; Howitt *et al.* 1996; Suchet 1996, 2002; Howitt 1998, 2001; Howitt & Jackson 1998; Head 2000b; Gill 2005a; Jackson *et al.* 2005). In this work 'ontological multiplicity' is an important reference point (Howitt & Suchet-Pearson 2003). The existence of multiple, simultaneous ways of

knowing the world is acknowledged and forms a point of departure for theorising relationships between humans and the non-human world.

One way in which nature and water may be considered social is through the construction and production of nature. The social construction of nature may be understood as the construction of concepts of nature, or the processes of constructing nature in the physical and material sense (Demeritt 2002). David Demeritt discusses the variety of ways in which the term ‘social construction of nature’ is used. He proposes two broad categories; the first, ‘construction as refutation’, uses construction as a metaphor to refute false beliefs about the world. This approach is consistent with empiricism and positivism. The second category—‘construction as philosophical critique’:

is concerned with situating human knowledge socially or alternatively with advancing an understanding of reality or specific entities as socially produced, rather than as simply given with fixed ontological properties. These more metaphysically inclined varieties of constructionism are aimed against certain philosophical understandings of objectivity, truth and reality (Demeritt 2002: 771).

It is this second form of social construction upon which I draw in this thesis, particularly in my analysis of conflicts over water in the Lake Eyre Basin in chapter 4.

Efforts to rethink water resource management that aim to address exclusion and colonialism require rethinking water itself. As discussed in the previous section, water resource management is limited by a construction of water as a ‘resource’, or an economic good or service. Social nature offers alternatives to the construction of water as a resource, considering instead the multiple ways that water is co-constituted through complex social and natural processes. It opens possibilities for thinking about water as living and life-giving, and as interconnected with other living and non-living entities and processes.

An analysis of water as social nature presents opportunities to develop more complete, complex and nuanced understandings of water, and to find more just and sustainable ways of living with water. According to Bruce Braun:

understanding nature as social—seeing the world in terms of nature-culture ‘hybrids’—presents the best way to understand and interrogate present-day social and environmental conditions and to imagine steps toward ecologically sustainable and socially just futures (2002: 10).

Instone asserts that ‘understanding the discursive construction of nature, and the practices through which we bring ‘nature’ into our social worlds, is vital for actions seeking to combine justice, decolonisation and nature conservation’ (2004: 136).

In this thesis I am concerned both with the ways that water is socially constructed through space and time, and with water’s agency. According to FitzSimmons and Goodman:

Until recently, it has become a commonplace in social theory to ignore the specific ‘agency’ and ‘materiality’ of nature or, where that agency has been admitted, to conceive of it within the disabling binary logics that have for so long organised modern thought (1998: 194).

Throughout the thesis I consider the ways in which water forms, shapes, changes and affects landscape, places, people, cultures, the non-human living world (plants and animals), and interconnections between these entities. I use the concept of ‘variability’ to explore the diverse, changing and complex ways that people, water, and the non-human world are interconnected. Other theoretical frameworks such as Actor Network Theory (Callon 1986; Latour 1993 *inter alia*) would also provide interesting ways of approaching this research. My research takes water and place as key nodes in an *actor network* (of sorts), but I focus more on the ‘construction’ of these nodes than on their interrelations in the sense of Actor Network Theory. Ideas and models from elsewhere have been laid over

Australian landscapes throughout the continent's European settlement history, often with devastating affects (see chapter 3). Rather than continue this process, I choose to develop a new framework—'valuing variability'—that emerges from the particular place I am studying, and responds to the specific context of Australia. I do so by drawing on the discourse of social nature, 'rethinking natural resource management', Australian Aboriginal Studies, and ecosystem thinking, all of which prioritise interconnection.

1.7 Methodology and methods

1.7.1 Methodology

This research is informed by a multidisciplinary discourse—emerging from human geography, resource and environmental studies, and Aboriginal studies—about the subjectivity of knowledge (Haraway 1991; G. Rose 1997; Howitt 2001), and the existence of multiple, co-existing ways of knowing the world (D. Rose 1999; Howitt & Suchet-Pearson 2003). A broadly postcolonial literature informs the complex networks of power through which people structure relationships (Sharp *et al.* 2000), and the nature of relationships people form with other people and place in Australia (Jacobs 1996; Gelder & Jacobs 1998; Suchet 2002). These discourses have led to the primary research method of in-depth, open-ended interview, which has provided opportunities for listening to and learning from others, and has enabled me to be 'available to be surprised, to be challenged, to be changed' by the dialogue of the research project (D. Rose 1999: 175). Anthropologist Deborah Bird Rose describes the key role of dialogue in research in the context of her work in the Victoria River District in the Northern Territory:

dialogue begins where one is, and thus is always situated ... dialogue is open ... the outcome is not known in advance. Openness produces reflexivity, so that one's

own ground becomes destabilized. In open dialogue one holds one's self available to be surprised, to be challenged, and to be changed (1999: 175).

Feminist geographers in particular have written extensively about the subjectivity of knowledge, and the process of 'situating knowledges'—making visible the specific circumstances that shape knowledges (G. Rose 1997: 305), be they gender, race, class, culture or otherwise. They describe knowledge as partial, uncertain and limited (Haraway 1991; Harding 1991; G. Rose 1997), and focus on subjectivity in order to avoid 'false claims to universally applicable knowledge which subjugate other knowledges and their producers' (G. Rose 1997: 307). 'Situating knowledges' avoids what Haraway (1991: 189) and Gillian Rose (1997: 308) describe as the 'god-trick' of claiming to see the whole world from nowhere.

According to Gillian Rose, the aim of situating academic knowledge is to 'produce nongeneralizing knowledges that can learn from other kinds of knowledges' (1997: 318). This aim is consistent with the approach I take in this research of listening to and learning from others. I have learnt the importance of listening and learning through working with Australian Aboriginal people, prior to and during this research, and through a multidisciplinary literature of Australian Aboriginal Studies. Situating knowledges recognises the knowledges of both the researcher and the researched (G. Rose 1997).

Place plays an important role in listening and learning—particularly in Aboriginal Australia, where place and knowledge are intimately connected. The Aboriginal English term 'Country' encapsulates the interconnections between people, place, culture, Dreamings, histories, and all living and non-living things. According to Deborah Bird Rose, Country is:

Small enough to accommodate face-to-face groups of people, large enough to sustain their lives, politically autonomous in respect of other, structurally equivalent countries, and at the same time interdependent with other countries, each country is itself the focus and source of Indigenous law and life practice. To use the philosopher's term, one's country is a nourishing terrain, a place that gives and receives life (1999: 177).

Place can be a powerful influence in research. In this research I consciously employ 'place' as an 'actor' in my methods. When interviewing people I sit down with them, in their place. Many of my interviews have taken place at a kitchen table; some under a tree, on a fishing trip; in a Hilux travelling around a property; in a local café. These are the places known to the interviewee. Listening to people in their places is significant: it provides a familiar context for the interviewee and contextualises the knowledge they share with me. At the same time I am conscious that *I* am in a new place. The physical setting is not known to me; ways of being in this place are not mine. An 'interview' is being conducted, but its terms are not solely determined by the interviewer; the precise conduct and timing are largely decided by the interviewee and framed by the place. I apply aspects of what I have learnt through working with Aboriginal people and through Aboriginal studies in my field research, particularly the importance of listening to and learning from others, and the significance of place.

Postcolonial discourse further informs this research methodology (Blunt & Rose 1994; Jacobs 1996; D. Rose 1999, Tuhiwai Smith 1999). This discourse emerges from an analysis of the ongoing structures and processes of colonisation, complex networks of power, and relationships between people and place, and has particular relevance for the Australian context. Postcolonial studies focus on the structures and processes of colonial governance

and power, and provide a framework for understanding Australia as a colonised place. Colonial structures and processes directly affect the types of interactions and relationships people form with other people and with place—often relationships of control and domination. In central Australia, colonial power has played out dramatically in interpretations and expectations of landscapes, and forms and patterns of land use (I consider the enormous implications for water in chapter 3). Colonisation involved importation and imposition of strategies for living, rather than development of methods derived from place.

Central to postcolonial discourse of methodology is the understanding that colonisation is not simply a single point in time—the point of colonial contact. Rather, colonisation is complex and multifaceted, experienced differently from different positions in the colonial project, and changing through time. The complexity of colonial processes has implications for research. The researcher must be aware of the role of power in the research relationship—traditionally interpreted as the power of the coloniser over the colonised. A postcolonial critique illuminates the more nuanced ‘entanglements of power’ (Sharp *et al.* 2000), involved in both fieldwork and in writing (McDowell 1992; Blunt & Rose 1994; Jacobs 1996).

The research methodology and the methods I employ are consistent with the approach I develop for ‘managing’ water, or imagining more just and sustainable ways of living with water. Most importantly this includes: acknowledging the existence of multiple knowledges; listening to and learning from others; recognising the importance of place; and being open to surprise, challenge, and change.

1.7.2 Methods

Research methods comprised a field component involving in-depth, open-ended interview, and participant observation. I conducted my research in accordance with the National Ethics guidelines established by The Australian National University and the Institute of Australian Geographers. In addition, the research drew on discussions with numerous contacts who were not formally interviewed. Critical analysis of management documents and secondary sources played an important role in developing my understanding of place and water places.

The fieldwork component of the research involved three field sessions undertaken in 2002 and 2003. Each involved extensive travel from Canberra. In the first field session I sought to develop my understanding of the structures in place in the Lake Eyre Basin and the main issues facing the Basin, particularly in relation to water. I undertook a trip to Adelaide in September 2002. Adelaide is home to many of the government bodies and institutions involved in water management in the Lake Eyre Basin, including the South Australian Department of Water Land and Biodiversity Conservation (DWLBC), the Arid Areas Catchment Water Management Board (AACWMB), South Australian universities involved in research in the Basin (in particular the University of Adelaide and Flinders University), the Australian Conservation Foundation—members of which were involved in recent conflicts in the Lake Eyre Basin over water—and several individuals affiliated with the Lake Eyre Basin Coordinating Group (which I discuss later in the thesis). During this trip I met several people who have played key roles in the Lake Eyre Basin, introduced myself and my project, sought their support, and in some cases arranged future meetings during which I would undertake interviews.

The second field trip took me to Birdsville, in October 2002 for the Lake Eyre Basin Ministerial Forum and Biennial Conference. It attracted people living and working in the Lake Eyre Basin who are involved in water and other natural resource management issues, and included State, Territory and Federal government officials, policy-makers, pastoralists, ecological scientists, other academics, town residents, tourism operators, mining and petroleum representatives, Aboriginal people, and other interested in the Lake Eyre Basin.

The conference aimed to:

provide an opportunity for members of the Lake Eyre Basin community, scientists, government officials and other parties with an interest in the sustainable management of the Basin to exchange information and views relevant to the implementation of the Lake Eyre Basin Intergovernmental Agreement (discussed in chapter 4) (Lake Eyre Basin 2002: 4).

I registered as a participant at the meeting and used the method of participant observation to learn about the structures, processes and issues in the Basin. In particular, I observed dynamics between 'stakeholders'; communication and decision-making processes; the level of involvement of different stakeholders (for example, few Aboriginal people or town people attended); rapport between government policy- and decision-makers and people living in the Basin; and the issues that were dominant or widely considered the most important. As the conference was attended by many of the people involved in water issues in the Lake Eyre Basin, this trip provided opportunities for me to identify, meet and speak with these people, and arrange future meetings.

The act of travelling to Birdsville is not insignificant. Many times during my travels in the Lake Eyre Basin I heard people express discontent at government officials or 'experts from the cities' who attempt to work or undertake research in the Lake Eyre Basin from a

distance. The only way to fly to Birdsville is by chartering a plane; travelling by road involves two days driving or more from the major cities. I travelled by road from Adelaide with a group of ecologists from the Aridflo project (discussed in chapter 3). The trip is 1 200 km; 600 km is on unsealed road. Some people interpreted my travel to Birdsville—at the centre of the Lake Eyre Basin—as a sign of my commitment to the project and, more importantly, to the place. Travelling by road was viewed more positively; I had not flown in with the ‘government people’, thereby over-flying the places that many of the people of the Basin call home.

The third trip was my major field session, during which I undertook my interviews. During the two-month trip, I drove 10 000km and undertook interviews with 32 people. I also met and spoke with a number of people who assisted me greatly and who I learnt from, but did not formally interview. My initial list of interviewees comprised people recommended to me by former coordinator of the Lake Eyre Basin Coordinating Group, Kate Andrews. These were primarily people involved in Lake Eyre Basin catchment management processes, or in the conflicts over water during the 1990s. I then expanded my list of potential interviewees, focusing on the south-eastern section of the Basin, by approaching people I met in Adelaide and at the Birdsville conference, and people recommended to me by other interviewees and contacts (a technique known as ‘snowballing’). I specifically sought out a number of individuals on the basis of their role in water management or in one of the two conflicts over water, and also intentionally sought conversations and interviews with a number of people not involved in water management. As such, my list grew and changed as the field trip progressed, but it always comprised people who expressed an interest in talking with me about water.

This selection method worked well. I am interested in learning about people's experiences of particular water and water places, which requires a level of interest on the part of my interviewees. I found that my research had broad appeal; people in the Lake Eyre Basin wanted to talk about water. I did not aim to gather a representative cross-section, nor an exhaustive list of values associated with water, but rather to develop a sense of the complexity and texture of values in a place. I spoke with a range of people whose relationships with water and water places in the Lake Eyre Basin differed greatly. This list includes: pastoralists who have lived in the Basin all their lives; pastoral women who married and moved to the Basin; station managers who have lived and worked on a property for short time, before moving on to another property; Aboriginal people born and living in the Basin; scientists who have worked in the Basin for many years; government policy- and decision-makers who spend most of their time outside the Basin; employees of mining and petroleum companies who work on a fly-in/fly-out basis; people living in the towns of the Basin; and tourism operators whose work focuses on the experiences of visitors to the Basin. My interviewees hence hold a diverse set of values and of worldviews.

During the major field session I observed two other natural resource management meetings. The first was the second meeting of 'Desert Channels Queensland' in Longreach. The second was the South Australian Interim Natural Resource Management group, held in Blinman in the northern Flinders Ranges. These two organisations are the new state bodies responsible for catchment management in Queensland and South Australia respectively, since the introduction of the National Heritage Trust 2 and de-funding of the Lake Eyre Basin Coordinating Group in 2003 (I discuss the Lake Eyre Basin Coordinating Group in chapters 3 & 4). At each of these meetings I briefly summarised my research. The purpose of my attendance was two-fold: to introduce or reintroduce myself and my project

to the people on those boards; and to develop my understanding of decision-making processes and major issues of concern in the Basin.

In the course of travelling long distances, I stayed on the properties of several of the pastoralists I interviewed, and in the homes of some others. In most instances we spent at least several hours together; in a number of cases, several days. In contrast, interviews conducted outside the Lake Eyre Basin, particularly those with government employees, generally lasted very little more than the formal interview time, though were in some cases followed up with conversations by telephone or email.

I aimed to develop an understanding of the meanings and values associated with water in the Lake Eyre Basin, and the extent to which these meanings and values are recognised in current natural resource management. I tailored questions slightly to individuals, but employed a standard list of issues to discuss. In the interviews I asked people about the forms and functions of water in their lives; about how they interact with water, and the factors influencing how water is used, managed and lived with. I asked pastoralists to describe the water on their property, and others about the water in their lives. I asked about water-related issues people consider to be priorities, for their lives and for the Lake Eyre Basin. People spoke about their roles in and opinions of natural resource management processes in the Lake Eyre Basin, and about the emergence of the language of 'social and cultural values' in natural resource management: what it means to them and why this language is appearing in natural resource management. I asked some people about the conflicts over water, but knowing that these conflicts are still fresh in the minds of some of my interviewees, I chose to avoid certain questions in certain contexts to respect the sensitivity of particular issues.

The fieldwork informed my understanding of the forms of water, its functions, the meanings and values people associate with water and water places, the ways in which people live with water and some of the reasons for these ways of living. I came to understand that meanings and values associated with water are diverse, changing and complex. Values are interconnected; what people value about water crosses the established categories of value described in sustainable development discourse and reinscribed at the Birdsville meeting (which I discuss in chapter 5, section 5.5.2).

While interviewing people provided me with insights into the values *people* attribute to water, I did not want to limit my research to people; I aimed to learn about the values of water in and for the non-human world. Ecological and geomorphological literature and documents—as well as interviews and discussions with ecologist and geomorphologists—proved extremely valuable. Ecology and geomorphology help me develop an understanding of interconnection, change and process in the place I am studying. These disciplines helped me develop an understanding of human interpretation of the non-human world. Although they represent *human interpretation*, studying these areas allows me to develop an analysis that is not entirely human-centred.

I took detailed notes during all interviews. I recorded and fully transcribed interviews, when granted permission to do so. In some cases, interviewees requested that they see the transcript before I used their words in my work; in others, that they see the context in which I referred to or quoted them. Others did not want to see the transcript, and granted permission for me to use the material from the interview in my thesis and papers emerging from it. In several cases I contacted people after the fieldwork for details or additional information.

Consistent with my intention to listen and learn, and to acknowledge the knowledge of others, I present the words of the people I interviewed, allowing them to speak for themselves. Clearly, as the researcher and writer, I create the context for their words and ideas and present the interpretation; the conclusions I draw should not be attributed to the participants. By acknowledging their knowledge I intend to not only attribute words and ideas to individuals, but to thank them for their time and thoughtfulness. Throughout the thesis, I refer to interview transcripts in the form: '(surname, date of interview)'. People I identify in this way gave their permission to be identified as such in my thesis and in publications emerging from it. Those people who did not give permission I do not identify, and refer to their ideas in discussion only. When referring to the interviews I did not record, and therefore do not have a complete transcript of, I use the form: '(field notes, name, date of interview)'. These 'quotes' are taken from my field notes, and therefore do not necessarily represent the exact words used by the interviewee. Rather, they represent my best efforts to capture the language and the meaning. I use '(field notes)' alone to refer to my personal field observations. Consistent with the ethical approach I take, I will ensure that key organisations and individuals receive a copy of my thesis and/or relevant papers emerging from it, as a way of returning my ideas to the places and people that inspired them.

1.8 Thesis outline

In the following chapters I examine the particular water paths and water sites of the Lake Eyre Basin in order to move beyond an abstract notion of water, or water-in-general, towards an understanding of relationships between water, people and the non-human world, in a particular place (chapter 2). From there I move on to analyse changing ways of knowing Australian water (chapter 3). Early colonial relationships and the development

imperative were manifested in strategies including irrigation, water diversion and bore-drilling. These methods of control indicate an unwillingness to accept Australian landscapes in the state in which they were first encountered by settler Australians. Such non-acceptance has been reinscribed in more recent management strategies—notably the separation of land and water in natural resource management by the Council of Australian Governments. However, such ideas have been countered in recent decades by the social movements of environmentalism, Sustainable Development, and Aboriginal land rights, which indicate a shift in conceptualisation of water from development and control towards interconnection and holism.

In the Lake Eyre Basin, two conflicts over water during the 1990s led to people rethinking water (chapter 4)—their relationships with water and water places, and with other people and the non-human world. These two conflicts stimulated the first locally driven catchment management process in the Basin and new conversations about water. In chapter 4 I examine these conflicts and conversations, and consider the ways in which water was constructed through these processes. I argue that through rethinking water, people came to articulate more holistic understandings of water and values associated with water and water places.

In chapter 5 I analyse the concept of value, as applied to ‘nature’, and current practices of valuing nature and water. The discourse and practice of valuing nature emerges from diverse disciplinary approaches. While dialogue exists between some disciplines—particularly economics and ecology—the literature concerning nature’s values remains largely contained within separate disciplines. In this chapter I bring together some of these disparate discussions about the value concept and valuing practices through an analysis of dominant methods of valuing water, and the ways in which water is being valued in the

Lake Eyre Basin. I consider the limitations of current approaches to valuing water in order to find more just and sustainable ways of valuing water that capture the diversity, complexity, and changing nature of values associated with water.

The discrepancy between current methods of valuing water and the values associated with water in the Lake Eyre Basin provides the point of departure for chapter 6. In this chapter I propose a new framework for valuing water: 'valuing variability'. The term 'variability' is widely used in ecology and geomorphology to describe the water regimes—rainfall and river flow—of arid and semi-arid landscapes like the Lake Eyre Basin. During my fieldwork, people repeatedly spoke about the variability of water and its effects in the country they know. This chapter considers meanings and values associated with water and water places within the theoretical framework of variability. I argue that the concept of variability is central to water and its values in the Lake Eyre Basin. Finally, chapter 7 considers the implications of valuing variability for discourse and practice within the Lake Eyre Basin and in a broader context of valuing water.

CHAPTER 2

LAKE EYRE BASIN WATER PLACES

2.1 Introduction

The Lake Eyre Basin is characterised by a dry and highly variable climate. The Basin covers an area of 1.14 million km² in arid and semi-arid central Australia. The variability of water in the Lake Eyre Basin—both rainfall and river flow—provides a crucial context to this chapter, and forms a major theme of this thesis. Water, and water's variability, transforms physical and cultural landscapes, over short and very long time scales. 'Lake Eyre itself ... is the remnant of a once far greater lake, Dieri, which in the Pliocene, would have fulfilled Sturt's dream of an inland sea at the heart of a fertile, forested basin' (Puckridge 1992: 20) (See Figure 1.1).

This chapter is concerned with moving beyond an abstract notion of water, or water-in-general, to consider interactions with specific water in particular places. My discussion follows water paths and water sites through the Lake Eyre Basin to consider the diverse and changing interactions between water, people, place, and other living and non-living

entities that create places. The purpose of this close study of place is to provide a spatial and historical context for my research. As mentioned in chapter 1, I focus particularly on the south-eastern part of the Lake Eyre Basin.

I use the terms 'water paths' and 'water sites', and more inclusively 'water places', to express a sense of water's presence, and its agency, even during its physical absence. Water in the Lake Eyre Basin is ephemeral and episodic. During wet periods, the floodplains of Cooper Creek extend up to 60km wide (Knighton & Nanson 1994: 139). Dry times may see water in only the deepest waterholes. Most rivers and lakes do not permanently hold water. However, water can be seen in the landscape throughout the year, in the form of the paths it has cut or followed and the sites in which it has settled. Water places may be dry, but show evidence that water once occupied, travelled through, emerged from, or formed them. A water place may be an inter-dune clay-pan where rain falls from time to time, or a slight depression on a gibber¹ plain where adequate run-off has stimulated growth. Signs in the land/waterscape remain: a dry river bed; a white salt lake; lines of *Eucalyptus camaldulensis* (River Red Gum) or *Grevillea striata* (Beefwood); debris caught high in a tree; a cattle carcass held in mud (Figures 2.1 & 2.2). A 'water place' has a history and a future as well as a present; it suggests temporality. Water places tell stories of where water exists and travels, and more than that; they tell stories of *how* water existed in or flowed through a place, and the effects it has had. By using the terms water paths, water sites and water places, the roles, significance and relationships of water in this often dry land/waterscape are not lost.

Most obviously, water is found in rain, lakes, rivers, waterholes and springs. More subtly water exists in wells, soaks, claypans, in grasses, rain clouds, beneath the salt crust of lakes,

¹ The term 'gibber' defines the stony pavement surface that characterises much of Sturt Stony Desert and other parts of the Lake Eyre Basin away from the rivers and sand dunes.

Figure 2.1 A water site. Drying Kooncheri waterhole, Goyder Lagoon, with a cattle carcass trapped in the mud (right of centre of photograph). October 2002.

Figure 2.2 A water path. Cattle carcasses caught in tree-tops following a flood. Source: from the collection of the 'Australian Stockman's Hall of Fame and Outback Heritage Centre', Longreach (donated by Mrs N. Roby, Innisfail).

within the bodies of animals and plants. In the last century and a half, this list of water sites and paths has expanded to include bores, boredrains, tanks, dams, pipes and evaporation ponds. In this chapter I discuss the water places of the Lake Eyre Basin with reference to their nature and their variability, the human and non-human interactions that create them, and the meanings and values associated with these places. The water places form and reform physical landscapes and shape social and cultural landscapes. Water places are created and recreated by interactions between humans, water, place and non-human others.

2.2 Sky water: rain and evaporation

Mean annual rainfall in the headwaters of the Lake Eyre Basin rivers is 400-500mm, and it is as low as 100mm at the mouth of Lake Eyre (Knighton & Nanson 1994: 139). Evaporation in this area is as high as 3 600mm per year (Allan 1990: 81). In much of the Basin, evaporation exceeds 3 000mm. While mean annual figures point towards aridity, they conceal variability, and so marginalise a central characteristic of the Basin. They can also conceal the extent of aridity. Mean annual figures are influenced by a few extremely high rainfall events, and as a result annual rainfall in a given area is 'below average' for more than 50% of years (Friedel *et al.* 1990: 186).

Rain provides the main contribution to river flow in the Lake Eyre Basin. Monsoons can feed large flow events, and local rain contributes to smaller scale episodic flows. Large flows in the northern reaches of the Georgina and Diamantina Rivers and Cooper Creek are often fed by monsoon-driven climatic events. Sub-tropical monsoons occasionally extend as far south as central Queensland, delivering large quantities of rain to their headwaters. Further inland, rivers are often fed by local rainfall, which may affect only small parts of the Basin, creating localised episodic flows. Local effects vary upstream and

Figure 2.3 A water path near Lake Harry, off the Birdsville Track, South Australia. Local rain follows a depression in the gibber plain, stimulating localised vegetation growth. April 2003.

downstream, as rainfall events deliver different quantities of water and evaporation varies through the Basin.

Away from rivers, vegetation response varies according to local rainfall. High evaporation rates mean water places are ephemeral, and often change quickly. Patterns of rain vary dramatically. Local rain can create small water paths, exploited by life on a small scale (Figure 2.3). On a larger scale, while one pastoral property receives rain, providing fodder and relief, a neighbouring one remains dry (Morrish 5.03; Scott 5.03). But the presence of rain does not guarantee plant growth. Heavy rain following a long dry period can cause erosion and soil loss that outweigh benefits of growth. Heavy rain with no 'follow-up' rain may have little effect.

Australia's climatic variability has come to characterise the Australian continent. Dorothea MacKellar's love of 'a sunburnt country ... of droughts and flooding rains' (MacKellar 1911: 9) is invoked *ad infinitum* in popular culture. The variability of rainfall and river flow in Australia directly affected patterns of settlement in the emerging nation. Edward John Eyre's expedition to the centre of Australia in 1840 found a desolate and barren landscape. But his summation was soon overwritten by John McDouall Stuart's reports from his 1859 expedition. He states in his journal:

take it altogether I have not seen better runs in the colony, and in the driest summer the furthest distance from water will not be above five miles at the most, but the feed is so abundant that they would not require to go so far. On that account they will feed double and treble the number of stock that runs down the country do (Stuart, quoted in Harris 1980-81: 33).

Australia's European settlers did not recognise Australia's climatic variability at this stage, and so could not understand its implications. Only five years after Stuart's journey, in the most dramatic historical case, the 'Great Drought' of 1864-66 saw much of the recently settled country de-stocked and de-populated. I discuss the significance of attitudes to 'flood' and 'drought' in chapter 3, section 3.2.

2.3 Surface water

Three rivers dominate the Lake Eyre Basin: the Georgina and Diamantina Rivers and Cooper Creek. They trace paths towards Lake Eyre, in the most arid part of Australia and the lowest point on the continent. These internally draining rivers make the Lake Eyre Basin the largest internally draining basin in Australia (Allan 1990: 81), and one of the largest in the world (Kotwicki 1986: 4). Other rivers flow towards Lake Eyre or flood out

in the Simpson, Strzelecki and Sturt Stony Deserts. Major flood events—in which very large quantities of water enter Lake Eyre from any combination of its tributaries—come rarely. The largest recorded lake fillings have been in 1949-50, 1974-77, 1984 and 1989-90 (Kotwicki 1986; De Vogel *et al.* 2004; Geosciences Australia 2005). The year 2000 also saw large floods on Cooper Creek that reached the Lake. According to Kotwicki (1986: 50), prior to 1949 water was seen by settler Australians in Lake Eyre North only twice: in 1869 and 1922. Much more frequently, flowing rivers deliver small amounts of water, or flows evaporate before reaching the Lake terminus. The Basin is reliant on both these large events and smaller, more frequent flows, to recharge waterholes and feed water and sediment to floodplains.

The rivers of the Lake Eyre Basin are characterised by decreasing river discharge and rainfall downstream, and increasing variability, as they wind their way from the monsoon-dominated north towards more arid country with low rainfall and high evaporation. This pattern is markedly different from temperate regions of the world, where river flow increases downstream as a result of greater input from tributary rivers. It has significant implications for understanding place and for managing water resources.

As rainfall and river flow change through the Basin, so too the shape and nature of the rivers changes. In the upper reaches, rivers are confined within well-defined banks. The middle section of the Basin is characterised by its wide floodplain and anabranching channels. Further downstream still, at its most arid point, rivers become paths or traces, most often dry and with poorly defined banks over which water spills when water flows.

When rivers flow they deliver more than water. Water and the sediment carried by its flow combine to form and reform floodplains, feeding floodplain growth, shaping and reshaping

habitat, and producing pasture. Water plays a vital role in delivering sediment through the Basin. Sediment supports vegetation growth, which in turn supports diverse life-forms adapted to variability.

2.3.1 Cooper Creek

Cooper Creek is one of the two major river systems in the Lake Eyre Basin (the other being the Georgina-Diamantina). It is fed by the Thomson and Barcoo Rivers in central Queensland. From their headwaters, these rivers flow south-west towards the most arid part of central Australia. Where the Thomson and Barcoo Rivers meet, the waterway becomes Cooper Creek. In 1845 Charles Sturt named 'Cooper's Creek' for the South Australian Judge Cooper. It is often jovially remarked that Cooper's Creek is a *creek* fed by two *rivers*. Sturt wrote in 1845: 'I would gladly have laid this creek down as a river, but as it had no current I did not feel myself justified in doing so' (Sturt 1849). The naming of Cooper's Creek is telling; Sturt came upon and named the water course during a dry time, when its flow was little more than a trickle. At the time of its 'discovery' it was inconceivable that the trickle in the channel would, at another time, feed a vast floodplain, just downstream. The naming reveals a great deal about European expectations. The Thomson and Barcoo 'Rivers' fulfilled the Eurocentric imagination of a 'river', with regular flow and comparatively well-defined banks.

Cooper's Creek is referred to as both 'Cooper's Creek' and 'Cooper Creek'. In 1949 place-naming practices in Australia were officially changed in accordance with the Survey Office policy of dropping the genitive apostrophe, and at times the possessive 's', from place names (Surveyor-General's decision 21 November 1949) (QLD Department of Natural Resources and Mines 2003). For this reason, much scientific literature refers to 'Cooper

Creek'. However, many local people maintain the earlier naming tradition, and continue to know the river as 'Cooper's Creek'. Rather than adopt one naming practice or the other, in this thesis I use both, using 'Cooper's Creek' to signify local understandings, and 'Cooper Creek' to refer to official use.

The town of Longreach was built on a relatively permanent waterhole on the Thomson River, and is now a major administrative and service centre for central Queensland, with a population of 4 000 (Longreach Shire Council 2000-2003). Downstream of Longreach, the confined banks of the Thomson flow through the Mitchell Grass Downs. This is now primarily sheep grazing country, with some cropping and small-scale agriculture. The townships of Jundah and Stonehenge—with populations of 120 and 30 respectively in 2004—sit on the banks of the river. During the late 19th and early 20th centuries, Chinese market gardeners cultivated the floodplains in this area, providing vegetables to local towns and pastoral properties (Emmott 5.03).

Just downstream of the Thomson-Barcoo confluence, Cooper Creek flows through Windorah, a town of 60 people (in 2004). During the 1990s, the property Currareva, on the outskirts of Windorah, was the proposed site for a large cotton irrigation development. The proposal led to conflict and conversation about water, water places, and ways of life, and drew people from around the Basin and around Australia to Windorah. These events, centred on Windorah, provide the focus for discussion of conflict, conversation, and rethinking water in chapter 4. It is from this point on the river downstream that this study focuses.

From Windorah, Cooper Creek leaves its confined banks to open out to the 'Channel Country'. This name refers to the multiple channels the river forms. The Channel Country

is extensive: in parts the floodplain can exceed 60km in width, and it stretches 420km in length (Knighton & Nanson 2002: 1772). The channels are of two main types: narrow and deep primary channels that carry water and sediment in moderate flows, and broader, shallow channels that cut into the floodplain, flowing during larger floods. In places, channels expand to form waterholes, varying in length from 100m to over 20km (Knighton & Nanson 2002: 1772) (Figures 2.4 & 2.5).

In economic terms, the Channel Country is now some of the most highly valued cattle-grazing country in the Basin. The majority of properties in the region are owned by some of the largest grazing companies in Australia—Kidman Holdings, Stanbroke Pastoral Company, Australian Agricultural Company and Consolidated Pastoral Company. These sit alongside a handful of smaller family-owned properties that have been in operation since the 1860s (Fitzhardinge 2001; Griffiths 2001) when pastoralism in the region was established.

Today, tourism focuses around water, but the Channel Country remains largely inaccessible to tourists because it lies within pastoral lands. Though visited by few tourists, the Channel Country occupies a significant place in the Australian imagination. Poet A.B. 'Banjo' Paterson's popular poem 'Clancy of the Overflow', first published in 1889, paints a romantic picture of the life of a drover on Cooper Creek:

In my wild erratic fancy visions come to me of Clancy

Gone a-droving 'down the Cooper' where the Western drovers go;

As the stock are slowly stringing, Clancy rides behind them singing,

For the drover's life has pleasures that the townsfolk never know (Paterson 1895).

Figure 2.4 Cooper Creek floodplain south-west of Windorah during major flood, 6th April 1949.

Source: Gibling *et al.* 1998.

Figure 2.5 Cooper Creek Channel Country. Anabranching channels, South Galway Station, south-west Queensland. Photograph by G.C. Nanson.

After some 400km Cooper Creek swings sharply west towards the Innamincka Dome, a bedrock outcrop through which the river cuts. The pastoral property Nappa Merrie hosts each year some 35 000 visitors to 'The Dig Tree' (Forestry in Queensland 1999), a 200 year old coolibah tree (*Eucalyptus coolabah*) marked with an oval blaze bearing the words 'DIG 3 FT. N.W. APR. 21 1861' (Moorehead 1963: 95). In 1860 Robert O'Hara Burke led a party of 17 men, including second-in-charge William John Wills, in an effort to make the first south-north crossing of the Australian continent. The party left Melbourne in August, but Burke impatiently divided the group in order to make faster progress, leaving supplies and men at Menindee in NSW and at Cooper's Creek, South Australia. Here they established a depot in November, and Burke took Wills and two other men—John King and Charles Gray—to continue the journey. They reached the gulf in February 1861. Only three of the four men returned to the depot (Gray died on the journey) but they returned a month later than they had planned, and when they did, the remainder of the party had abandoned the camp. Before departing, the party buried a box with rations and a note, and left their mark on a nearby coolibah tree. When Burke, Wills and King dug the freshly turned earth they found that the depot party had left that very morning—the three men had missed them by some nine or ten hours (Moorehead 1963: 97; Cash 2001). Burke and Wills died of malnutrition on the banks of Cooper Creek, and were buried downstream of the Dig Tree. King was cared for by local Aboriginal people, surviving to be found by a search party in September 1861. The grave sites of Burke and Wills lie near Cullyamurra waterhole, a reliable freshwater source where Indigenous people survived for thousands of years (Fitzhardinge 2001: 8) (Figure 2.6).

The Innamincka Dome confines the vast floodplain flow to mere metres across. The entire flow is pushed through a narrow constriction known locally and informally as 'the Choke'. The force of water through the Choke has scoured Cullyamurra Waterhole—7 km long,

Figure 2.6 The 'Dig Tree'. Photograph taken c.1911. Source: National Library of Australia.

and up to 30 m deep at the up-stream end (Bowman 2003: 134). Unlike many waterholes in the lower part of the Lake Eyre Basin, Cullyamurra has not been dry in European history (Figure 2.7). Evidence of the life-giving quality of Cullyamurra waterhole is provided by the rock art at the Choke (Figure 2.8). It is of the Panaramitee style, which is prominent across a wide area of central Australia—including north-east South Australia, western Queensland and western New South Wales—and also occurs outside the arid zone in the central Queensland highlands, the Queensland Gulf country, south-east Cape York Peninsula, around Sydney, and in Tasmania (Morwood 2002: 57). The Panaramitee style was first identified by Lesley Maynard, in her 1976 Master of Arts thesis. She named this very old engraving style after the type-site on Panaramitee Station in north-east South Australia (Maynard 1976). Morwood suggests that it was widespread prior to 5 000 years ago, after

Figure 2.7 L.M. Gibbs at 'the Choke' on Cooper's Creek, near Innamincka. May 2003. Photograph by J.D. Jansen.

Figure 2.8 Rock engraving in the Panaramitee style beside 'The Choke', Cooper's Creek (lense cap shows scale). May 2003.

that time contracting to Tasmania and central Australia. If the Tasmanian engravings are from the same rock art tradition, then the Panaramitee style predates the formation of Bass Strait 11 000 years ago; a site in south-eastern Cape York named 'Early Man' has been dated at 14 000 years (Morwood 2002: 57-58).

Unlike the Channel Country upstream, Cullyamurra waterhole attracts vast numbers of tourists each year, who flock to water in dry lands. National Parks estimated that in 2002, 40 000–50 000 visitors were attracted to the reliable water of Cullyamurra and the adjacent township of Innamincka (Schmiechen 2004: 39). The permanent water of Cullyamurra forms a focus of human and non-human life in the region. Innamincka township was established around Kidman-owned Innamincka pastoral station and the Elizabeth Symon Nursing Home. The latter was opened in May 1929 as one of several 'outback' hospitals established by the Australian Inland Mission to provide medical services to people living in remote areas of inland Australia (Burchill 1960). Today Innamincka township is home to fewer than 20 people and a service centre. A study of Heritage Tourism in the Lake Eyre Basin—'Lake Eyre Basin Heritage Tourism: Future Directions' (initiated by the Lake Eyre Basin Coordinating Group, in conjunction with the Australian Heritage Commission)—identifies the 'Innamincka Cooper Creek Heritage Precinct' as one of the key tourism sites in the Lake Eyre Basin (Schmiechen 2004). According to heritage tourism consultant Joc Schmiechen, this area, incorporating Cullyamurra waterhole and the Burke and Wills sites, provides tourist access to the two key themes of tourism in the Lake Eyre Basin: water and heritage (Schmiechen 4.03).

Two water paths are traced from Innamincka. Most often water flows west and then north towards Coongie Lakes. However, in particularly large floods, water can flow south on Strzelecki Creek, when it breaches the high bar at the creek's off-take. Strzelecki Creek

traces a path towards Lakes Blanche, Callabonna, Frome and Gregory. The gradient of Strzelecki Creek is so low as to allow it to flow, at different times, in both directions: with a large flow on Cooper Creek, Strzelecki Creek flows south towards the lakes; yet with heavy local rainfall over Lakes Blanche, Callabonna, Frome and Gregory, water can flow north towards Cooper Creek. And water may, at times, flow north-west from Lake Gregory to rejoin Cooper Creek downstream of Coongie Lakes (Kotwicki 1986: 32; DeVogel *et al.* 2004).

The path formed by Strzelecki Creek was followed for the delineation of the Strzelecki Track—the eastern-most and least travelled of three major stock routes through the south-east Lake Eyre Basin. The Track follows the Creek closely from Innamincka to Lake Blanche, and then continues south-west to Farina (south of Marree) where it historically joined the rail head. The Strzelecki Creek most often exists as a string of ephemeral waterholes, with no permanent source of water anywhere along its length. Secure water can only be found in times of heavy rainfall and major floods on Strzelecki Creek. The central and southern parts of the Track were not permanently settled, and so only two bores were drilled along its length. As a result, drovers generally preferred to use the Birdsville Track, further to the west. In the 1930s the stock route was closed, and the bores were no longer maintained (Yelland 2002: 62-68). The Strzelecki Track is intrinsically connected to the legend of bushranger ‘Captain Starlight’. In 1870, Henry Arthur Readford (also known as Harry Redford) stole 1 000 head of cattle from Bowen Downs near Longreach, and drove the mob south along Cooper’s Creek and Strzelecki Creek. A white bull among the mob was sold in South Australia and later used as evidence against Readford at his trial. Boldrewood published the story of Captain Starlight in his 1888 ‘Robbery Under Arms’ (Boldrewood 1888), connecting Readford’s efforts with a fictitious character ‘Captain

Figure 2.9 Coongie Lakes, north-east South Australia. Cooper Creek flows north through the lake system. Source: Morton *et al.* 1995.

Starlight'. The path used by Readford was retraced in the 1890s to establish the stock route now known as the Strzelecki Track.

Following local heavy rain and flooding water from Lakes Blanche, Callabonna, Gregory and Frome, we return to Cooper Creek. From Innamincka, the majority of flow takes the North West Branch of Cooper Creek to Coongie Lakes, a complex system of ephemeral lakes and channels in the most arid part of Australia (Figure 2.9). Jim Puckridge—a river ecologist who has studied the rivers of the Lake Eyre Basin since the mid-1980s (Puckridge 4.03)—writes 'in a region better known for its dunefield deserts and gibber plains, lie some

of the world's most remarkable wetlands' (Puckridge 2001: 32). Coongie Lakes are characterised by flood and drought. Jim Puckridge describes the response of the lakes system to the variability of flow:

swamps become deltas, dunes become islands, dry pans become lakes and expand into seas. The waters teem with algae, zooplankton, crustaceans, fish, tortoises and birds. Waders arrive from Siberia, Caspian terns dive on schools of freshwater herring, tens of thousands of pelicans congregate to breed and feed. As the waters withdraw, meadows of flowers and tall green grasses cover the flats, and rainbow bee-eaters gorge on butterflies. A few years later the more ephemeral lakes may be cracked clay, shimmering with heat, rimmed by the bones of fish, and aquatic life will retreat to the deep waterholes of the river channel (Puckridge 2001: 32-34).

The lakes provide a diversity of habitat, changing over time with each flow (Reid & Gillen 1988; Reid & Puckridge 1990). Significant ecological and conservation values have been associated with the lakes system (Reid & Gillen 1988; Morton *et al.* 1995), and in 1987 Coongie Lakes was listed as a Wetland of International Importance under the Ramsar Convention (DEHAA 1999; Jenkin 1999: 259) (Figures 2.10 & 2.11).

Most flows on Cooper Creek stop at Coongie Lakes. However, with occasional very large floods, Coongie Lakes is no longer terminal (Sheldon *et al.* 2002: 15). The water path traces through the complex of the lakes, progressively filling each lake before spilling over to the next (Reid & Puckridge 1990), and finally pushing through the dune fields and gibber plains of Sturt Stony Desert, on its final south-west journey towards Lake Eyre. On its way it fills several waterholes and smaller lakes, including Lake Hope (also known as Lake Pando-Penunie). In 1992 a commercial fishing licence was issued for harvesting Lake Eyre Callop (undescribed species *Macquaria* sp. B) to the holder of Mulka Station, which

Figure 2.10 L.M. Gibbs at Coongie Lake. May 2003. Photograph by J.D. Jansen.

Figure 2.11 Coongie Lake sunrise. May 2003.

encompasses Lake Hope. When Cooper Creek flows to Lake Hope, it brings fish from permanent waterholes upstream. When the lake dries, it is cut off from Cooper Creek, and with evaporation and associated increasing salinity, the fish perish. Three flooding events re-filled Lake Hope between 1989 and 1991; during the operation of the fishing licence (1992-1994) the Mulka Pastoral Leases harvested 309 tonnes of Lake Eyre Callop (DEHAA 1999: 29).

Most flows that reach this final stretch of Cooper Creek disperse among the flood-outs east of Lake Eyre; what water remains often continues underground towards Lake Eyre as shallow saline ground water flows (Wopfner & Twidale 1967; Twidale & Wopfner 1990: 45).

2.3.2 Georgina and Diamantina Rivers

Together, the Georgina and Diamantina Rivers drain central and western Queensland. The Georgina River has its headwaters in the Barkly Tablelands of Queensland and the Northern Territory. The Diamantina River begins its path to Lake Eyre in the uplands of central Queensland. Like Cooper Creek, both rivers regularly inundate broad floodplains and complex systems of anabranching channels. Though their individual sub-catchments are smaller in area than the Cooper Creek catchment, together the Georgina and Diamantina Rivers contribute a greater quantity and more regular flow of water and sediment to Lake Eyre (Lake Eyre Basin Coordinating Group 2000; DeVogel *et al.* 2004). Only in very large floods does Cooper Creek provide greater flow. Downstream of the 'Channel Country' of these two rivers is the area in which my research is focused.

Below the anabranching section of the Diamantina River, the river is confined to a single channel. The town of Birdsville lies at a permanent waterhole on the river, on the edge of the Simpson Desert. Birdsville marks the head of the Birdsville Track, the most intensively used of the stock routes in the Lake Eyre Basin. Three stock routes in the south-east Lake Eyre Basin—the Oodnadatta Track, the Birdsville Track and the Strzelecki Track—were established to transport cattle from the pastoral lands in the south-west of Queensland and the north of South Australia to the railhead at Marree for transport to abattoirs in Adelaide and more distant markets. Fear of the spread of disease—particularly cattle tick (*Boophilus microplus*) from Queensland—led to stock routes ending at what were then colonial borders (now state borders) (Yelland 2002: 15-19). To improve the safety of stock routes, governments began establishing public wells, dams and tanks, and designating natural watering points along the routes. Watering points were generally spaced one to two days walk apart. Government watering points were most often leased to the owner or lessee of the surrounding country, who could then charge users—usually on a per head or per hundred head of stock basis—at a rate often stipulated by government (Yelland 2002: 41). Water became increasingly engineered: in addition to dams, tanks, wells and bores, water distribution methods were developed and fences were erected around waters. The landscape became dotted with evenly spaced watering points. Reliability of water supply was crucial to the pastoral industry and to the movement of stock.

During its peak years—the first four decades of the 20th century—it is estimated that 50 000 head of cattle were transported down the Birdsville Track per year. Annual averages are, again, misleading; seasonal variation means that in some years twice that number may have been transported. However, no official records of numbers were kept, so estimates are largely based on watering charges. The first stages of the Birdsville Track made use of permanent waterholes on the Georgina and Diamantina Rivers at Goyder Lagoon

(described below), but the remaining stages were dependent on Artesian bores (also described below), as the Track passed through the driest region of the Australian continent (Ratcliffe 1938; Yelland 2002: 53-61) (Goyder Lagoon and Artesian bores are described below).

Many of the early dams and tanks in the north of South Australia were dug in unsuitable country. Water loss through evaporation was very high, and dams were prone to siltation following rain, wind-blown sand and trampling by stock. Stock pressure on watering points during the late 19th and early 20th centuries is thought to have led to the closure or disappearance of some dams. Yelland (2002: 34-35) suggests this may go some way to explaining why the ruins of some early homesteads appear to be in waterless country.

The Birdsville Track was also used for transporting goods to the pastoral lands. In the early days of pastoralism in the region, camels provided the most effective means of transport. In January 1866 Sir Thomas Elder and the Beltana Pastoral Company brought drivers and 124 camels from Balochistán Province (in what is now Pakistan) to Port Augusta in South Australia (Hercus 1981: 39). The camels and their drivers—Urdu speakers widely and inaccurately referred to as ‘Afghans’—played a crucial role in opening up the country, enabling goods to be transported distances impossible by other means. They served the needs of the pastoral industry of the southern Lake Eyre Basin until the Central Australian Railway was built joining Adelaide with Alice Springs (discussed further below in section 2.4.1). With no rail or navigable rivers on the Birdsville and Strzelecki Tracks, camels continued to provide transport in the far east of the state into the 1920s (Hercus 1981: 39; see also Barker 1964; McKnight 1969) (Figure 2.12).

Figure 2.12 Camel train, Oodnadatta to Alice Springs mail run. Photograph taken in 1926 by Miss M. Colley. Source: National Library of Australia, Australian Inland Mission Collection.

Birdsville is currently home to around 100 residents, and is also an administration and service centre for pastoral properties in the region and for the tourist industry. Early efforts to publicise tourism in the desert include Rex Ellis' commercial camel treks into the Simpson Desert, which began in 1971. In 1973, during several successive years of flooding on the Georgina River, Ellis undertook the first commercial boat trip down Eyre Creek (the lower reaches of the Georgina River) into the Simpson Desert (Schmiechen 2004: 131). More recently, central Australian tourism has received more centralised promotion. In 2002 Australian governments, industries and communities celebrated 'The Year of the Outback'. Such publicity attracts tourists to remote towns like Birdsville, focusing on the history of the stock route. Increasingly, private four-wheel drive vehicle owners make the journey up the Birdsville Track, attracted by the unsealed road and the opportunity for a 4WD experience (Schmiechen 2004: 96). The bitumen Stuart Highway further west is a far more efficient and widely travelled route into central Australia, connecting Adelaide with Alice Springs, the largest town in central Australia. But the Birdsville Track offers different

Figure 2.13 Nappanerica (popularly known as ‘Big Red’ sand-dune), west of Birdsville. Looking west into the Simpson Desert. October 2002.

opportunities—four-wheel driving, heritage tourism and the appeal of a small and remote outback town. Birdsville—on the edge of the Simpson Desert (Figure 2.13)—is also the end-point for increasing numbers of tourists crossing the Simpson Desert by 4WD, and far less commonly by bicycle or foot. Commercial tours dominated early tourism in the Simpson Desert, but Joc Schmiechen, in a report on Lake Eyre Basin heritage tourism, suggests that the balance has shifted significantly to a majority of independent travellers, by ‘the advent of the Global Positioning System, the profusion of four-wheel drive vehicles, and the constant publicity through magazines and news media’ (Schmiechen 2004: 130).

According to linguist Luise Hercus—who has worked with and written extensively about the people of the southern Simpson Desert, the Wangkangurru—the Desert has recently been ‘opened up’ by seismic surveys from the 1950s and private expeditions, but for seventy years previous, it was rarely visited by humans (Hercus & Clarke 1986). For

generations the Wangkangurru lived and died in the Simpson Desert (Hercus & Clarke 1986: 51). Despite the lack of permanent surface water, the desert was permanently occupied by the Wangkangurru *mikiri-nganha*—the ‘Wangkangurru people from the wells’ (Hercus & Clarke 1986; Hercus 1990: 154). They also called themselves Wangkangurru *Mungathirri-nganha* ‘Wangkangurru people from the high sandhill country’. These terms differentiated them from the Wangkangurru *karla-nganha*, ‘the Wangkangurru from the Creek’ (either the Diamantina or Kallakoopah) (Hercus 1985: 41). Permanent surface water does not determine occupation. Nor does the existence of a permanent water source equate to the significance of a place or its maintenance (Macfarlane 2005a). According to Hercus (1990: 149) the Wangkangurru ‘had total occupation of the area, they made use of every possible resource, there was no wasteland, no empty country, no “desert”, everything “belonged” both in practical terms and in mythology’.

The *mikiri* were the only permanent water sources in the Simpson Desert. They were deep soaks or wells dug and maintained by the Wangkangurru. Some of the *mikiri* were very deep, requiring a person to clamber down through a long narrow tunnel, sometimes as much as seven metres into the ground (Hercus & Clarke 1986: 51). The *mikiri* were often located in inter-dune swales, which would collect water in times of heavy local rainfall, attracting animal and plant life. In this way Hercus and Clarke regard them as ‘resources nodes’ where people were able to obtain water and animal and plant foods in an arid landscape (Hercus & Clarke 1986: 61).

Hercus and Clarke (1986: 61) speculate that the *mikiri* may have come about by Wangkangurru ‘following the water down’. When surface waters receded after heavy rains, Wangkangurru would centre their camps around the swales, and dig wells to follow the water as it receded. Eventually they intercepted the permanent water table. Archaeological

and ethnographic evidence shows that the wells were centres of habitation, and facilitated movement and trade throughout the Simpson Desert (Hercus & Clarke 1986: 61). Archaeologist Isabel McBryde (1997: 7) argues that the networks of east central Australia are among the most extensive known from hunter-gatherer societies worldwide, and describes the social values and exchange practices as 'adaptive strategies' for life in the desert. Analysis of archaeological sites indicates that Wangkangurru traded material goods of both economic/technological and symbolic value (McBryde 1997: 11).

In times of rain the Wangkangurru *mikiri-nganha* moved away from the *mikiri* across a broad area of desert, making use of the many *irpi* (claypans) and *ikara* (swamps) (Hercus 1985). In dry times, when the claypans and swamps no longer held water, the Wangkangurru would return to make camp at the *mikiri*. Mick McLean *Irinjili* was the last Wangkangurru man born and raised in the Simpson Desert (he lived from about 1888 to 1977). According to Hercus (1985: 25), he had 'an immense store of traditional knowledge', and Hercus' research draws strongly on what she learnt from him. In an interview with Hercus (1990: 154), Mick McLean *Irinjili* describes building dams across claypans to prolong the life of those water sources. Other accounts tell of digging channels in the claypans to delay the return to the *mikiri*. Hercus tells:

One of the traditional song cycles of Wangkangurru literature deals with the theme of the poor taste of the water of one of the soaks, *Pulupudnunha* ... and people longed for rain so that they could go out to the swamps, but the soaks were always there when all the surface water had dried out: there was no reason to leave the desert (Hercus 1985: 25).

From first European contact, numbers of Aboriginal people living in their Country (throughout Australia) began to decline. Some people were forced from traditional lands

towards missions and stations. Others moved towards these sites of European settlement in pursuit of rations provided there. Some Aboriginal people were murdered by Europeans; Hercus provides an account of some eastern Wangkangurru who went to the Kalidawarry waterhole near Lake Muncoonie in south-western Queensland for a *Warrthampa* ceremony. 'Practically all who took part were murdered by the police in retribution for the death of a white man' (Hercus 1986, 1990: 156). In the 1880s there were large numbers of Wangkangurru living in their Country. In 1886 David Lindsay led an expedition to explore the water resources of the Simpson Desert to determine whether the area was suitable for pastoral development. According to Hercus (1990: 157) Lindsay conducted himself well towards the Wangkangurru, and they came to believe that not all Europeans were 'evil'. Soon after, people began to leave the desert for missions and stations and the regular supplies of food they offered. The last Wangkangurru left the Simpson Desert in 1899-1900, and at this time the mikiri country was left uninhabited.

Auntie² Linda Crombie is a Wangkangurru woman who lives in Birdsville. She has lived in the region her whole life. Mick McLean *Irinjili* was her father. Pressure on the wells increased as Aboriginal people from other countries, who were displaced from their own, moved into the mikiri country (L. Crombie 4.03). The mikiri couldn't support the larger population, leading the Wangkangurru to leave the desert. When the Wangkangurru *mikiri-nganha* left their Country they went to the nearest pastoral properties and found rations. Auntie Linda tells me about when her family left the Simpson:

We come out from the desert, go to the first lot of house. Whitefella there got tucker—government sent a ration out to everyone. And next time they sent it again

² The prefixes 'Auntie' and 'Uncle' are terms commonly used in Aboriginal Australia to refer to Elders. They connote respect and recognition of knowledge and seniority.

to Pandie³. Old Lou⁴ wrote away and told them 'get these people [rations] ... and more people was dying, starving'. Old Lou write away and told them—government boss—told them how many people: mum and dad and me and brother. ... They give a big bag of flour, bag of sugar, and tea, tobacco, matches. And give us clothes—they give us a big shirt. Run around with a big shirt. Next time dad said 'they don't want shirt, them kids. They want dress and pants, knickers!' Old Lou wrote away and told them all (L. Crombie 4.03).

After leaving the desert, the Wangkangurru didn't return.

No. Stay home. Old Lou said 'see this old peoples here, more of them starving. Don't you fella go out there'. He put a stop to it. He said people was, you know, sick.

We sat on the bank of Jardine waterhole on the Diamantina River near Birdsville and fished. Auntie Linda spoke to me about how her family got water in the desert:

It's springs. See that Jardine⁵ there? Like that. You go out there now and you dig that spring out and you get water. But the people [who have] got a well know where people got to go.

Her father used to look after the mikiri:

There's one well like from here to the pub. One well here. Another one further away. ... we go from well to well. And dad said 'now you fella', he made a big meeting, you know. He said: 'Water's short of water here now. We can't all live in

³ Pandie Pandie Station, just south of Birdsville.

⁴ Auntie Linda told me 'Old Lou' was 'an old German'. He was most likely a Lutheran missionary working in the region (see Stevens 1994).

⁵ Auntie Linda is referring here to the spring that feeds Jardine waterhole.

Figure 2.14 In easily accessible areas, *mikiri*—or ‘native wells’ as they are commonly called—have become minor tourist sites. This one (with J.D. Jansen) is beside the road between Jundah and Stonehenge near the Thomson River, south-west Queensland. May 2003.

it. Water’s running dry, you know, too many people’. Anyway, some went back to Boulia, some went back to Bedourie, and we went back to Mt Gason.

... too many blackfellas there ... biggest mob! ... *Mithaka* and all that, *Wangkamala*—that’s their name. They go everywhere. They stop and then the water’s short. Them people don’t know much. ... Dad told us ‘they better go back to Boulia’. They went back to Boulia alright. Some people come over from Alice Springs joined up staying there. Got the three soakage, gone. They calls it *mikiri* (L. Crombie 4.03).

According to Auntie Linda, no one looks after the mikiri now (L. Crombie 4.03) (Figure 2.14). After the Wangkangurru left the desert, their precise locations were lost. In the

1980s, Adelaide-based Dennis Bartell—with Luise Hercus and prehistorian Peter Clark—relocated nine of them using historical records, in particular, the journal of David Lindsay (Hercus 1986: 51). Now many Wangkangurru and their descendents live in towns near their traditional Country, including Birdsville, Boulia, Bedourie, Marree, Oodnadatta, Windorah and Port Augusta.

Throughout Australia Aboriginal people, including some Wangkangurru, have comprised a large proportion of the work force on pastoral stations, droving and mustering, and working domestic jobs such as cooking, cleaning and looking after children (McGrath 1987; D. Rose 1991; Baker 1999). However, total employment on pastoral stations has declined dramatically over the past three decades, and Aboriginal employment has been particularly affected. This time of declining employment corresponds to the controversial Pastoral Industry Award of the mid- to late-1960s that introduced compulsory award wages for Aboriginal workers⁶ (see McGrath 1987; Jebb 2002). Widely considered an issue of human rights and industrial equity at the time, the introduction of equal wages had devastating effects for some Aboriginal people. Many pastoral stations were unable to afford, or unwilling to pay, the extra costs of wages for Aboriginal workers, who had previously often been ‘paid’ for their labour with ‘tucker and supplies, and occasionally some unsubstantial housing’ (McGrath 1987: 122). Auntie Linda tells me: ‘We went out to

⁶ Award wages for Aboriginal workers was the subject of considerable public debate between 1965 and 1969, and application of award wages was a lengthy and staggered process across the country. In 1965 the Commonwealth and the Pastoralists and Graziers Association successfully argued that Aboriginal people were not socially or culturally ready for a strict wage system, nor that state and federal governments were ready to replace the pastoral station welfare system with settlements and town-based services. The wages case hearings began in 1965, and the Pastoral Industry Award wages decision was made in 1967. However, it was applied on a state-by-state basis, as other exclusions were lifted by the states. The Award applied to Australian Workers Union members, but not ‘full-blood natives’ employed as stations hands unless they held a Certificate of Citizenship (Jebb 2002).

Alton Downs⁷. I was cooking in the camp. We took sugar and tea and flour. They can't pay you. Can't afford to pay ... Terrible that' (L. Crombie 4.03).

Aboriginal people had formed a substantial proportion of workers on cattle properties. Working on pastoral properties—particularly droving and mustering—was a way for many Aboriginal people to maintain relationships with their Country in their daily lives (McGrath 1987; Baker 1999; Jebb 2002; Gill 2005a). Historian Ann McGrath writes:

To protect their country and its people, Aborigines had to teach station whites many things. Aborigines worked the stations; they managed the land in new ways, through old principles. They have made the cattle industry their own; they are still the majority of those living on northern pastoral stations, and their dynamic culture leaves a distinctive mark on bush life (McGrath 1987: viii).

As a result of the Pastoral Industry Award, many Aboriginal workers were 'dismissed' from their pastoral work, and sent away from the pastoral station and thus their Country. Hercus (1990) describes this dispersal from stations as the most recent stage of a general move away from traditional lands.

Returning to follow the river downstream, water reaching Birdsville on the Diamantina River frequently continues 80km downstream to Goyder Lagoon and then on to Lake Eyre (Kotwicki 1986: 36). The Georgina River, below its Channel Country, becomes Eyre Creek, and flows through the Eastern Simpson Desert, and further downstream the combined waters of the Georgina and Diamantina Rivers flood out to form Goyder Lagoon, a 1 300km² ephemeral swamp (Kotwicki 1986: 36). Regular floods bring both water and

⁷ Alton Downs Station, west of Birdsville.

Figure 2.15 The gibber plain of a dry Goyder Lagoon. October 2002.

sediment to floodplains, stimulating floodplain growth and producing diverse and extensive habitat. Its regular inundation makes Goyder Lagoon valued grazing country (Figure 2.15).

The main paths from Goyder Lagoon to Lake Eyre are the Warburton River and its major anabranch Kallakoopah Creek. When dry this area north of Lake Eyre is patterned with sand dunes, clay pans and gibber plains. During large floods, it becomes a complex system of channels and lakes—including Peera Peera Poolanna Lake, Lake Griselda, and Lake Umaroona—with sand dunes forming islands within the floodwaters.

2.3.3 Lake Eyre

Lake Eyre, the terminus of the internally draining Lake Eyre Basin, lies in the most arid part of Australia. Lake Eyre covers an area of 9 330km², and comprises two lakes—Lake Eyre North (8 030km²) and the much smaller Lake Eyre South (1 300km²)—connected by

2. LAKE EYRE BASIN WATER PLACES

Figure 2.16 Lake Eyre bathymetry, showing the deepest areas in the southern bays of Lake Eyre North—Belt Bay, Jackboot Bay and Madigan Gulf. Source: Kotwicki 1986.

Goyder Channel (Dulhunty 1990: 101). The lake bed is the lowest part of the Australian continent, lying at around 15m below sea level. According to Dulhunty (1990: 103) the continual wetting and drying of the lake's salt crust alters the precise depth and location of the deepest point of the lake over time⁸ (Figure 2.16).

⁸ The issue of Lake Eyre's depth is complex. Dulhunty states: 'It may be appropriate to suggest that the lowest point on the Australian continent occurs somewhere in the southern bays of Lake Eyre North, that it may change location in time, and that the nearest approximation to the level value of this surface may be the mean of lowest values found at different times by both bathymetric and drylake levelling in the lowest areas of the three bays: 14.8m below sea level (Australian Height Datum)' (1990: 103).

Water most regularly flows to Lake Eyre from the Georgina and Diamantina Rivers and Cooper Creek, but the lake periodically receives water from all parts of its Basin, and from local rainfall. While the headwaters of the major Lake Eyre Basin rivers are fed by roughly annual monsoons from northern Australia, Lake Eyre may only see local rain every few years. Water flows to the Lake from its tributaries episodically. Major filling occurs rarely. Prior to the first recorded filling in 1949-1950, it was thought that no *significant* amount of water ever reached the Lake (Dulhunty 1990: 104). In 1949 an extremely large flood on Cooper Creek flowed to Lake Eyre, beginning a filling event from the Cooper, Georgina and Diamantina Rivers. The largest filling in European history was 1974-1977, resulting from floods on all tributaries, beginning with the Georgina and Diamantina Rivers. At its peak, the Lake was 6.1m deep at its deepest point in Madigan Gulf (Kotwicki 1986). In 1984 Lake Eyre South filled and overflowed into Lake Eyre North via the Goyder Channel (Figure 2.17). In 1989-1990 a series of floods on Cooper Creek flowed to Lake Eyre and overflowed into Strzelecki Creek to fill Lake Blanche (Kingsford *et al.* 1999: 231). And in 2000, flow reached Lake Eyre from Cooper Creek.

Between these major fillings, smaller floods episodically deliver water to Lake Eyre. Although widely considered a dry salt lake, varying amounts of water may be present on the lake surface much of the time, delivered by small floods, local rain or surfacing ground water (Figure 2.18). Dulhunty (1990: 104) describes the way waters 'blow about in the southern bays of the north lake', and suggests there may be some water in the lake, in widely varying quantities, up to 75% of the time. Beneath the salt crust water mixed with sediment is stored as thick mud. In the southern bays—Madigan Gulf, Belt Bay and Jackboot Bay—the salt crust is up to 460mm thick (Dulhunty 1977). With each filling, the salt crust dissolves partially or fully. As the water evaporates, the settling salt is redistributed, creating a constantly changing lake surface.

Figure 2.17 Satellite image of Lake Eyre during the 1984 floods. 22nd February. Source: Kotwicki 1986.

Figure 2.18 Lake Eyre sunrise, with 10cm of water on the lake surface. May 2003.

Lake Eyre was named for the first European to sight its shore. In 1840, Edward John Eyre located Lake Eyre, as well as Lakes Frome, Callabonna, Blanche and Gregory. Eyre surmised that along with Lake Torrens, these newly identified lakes formed an impassable 'Great Horseshoe Lake' (Figure 2.19). Its existence prevented further exploration to the north by Eyre, and turned his party back. Eyre's expedition was the first concerted and recognised attempt to reach the centre of the continent from the south (Langley 1969). The great horseshoe lake remained a barrier to exploration of the inland, leading others—aiming to reach the centre of Australia, cross the continent, locate arable lands, or find the fabled 'inland sea'—to skirt around its east or west side (Cumpston 1964; Litchfield 1983: 1). Historian John H.L. Cumpston wrote:

An inland sea and a great internal river were continuously present as persistent and elusive mirages throughout the whole history of Australian exploration, and they provide the main theme for the story of that exploration (Cumpston 1964: author's note).

Belief in an inland sea provided the initial drive for Charles Sturt's Central Australian Expedition of 1844-1845. In 1844 Sturt wrote: 'My plan is to go up the Darling to get as soon as I can into the tropics. I have a strange idea that there may be a central sea not far from the Darling in 29°, and I should be prepared for a voyage' (quoted in Langley 1969: 194). Several sources of evidence fed his conviction of the existence of an inland body of fresh water; in particular, he had observed rivers running inland and birds migrating north from Adelaide and north-west from the Darling River (Beale 1979: 175). He was further driven by societal expectations. He knew that 'only hollow thanks went to the discoverers of sterile country. Eyre had been virtually shunned despite his exploits in the desert, while Mitchell had been knighted and rewarded financially after stumbling onto the rich pastures of central Victoria' (Stokes 1986: 151).

While Sturt was driven by a personal desire to find the inland sea, this was not the official aim of the expedition. Rather, it sought to locate a catchment boundary running north-east to south-west, and so determine the extent of the south-eastern rivers, and open possibilities for land and rivers lying to the north and west. Nonetheless, Sturt included in his party two sailors and one boat (Langley 1969: 196-197). Sturt travelled north with his party from Fort Grey, on the Darling River, through what came to be called 'Sturt's Stony Desert', and Goyder Lagoon, until he reached the sand sea of the Simpson Desert. At this point he turned back, returning with grave disappointment at having not reached the centre of the continent, nor finding an inland sea (Langley 1969) (Figures 2.20 & 2.21).

The flocks of birds Sturt and others had observed migrating towards the centre were, and are, drawn to ephemeral waters. During the early period of exploration of central Australia—the mid-19th century—the immense variability of rainfall and river discharge in the inland was not understood. The ephemeral nature of rivers and lakes of the Lake Eyre Basin was not known; nor was the central characteristic that rainfall and river discharge decrease downstream, resulting in the river's terminus being the most arid part of the catchment. Expectations were based on understandings of other places. In humid-zones rivers running inland and birds migrating inland suggest an inland water source. However, the water places of the southern Lake Eyre Basin are characterised by their ephemeral nature, and bird-life responds to ephemeral waters in dramatic ways.

Kingsford *et al.* (1999: 240) estimate the floods on Cooper Creek during 1989 and 1990 may have provided habitat for up to one million waterbirds at Lake Eyre, the lower Cooper Creek and Lake Blanche. During aerial surveys they identified 41 species of waterbirds establishing colonies in the area, including Australian pelicans, cormorants, black swans, terns and silver gulls (Kingsford *et al.* 1999: 236). The response of living things to water's

Figure 2.20 Many inland explorers were confident of finding a great river or inland sea. This photograph shows camels carrying a boat and long poles on an inland expedition. Source: National Library of Australia, John Flynn Collection.

Figure 2.21 'Sturt's Boat'. This sculpture by Anthony Hamilton is located at Tibooburra Pioneer Park, far north-west NSW. The park was opened on 17th July 1999. Hamilton's sculpture is a full-size replica of the 27 foot long whaleboat that Charles Sturt hauled across inland Australia on a wagon during his 1844 expedition. He carried it with the intention of rowing around the inland sea. The boat was abandoned at Depot Glen, close to the site of this sculpture. May 2003.

spatial and temporal variability provides a visually striking illustration of the variability of the Basin. When dry, it can be difficult to spot a living thing on the salt bed of Lake Eyre; when wet, thousands of birds can be found gorging on hundreds of thousands of fish from dozens of species.

As the inland sea (that Lake Eyre failed to be) inspired early European explorers to travel to central Australia, contemporary 'explorers' in the guise of tourists continue to be attracted to Lake Eyre. Tourist numbers are strongly influenced by water, and so they flock to Lake Eyre following the water and the birds (field notes 5.03). When water is scarce, so too are tourists. Tourist flights over the Lake are now popular. From the air, or space, it is possible to see in the outline of the Lake, the kangaroo skin of Wangkangurru stories.

2.3.4 Lakes Gregory, Blanche, Callabonna and Frome

South-east of Lake Eyre lie Lakes Gregory, Blanche, Callabonna and Frome (see Figure 1.1). These lakes receive and hold water intermittently and can be fed in numerous ways: from the south by rivers running from the northern Flinders Ranges to Lake Frome and on to Lake Callabonna; from the south to Lake Blanche, which may then overflow to Lake Gregory; or from the north to Lake Blanche from Strzelecki Creek. Occasionally, water may flow from Lake Gregory onto Cooper Creek, via the palaeo-channel known as the Warrawoocara Channel (Kotwicki 1986; Nanson *et al.* 1998; De Vogel *et al.* 2004).

These lakes, with Lake Eyre, formed the imagined 'great horseshoe lake' of the mid-19th century. In 1858 the barrier of the horseshoe lake was finally broken, when Benjamin Herschell Babbage recognised the separate body of water that came to be known as Lake Eyre. In 1857 Augustus Charles Gregory had passed between Lakes Blanche and

Callabonna, demonstrating that there was no continuous lake in the north-east. Babbage had now shown the same was true in the north-west (Harris 1980-81: 31; Boyd 1990: 107). It was at this time that Lake Eyre was named for the first European to sight its shore (Litchfield 1983: 1). Perhaps ironically, a real horseshoe lake had existed some 130 000 years earlier. Lakes Gregory, Blanche, Callabonna and Frome formed a 'mega-lake', fed by the Strzelecki Creek (Hesse *et al.* 2005: 63). Nanson *et al.* (1998) suggest a massive overflow event from this mega-lake to a 'mega-Lake Eyre', via the Warrawoocara Channel. In present times these lakes are ephemeral and most often dry.

2.3.5 Northern, western and southern rivers

The water paths west and south of Lake Eyre display the same patterns of ephemeral and episodic flow as the other rivers of the southern Basin. In the south the Frome River flows to the southern-most tip of Lake Eyre North. Warriner Creek and Margaret River drain to Lake Eyre South. In the west, the Macumba and Neales Rivers provide irregular but significant flows to the north-western tip of Lake Eyre. Numerous smaller rivers trace paths to the western shores of Lake Eyre. In 1918 Hunt wrote:

There was no telegraphic communication between Oodnadatta and the south, from noon on 6 March until the evening of 9 March, owing to the water rising high above the wires at Peake Creek [a tributary of the Neales River]; and the train from Warrina was detained for five days. The flood water at the Peake Creek (about 10 miles from Warrina) rose 12 feet above the bridge, and the rapidity with which it subsided was remarkable. Between Dalhousie and Macumba stations a plain about 40 miles long was under water (Hunt 1918, quoted in Kotwicky 1986: 44).

Between 2000 and 2004 a research project titled 'Aridflo' (discussed in further detail in chapter 3, section 3.4.3) collected data on flood levels on the Neales River. During the period of the project extremes of drought and major flood events occurred, confirming the great variability of the river system.

In the far north-west of the Lake Eyre Basin, the major rivers are the Hay, Plenty, Hale, Finke and Todd. Although these are considered part of the Lake Eyre Basin, their flow does not reach Lake Eyre. Bonython (1963) suggests that there is some evidence that the waters of the Finke reached Lake Eyre in 1909, 1938 and 1945, but Kotwicki (1986: 42) questions this evidence. Rather than contributing flow to the Basin's terminus, these rivers and their catchment are part of the geological depression of the Lake Eyre Basin. Currently their waters flood out into the sand dunes of the Simpson Desert.

The present town of Alice Springs—largest population centre in the Lake Eyre Basin, home to 30 000 people—is built on the banks of the Todd River. The original settlement of Alice Springs was around 3km upstream, and was established as a permanent settlement for the Overland Telegraph Line, discussed below (in section 2.4.1). Explorer John McDouall Stuart named the Todd River for Charles Todd—Superintendent of Telegraphs for South Australia—and Alice Springs for Todd's wife. Alice never travelled to the town that bore her name.

The Finke River is the largest of these north-western rivers. Water flows along its path after significant rains, filling waterholes and ultimately evaporating or flowing into the sand dunes of the Simpson Desert. Historian Ingereth Macfarlane (2005a) describes how the Finke River is understood and named in the Lower Southern Arrernte language of the people who speak for this Country. Stories of the ancestral being who created these places

include the history of Kirrki the kestrel hunting two snakes. The story tells of the snakes making tunnels beneath the sand to escape Kirrki, giving rise to the course of the lower Finke River (Hercus & Potezny 1993; Macfarlane 2005a). According to Macfarlane this history 'reflects the covert nature of desert water, found largely below ground' (2005a: 310). It is also consistent with scientific understandings of the way water travels underground through the Simpson Desert.

2.3.6 Away from the rivers

Away from the rivers water sources are less visible. Yet water exists throughout the country. Rain-fed water sites exist temporarily in the landscape. John McEntee (4.03), owner and manager of Erudina Station near Lake Frome, has spent many years learning from local Aboriginal people—including *Arabanna* and *Maljangapa*—about the Country in which he lives. During my fieldwork I spent a week at Erudina talking with John. He has an extraordinary interest in and knowledge of the Aboriginal history of the region surrounding his property. He spoke to me at length about water in this semi-arid landscape.

Aboriginal peoples of arid and semi-arid Country know of a wide range of water sources away from the rivers. According to Deborah Bird Rose Aboriginal people developed a way of inhabiting the continent that 'responded to risk and uncertainty with a range of social and physical measures that ensured a balance between control and flexibility, and thus ensured human and other forms of life' (2004a: 35-36). Where permanent water is scarce, ephemeral water is vital. Crab-holes or *gilgai*—as they are known in far western New South Wales—form in muddy soil. They form depressions when dry, but the muds swell to fill that depression when wet. The muds quickly settle to the bottom leaving clear water that lasts for 1–2 weeks. Claypans (discussed above in section 2.3.2) are shallow water places.

They can also hold water for 1–2 weeks, and always hold suspended clays. The *Maljangapa* of far western New South Wales and eastern South Australia near Lake Frome, and near Erudina, get their name from this water source: ‘maljangapa’ means ‘muddy water’ or ‘claypan water’. Their Country can be defined by the extent of the clay pans. In other places people enlarge *ngamma*—depressions that form in limestone or granite rock surfaces—to increase their water holding capacity, and the duration they will keep that water. *Ngamma* can hold water for around 1–2 months (Magarey 1894-95; Bayly 1999; McEntee 4.03).

For early European explorers, the quest to find a significant body of water in the inland was reinforced by the search for daily water adequate to satisfy men and horses. These men relied heavily on the local knowledge of Aboriginal people they met along their journeys. Some, such as Sturt, appear to have maintained a relatively good rapport with local people, who often advised him and directed him towards water. At times though, Sturt chose to ignore their advice about water, being determined to stick to his ‘prearranged course’ towards the centre of Australia, and away from locally known water sources. Sturt’s diaries show that on more than one occasion he set off in directions contrary to the advice of Aboriginal people he met, leading his party ever north-west—towards the centre—into the Stony Desert and the most arid part of the country, rather than towards the more permanent waterholes of Cooper’s Creek (Stokes 1986: 158, 162; Langley 1969).

The diaries of European explorers tell of their exploitation of the gilgai, claypans and *ngamma*, which were carefully maintained and conserved by Aboriginal people. In his diaries from his 1875 expedition in South Australia, Ernest Giles describes his party coming upon a claypan near Lake Torrens:

we came to a place where there was a considerable fall into a hollow, where there existed some bare clay ... the surface was perfectly dry, though in a small drain or channel, down which in times of rain, water would descend to it, by the blessing of Providence we stumbled on a supply of yellow water. ...when I led the camels to the place, down they fell on their knees in the mud and water, and drank and drank, and I again joined them and also drank, and drank, and drank. Ah! dear reader, if you have never suffered thirst you can form no conception what agony it is. But, talk about drinking, I couldn't have believed that even thirsty camels could have swallowed such enormous quantities of fluid (Giles 1979: 28-29).

In contrast to this episode, Aboriginal peoples' use of freshwater involved care and restraint. Deborah Bird Rose explains:

Exclusive rights to waterscapes are a key factor in inhabitation of country. On the one hand, countries were under the control of the people who belonged there and who, through creation, bore responsibility for the country and its living things, including water. Their on-going subsistence depended on control of resources, and this is a matter of life and death. For example, one cannot plan to rely on a certain place that is a source of fresh water, only to arrive and find that somebody else has used it all up. ... On the other hand, flexibility is also a key factor. Indigenous people's main adaptation to uncertainty was to develop social ties that enabled people to move to resources as they became available (2004a: 36-37).

This way of living with water involves respecting water's variability and working with it.

Animals and plants are closely connected to water. John McEntee has learnt from Aboriginal people that good sites for soaks can be located by carefully observing kangaroos and other animals digging in dry creek beds or elsewhere. Animals and plants are found at

Figure 2.22 Seismic line across the Simpson Desert. Source: Shephard 1992.

water places: people need to look after water sites because they are a precious source of water for people and animals, and because those animals provide food for people. Nardoo (*Marsilea drummondii*)—good for making cakes—often grows around crab-holes. And water can be found in the bodies of plants and animals: the roots of *Hakea leucoptera* hold drinking water, as do aestivating frogs (*Cyclorana platycephala*) that burrow underground during the hot summer months. Water from both of these sources must be drunk within a day, or it will spoil (Magarey 1894-95; Bayly 1999; McEntee 4.03).

Seismic lines now form new water paths. During the 1950s and 1960s extensive petroleum exploration in north-east South Australia involved the construction of vehicular tracks for surveying. These ‘seismic lines’, or ‘shotlines’, were formed by scraping vegetation and topsoil to create linear tracks through the landscape (Shephard 1992: 134-136) (Figure 2.22). Jenkin (1999: 366) explains that ‘old seismic lines affect local patterns of water flow’.

Figure 2.23 L.M. Gibbs and John McEntee beside a wind pump and 'turkey's nest', Erudina Station, South Australia. April 2003. Photograph by J.D. Jansen.

Figure 2.24 Public amenities at Jundah, south-west Queensland. May 2003.

The removal of topsoil accelerates erosion and interferes with surface drainage patterns, in some cases leading to formation of 'irrigation channels' beside the tracks, which in turn encourage the growth of water-loving plants (Shephard 1992: 134-136).

At pastoral stations and in towns there are new water sites away from the rivers: dams, 'turkey's nests' (raised dams built with earth walls), windpumps, water tanks. After driving all day on hot, dry roads, my travelling companion and I were pleased to find the rest area and public amenities in Jundah town centre: a rainwater tank with drinking water; toilets; showers; a tap and sink with a mirror; a large washing basin; green grass beneath the cool shade of trees (Figures 2.23 & 2.24).

Figure 2.25 Water bottle used by Captain Charles Sturt. Source: National Library of Australia.

Travelling away from the rivers, people carry their own water. When they were living in the Simpson Desert, Wangkangurru carried water in waterbags made of hare-wallaby skin (*Lagorchestes*) or rat-kangaroo skin (*Caloprymnus*). In an interview with Luise Hercus, Mick McLean recalls people taking water from the soak at Balcoora—where he stayed for a long time—when they were leaving the Simpson Desert (Hercus 1985: 35). Sturt carried water in a sealed water bottle. Travellers in the Basin today are advised to carry a minimum of ‘six litres per person per day’ in the arid zone (Department for Environment and Heritage 2002: 2), and so, most 4WD vehicles found in the Lake Eyre Basin carry multiple plastic water bottles (Figures 2.25 & 2.26).

Figure 2.26 Kangaroo skin water-bag. Water-bags of this type—made from the skins of kangaroos, wallabies and smaller mammals—were used by Aboriginal people in the Simpson Desert and elsewhere. This one was from Glenormiston Gorge on the Georgina River system, far west Queensland (nearly 400km north of Birdsville) and was collected in the late 19th Century. Source: National Museum of Australia.

Auntie Linda Crombie told me about her father making water-bags similar to this one: 'Dad had to skin a cat to make a water-bag ... just gotta give a little bit drink. We was used to it, you know, out in the desert' (L. Crombie 4.03).

2.4 Ground water

Ground water is a vital water source in the desert, and provides a stark contrast to the ephemeral and episodic waters of rainfall and river flow. Shallow ground water sources, such as soaks, seeps and springs, provide the most easily accessible ground water. Prior to European development of the inland, these shallow ground water sources, combined with the mound springs—surface expressions of much deeper ground water—and the mikiri (discussed above in section 2.3.2), provided reliable water sources to people and other living things who knew where to find them. Soon after European settlement, these sources did not provide water in quantities large or reliable enough to provide for the new land uses. The new non-aboriginal settlers often enlarged wells dug by Aboriginal people. They continued to dig and drill for other sources of water and in so doing, formed new water sites and water paths.

2.4.1 Mound springs

Mound springs form an interface between surface water and ground water; this water manifests at the surface, but emerges from the Great Artesian Basin (which I discuss in detail below in section 2.4.2). They form a link between surface water and ground water. Mound springs exist in a variety of forms including seepages, ponds, flowing springs and large pools fed by springs. The term ‘mound spring’ refers to a distinct ‘mound’ surrounding some springs, which is created by the spring itself. The mounds are formed by sediments from chemical precipitates derived from dissolved solids in the spring water, sub-surface materials brought to the surface by the spring water, organic matter, and wind-blown clays, silts and sands from the surrounding area (Boyd 1990: 109).

Figure 2.27 Location of South Australia's mound springs. Source: Boyd 1990.

Around the south-western margins of the Great Artesian Basin there is a broad arc of mound springs, stretching from Dalhousie around Lake Eyre to Lake Frome (Figure 2.27). The size and shape of the springs varies; the largest are more than 100 metres across and up to eight metres in height. Waters from the springs tend to be warm—mostly between 20°C and 35°C, but with extremes of 14°C and 46°C. Water emerging from the springs has begun its path in either the Queensland uplands in the east of the Great Artesian Basin, or the uplands in the west of the Simpson Desert (Boyd 1990).

Mound springs are a rare permanent water source for humans and non-humans; they form foci for plant and animal life. Archaeological remains found at many mound springs provide evidence for large Aboriginal camp sites (Boyd 1990: 107). The springs feature in Aboriginal stories from the area, representing ancestral snakes, graves, campsites, and native onion peelings (Hercus 1980). The arc of mound springs is associated with 'richly patterned trade and communication routes' that connected the region in a continent-wide

network (C. Harris 2002: 8). Because the springs are isolated, some sustain endemic species not found elsewhere. In particular, micro-fauna are dependent on particular mound springs; species are often restricted to a single spring.

For European explorers on the western side of Lake Eyre, the mound springs were an important water source. Babbage and Warburton⁹ each identified and named a number of springs in 1858. In following the arc of springs between Lakes Torrens and Eyre, their travels successfully refuted the myth of the great horseshoe lake (Harris 1980-81: 31; Boyd 1990: 107). The effective removal of the great horseshoe barrier was significant in that it enabled further exploration north. The mound springs provided the stepping stones for doing so. John McDouall Stuart used the mound springs as camp sites during his pastoral survey in 1859, continuing the practice of naming along the way. He recognised their importance and later used them for his transcontinental crossing of 1861-62 (Harris 1980-81: 31; Boyd 1990: 107).

The reliable water supply provided by the mound springs, coupled with newly found grazing lands, enticed pastoralists quickly into the region. By 1859-60 the first pastoral stations in the South Australian portion of the Lake Eyre Basin were established: Mt Hamilton, Finnis Springs, Marree, Mundowdna, Callanna, Stuart Creek, Billa Kalina, and Anna Creek Stations (Gee 2000: 10-12). These stations relied on the permanent waters of the mound springs, and made use of rainwater people collected in tanks, wells they dug within months of pastoral settlement, and where possible, natural water sites including creeks, waterholes and floodplains. Few other watering points existed in this region, so the

⁹ Major Peter Edgerton Warburton was South Australian Commissioner of Police, sent out to recall the officially sponsored expedition of Benjamin Herschell Babbage in 1858, which was deemed by the Government to have been slow and achieved little (Harris 1980-81: 26).

areas surrounding the mound springs suffered heavy impact from stock (Gee 2000: 29-30). In 1864-1866—less than five years after settlement of some of these stations—a dry time occurred that came to be known as ‘The Great Drought’. The mound springs provided permanent water sources, so the problem of the Great Drought for stations near the mound springs became one of food shortage more than water shortage. Fodder was severely reduced, watering points were few, and imposed stock numbers were high. In 1857 the law decreed carrying capacity of 16 head of cattle or 100 head of sheep per square mile (Litchfield 1991: 63; Gee 2000: 27). After the drought, rates were reduced to around 25% of these figures (Gee 2000: 31). Huge numbers of stock perished, and many pastoralists were forced off the land. Those who stayed were later penalised for persevering on such marginal country. Transport of goods to the stations became prohibitively expensive, and at worst, impossible. The inexperience of pastoralists in terms of running stock on this country and the general lack of understanding of the highly variable rainfall and river discharge regimes severely limited their ability to respond to the drought (Gee 2000: 29-30).

From the time of European exploration in the inland to early pastoralism the mound springs played a crucial role in ‘opening up the country’. Two of the most important developments in this process were the Overland Telegraph Line and the Central Australian Railway. Both followed the arc of mound springs, from the south to the north-west of Lake Eyre, from Adelaide through the centre and towards the northern coast of the continent. These water sites were directly responsible for forming the social landscape of the southern Lake Eyre Basin.

The Overland Telegraph Line linked South Australia to the north coast and then to Britain via submarine and overland cable. The route was first traversed by Stuart in 1861, and the

line was completed in 1872 (Madigan 1946: 9; Harris 1980-81: 33). It was during the telegraph survey in 1870 that the Dalhousie Springs complex—the most extensive mound springs system in the north-east of South Australia—was first sighted by Europeans (Harris 1980-81: 31; Boyd 1990: 107). The mound springs provided a permanent water source for the repeater stations, required every three hundred kilometres to pick up and re-transmit signals. These stations were large complexes of telegraph buildings, residences, blacksmiths, stores, stables and sheds, and supported a small permanent population. The mound springs were essential for the daily water needs of the population, and for watering the horses and camels used for line maintenance. The mound springs determined the location of two of the South Australian repeater stations: Strangways Springs and the Peake. Other South Australian repeater stations were at Port Augusta and Beltana in the Flinders Ranges (Harris 1980-81: 35). Alice Springs, now home to almost half the population of the Lake Eyre Basin and the largest population centre, was first established as a repeater station site for the line (Figures 2.28 & 2.29).

The Overland Telegraph Line became a major thoroughfare, not only for telegraphic communications, but for people travelling between Adelaide, the centre, and the north, bringing supplies for the repeater stations, and maintaining the line (Macfarlane 2005b). The Overland Telegraph Line cut through Kuyani and Arabanna Country. According to anthropologist Bruce Shaw (1995: 8) the line caused competition for water resources as explorers, telegraph and railway workers, and farmers sought to use the water of the mound springs, around which Aboriginal peoples' lives were focused.

Figures 2.28 & 2.29 Alice Springs repeater station, Overland Telegraph Line. July 2005.

Like the Overland Telegraph Line, the narrow-gauge Central Australian Railway¹⁰ line linking Adelaide to Alice Springs, followed the arc of the mound springs. A line connecting Adelaide with the north was first proposed in 1858. Construction began in 1878, with the railhead reaching Marree (then Hergott) in 1884, and Oodnadatta in 1891. There it remained for the next 40 years until in 1929 it was extended to Alice Springs. The imagined connection between Adelaide and Darwin was finally achieved in 2003 (Australasia Railway Corporation 2004). While the railway line did not rely entirely on the mound springs for its water supply—instead water for the steam trains was often sourced from dams and bores—the mound springs provided a reliable water source in the event that those sources failed. Harris (1980-81: 35) clearly describes the significance of the connection between the railway and the mound springs: ‘it was the mound springs which had allowed Stuart direct access to Central Australia; it was the mound springs which encouraged pastoralism to follow in his wake, and it was the pastoral industry which the railway was primarily built to serve’.

Later, the Oodnadatta Track followed the mound springs from Hergott to Charlotte Waters on the Finke River. The Oodnadatta Track connected what was then the Northern Territory of South Australia (now the Northern Territory) with the markets in the south. Although the Oodnadatta Track was the longest stock route in the Basin, the railway from Marree to Oodnadatta meant that stock were only walked in significant numbers on the northern section of the Track. Like the Birdsville Track, camel trains were used on the northern section to transport goods from the south into the pastoral lands (Yelland 2002).

¹⁰ Various known as the Central Australian Railway, the Great Northern Railway, and from the 1930s the Old Ghan Railway. The name of the Ghan is widely understood to derive from the ‘Afghans’ who played a central role transporting goods in the region from the 1860s. Gee (2000: 65) contends that the origin of the name in fact lies in the Sydney based Commissioner of Commonwealth Railways, G.A. Gahan. Perhaps the true derivation of the ‘Old Ghan’ is a felicitous combination of the two.

The mound springs are no longer used by the pastoral industry. Growing threats to the springs—particularly the proposed Roxby Downs mining operation in the late 1970s and early 1980s—led to increased attention on the sites, and eventually to organised plans for conservation and management. Most are now fenced, and some are protected as Indigenous sites under the Aboriginal Heritage Act 1988 (C. Harris 2002: 10), though at many fences are not maintained (field notes, Dodd 5.03). The springs are now a popular tourist site; tourists learn about the ecological anomalies of the springs, and their importance in Aboriginal cosmology. Reg Dodd—an Arabanna man and Marree resident—operates a tourism business that focuses on the mound springs, describing their ongoing significance for Aboriginal people, and educating people about land, culture and politics (field notes, Dodd 5.03).

2.4.2 Great Artesian Basin

When bores were first drilled in the Lake Eyre Basin in the mid-late 19th century, little was known about their source. Bores were widely considered an endless water supply (Powell 1991; Cox & Barron 1998: 73), an attitude that led to their flows being spread across the landscape to feed thirsty cattle. The Great Artesian Basin was first tapped in the 1870s, and drilling continued enthusiastically for use by pastoral properties, towns, and development corridors. The source and extent of this ground water aquifer was realised by the end of the 19th century (Cox & Barron 1998: 73-74).

The Great Artesian Basin underlies much of the Lake Eyre Basin. It is the largest ground water aquifer on the Australian continent, and one of the largest in the world, with an area of 1.7 million km² (Cox & Barron 1998: 11) (Figure 2.30). The depth of the basin varies throughout, and water pressure corresponds to depth. Pressure is greatest at the Basin's

Figure 2.30 The Great Artesian Basin. Source: adapted from Alexander *et al.* 2000.

deepest points, in the north-east of South Australia, close to the centre of the Lake Eyre Basin. Recharge into the Basin is extremely slow; recharge zones are restricted to a narrow arc in the east, along the edge of the Great Dividing Range, and to a lesser extent along the western margins of the Basin (Cox & Barron 1998: 50).

The Great Artesian Basin is the manifestation of the ‘inland sea’ of the Cretaceous period (around 100 million years ago). The sediments that form the Basin were laid down during a number of cycles of wetting and drying over a period of 140 million years (from the Late Triassic/early Jurassic to the Late Cretaceous periods). However, the main two phases were when central Australia was covered by a vast shallow marine environment (during the Early Cretaceous). This sea—at its largest size—laid down mudstone, siltstone and lithic sandstone. During the Late Cretaceous, a smaller area was covered by lakes and streams, during which time sandy sediments were laid down (Cox & Barron 1998: 41).

Figure 2.31 Cross-sectional diagram of the Great Artesian Basin. Source: Cox & Barron 1998.

2.4.3 Bores

The bores of the Great Artesian Basin quickly replaced the shallower and lower-capacity wells that preceded them. In many parts of the Basin—such as along the Birdsville Track—artesian water is held below ground at sufficient pressure to enable it to be brought to the surface through a bore, without being pumped (Figure 2.31). In other areas—including the western edge of the Basin—water pressure is comparatively low, and extensive infrastructure was required to bring water to the surface. This added a new financial, maintenance and administrative dimension to the provision of water, including arrangements between the lessee of the pastoral property and the Government (Yelland 2002: 38).

Bores enabled water to be brought to the most valuable grazing lands. In many parts of the Lake Eyre Basin, perennial growth is found on the dry gibber plains. The river country is characterised by seasonal growth. The mound springs—relied upon heavily by the pastoral industry before the Great Artesian Basin was tapped—tend to be low-lying saline areas away from good grazing country (Badman 1991: 52). Bores could now be drilled in

locations to take best advantage of feed, thereby combining food and water. In addition, new watering points on the gibber plains reduced grazing pressure on the country surrounding waterholes and mound springs. With increasing technology, watering points could be further increased and manipulated through the use of polypropylene piping, taking water from the bore to tanks and troughs. Watering points could be spread out, turned off and moved. Bores created new water sites, and poly-pipe became the newest water path.

2.4.4 Boredrains

The bores of the Great Artesian Basin were originally designed as 'free flowing' bores. Once water reached the surface (either unassisted under high-pressure, or pumped), it flowed out across the landscape, running to a natural depression in the ground, following a creek-line, or filling a drainage ditch dug by pastoralists for that purpose. The result is a 'boredrain'. Boredrains serve the function of dispersing water and allowing hot ground water—sometimes reaching boiling point—to cool sufficiently for stock to drink.

Boredrains provide a very low maintenance method of water distribution. Although evaporation rates are extremely high (over 3 000 mm per year in much of the Lake Eyre Basin), bore water flows from bores more quickly than it evaporates. Some boredrains are extremely long; according to Cox and Barron in 1949 the longest exceeded 150km (1998: 85). Many are hundreds of metres long. Cox and Barron (1998: 45) estimate a total of 4 700 flowing artesian bores, 30 000 non-flowing bores, 3 500 petroleum exploration and production wells, and more than 34 000 km of boredrains (1998: 86). However, estimates are difficult because poor regulation has meant records are lacking (1998: 73-78) (Figures 2.32 & 2.33).

Figure 2.32 Muloorina boredrain. May 2003.

Figure 2.33 Mungerannie boredrain. October 2002.

Bores and boredrains are now central to the appearance and land use of the Lake Eyre Basin. Bores provide a vital water source upon which much of the industry and communities of the Lake Eyre Basin depend. The Great Artesian Basin has altered places, creating water places and changing places previously characterised by ephemeral water or no water. The reliability of the Great Artesian Basin water has allowed new water places to be formed: wind pumps and water tanks, taps, showers, and public facilities for local populations and the increasing tourist industry.

Originally designed to secure and disperse drinking water for stock, boredrains have become much more than stock watering points. Boredrains have changed the physical landscape, becoming sites of permanent surface water in landscapes characterised by ephemeral water. This permanence has changed the landscape, attracting plant and animal life dependent on regular water. People too are drawn to these water sites. As described in section 2.3 (and later in chapter 3, section 3.2.3), early bores were drilled along the stock routes linking the pastures of north-east South Australia and south-west Queensland with the railhead at Marree. The original stock routes have swayed little in their transformation into main roads used by locals and tourists alike—the Oodnadatta, Birdsville and Strzelecki Tracks. As such, several bores and boredrains can be found close to these roads. At some—such as Mungerannie on the Birdsville Track and Coward Spring on the Oodnadatta Track—station owners or managers have built spas, showers and other facilities. Local people hold swimming lessons (Oldfield 4.03) and local people and tourists stop at these water places to camp, picnic, bird-watch or cool down in the shade of a water-loving tree.

With growing environmental awareness since the 1980s and increasing understanding of the Great Artesian Basin, the finite nature of the Great Artesian Basin waters has become

widely accepted. Free flowing bores have been found to waste water through evaporation and seepage—up to 90% of total bore discharge, according to Cox and Barron (1998: 86)—and have a significant impact on bore pressure. Groundwater scientists have found that the massive flow of water from thousands of bores across the Great Artesian Basin is directly responsible for pressure dropping in many parts of the Basin. This is resulting in many bores failing to reach the surface through lack of pressure, and is also affecting the mound springs.

Although recharge undoubtedly takes place in the Great Artesian Basin, current rates of extraction are widely considered to be too high. Accurately determining discharge and recharge is complicated by numerous factors (Cox & Barron 1998: 118-119), but concern about over-extraction has led to major efforts to reduce extraction from the Basin. Water pressure in particular places is affected by overall water extraction, but particularly by local extraction. In addition to the pastoral bores and boredrains, mining and petroleum operations at Roxby Downs and Moomba extract vast amounts of water from the Great Artesian Basin (Australian Groundwater Consultants 1984; Lance 1992). Bore pressure near major extraction sites is reduced more rapidly and to a greater extent than pressures at a distance from extractions sites. In particular, the mound springs and station bores near the Roxby Downs bore fields south of Lake Eyre are affected by the reduced local artesian pressure caused by the mine bore fields. This has caused a strong sense of concern among some people in the area (Dodd 5.03; Mitchell 5.03).

This increased concern for conservation of artesian waters and bore pressure, coupled with technological development, has led to a Basin-wide project to cap free-flowing bores. Capping the free-flowing bores of the Great Artesian Basin involves attaching a device to the bore, enabling the flow to be controlled or stopped. It is a long and difficult process.

There are several thousand free-flowing bores. Bore water at many bores is under very high pressure and temperature; three bores at Clifton Hills, in the deepest part of the Basin, are 98.9°C, 99°C and 102°C (Weston 4.03). At most bores, capping involves channelling water into closed tanks and dispersing it through polypropylene pipes. In some cases flows are controlled rather than stopped, allowing a reduced amount of water to continue to flow into established wetlands.

However, free-flowing bores have transformed the landscape. New ecosystems have formed around boredrain, and new water places have emerged. Boredrains have physically and conceptually become 'boredrain wetlands'. Providing a diversity of habitat, a wide range of non-stock animals is attracted to boredrains. Many birds are now more common at boredrain wetlands than at mound springs (Badman 1991: 55). Purnie Bore on the western edge of the Simpson Desert provides an example of a boredrain 'which has increased the local bird diversity and permitted long term occupation of the desert by species with a high water requirement. Over 50 species of birds have been recorded at the Bore' (Shephard 1992: 38).

At a time of increased environmental awareness, wide-spread conservation values associated with wetlands, and in the context of the knowledge of the finite nature of the Great Artesian Basin, people living and working in the Great Artesian Basin area are debating the ecological and social values of the boredrain wetlands (see for example CERM 2002), and pushing for selected boredrains to retain their flow (Mitchell 5.03). The bore-capping project reveals the complex values associated with these water places. There are conservation values associated with the 'wetlands'; economic values associated with the capping project; and social and cultural values associated with these water places. This complex suite of interconnecting values is the subject of chapter 6.

2.4.5 Water mining

Two major mining operations affect water and water places in the southern Lake Eyre Basin: WMC's Roxby Downs copper, gold and uranium mine and Santos' Moomba oil and gas works. Ground water is central to both operations. The meaning of water differs significantly at the two sites.

Roxby Downs is located south of Lake Eyre, outside the Lake Eyre Basin. However, it makes use of ground water from the Great Artesian Basin, and its two borefields lie within the Lake Eyre Basin, 100km and 200km from the mine. In this way, the ground water it extracts from the Great Artesian Basin impacts upon people and places in the Lake Eyre Basin. Water is a central component of mining operations at WMC's Roxby Downs mine. Large quantities of water are required for processing minerals. The mine has a 42 megalitre per day capacity, and currently makes use of 32 megalitres per day. According to WMC environmental scientist Darren Niejalke (5.03) the mining operations are completely reliant on Great Artesian Basin water quality and bore pressure.

The large quantity of water extracted by the mine is having an impact on ground water elsewhere. Two major water-related concerns of WMC are reduction in bore pressure resulting from draw-down of the ground water body due to extraction (by the mining company and other users) and the effects of draw-down on nearby mound springs (Neijalke 5.03). Some neighbouring pastoral stations report reduced pressure in their bores due to WMC's extraction (Dodd 5.03; Mitchell 5.03).

Reg Dodd is concerned about the effect of ground water extraction and draw-down on the mound springs. He says the impact on the springs is complicated, and people know little about them. He tells me that Aboriginal people used to clean out the springs, but now they

are being choked by vegetation. WMC are monitoring the springs, but there is no management, he says. People are talking and holding meetings, but no one is going out and looking after it. Many of the water places have stories attached (field notes, Dodd 5.03).

By being given a story about how that waterhole was created, by your great ancestors, it gives you connection to that place. It makes you have responsibility to look after it; take care of it. Tells you how you get that land looked after. You can't get someone from outside to do it, because it belongs to you (field notes, Dodd 5.03).

Ground water is also a key issue at Santos' Moomba oil and gas works. Moomba is located in far north-east South Australia, between Cooper Creek and Strzelecki Creek. Santos has explored for oil and gas in the Lake Eyre Basin since 1954 (Santos 2004), and has been mining gas since 1963 (Santos 2005). Since the 1960s the Moomba operations has extracted oil and gas from the largest and most prolific hydrocarbon reserves on the onshore Australian continent, and it supplies oil and gas to Adelaide, Melbourne, Canberra, Sydney and Brisbane.

At Moomba water is a by-product of mining operations. When drilling for oil and gas, water tables are invariably struck. Water mixes with oil and gas, and must be removed to make the mineral product viable. Unlike anywhere else in the Lake Eyre Basin that I travelled to or researched for this project, at Moomba, water exists in vast quantities and is considered a waste product—a product to be disposed of (field notes 5.03). Water is separated from oil and gas through a multi-stage process that ends in large evaporation ponds (Figures 2.34 & 2.35).

2. LAKE EYRE BASIN WATER PLACES

Figures 2.34 & 2.35 Evaporation ponds at Moomba, north-east South Australia. May 2003.

Evaporation is not expensive, but this is Great Artesian Basin water, so there is increasing pressure—from society and legislation—to change practices. According to John Hudson of Santos (field notes, Hudson 5.03), Santos is investigating other means of using or disposing of the unwanted Great Artesian Basin water, including pushing water back into drill holes and aquifers, and making use of a larger proportion of the operation's waste water.

Ground water is brought to the surface for multiple reasons. All extraction transforms the landscape, creating new water places and new meanings, and changing meanings of the places they transform. New and changing water places form new relationships between water, people, place and the non-human world.

CHAPTER 3

KNOWING AUSTRALIAN WATER

3.1 Introduction

The aim of this chapter is to describe the changing role of water in Australia, in order to provide an historical and institutional context for this study of water in the Lake Eyre Basin. In this chapter I describe a shift that is beginning to take place in ways of knowing Australian water, which I characterise as a shift from an engineering approach towards ecology; a shift from a colonial notion of water as a tool of development, towards a more holistic and interconnected understanding of water.

Early colonial relationships with water were driven by a development imperative. I examine the tools of development—irrigation, river diversion and bore-drilling—in section 3.2. In section 3.3 I consider the ways that non-acceptance and a desire to transform landscapes have persisted, through recent management strategies, including the separation of land and water in natural resource management by the Council of Australian Governments (CoAG),

and the problematic definition of a river used in the Queensland Water Resources Act, and in the form of renewed calls to 'turn the rivers inland'.

Despite the persistence and reinscription of early attitudes to Australian landscapes, these ideas have been countered in recent decades by pressures from both within the natural resources industry, and outside it; notably increased environmental awareness, the management imperative of sustainable development, and Aboriginal land rights (section 3.4). These social movements have influenced relationships with, and ways of knowing, Australian water. Three case studies from the Lake Eyre Basin illustrate the shift in ways of knowing Australian water emerging from the social changes mentioned above: 1. water management strategies; 2. locally-driven catchment management processes; and 3. ecological research projects.

3.2 Colonial relationships with water

The role of water as a tool of colonisation and development is well documented (Reisner 1986; Powell 1989, 2000; Worster 1992; Gedicks 1993; Howitt *et al.* 1996; World Commission on Dams 2001; *inter alia*). In Australia, colonialism and the imperative to develop the inland and the nation have significantly influenced human relationships with water and place. From early in Australia's colonisation, settler relationships with Australian water were based on the predictability and regularity of European water regimes.

There is a long-standing desire on the part of settler Australians to transform Australia's landscapes (Powell 2000). This desire to transform has been driven by an imperative to make land productive and develop an emerging nation in both an economic and cultural sense, as well as by a broader colonial project of control of people, place and nature. Water,

in particular, did not fulfil the expectations of Australia's colonisers. According to Jay Arthur:

Colonial Australia has always had a problem with water: it's never where it's wanted, and never around when it's needed. Although nineteenth-century explorers eventually accepted that there was no inland sea, they and the colonists that follow them still struggle with rivers that turn into marshes, and lakes not of clear blue water, but of salt (2003: 18).

As knowledge was laid over Australian landscapes, so too was the English language, creating—Jay Arthur asserts—a 'default country', which may be understood as 'the kind of country implicitly present in the English language' (2003).

The continent's water regimes posed significant challenges to European understandings of nature and systems of agriculture. According to Handmer *et al.* 'the land was perceived as virtually endless, but dry' (1991: 6). Much development was driven by 'visions of greening a drought-ridden continent'. Arid and semi-arid inland Australia has historically played an important role in the imagination, understanding and development of the nation (Griffiths & Robin 1997; Robin 1998, *in press*), and water—or the lack thereof—has been central to this role. The absence of water in Australia equated to 'dead' land. In 1946 Madigan described central Australia as the 'Dead Heart', providing an evocative and poetic image of the inland and its waterscape (Madigan 1946). Adding water to this strange, dry landscape quickly came to present a solution to the perceived problem of the 'dead' and 'drought-prone' inland.

So began the disembedding of water from place. The methods of irrigation, river diversion, and bore-drilling made it possible to add water to dry landscapes from regions of relatively high rainfall or river flow, or from plentiful underground sources. This possibility of

transplanting water from one place to another separates water—physically and conceptually—from its constituent parts (land and plant and animal life) and from its context (place, meaning and lives). This separation has become entrenched in contemporary natural resource management, a theme I discuss in section 3.3.1.

Engineering enabled water to become the primary tool of development in Australia, as it has been elsewhere (Reisner 1986; Powell 1989: 8-10; Cosgrove & Petts 1990; Worster 1992). The three dominant methods of water and land manipulation employed were each explicitly aimed at transforming Australia's arid and semi-arid landscapes. Powell asserts: 'The thread linking the colonial and early federal periods is readily traced to a stiffening resolve to subdue, harness and transform the natural environment' (2000: 55).

3.2.1 'Just Add Water': irrigation

'With irrigation ... there is no dead season in the year'.

Elwood Mead 1914: 258

Irrigation quickly became the solution to the problem of Australia's lack of water, and thus the primary tool with which the emerging nation would be developed. The connection between irrigation and development was strong. Economist Bruce Davidson, in his opening remarks to *Australia Wet or Dry? The physical and economic limits to the expansion of irrigation*, clearly expresses the significance of irrigation in the Australian imagination: 'No belief is more firmly held in Australia than that the scarcity of water has seriously hindered the nation's development' (Davidson 1969: 1).

Under the Chairmanship of Alfred Deakin (then Victorian Minister of Water Supply, later Commonwealth Prime Minister), Victoria's Royal Commission on Water Supply in December 1884 equated irrigation with development. The reports of the Royal Commission deemed irrigation to be a 'sound investment' and necessary to 'progress' if Victoria was to 'utilise her abundant natural advantages, bring her productiveness to the highest point, and secure to the agricultural population of her arid districts a permanent prosperity' (quoted in Powell 1976: 131).

Victoria was the focus of early irrigation projects. The Murray-Darling Basin—and in particular the Murray River—is the major water-supplying system in the country. Despite the variability of flow in parts of the Murray-Darling Basin—particularly the upper reaches of the Darling in northern New South Wales—the Murray delivered relatively reliable flow prior to development. This fact led to early exploitation of the Murray River and intensive irrigation development of the surrounding plain, which came to be known as 'the Riverina'.

Irrigation development in the Murray had its roots in the Irrigation Act of 1886—a dramatic departure from the preceding cautious Water Conservation Act of 1883 (Davidson 1969: 53). Alfred Deakin was a champion of irrigation at that time. He drew heavily on experiences in the United States to justify major irrigation development in Victoria, and regularly called upon the expertise of Elwood Mead, second Chairman of Victoria's State Rivers and Water Supply Commission (between 1907 and 1914). Mead's prior position was as Chief of the Irrigation and Drainage Investigations Bureau in the US Department of Agriculture. During that time he wrote his 1903 *Irrigation Institutions*, in which—according to Joseph M. Powell he 'enunciated a philosophy that brought applause in Victorian circles. Mead had been preaching the value of new irrigation settlements as the

pioneering nuclei and stable foundation of further settlement expansion in marginal territory' (1989: 150).

Mead enthusiastically promoted irrigation, at its core a process of disembedding water from its context and its constituent and dependent parts by moving it from one place to another. At the same time he also promoted the connection between land and water:

No adequate system of irrigation laws, or any enduring prosperity for the people who till the soil, can be built on separate ownership and divided control of land and water. The fundamental condition of success is that these two joint agents of production should be disposed of together, and that with every title to irrigable land should go an interest in the stream which gives it value (Mead 1903: 23).

Mead's 1914 claim that: 'With irrigation ... there is no dead season in the year' (1914: 258), reveals a great deal about attitudes and expectations towards irrigation. Not only would irrigation overcome the vagaries of Australia's climate, it would enable year-round production, therefore overcoming the seasonal variation in productivity experienced in all agricultural landscapes. Mead's claim also provides an early reference to Australia's climate and landscapes as 'dead'.

Despite its political popularity, the efficacy of irrigation was strongly questioned by a number of scientists and government employees. Handmer *et al.* (1991) describe the 'controversies' roused by George Goyder (1826–1898), Griffith Taylor (1880–1963), Francis Ratcliffe (1904–1970) and Bruce Davidson (1924–). Each argued that environmental factors would limit development of the nation, and in so doing, brought into question the popular belief that irrigation would enable unhindered development.

Public response to such critiques demonstrated the unwillingness of people to accept the notion of environmental limits to growth.

George Goyder was Surveyor-General of South Australia between 1861 and 1894. According to Sheldrick, after just over fourteen years in the colony, Goyder had ‘not only grasped the reality and impact of unpredictable rainfall, but had put his knowledge to use mapping the border at which it became too great to sustain European-style agriculture’ (2005: 56). ‘Goyder’s Line of Rainfall’—or ‘Goyder’s Line’—quickly attracted controversy. Described in 1865, Goyder’s Line was originally intended as an administrative tool to guide government provision of drought relief during the Great Drought of the mid-1860s (Powell 1976: 86; Sheldrick 2005: 57). The line described the extent of *reliable* rainfall; however, the subtlety intended by Goyder was quickly lost. It became commonly understood as an ‘approximation of an isohyet of average annual rainfall—an estimation of aridity rather than variability’ (Sheldrick 2005: 58). Goyder’s Line was popularly understood to represent the extent beyond which agricultural production was not viable, and was then endorsed as the official frontier for agriculture. Following the Great Drought of the 1860s, the 1870s was marked by high rainfall north of Goyder’s Line. Increasing pressure for additional agricultural land, coupled with successive years of high rainfall, led to farmers moving north in increasing numbers. Powell describes: ‘Exhilarated by the success of the northward expansion of intensive farming in a succession of good years, popular demand grew for the abandonment of this arbitrary limit’ (1976: 86). Goyder’s Line came to be widely ridiculed.

According to Sheldrick the problem of Goyder’s Line was ‘the simple inability [for people] to think in terms of rainfall *variability* as an aspect of climate’ (2005: 64, my emphasis). She suggests that the misunderstanding about Goyder’s Line was ‘concealed by the misleading

Figure 3.1 Goyder's Line, South Australia. Source: adapted from Meinig 1962.

familiarity of the words “unreliable”, “uncertain” and “precarious”’. While Goyder recognised the variability of rainfall in southern Australia, his intention to describe this variability was widely misunderstood. ‘People unthinkingly assumed they had fully comprehended what Goyder had to say, though all that seems to have been retained was a sense that rainfall in the north wasn’t good enough’ (Sheldrick 2005: 64). Goyder’s ‘unreliable’ rainfall was officially interpreted as ‘deficient’ rainfall (Figure 3.1).

In the 1920s, geographer Griffith Taylor challenged—on environmental grounds—the popular belief that Australia could sustain 500 million people. Describing limits imposed by the environment, he estimated a population of 20 million by the year 2000 (Handmer *et al.* 1991: 6); a figure reached in 2004 (Australian Bureau of Statistics 2005). Taylor was derided for his ‘unpatriotic acknowledgement that Australia was a continent beset by drought’ (Sheldrick 2005: 65).

In the 1930s British biologist Francis Ratcliffe was commissioned to conduct a survey of the problem of erosion and soil drift in South Australia (Ratcliffe 1938). He found that the land was not suited to the settlers’ economy or way of life (Dunlap 1997: 79), and questioned the refusal of Australians to recognise ‘drought’ as a normal part of Australia’s environment and climatic regime (Powell 1988). Ratcliffe’s final report concluded that:

pastoral settlement in the arid belt (or anywhere else for that matter) was merely self-destructive if the system of stocking and management practiced led to the progressive depletion of certain of the most important components of the pastures. If settlement was to be on a permanent and stable basis, stocking must be in equilibrium with the vegetation; that is to say, it must permit complete recovery of those plants that are periodically over-grazed. Deterioration, erosion, and drift will increase with every recurring drought unless the stocking policy is adjusted to suit the conditions imposed by the climate and the vegetation (1938: 324-325).

He writes that in the year that has passed since completing the report his mind has been ‘haunted by doubt’ (1938: 325):

Was there *any* system of stocking and management, workable and economic in practice, that would preserve the vegetation of the semi-arid country, and thus ensure the survival of human settlement in these areas? This was the question that

kept hammering in my head. Worry and puzzle as I might, I could see only one answer; and it was not the answer I had hoped to find (Ratcliffe 1938: 326).

Ratcliffe's recommendation that pastoral lands be consciously de-stocked in order to preserve the country was politically and socially unpopular (Powell 1988; Dunlap 1997; Robin 1997). According to Dunlap, Ratcliffe's analysis: 'concentrated on economic and social elements, but it was ecological in the broad sense. It saw the situation in terms of relationships, processes, and limits imposed by the environment, and the solution was to fit the social and economic order to the natural one' (1997: 79).

Bruce Davidson provided controversial economic critiques of irrigation in various parts of the country (Powell 1989: 254). He focused his attention on physical and economic limits to development of major irrigation schemes in his two books *The Northern Myth* (1965) and *Australia Wet or Dry?* (1969):

Australians will only cease to believe that irrigation is a profitable means of using the nation's resources when the part it has played in the nation's economic development is accurately measured, and the future profits which can be expected from new irrigation schemes are contrasted with the greater returns which might be expected from other forms of development. The faith in irrigation as the cure for drought will only be erased when the part played by irrigation areas during periods of drought is accurately described (1969: 5).

Like Goyder, Taylor and Ratcliffe, Davidson emphasised Australia's climatic variability and the resultant dramatic differences in annual agricultural production. In doing so, all four attempted to normalise drought as a part of Australia's climatic regime. Goyder, Taylor,

Ratcliffe and Davidson questioned popular attitudes towards Australia's environments, and criticised the unquestioning faith in the power of irrigation.

3.2.2 'Turning the Rivers Inland': water diversion

As irrigated agriculture grew and river waters were exhausted, additional sources of water were sought. So began the focus on the project of 'turning the rivers inland'; diverting flow from coastal rivers to river channels running towards the dry interior. Many Australian coastal rivers lie in higher rainfall areas than adjacent inland regions—notably those along the eastern seaboard, separated from the dry interior by the Great Dividing Range. In these relatively high rainfall areas extensive irrigation is often not required, or is made unfeasible because of topography. Water in coastal rivers was not considered by water resource planners to be 'useful' because it did not contribute to irrigation, and therefore to national development. Rather, these waters were widely deemed to be 'wasted' flowing out to sea.

The intensity of irrigation development in the Murray-Darling Basin turned the gaze of water managers to possibilities for river diversion in the area. The Snowy Mountains Hydro-Electric Scheme represents the only significant realisation of the plan to 'turn the rivers inland'. The project, begun in October 1949, involved damming the headwaters of the south-eastern coastal Snowy River, diverting its waters through a series of tunnels into the headwaters of the Murray and Murrumbidgee Rivers. The Scheme was a joint project of power-generation and water 'conservation' for the purposes of irrigation (McHugh 1989). Samuel Hays described the origins of multi-purpose river development in the United States in the first decade of the twentieth century: 'The movement to construct reservoirs to conserve spring flood waters for use later in the dry season gave rise both to the term 'conservation' and to the concept of planned and efficient progress which lay at the heart

of the conservation idea' (Hays 1959: 5). Clearly this use of the term 'conservation' differs dramatically from its contemporary counterpart.

The Snowy Mountains Scheme was the result of over sixty years of proposals and speculation about the development of the water resources of Australia's highest land area (McHugh 1989: 9). The concept of river diversion long predates its construction. Diversion of coastal rivers had been discussed in the 1884 Royal Commission on the Conservation of Water and again in 1903 by the Interstate Royal Commission on the River Murray (Davidson 1969: 161-162). The drought of the 1880s in the western plains of NSW provided the impetus for investigation of possibilities for diverting snow-melt fed waters from the Snowy Mountains to the agricultural regions west of the range. The hydro-electric potential of the Snowy Mountains was not considered until 1908, when nearby Tumut was considered as a site for the nation's new capital city (McHugh 1989: 268). The recommendation for a dual-purpose scheme was passed in 1948, and formed the basis of the final Scheme as passed by Parliament in 1949. The final project saw the combined use of the waters from all of the Snowy Mountains rivers: the Snowy, the upper Murrumbidgee, the upper Murray and the Tumut (McHugh 1989) (Figure 3.2).

Environmental historian George Seddon (1994) describes the 'beautifully flexible engineering system' of the Snowy Scheme, in which water can flow—or more accurately be pumped or released—between several lakes and reservoirs. Water is transported from Island Bend to Eucumbene, or vice versa, according to need. It can be released from Eucumbene to Jindabyne and the Snowy River via its original path, the Eucumbene River. Or it may follow the principal outlet from Eucumbene Reservoir under the Main Range to Tumut and the Murrumbidgee River (of which the Tumut is a tributary). According to Seddon, 'The elegance of engineering, cleverly integrated though it is, cannot conceal the

Figure 3.2 Snowy Scheme, showing the major reservoirs and river diversions. Source: Seddon 1994.

fact that there is not one Snowy Mountain Scheme, but two—one for the Murray and Victoria, one for the Murrumbidgee and New South Wales' (1994: 20). Seddon's two Snowy Schemes speaks of multiple users and uses of the waters of the Snowy, and begin to shed light on the multiple simultaneously existing meanings and values associated with Snowy waters.

Perhaps the most ambitious river diversion project proposed in the post-war period was the Bradfield Plan. Initially proposed by one of Australia's most celebrated engineers J.J.C. Bradfield in the 1930s, and promoted by the immensely popular writer Ion Idriess, the Bradfield Plan aimed to divert flow from northern Queensland coastal rivers to the inland. Bradfield suggested the headwaters of the Tully, Herbert and Burdekin Rivers could be dammed, their reservoirs linked by a series of tunnels, and their cumulative flow diverted across the Great Dividing Range. This water would enter the upper reaches of the Thomson River, a major tributary of Cooper Creek. The plan aimed to transform arid central Australia: to 'water the inland', to 'make the desert bloom'. Bradfield's scheme brought the Lake Eyre Basin firmly into the irrigation picture, and therefore into the all-important active role of nation building (Davidson 1969; Powell 2000) (Figure 3.3).

According to Bradfield's proposal, dams could be built across the Georgina and Diamantina Rivers and Cooper's Creek in south-western Queensland and used to irrigate millions of acres, converting marginal pastoral land into productive agricultural land. Bradfield made a more radical argument that these new expanses of water would in turn lead to an increase in rainfall over a much larger surrounding area. Davidson argued that 'there is no evidence to suggest that the irrigation of a large area in the interior would increase the rainfall of the region' (1969: 229). However, it was a persistent myth, and along with the desire to 'make the desert bloom', has been the driving force of numerous re-workings of Bradfield's Plan into the present (as we shall see in section 3.3.3).

Figure 3.3 The Bradfield Scheme, showing major river diversion tunnels. Source: Davidson 1969.

3.2.3 Artesian waters: bores and boredrains

Bores and boredrains were instrumental in the development of the inland and the nation, and particularly the Lake Eyre Basin. Like irrigation and river diversion, bores and boredrains transformed the landscape. Of these three methods bores have had the most direct and significant affect on the Lake Eyre Basin. The practice of drawing ground water to the surface is common in many parts of the world, and was central to the European settlement of arid and semi-arid inland Australia.

Figure 3.4 Free-flowing bore at Bedourie, south-west Queensland. Photograph taken on a survey trip undertaken in 1927 by Rev. J.A. Barber and Dr George Simpson for the Flying Doctor Scheme. Source: National Library Australia, Australian Inland Mission collection.

Settlers found shallow ground-water sources very early in the period of expansion, but the discovery of the Great Artesian Basin in the late 1870s (discussed in chapter 2) precipitated dramatic change in the Lake Eyre Basin by providing the reliable water required for developing the Basin for pastoralism (Figure 3.4). Since about 1883 the bores of the Great Artesian Basin have provided a constant water supply to pastoral properties and townships in the regions overlying the groundwater aquifer (Yelland 2002: 37). As the Lake Eyre Basin largely overlaps the boundaries of the Great Artesian Basin (Figure 3.5), its pattern of settlement and development were strongly affected by the development of Great Artesian Basin bores.

The Great Artesian Basin enabled the establishment of relatively safe stock routes from inland floodplain pastures to railheads and markets. The most significant of the Lake Eyre Basin stock routes—the Birdsville Track—formed a path from the floodplain pastures of

Figure 3.5 The boundaries of the Great Artesian Basin showing the overlying Lake Eyre Basin.
Source: adapted from Reyenga *et al.* 1998.

Cooper's Creek and the Georgina-Diamantina River to the railhead at Marree. From 1890 ten artesian bores were drilled along the Birdsville Track, spaced at roughly two-day cattle walking distances. By 1916 all ten bores were in operation (Yelland 2002: 38). Away from the stock routes artesian bores allowed stocking rates and practices that would not have been possible had stations been reliant on river and rain water.

Artesian waters have transformed lives and landscapes. Bores enabled pastoralists to take water to parts of properties that don't otherwise receive water. With artesian bores, pastoralists are able to 'spread out' their stock away from rivers and waterholes to other parts of properties, such as the gibber plains where perennial grasses grow. Boredrains converted river channels to conduits for water, and created new water sites in arid landscapes. In towns such as Birdsville, the drilling of a bore altered people's daily lives by ending the need to cart water from the river each day, thereby changing people's relationships with the river. The bores of the Great Artesian Basin have provided a secure and reliable water source for the pastoral industry and for towns. They have largely enabled people to overcome the effects of the unreliable and variable rainfall and river flow that characterises inland Australia. In providing reliable water to places characterised by variability, they have transformed the landscape and people's interactions with place.

3.3 Transforming the landscape: contemporary manifestations of colonial desires

The desire to transform Australian landscapes is persistent, and water continues to play a central role in the transformation. In this section I consider the continuation of colonial attitudes towards Australian land- and water-scapes by examining three examples of their contemporary manifestations. Colonial relationships are reinscribed in recent management strategies, most notably in first, the significant separation of land and water in natural resource management by the Council of Australian Governments (CoAG), and second, in the ill-fitting definition of a river used in policy and legislation, including the Queensland Water Resources Act. Third, the desire to transform Australian landscapes persists in the form of renewed calls to 'turn the rivers inland' in order to provide relief to drought-affected farmers in the inland (Farmhand Foundation 2002).

3.3.1 Separation of land and water: CoAG Water Reforms

Colonial relationships with water separated water from land conceptually and bureaucratically. Through the methods of irrigation, river diversion and bore drilling, water is extracted from relatively well-watered places—above or below ground—and transported to dry places, disembedding water from land. These methods over-ride both precipitation and water delivered by rivers. River channels are transformed into conduits for water as a product, over-riding the character of place and destroying the interconnections between land and water. In 1994 the Council of Australian Governments—through the CoAG Water Reforms—formalised this separation of land and water.

Australian water policy has long been influenced by the experience of the United States. During the 1880s Alfred Deakin adhered to advice from the US ‘to protect the fundamental indivisibility of land and water’ (Powell 1989: 107). According to Director of the US Geological Survey and arid lands expert Major John Wesley Powell, ‘The right to use water should inhere in the land to be irrigated, and water-rights should go with land titles’ (cited in Powell 1989: 107). Water and land were tied with the purpose of preventing the monopolisation of water rights and the development of water market speculators (Powell 1989: 107; Connell *et al.* 2005).

One hundred years later, United States water policy was once again influential, this time in the process of separating land and water in Australia. Drawing on US experience, American economist Alan Randall presented a water reform proposal for transferable water entitlements in Australia that necessitated the explicit separation of interests in land from interests in water (Randall 1981). The rationale for Randall’s proposal was the perceived shift in Australia towards a ‘maturing water economy’. He claimed that as a result of this

maturing phase, 'the issues, priorities and relative cost of alternative solutions in the future will be quite different from those of the earlier expansionary phase' (1981: 195).

Following advice from Randall and others, in 1994 the Council of Australian Governments collectively committed to a process of water reforms, which separated land and water to facilitate water trading. The process had two key aspects: first, the separation of interest in land from interest in water, and second, the improvement of water pricing arrangements. These two steps firmly established water as a commodity, as opposed to an interconnected system. The 1994 CoAG decision stated in relation to water allocations or entitlements:

the State Government members or the Council, would implement comprehensive systems of water allocations or entitlements backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality (CoAG 1994).

In June 2004 CoAG released the National Water Initiative, which revisits the 1994 CoAG Water Reforms and those aspects of it that were not yet implemented. The specific focus of the National Water Initiative is 'the establishment and trading of water rights, environmental flow provisions, intergovernmental coordination and institutional development, regional and catchment scale planning and intensive information systems' (Connell *et al.* 2005). Separation of land and water is crucial for water trading. According to Connell *et al.* 'The NWI [National Water Initiative] proposes the most significant change in water policy since Federation in 1901, and incorporates the efforts and hopes of a wide range of policy actors' (2005).

In contrast to the policies of the late 19th century, the CoAG Water Reforms and the National Water Initiative focus on economic growth (and, arguably, environmental

sustainability). Connell *et al.* assert: 'Social issues are still important, but the emphasis is on mitigating the impacts of changing economic circumstances rather than promoting the growth of communities' (2005).

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) condones further separation of land and water. In a CSIRO Land and Water report, 'Robust Separation', Young and McColl describe separation of interests in water and land as presenting the following benefits:

Separation of the interest into its component parts facilitates development of more economically efficient management and accounting systems. It facilitates adjustment of part of the system without having to review the whole system. This reduces transaction costs. Moreover, risk management is more efficient when each type of risk is managed separately (2002: 25).

Young and McColl's report clearly illustrates the prioritisation of economic growth. Further, the approach they support raises a significant problem: complex systems that are physical, ecological, social and cultural are reduced to separate components; a process that necessarily overlooks and de-prioritises interconnections.

Separation of land and water is highly problematic, for a number of reasons. Young and McColl themselves report that water trading—based on separation—has led to 'undesirable environmental impacts' (2002: 19). Equally significantly, separation is reductionist. Separation over-writes and ignores vital interconnections. First, physical interconnections between land and water—including geomorphology and ecology—are paramount. Key aspects include the crucial role of water in forming, creating and transforming landscapes, and the co-constituency of land and water, and living and non-living things reliant upon them. Separation of land and water is particularly problematic in many parts of Australia—

including the Lake Eyre Basin—that are characterised by highly variable river flow and extensive floodplains. Secondly, human understandings and values associated with land and water are often based on interconnections, as I discuss in chapter 6.

CoAG enshrines water trading—and therefore the separation of land and water—as a legitimate and desirable form of human interaction with water and the environment. By separating land and water, the CoAG Water Reforms and the National Water Initiative reinforce an inability to accept Australian landscapes, and an unwillingness to prioritise interconnections between water and land, and living and non-living things.

3.3.2 Definition of a river: overland flow and the Queensland Water Resources Act

Effective management of Australia's dryland rivers is seriously hampered by the definition of a river used in policy and legislation guiding catchment and water management. The Australian Macquarie Dictionary (1997) defines a river as 'a considerable natural stream of water flowing in a definite course or channel or series of diverging and converging channels'. The Queensland Water Resources Amendment Act 1998 (amending the Queensland Water Resources Act 1989) is, among other legislation, based on such a definition. Yet the rivers themselves are characterised by ephemeral flow that occurs largely outside the confines of definite channels. Ecologist Richard Kingsford claims that 'Application of this definition to many dryland rivers is problematic because they are temporary ... may not carry high volumes of water and may not even have a definite course or channel' (2000: 2). He states: 'Floodplains and some distributaries are not defined as water-courses, so few restrictions apply' (2000: 8).

Owner and manager of Moothandella Station in south-west Queensland, Bruce Scott, told me:

The Channel Country is so different to other rivers, in the way that it flows, the way that the regime happens when it runs. And this is probably something that you'd never get this through to government, but there needs to be a separate legislation for dealing with how it's described. In English law it's described as a bed and banks. Well, it's nothing like that. It may have a bed and bank when it stops running, as in waterholes. People talk about flooding. Well it doesn't flood, it just runs. And inundates its path (Scott 5.03).

People living and working in the Lake Eyre Basin understand the significance and implications of this inaccurate definition. During my fieldwork, a number of people discussed the problems it raises. Bruce Scott's neighbour Bob Morrish, owner and manager of Springfield Station, explained that in recent years the Queensland government has begun addressing the important issue of overland flow:

When Rod Weldford was Minister [for Environment, Heritage and Natural Resources] he instituted a process for covering a huge gap in water resource management, in relation to the management of what the Queensland government anyway call 'overland flows'. In other words, water on floodplains; basically water on floodplains that's not in defined channels. Because there is this problem: the Water Resources Act still talks about ... this concept of a 'water course', and that's something that's meant to look like a conventional European river. And quite clearly the major transport of water in the Channel Country rivers and the arid rivers is not through the actual main channels, but during floods it's over the floodplains. And as of about 1999–2000 the Water Resources Act still had no control over developments on floodplains (Morrish 5.03).

The Act ignores the character of rivers in the Lake Eyre Basin, enforcing a universalised definition of a river. The implications of this ill-fitting definition are significant:

... to my knowledge they still haven't cleaned up the Water Resources Act to the extent that we could, for instance, stop a developer buying this place here and building a low bank ... any earth structure under five metres high is not what's called 'licensable' under either the Water Resources Act or the Planning Act ... So a person could build a 5 metre high bank from one side of this floodplain to the other, as long as they didn't build it in the actual channel. And they could clock up all the water on that floodplain. I could do it; I think I would still be legally entitled to do that. Now that is a very big problem (Morrish 5.03).

The possibility of such a construction became a very real threat in the 1990s when a large cotton irrigation development, involving 'off-stream' storage, was proposed for Cooper's Creek (I discuss this proposal in detail in chapter 4).

The role of flow on floodplains in dryland rivers is not well understood. Sheldon *et al.* state: 'The significance of variable degrees of connection among river floodplain habitats of dryland rivers, and the complex role of the hydrological regime, is virtually unknown' (2002: 14). Kingsford claims that while understanding of flows in dryland rivers has increased, 'the focus has been mainly on the instream components of these rivers ... Most data comes from river gauges in the main river channel. But dependent wetlands are a critically important part of a river system; their role has received relatively little attention in river ecology' (2000: 9).

The definition of a river in Australian natural resource management presents major problems for managing water paths characterised by ephemeral flow occurring predominantly on floodplains. According to Kingsford definitions are significant because

they 'can bias treatment of dryland rivers for conservation, management and appropriate cost benefit analyses and research resources' (2000: 2). The persistence of such an inappropriate definition is indicative of the failure of current management regimes to embrace the specific character of Australian rivers, in favour of a universalised definition of a river.

3.3.3 Drought-proofing and the persistent myth of the inland sea: Farmhand Foundation

The most recent manifestation of J.J.C. Bradfield's Plan of major river diversion in Queensland first appeared in October 2002. During the 'drought' or dry season experienced in many parts of Australia during the first years of this century, the desire to 'turn the rivers inland' was once again voiced in a public forum. This time the promoters were a grouping of prominent Australian business and media barons, including Bob Mansfield, Kerry Packer, Richard Pratt, John Singleton and Alan Jones. (It is perhaps not coincidental that these men have significant interest in pastoral businesses in drought-affected areas). The 'Farmhand Foundation', begun in October 2002, called for Australians to 'Lend a Hand' in providing 'immediate relief to families suffering the affects of drought' (Farmhand Foundation 2002).

In addition to their fundraising activities, the Farmhand Foundation aimed to 'promote long term strategies to help "drought proof" Australian agriculture' (Farmhand Foundation 2002). Farmhand Foundation member Kerry Packer claimed 'Australia could be better drought-proofed than it is at the moment' (Fraser & Karvelas 2002: 5). River diversion—and in particular Bradfield's vision—was actively promoted in the early stages of the organisation as a long-term strategy to address drought (Australian Conservation

Foundation 2002; Farmhand Foundation 2002). The Farmhand Foundation's website has since been updated, following the release of a report commissioned by them in 2004 entitled *Talking Water: an Australian guidebook for the 21st century*, which recognises the ecological and economic barriers to river diversion (Osborne & Dunn 2004: 96-97).

The language of 'drought-proofing' and 'drought-mitigation', and the ongoing contemporary debates around these themes, is illustrative of the lack of acceptance of Australia's water regimes (Arthur 2003). To Bradfield, and proponents of his plan of river diversion, 'drought mitigation' means ensuring a constant and reliable supply of water. An alternate way of imagining 'drought mitigation' might involve recognising that: 1. drought is a normal part of Australia's climatic regime; and 2. 'drought' is not simply a physical phenomenon but a social and cultural perception of the impacts of climatic variability on agricultural practices. In this way of thinking, 'drought mitigation' might be differently conceived as preparations, or alterations to practice, designed to limit potential negative impacts of climatic variability on economic activity, production and lifestyle. Rather than ensuring regular water supply irrespective of season, place, rainfall and river flow, drought mitigation might come to mean interactions with place that are not dependent on regular, secure water supply.

The vision of a well-watered inland promoted by Bradfield's plan of river diversion, and revisited by the Farmhand Foundation, recalls days of European explorers searching for the mythical inland water source. The 'Inland Sea', it appears, has not yet left the national imagination. Environmental and climatic variability is still not widely accepted in Australia. The desire to transform Australian landscapes persists. Powell describes:

the ‘drought-proofing’ of wished-for ‘yeoman’ farmers is still cited as a *justifiable response to environmental uncertainty*, and bright-eyed engineering students frequently pop into geography departments for new information on Dr Bradfield’s patent ‘inland sea’ cure-all—dredged from the archives of a less cynical age (1988: 323–4, my emphasis).

The Snowy, Bradfield and other grand plans, as well as the more mundane frequency of farm dams and weirs dotting Australia’s waterways, provide physical marks on the landscape. Equally significantly, the persistent language of ‘drought-proofing’ and ‘drought-mitigation’ attests to the attitude of non-acceptance of Australia’s environments, and variable climates and water regimes. Francis Ratcliffe’s 1938 warning of the implications of refusing to accept drought as part of Australia’s variable climate and environments retains its urgency.

3.4 Environmentalism, sustainable development and Aboriginal land rights: towards new ways of knowing Australian water?

In recent decades the movements and myths described above have been countered by shifts from within the natural resources industry as well as broader social change and pressures arising outside it. Most significant among these are increased environmental awareness, the management imperative of ‘sustainable development’, and Aboriginal land rights. These developments have led to a shift in ways of knowing water from a tool of development and control towards interconnection and holism.

The rapidly changing world of the 1950s Cold War period saw superpower tensions over resources escalate dramatically (Howitt 2001). According to Howitt (2001) the imperatives

of industrialisation and development saw little concern for the long-term environmental costs of development and the complexity of social processes it sets in motion. During the later 1960s and 1970s an increasingly strong environmental movement in Australia and internationally began to question and oppose projects of resource exploitation and development. Increasing environmental awareness came to influence thinking and practice around water.

Since the 1980s there has been greater emphasis on environmental issues, and institutional focus on social justice and economic equity. In 1983 the United Nations established the *World Commission on Environment and Development*. By bringing together the often-conflicting realms of 'environment' and 'development', the complex interconnections between environmental, social and economic concerns were brought under close critique. In 1987 the World Commission on Environment and Development brought these issues to prominence with the publication of its report *Our Common Future* (WCED 1987). *Our Common Future*—which came to be known as the 'Brundtland Report', for the Chairman of the Commission, Gro Harlem Brundtland—played a central role in establishing the concept of 'sustainable development' (see also Escobar 1996). *Our Common Future* provides the following definition:

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (WCED 1987: 43).

Defined in terms of human needs, sustainable development is inherently anthropocentric. However, it recognises the significance of the 'environment' in its ability to provide for human needs, and explicitly acknowledges global social and economic inequality. Environmental, social and economic concerns are conceptualised at the global scale. The notion of 'global environmental problems' is a recent invention; according to Escobar it emerges from 'the ecological fervour fostered by the Club of Rome reports of the 1970s, which provided a distinctive vision of the world as a global system where all parts are interrelated, thus demanding management on a planetary scale' (1996: 49).

Sustainable development has led to wide spread change in resource management. The 'triple-bottom-line' management framework of economic, environmental and social sustainability (Elkington 1998) has been enthusiastically endorsed across resource industries and the broader corporate world. However, interpretation of both sustainable development and the triple-bottom-line is variable and often vague (Dovers 2005). Notwithstanding its loose interpretation, the discourse of sustainable development has enabled a more holistic consideration of complex interconnections between biophysical and socio-cultural aspects of natural resource issues.

The focus on difference and diversity of the post-modern era has contributed to a shift towards holism and inclusiveness in natural resource management. The notion of the 'other' has, according to Howitt, become 'an important, if somewhat abused and often confused image of the cultural and human diversity that is smothered by modernist totalising visions' (2001: 315). This concern for difference and diversity has manifested in resource management as efforts to consider 'other' voices and experiences; that is, those that lie outside the hegemonic Western development imperative and that are often silenced by it. For example, the Brundtland Report specifically addresses 'the essential needs of the

world's poor' (WCED 1987: 43). It also acknowledges the particular effect development has on 'tribal and indigenous peoples', asserting that:

Tribal and indigenous peoples will need special attention as the forces of economic development disrupt their traditional lifestyles ... Their traditional rights should be recognized and they should be given a decisive voice in formulating policies about resource development in their areas (WCED 1990: 12).

Around the world Indigenous peoples in particular have faced—and continue to face—displacement, dispossession and cultural and physical genocide at the hands of industrialisation and resource development (Howitt 2001). In Australia, Indigenous rights and interests have gained a high profile in resource issues since the early 1990s. The *Mabo* decision of 1992, the *Native Title Act* 1993, and the *Wik* decision of 1996 were key moments.

In 1982 three Murray Islanders¹ (also known as the Meriam people)—Eddie Mabo, David Passi and James Rice—brought an action against the State of Queensland to the High Court of Australia. They asked the Court to declare:

1. That the Meriam people are entitled to the Murray Islands
 - a. as owners; or
 - b. as possessors; or
 - c. as occupiers; or
 - d. as persons entitled to use and enjoy the Islands; and
 2. That the State of Queensland has no power to extinguish the Meriam people's title
- (Butt & Eagleson 1998: 8).

¹ The Murray Islands is a group of three islands in the Torres Strait, home to the Meriam people, 'a dynamic seafaring, fishing and gardening people' (Sharp 1996).

On the 3rd of June 1992—ten years after the initial action—the High Court handed down its ruling that *native title* is a form of title recognised by Australian common law. The High Court ruled that the Meriam people ‘are entitled as against the whole world to possession, occupation, use and enjoyment of the lands of the Murray Islands’ (cited in Butt & Eagleson 1998: 92), and that the State of Queensland has the power to extinguish the Meriam people’s title by valid exercise of powers consistent with Commonwealth laws (Butt & Eagleson 1998). The ruling recognised that the Meriam people had native title over their traditional lands.

Native Title is the recognition in Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. Where that traditional connection to land and waters has been maintained and where government acts have not removed it, the law recognises this as native title (National Native Title Tribunal 2005).

The *Mabo* decision overturned the concept of *Terra Nullius* (the idea that the Australian continent legally belonged to no-one at the time of European arrival), and recognised for the first time that Indigenous Australians may continue to hold native title (National Native Title Tribunal 2005). According to Howitt the Australian High Court judgement of 3 June 1992 ‘transformed the geopolitics of resources in Australia’ (2001: 205). Butt and Eagleson (1998) suggest that the *Mabo* ruling is one of the most significant court decisions in Australia’s history.

Among other things, the *Mabo* decision led directly to the *Native Title Act* 1993. The *Native Title Act*—which came into action on 1st January 1994—addressed a number of fundamental issues that the *Mabo* decision had left undecided. The *Native Title Act* established a National Native Title Tribunal and a process for Indigenous people to prove

that they had native title to land. The *Act* also provides protection of native title against future extinguishment, and regulates future activities over land where native title exists (Butt & Eagleson 1998: 96-97).

A third decisive case took place in 1996 when the High Court passed the *Wik* decision, in which it ruled that pastoral leases do not necessarily extinguish native title. Prior to the *Wik* case, it was thought that native title was extinguished by a freehold grant or by a lease (Butt & Eagleson 1998). While the decision was limited in its legal scope—it did not decide whether native title existed in this particular case, but that it had not *necessarily* been extinguished by the granting of a pastoral lease—it was both highly significant and controversial. In 1998 important amendments were made to the *Native Title Act* 1993 in response to the *Wik* case.

The *Mabo* decision had significant implications for Aboriginal claims to land. Yet, native title recognises rights and interests of Aboriginal and Torres Strait Islander people in land *and* water—including inland, off-shore and ground waters—and according to Toussaint *et al.* ‘water-based evidence from diverse locations has sometimes proved as crucial as that inspired by the land’ to native title land claims (2005: 62). However, recognition of rights to water has been slower to develop than rights to land. This is in part due to the complex nature of rights to water in Australian law. It also relates to the conflict between the *separation* of land from water in management frameworks (as discussed in section 3.3.1) and Aboriginal understandings of the *interconnection* between land and water (see Sheehan 2001). Jackson *et al.* suggest that the greater significance of land over water in the western environmental consciousness in part ‘explains why Indigenous relationships to land, rather than water, have tended to be more readily recognized and documented’ (2005: 106). Marcia Langton claims that in Australian common and statute law:

land is seen as more or less fixed, while water is seen as fluid. The latter's fluidity has resulted in a web of legal difficulties with respect to the formalisation and recognition of water rights in Western law. The theoretical space between the indigenous recognition and the Western legislation of water rights has created a need for a broader understanding of indigenous rights to waters and water sources (2002: 44).

Aboriginal organisations and communities are actively engaged in negotiating rights and agreements to inland waters. One of the most prominent cases is the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) an alliance of traditional owners whose country is along the Murray River and its tributaries. According to geographer Jessica Weir the traditional owners of MLDRIN are negotiating 'complex arguments about rights and identity in their negotiations with State and Federal governments, and the multi-jurisdictional bodies the Murray-Darling Basin Commission and Ministerial Council'. They are also involved in communicating 'a holistic philosophy about water within a management and policy context which otherwise would separate nature and culture' (Weir *in press*). No such process currently exists in the Lake Eyre Basin.

The issue of Aboriginal land rights, combined with environmental awareness and sustainability, has led to an increased interest in Aboriginal land management practices. This may suggest an interest both in reconciling Australia's violent history with regards to Aboriginal Australians, and an interest in developing an understanding of other ways of knowing Australian environments. It is consistent with a broader shift in hegemonic relationships between people and place—specifically Australian water places—from control towards understanding; from engineering towards holism and interconnection.

3.4.1 Water management strategies: the Lake Eyre Basin Agreement

The 1950s heralded dramatic changes in water management internationally. Sewell (1985) argues that it was a time during which 'planning' became a continuous activity. Conceptualisation of water shifted from water as a commodity or service, to water as 'a key ingredient in economic and social policy', and the focus of water management shifted from technical to economic, social and environmental (Sewell 1985: 3). Prior to 1980 no state or territory in Australia had 'any form of comprehensive water plan, and the provision of water to all sectors and to all major users was governed by demand' (Handmer *et al.* 1991: 3). David Ingle Smith describes this demand-driven approach as being focused on 'providing engineering measures to harness the resource, almost regardless of the cost of capital works, equity, or environmental effects. Concern over the efficient use of water, in terms of price or environment, was not a major factor' (Smith 1998: 78). From the 1980s the water industry in Australia began to recognise that in order to address the emerging problems of supply, 'information' about water use was needed (Smith 1998).

The first attempts to develop a comprehensive knowledge of water use were the *Review of Australia's Water Resources 1975* (Australian Water Resources Council 1976) and *The First National Survey of Water Use in Australia* (Australian Water Resources Council 1981). During the 1980s the states and Commonwealth produced a number of key water resource management documents, which emerged from these early efforts. Most significant among them was the Commonwealth report *Water 2000: a perspective on Australia's water resources to the year 2000*, published in 1983 by the Australian Department of Resources and Energy (Department of Resource and Energy 1983). According to Handmer *et al.* (1991) and Smith (1998) this, and accompanying reports, represented a turning point in interest and concern in water. *Water 2000* highlighted deficiencies in information and identified a need for planning in water management, recommending that: 'all states should develop, on a rolling

long-term basis, water plans as an integral component of longer term planning strategies' (Department of Resource and Energy 1983: 93). Water management in Australia is made more complex by each state and territory having different approaches to water planning (Handmer *et al.* 1991). The *1985 Review of Australia's Water Resources and Water Use* (Department of Primary Industries and Energy 1988)—a direct outcome of *Water 2000*—enabled comparison across states and territories for the first time.

In South Australia, the *Water Resources Act (1976)* predates similar legislation in other states and territories. Notably, South Australia is the state furthest downstream in both the Murray Darling Basin and the Lake Eyre Basin. As a result, it is most affected by actions undertaken by the states upstream: in the case of the Murray Darling Basin, New South Wales, Victoria and the ACT; and in the case of the Lake Eyre Basin, Queensland, and to a lesser extent New South Wales and the Northern Territory.

Social change since the 1950s, and in particular social movements in more recent decades, has focused attention within natural resource management on environmental, social and ethical concerns. In 1985 Sewell described seven major themes affecting change in water management: adoption of a comprehensive viewpoint (incorporating multiple uses of water, recognition of the embeddedness of water in social and economic contexts, and multi-disciplinary approaches to water management); recognition of a range of choice in approaches to water issues; conceptualisation of water as an economic good; the river basin as an areal unit; public involvement; environmental impacts; and social impacts (Sewell 1985). Although this list is somewhat generalist, it provides a clear summary of the nature of change since the 1950s and focuses attention on the broad themes.

Water management strategies in the Lake Eyre Basin in recent years reflect some of the key changes described above. In the Lake Eyre Basin, the most significant Basin-wide management document is the Lake Eyre Basin Agreement. In May of 1997 a Heads of Agreement for the Lake Eyre Basin was signed by the South Australian and Queensland governments, responsible for water management, and the Federal Minister for Environment as a supporting party. Bernice Cohen—Senior Policy Officer with South Australia's Department of Water, Land and Biodiversity Conservation, and involved in Lake Eyre Basin processes since the early 1990s—describes the Heads of Agreement as 'a statement of good faith to develop a formal inter-jurisdictional agreement' (Cohen 2000: 4) for the management of water and related resources, based on principles of integrated catchment management and ecologically sustainable development (Lake Eyre Basin Coordinating Group 2003).

The Lake Eyre Basin Agreement was signed in Birdsville on 21st October 2000 by the South Australian Minister for Water Resources (Mark Brindal) and the Queensland Minister for Environment, Heritage and Natural Resources (Rod Welford); it had previously been signed by the Commonwealth Minister for the Environment and Heritage (Robert Hill) in Adelaide. The Lake Eyre Basin Agreement provided for the first time a framework for the Queensland, South Australian and Commonwealth governments to cooperatively manage water and related resources across borders. The Agreement applied only to the Queensland and South Australian portions of the Cooper and Georgina-Diamantina catchments—the 'Lake Eyre Basin Agreement Area'—with the opportunity for New South Wales and the Northern Territory to sign at a later date (Figure 3.6). The Agreement came into force following approval and ratification by each State through

Figure 3.6 Lake Eyre Basin Agreement Area. Source: South Australian Department of Water Resources 2001.

legislation². To carry out the purpose and objectives of the Agreement, a Ministerial Forum—comprised of a Minister from each signatory State and the Commonwealth appointed by that jurisdiction—was established in the Agreement. The purpose of the Agreement was:

² South Australia passed legislation in April 2001 and Queensland in August 2001. Commonwealth legislation was not required, but the Commonwealth government introduced the *Lake Eyre Basin Intergovernmental Agreement Bill (2001)* 'to confirm its commitment to the future sustainable management of the Lake Eyre Basin and the protection of dependent environmental and heritage values' (Parliament of Australia 2001: 5).

to provide for the development or adoption, and implementation of Policies and Strategies concerning water and related natural resources in the Lake Eyre Basin Agreement Area to avoid or eliminate so far as reasonably practicable adverse cross-border impacts (Australian Government 2000: 5).

Prior to the Agreement land and water management policy did not cross state and territory borders. According to a much-publicised information brochure 'The Lake Eyre Basin Agreement: your questions answered', the Agreement:

establishes for the first time a cooperative framework for our three Governments to work towards sustainable management of these cross-border river systems and their related natural resources, and ensuring the continued viability of the industries and communities they support (South Australian Department of Water Resources 2001).

In marking the first attempt by governments to consider the Lake Eyre Basin as a catchment or river basin, the Agreement represents movement towards a more holistic view of the Lake Eyre Basin. The Agreement is supported by ten 'guiding principles' (Table 3.1), marking a shift towards ecology, interconnections and holism. The Agreement aims to consider 'river systems' (ecology), industry and communities. It acknowledges multiple perspectives, identifying its 'stakeholder interests' as: 'Aboriginal, agricultural, conservation, mining and petroleum, pastoral, and tourism' (South Australian Department of Water Resources 2001). This list is both generalised and problematic, but goes some way to recognising a diversity of perspectives that are beginning to be considered in natural resource management.

Table 3.1: Lake Eyre Basin Intergovernmental Agreement, Part III: Guiding Principles (Australian Government 2000: 6-7)

3.1	Consideration of all issues and the making of all decisions under this Agreement will be guided by the following Principles, namely that it be acknowledged:
(a)	that the Lake Eyre Basin Agreement Area has important social, environmental, economic and cultural values which need to be conserved and promoted;
(b)	that there are landscapes and watercourses in the Lake Eyre Basin Agreement Area that are valuable for aesthetic, wilderness, cultural and tourism purposes;
(c)	that naturally variable flow regimes and the maintenance of water quality are fundamental to the health of the aquatic ecosystems in the Lake Eyre Basin Agreement Area;
(d)	that the water requirements for ecological processes, biodiversity and ecologically significant areas within the Lake Eyre Basin Agreement Area should be maintained, especially by means of flow variability and seasonality;
(e)	that flooding throughout the catchments within the Lake Eyre Basin Agreement Area is beneficial in that it makes a significant contribution to pastoral activities as well as flood plain ecosystem processes;
(f)	that the storage and use of water both within and away from watercourses, and the storage and use of water from associated ground water, are all linked and should be considered together, and that water resources throughout catchments within the Lake Eyre Basin Agreement Area should be managed on an integrated basis;
(g)	that precautionary approaches need to be taken so as to minimise the impact on known environmental attributes, and reduce the possibility of affecting poorly understood ecological functions;
(h)	that natural resource management decisions need to be made within the context of the National Strategy for Ecologically Sustainable Development and relevant national and international obligations;
(i)	that the collective local knowledge and experience of the Lake Eyre Basin Agreement Area communities are of significant value; and
(j)	that decisions need to be based on the best available scientific and technical information together with the collective local knowledge and experience of communities within the Lake Eyre Basin Agreement Area.

The information brochure refers to ‘sustainable management’, and point (h) of the Agreement notes: ‘that natural resource management decisions need to be made within the context of the National Strategy for Ecologically Sustainable Development and relevant national and international obligations’ (Australian Government 2000: 7; Table 3.1). This focus on sustainable development emerges from the Brundtland report and the associated management imperative for Sustainable Development. The Agreement makes further reference to the globalisation and multiple scales of management though explicit reference to: ‘national and international obligations’ (above, point (h)), and ‘local knowledge’ (points (i) and (j) (Table 3.1)).

The social movements of recent decades have led to increasing inclusion of people in natural resource management. As part of this process, management strategies such as the Lake Eyre Basin Agreement are beginning to include the concept of 'value'. Three of the guiding principles of the Agreement are:

- (a) that the Lake Eyre Basin Agreement Area has important social, environmental, economic and cultural values which need to be conserved and promoted;
- (b) that there are landscapes and watercourses in the Lake Eyre Basin Agreement Area that are valuable for aesthetic, wilderness, cultural and tourism purposes;
- (i) that the collective local knowledge and experience of the Lake Eyre Basin Agreement Area communities are of significant value (Australian Government 2000: 6).

While the concept of value is beginning to appear in management strategies, its definition is broad and somewhat problematic. For example, points (b) and (i) above suggest that these things are valued universally, overriding specific local values.

The Agreement does not consider these values explicitly or in detail; however, Bernice Cohen suggests that they inform the document:

You can see more than glimmerings of social and cultural values of water in the Lake Eyre Basin Agreement—a key document. We will see it in catchment plans, in NRM [Natural Resource Management] regional plans. In South Australia some values sit within different legislation. For example: the Aboriginal Heritage Act; The State Heritage Act, which covers non-Aboriginal heritage including contact sites; the National Parks and Wildlife Act. They are integrated quite well in some places ... Integration is starting now in higher level documents. This represents the beginning of thinking on these issues (field notes, Cohen 4.03).

I discuss the concept of value and the current use of value in natural resource management in detail in chapter 5.

In addition, and of particular significance to this thesis, three guiding principles of the Agreement relate to the variability of water in the Basin. They note:

- (c) that naturally variable flow regimes and the maintenance of water quality are fundamental to the health of the aquatic ecosystems in the Lake Eyre Basin Agreement Area;
- (d) that the water requirements for ecological processes, biodiversity and ecologically significant areas within the Lake Eyre Basin Agreement Area should be maintained, especially by means of flow variability and seasonality;
- (e) that flooding throughout the catchments within the Lake Eyre Basin Agreement Area is beneficial in that it makes a significant contribution to pastoral activities as well as flood plain ecosystem processes (Australian Government 2000: 6).

These points refer to the physical variability of the Lake Eyre Basin river systems and the effects of variability on ecosystems and pastoral practices. They illustrate a shift away from the development and engineering imperative of earlier periods towards an emphasis on ecological systems and processes.

3.4.2 Locally-driven catchment management: the Lake Eyre Basin Coordinating Group

The Lake Eyre Basin Heads of Agreement (1997) and the Lake Eyre Basin Agreement (2000) stemmed from a locally-driven catchment management process, which eventually took the form of the Lake Eyre Basin Coordinating Group. In this section I consider the

ways in which the broad movements and discourses of social change (discussed above) provide a vital context for the creation of locally-driven catchment management. I continue this analysis in chapter 4, discussing in detail the progression towards locally-driven catchment management, arguing that the process was stimulated by specific local conflicts.

The Lake Eyre Basin Coordinating Group was formally established in October of 1998, following a community-led process that began in May 1995 in response to a perceived threat of World Heritage listing of parts of the Lake Eyre Basin. Ecological scientists working in the Basin had been calling for catchment management since at least 1992 (Puckridge 1992), asserting that the environments of the Basin should be managed on a catchment scale, not within state borders. As described above, land and water are managed by states, not the Commonwealth, and this has particular implications for river systems that cross state borders such as those of the Lake Eyre Basin and Murray Darling Basin. During the past two decades, local residents, land and water managers, scientists and conservationists have made considerable effort to overcome this management constraint. The Lake Eyre Basin Agreement was a response from governments to calls by local people—primarily pastoralists—for integrated catchment management.

Conflict over water in the Lake Eyre Basin was part of a broader national and international debate about the perceived benefits and threats of environmentalism. As part of this debate, people in the Lake Eyre Basin embarked on a process of rethinking place and people—place or human—nature interactions, and expanding understandings of water. Similarly, catchment management represents a response to the environmental discourse of recent decades, growing ecological and environmental awareness, and a broad move towards holism and interconnection. Historically, relationships between settler Australians and water were characterised by control and domination, and water was perceived as a tool

of development that could be separated from its constituent parts—the river bed, the river banks, the floodplain, the living things dependent upon it. In contrast, Integrated Catchment Management shifts from thinking of water as a separate entity towards integration and interconnection. It represents a shift from an engineering approach towards an ecological approach to living with water, and as such represents a new way of knowing Australian water.

The process for Integrated Catchment Management in the Lake Eyre Basin was led by community members. It emerged from community concern and public meetings. People living and working in the Lake Eyre Basin are intimately involved in the management of water as a 'natural resource'. They created structures that enabled their participation in decision-making. The Lake Eyre Basin Coordinating Group was integrating and holistic in its Basin-wide focus, and by involving local people in catchment management. In this way, the process reconnected the established separation of 'nature' and 'society'. The Lake Eyre Basin Coordinating Group, and locally-driven integrated catchment management more broadly, challenges firmly established attitudes and principles guiding interactions between humans and nature, and in particular between humans and water. Where water was historically understood as something with which one transforms the landscape, the Lake Eyre Basin Coordinating Group opened possibilities for people to discuss and devise new 'ways of living with water'.

The processes instigated by the Lake Eyre Basin Coordinating Group have implications beyond the Basin. In fostering a process of rethinking water, the Group sets precedents for developing new relationships between people, water and water places, and in doing so, expands Australia's water conscience.

3.4.3 Ecological research projects: Aridflo and WISE

Two ecological research projects of note have been undertaken in the Lake Eyre Basin in recent years: Aridflo, 'Environmental flows for Australian arid zone rivers', and WISE, 'Water Information Systems for the Environment'. The two projects have been conducted in the context of social change—environmentalism, sustainable development and Aboriginal land rights—and have been shaped by the Lake Eyre Basin Agreement and the Lake Eyre Basin Coordinating Group. Aridflo and WISE contribute to ecological understandings of Lake Eyre Basin river systems, and they broaden water knowledges in the Basin. Prior to the Lake Eyre Basin catchment management process scientific and local water knowledges were held separately. Aridflo and WISE have brought these ways of knowing water into conversation.

Aridflo began in January 2000 and the final report was completed in July 2004. Aridflo 'aims to improve the knowledge of the relationships between river flows and the ecosystems of the rivers and wetlands of the Lake Eyre Basin' (Aridflo 2000: 1). The project involved ecological and hydrological scientists from the University of Adelaide, University of Melbourne, CSIRO, the Australian National University and the Murray-Darling Freshwater Research Centre. It was administered by the South Australian Department for Water Resources in collaboration with the Queensland Department of Natural Resources and Queensland Parks and Wildlife Service. The project involved surveys of fish, waterbirds, macroinvertebrates and vegetation, as well as water quality and flow. The project examined fifty waterbodies in three river systems—the Cooper, Diamantina and Neales (Aridflo n.d.)—working across state borders in Queensland and South Australia. Extensive field research involved students and other volunteers in the project.

WISE—'Water Information Systems for the Environment'—is an ongoing project facilitated by the New South Wales National Parks and Wildlife Service that aims to produce a database of information pertaining to water in a number of catchments in Australia. It initially focused on the sub-catchments of the Darling River, but has expanded to include the Cooper Creek catchment. In its final form, WISE is a CD-ROM and web-based catalogue of scientific and local knowledge. Ecologist Richard Kingsford, who has worked extensively on the project, explains: 'The core database ... is encapsulated in a quote by Samuel Johnson (1775), "Knowledge is of two kinds: we know a subject ourselves or we know where we can find information upon it". WISE is the second part of this' (Kingsford & Davis 2002: 29). The database includes multidisciplinary scientific research, and a multimedia section covering a wider range of issues such as information on the towns, rivers, protected areas, and historic and cultural sites of the catchment. 'There are more than 200 photographs of the catchment which, in addition to videos and oral history interviews, enable users to get a visual impression of the catchment and the people who live and work there' (Kingsford & Davis 2002: 30).

The primary aim of both Aridflo and WISE is to further ecological understandings of the river systems of the Lake Eyre Basin, whether that be through original research or through collating and making widely available existing research. Relatively little research has been undertaken on these river systems, and they remain poorly understood. The number of gauging stations on the rivers of the Basin provides an illustration of the limited data available. Gauging stations are used to collect basic flow data required for most ecological and hydrological research. Prior to Aridflo, the Neales River west of Lake Eyre, did not have any gauging stations on its length. There are three gauging stations along the more than 1 500 km length of Cooper Creek. They are located at Currareva, Nappa Merrie and

Innamincka. Knighton and Nanson (1994) describe their presence as exceptional for an arid zone river. Sheldon *et al.* assert that:

efforts to manage and conserve the surface water of these rivers [of arid and semi-arid Australia] are hampered by limited scientific data on the ecology of their flora and fauna and on their responses to the high natural variability of flow regime that typifies dryland rivers (2002: 13).

Aridflo and WISE have contributed significantly to understandings of the complex river systems of the Lake Eyre Basin. While the primary aim of these two projects is arguably scientific in nature, both projects have led to expanding water knowledges, beyond science, and relate directly to the social movements discussed in this chapter.

The institutionalisation of sustainable development and the 'triple-bottom-line' has established community consultation as a basic aspect of natural resource management and other land and water research projects. Community consultation is a required component of both Aridflo and WISE. However, in both projects, people have invested in relationships beyond the required level of consultation. Ecologist Jim Puckridge—a key scientist on the Aridflo project—speaks about relationships between scientists and pastoralists:

I guess the Aridflo project has contributed to an improvement in those relationships as well because we've had to go around consulting. It's been a requirement of the project, and probably sensibly, we've had to go around consulting routinely with pastoralists and that has produced a much easier, and more relaxed dialogue—there's certainly nothing like spending time with people face to face to [dispel] some of the suspicions. ... I suppose we've been very careful, and we have to credit [Aridflo Project Manager] Michael Good with a lot of this too; he's been meticulous about consulting exhaustively throughout the process

with the local people, and informing them as the process has gone on, getting us to present ourselves and consult as well (Puckridge 4.03).

Michael Good tells me that working with the community does not make Aridflo unique; rather, it is the way to do business (field notes, Good 4.03). Although there are research projects that do not involve local people, they are becoming fewer and fewer. But communication throughout Aridflo has not been limited to formal community consultation. Communication is ongoing, and people have invested in relationships. I travelled along the Birdsville Track with the Aridflo researchers en route to Birdsville in October 2002. Along the way we stopped at a number of properties for social visits before making our way on our journey. There was clearly a rapport between many of the local pastoralists and the scientists on the road and in Birdsville.

Local people are involved in these research projects to varying degrees. Scientists working on rivers and waterholes on pastoral properties must speak to the station manager each time they need access. But 'involvement' of pastoralists in research goes beyond granting permission. An important way that local people—particularly pastoralists—are involved in research is through sharing their local knowledge with the scientists. 'Sustainable development' discourse and the 'triple-bottom-line' have influenced the value associated with local knowledge in recent years. There is a growing recognition that the intimate local knowledge and long-term observation often held by local people cannot be replicated by even the most rigorous scientific research project. The river systems of the Lake Eyre Basin are characterised by highly variable long-term patterns. Sharon Oldfield, owner of Cowarie Station on the lower Cooper's Creek, explains:

If you've spoken to ten people, ten people would have told you—every time the river runs it's different. Every season it's different, every time it rains it's different.

It changes constantly, it changes all the time, it's always different. And in a ten year period, if you can see a full cycle in ten years, then you're doing very well (Oldfield 4.03).

The reliance on short-term observation is in part a factor of the relatively short history of European settlement and migration in the Lake Eyre Basin. However, natural resource management continues to be characterised by short-term research and funding. Handmer *et al.* state: 'For both drought and floods, the lack of long runs of rainfall data in regions of extreme variability led to what are now seen as ill-judged decisions for agriculture and settlement' (1991: 11). Reliance on short-term observation has led to poor understandings of river function and of ecological, social and cultural interactions between the rivers, their ecosystems and people. Investment in long-term observation, research and funding is needed to ensure the errors of the past do not continue. This means bringing local knowledges—often marked by long-term observation—into natural resource management.

WISE explicitly incorporates local knowledge. The project gathers scientific and local knowledge together in the same database. It interweaves oral histories with ecological observations and hydrological studies. Qualitative and quantitative data sit side-by-side in order to present a more complete 'picture' of the catchments than could be gained by either of these methods alone.

Jim Puckridge spoke about the importance of different sorts of local knowledge to Aridflo:

That's been useful particularly for extra info about the hydrological history of the rivers. And understandably I suppose, for pastoralists the main concern is flow—events of flood and drought. ... there's no hydrological information except what can be gleaned from the local landowners and also what we can glean from past

rainfall records and model—you know predict through complex modelling—what flow would be in certain [events]. But if you're worried about that sort of issue on the Murray Darling you go to the nearest gauging station and get the data from it. So they've made important contributions in that respect. Pete [Weston, Manager of Clifton Hills Station]—most conscientious of them—has pegged the major flood levels, points in the flood. Also they've been useful in information about ... some of the more obvious biological events like waterbird colonies and breeding populations and so on, and what wetlands have what birds on. ... It hasn't the same rigour as scientific observation of course, but it's still useful. Often it can direct your attention to some wetlands rather than others as priorities. And sometimes people have made observations, which are the product of much longer period of experience of the rivers than we have. So for example they've seen tortoises in the Diamantina, and we had never recorded them, and now we've actually found some (Puckridge 4.03).

Both local people and scientists recognise the importance of long-term observation and relationships with place in developing understandings of river systems where variability is great, and cycles of wet and dry are long and unpredictable. Several pastoralists supported extensions of funding for Aridflo on the grounds that it is not possible to develop a complete understanding of those river systems over a short period (Emmott 5.03; Oldfield 4.03; Rickertt 4.03). Angus Emmott says of research projects like Aridflo and WISE:

I think they're absolutely crucial because the information that's coming out of those ... is showing us number one, how good a condition the rivers are, and number two, how highly variable they are ... it's showing how it's geared to handle the boom and bust, and how rich a system it is, but how vulnerable it is to changes (Emmott 5.03).

However, despite these benefits:

they're not long enough. That's the major problem we've got with all this whole issue with grants is they're all limited in time scales, and when you operate in systems like this a limited time scale does not give you a proper look at how things operate, because time-spans over which the systems out here operate are huge. ... research projects have to match the type of environment they're operating in. And these environments operate over a longer period, and to get really meaningful results, projects have to run over quite a long time period. They don't fit in a three year political cycle or a one year grant funding cycle (Emmott 5.03).

The discrepancy between human political cycles and ecological cycles, and the associated problems for water resource management are well documented. Sneddon *et al.* consider the implications of this discrepancy:

The temporal dynamics of river basins and their associated organisms are ... frequently at odds with human priorities of water use. ... The flows of impounded rivers are managed according to the separate, and at times contradictory, logics of hydroelectric power generation, irrigation releases, and flood control. ... the institutions charged with managing aquatic ecosystems or river basin may be more responsive to short-term political and economic goals than to the long-term resilience and integrity of the system under consideration. Ironically, these same institutions may be locked into rigid management strategies that afford little opportunity to respond to the surprises and disturbances that are increasingly perceived as inherent to ecosystem dynamics (2002: 666).

John and Helen Rickertt (5.03) of South Galway Station are very supportive of both research projects, and told me that scientists are now beginning to respect the observations

and understandings of pastoralists. They and others suggested that there is a growing interest in ecological knowledge and support for research within the pastoral community. This is partly the result of ecological understandings becoming more important in property management. John Rickertt tells me that:

Once upon a time managing a cattle station was about just that. Now a property manager does production analysis, Environmental Management Strategies, sits on committees and has to be involved in much more. There are all these additional tasks, but managing a property is a full time job in itself (field notes, Rickertt 5.03).

Communication and interest is two-way: scientists listen to and learn from the experiences and knowledge of pastoralists and pastoralists listen to and learn from the scientific understandings of scientists. Michael Good told me of the importance of partnership with the community, and asserted that 'the science should have some relevance to the community' (field notes, Good 4.03). According to Powell science communication has been a long-term project. By 1900 a number of 'perceptive observers' had stressed the importance of improving the means of communicating findings of scientists and technicians to the Australian public (Powell 1976). The realisation of effective communication has been somewhat elusive. The Aridflo and WISE projects continue the work towards this goal.

Vanessa Bailey (5.03), Aridflo's Queensland coordinator, is involved in producing the final community report for Aridflo. She told me that the community report is an important part of the project, providing both scientific feedback and a collation of local knowledge articulated during the project, including some pastoral and Indigenous perspectives. Feedback to the community in a form that is useful is crucial. Determining first, what information people want, and second, what form it should take, are ongoing challenges.

This combination of forms of local involvement—community consultation, investing in ongoing relationships, valuing local knowledge, listening and learning—indicate increasing and improved communication between scientists and pastoralists through these two ecological research projects. Michael Good says prior to Aridflo, the community had some distrust of scientists (field notes, Good 4.03). There was a wide perception among local people that scientists would come to the area and do research, and local people would not hear from them for several years. In the experience of some local people, information was not passed back to the community. Yet ‘the community wants to know what is going on in their own back yard’ (field notes, Good 4.03).

Maree Morton, owner and manager of Innamincka Station, explained that prior to the Lake Eyre Basin Coordinating Group local pastoralists’ experiences with scientists were not good. Prior to improved relationships following the recent conflicts I discuss in the next chapter, relationships were characterised by fear and distrust. She says that through Aridflo and WISE, those relationships have improved. Communication and getting to know people is vital. ‘In the past, researchers wouldn’t even tell you they were there; they didn’t value you enough to include you in their reports’ (field notes, Morton 5.03).

Aridflo and WISE have fostered development of expanded understandings of water and water places, by presenting opportunities for people to listen to and learn from other ways of knowing water. Sharon Oldfield told me ‘the community are, as a whole, pretty much behind Aridflo’. When I asked her why, she explained:

Because it’s teaching them more about their area. They’re getting now a different understanding from things they already know. Like sometimes you know something, and this is just a different way of understanding the same thing. And certainly the good things that are coming out of it—that excites people. And this is

something that these people love. They live and breathe this country; it's their life. It's not just a job. It's your home, it's where you live, it's what you do. And it's pretty exciting to find all these different things. And it's another way too to share some of the knowledge that you've got with different people. Not that you want to go there and blow your bags and say 'hey listen, I know all about this', but there's obviously a degree of comfortableness that they can actually converse about these things. ... So it's a way to exchange knowledge, it's a way to learn more about something that they have quite a degree of understanding about anyway, but at a different level. And I think from the scientific point of view, I think the same thing can go for them. ... They're learning from each other, and there's been identifying of each other's knowledge, and a marrying up of that knowledge too, to get a bit more of a complete picture. So people are very supportive of it. Very behind it (Oldfield 4.03).

These ecological research projects have encouraged and fostered expanded knowledge of water and water places. Yet, when considering the 'community' both projects refer primarily to the pastoral community. While this group represents the largest land owning or managing group, it by no means represents the only local knowledge system or 'other' perspective in the Lake Eyre Basin. The Aridflo project involved a 'community reference group', installed to address concerns raised by members of the community about the validity of the science conducted and the role of the community in the project. But the community reference group comprised pastoralists, government representatives and one pastoral company environment officer (Aridflo 2000: 3); clearly not an exhaustive representation of the Lake Eyre Basin 'community'. Most significantly, the community reference group did not include any Aboriginal community members or representatives. According to Don Rowlands (4.03) Aboriginal issues are gaining attention in land

management, but Aboriginal people and their ways of knowing continue to be marginalised:

People are starting to understand a bit more now [about Aboriginal issues] but when they are writing it up they still leave it out. Aboriginal people know about the history of the river systems. Burning is an example. Non-Aboriginal people are now using burning to promote regrowth, but they don't recognise that Aboriginal people have been using it for many years. With water maybe it will be the same. All land management is reverting to Aboriginal land management. Surface water was used by Aboriginal people to the max. They might have been able to go out to the Simpson and use water there while it lasted and give the river a rest. Now station people are starting to follow the same principles (field notes, Rowlands 4.03).

A growing focus on 'Aboriginal land management' is consistent with the sustainable development imperative, and the recognition of multiple perspectives and marginalised voices. However, in the Lake Eyre Basin, as elsewhere, Aboriginal people and Aboriginal interests remain outside the organised natural resource management process. I explore this issue further in chapter 4.

CHAPTER 4

RETHINKING WATER: CONFLICT AND CONVERSATION IN THE LAKE EYRE BASIN

4.1 Introduction

During the 1990s two major conflicts over water took place in the Lake Eyre Basin. The first was a proposal by conservationists and ecological scientists for parts of the Lake Eyre Basin to be nominated for World Heritage listing. The second conflict arose from a proposal for a major cotton irrigation development on the banks of Cooper Creek, at the property 'Currareva' near Windorah. Through these two conflicts, alliances and relationships shifted. Conversations between people involved in the process expanded understandings of water and water places for those people. Most significantly, these two conflicts led directly to the first locally driven, inter-jurisdictional catchment management process in the Lake Eyre Basin, which eventually took the form of the Lake Eyre Basin Coordinating Group (as briefly described in chapter 3, section 3.4.2).

In this chapter I analyse these conflicts and conversations at two levels. These events can be read as conflicts over water, where water is understood as an object, a physical entity, a resource. The disputes reflect diverse interests in water; they represent conflicts over scarce resources and different use values. However, these events might also be understood as conflicts over *ideas* about water and water places. They can be understood as struggles over meanings of water, place and nature.

Geographer Bruce Braun (2002) critically examines the conflict surrounding the temperate forest of Clayoquot Sound in British Columbia, western Canada. In their analysis of the conflict Braun and Wainwright ask 'what is this conflict about?' They suggest that through one reading it is over 'the fate of the rainforest and who benefits from its use'. However, to this they pose the following counter-questions:

what rainforest? What are we referring to when we speak of the 'rainforest'? How is it that we are able to speak of something called a 'rainforest'? What is included in this thing, and what is excluded from it? Ultimately, what are the political consequences of framing the forest in these terms? (Braun & Wainwright 2001: 45).

Braun and Wainwright write: 'Although commonly represented as a struggle over the "temperate rainforest", these struggles are also in part an effect of, and waged over, the very concepts used to discuss these landscapes' (2001: 50). Similarly, the conflicts over water in the Lake Eyre Basin were in part over water and water places as objects, but they were also about the concepts of water and the values behind those concepts. In this chapter I discuss the conflicts and conversations, and the constructions of water and water places that emerged through them.

According to Braun and Wainwright: 'To argue that environmental disputes merely reflect competing "interests" assumes that what is perceived as natural is self-evident, and exists

external to the domain of power and politics that geographers and political ecologists set out to study' (2001: 42). In this analysis of conflict in the Lake Eyre Basin, I seek to examine the ways in which water and water places were constructed through these two conflicts. In using 'construction' as an analytical tool, I do not subscribe to the ' "strong constructivist" view that language precedes and produces the world and that denies any part in the construction of knowledge to the material world itself' (Braun & Wainwright 2001: 45). I do not emphasise processes of constructing the physical and material world, but to processes of constructing *concepts* of water and water places (Demeritt 2001: 23). I use construction-as-philosophical-critique (Demeritt 2001, 2002) to draw attention to the partial—both incomplete and subjective—nature of ways of knowing water. I seek to explore the 'inevitable intertwining of society and nature in any and all social and ecological projects' (Braun 2002: 10); to question the culture/nature, subject/object and representation/reality dualisms established and reinforced through Enlightenment thinking (Head 2000a; Demeritt 2002). In so doing, I acknowledge the existence of multiple, simultaneous, diverse, changing and contested ways of knowing water and water places.

Through this series of processes—conflicts and conversations—people came to rethink water, to expand their understandings and to articulate a broader and more holistic understanding of water and water places. These conflicts and conversations highlight diverse and changing ways of understanding and valuing water, and the multiple, co-existing knowledges that shift and expand over time. According to geographer and historian Joe Powell reference is often made to Australia's 'water-conscious electorates' and to Australians' attitude of 'water sensitivity', but he argues that these terms are too narrow. Powell draws attention to 'the absence of a genuine "water ethic" or "water conscience" in our society' (1989: 13). In this sense, the events discussed in this chapter led to an expanded 'water conscience' for all involved.

During the fieldwork for this research, I did not interview people closely about the conflict over World Heritage. Early in the fieldwork I came to understand that the dispute remains difficult for some people to discuss. Importantly, people wanted to talk about the positive things that came out of the conflict—namely, the ‘meeting of the clans’ (Oldfield 4.03), or the coming together of diverse interests—that occurred as a result of the two conflicts. People also spoke enthusiastically about the conflict over Currareva cotton, perhaps because it has been a uniting experience and resulted in positive outcomes for many people who have interests in the Basin. Geographer Tom Jenkin (2001) has written a more detailed account of the World Heritage conflict, focusing on the details of the conflict and meanings of place. Jenkin and I interviewed several of the same people from this relatively small community. Some of their stories are published therein. I decided that my ethical responsibility was to recognise that these people have recently spoken to an academic researcher about these histories, which for some, remain painful. In this chapter I focus on an analysis of the series of events from conflict to conversation, and the processes of rethinking water that people undertook during this time.

4.2 World Heritage

The World Heritage Convention is administered by the United Nations Educational Scientific and Cultural Organization (UNESCO). UNESCO:

seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity. This is embodied in an international treaty called the *Convention concerning the Protection of the World Cultural and Natural Heritage*, adopted by UNESCO in 1972 (UNESCO 2005a).

The World Heritage Convention was invoked in the Lake Eyre Basin by conservationists and ecological scientists anxious to conserve and appropriately manage sites they deemed to be of environmental significance, primarily aquatic environments. They came into conflict with pastoralists and the mining industry in the Lake Eyre Basin, who saw World Heritage as potentially threatening their industries, particularly their access to surface and ground water resources. The conflict came to be focused on water and water places. At one level the conflict might be understood as a conflict between conservation of environmental values or 'natural heritage', and security of rural industries, businesses and livelihoods. However, considered within a different framework, the conflict can be read as being between constructions of the water and water places of the Lake Eyre Basin.

4.2.1 The Proposal

The original proposal for parts of the Lake Eyre Basin to be listed under the World Heritage Convention was made in the mid-1980s by the Conservation Council of South Australia and the Australian Conservation Foundation. The area proposed was referred to as the 'Eastern Arid Rivers Region', and it lay entirely within the state borders of South Australia, in its north-eastern corner (Reader 1985). It included the complex ephemeral wetlands of Coongie Lakes, the floodplain of the lower Cooper Creek, the floodplain of the lower Diamantina River, including Goyder Lagoon, the South Australian mound springs, and Lake Eyre. The proposal gained support from The Wilderness Society, the Arid Lands Coalition and Friends of the Earth (Reid 1994: 275), but the campaign remained relatively low profile, attracting little support or attention outside South Australia. Reid (1994) and Parnell (1994) attribute this lack of national attention in part to the nature of the proposal: the Eastern Arid Rivers Region was an arid zone area in remote southern central Australia, and the proposal came at a time when the conservation movement was

heavily focused on forest issues in the high rainfall regions of the eastern states. According to Parnell, 'the land in question has rather shorter trees and they tend to be spaced further apart than say in the Daintree or Farmhouse Creek' (1994: 237).

The South Australian government commissioned an assessment of World Heritage values in the region in 1985, and concluded that it appeared to be ineligible for listing (Jenkin 2001: 20). Four years later, the Conservation Council of South Australia (CCSA) recommenced its campaign, with more focused and concrete objectives. These included international recognition of the value of the region's wetlands, and appropriate protection and management of the area (Reid 1994: 281). Arid zone ecologist Julian Reid described the region's water resources as being at the core of the World Heritage proposal, and of the conflict that ensued (1994: 275).

Broad political support for the World Heritage campaign was limited until 1990 when members of the Conservation Council of South Australia and the Australian Conservation Foundation attended the 18th General Assembly of the International Union for Conservation of Nature and Natural Resources (IUCN) in Perth. The two Australian conservation agencies presented to the Assembly a resolution calling for assessment of World Heritage values in the Lake Eyre Basin (this call was not limited to South Australia). The General Assembly endorsed the resolution, providing crucial international attention, and pressure for the Australian governments to reconsider the issue (Puckridge 1996: 1; Jenkin 2001: 22). The Federal and South Australian Governments supported the resolution, but the Queensland and Northern Territory Governments did not (Fergie 1996). Federal Minister for the Environment, Senator Graham Richardson, promised to investigate the World Heritage values of the region; however, little further political action was taken during the following two years (Reid 1994: 281).

During this time, campaigning by local conservationists and ecological scientists continued. Jenkin (2001) suggested that the World Heritage proposal was rejuvenated in the 1990s in the context of growing understanding of the ecological values of and threats to the region. In particular, Jenkin cited Reid and Gillen's (1988) *Coongie Lakes Study*, and The Royal Society of South Australia (Tyler *et al.* 1990) collection *Natural History of the North East Deserts*, as contributing significantly to the growing ecological understanding of the region. It was at this time that ecological scientists and conservationists began to refer to the 'Lake Eyre Basin' as an entity. This linguistic shift provides a significant indication of changing thinking about the region as a catchment. It coincides with the broader movement towards integrated catchment management, and growing recognition of ecological values of the arid zone. An important by-product of the World Heritage proposal was that the 'Lake Eyre Basin' came into being as a political *idea* and *agent* as well as a geographical *space*.

In the proposal and through the campaign for World Heritage listing, the Lake Eyre Basin was largely described in terms of this new ecological understanding. The campaign clearly established water and water places of the Lake Eyre Basin as 'natural'. Places proposed for listing were referred to as 'some of the world's most remarkable wetlands' (Friends of the Lake Eyre Basin n.d.) (Figure 4.1), and as 'wilderness' (Reader 1985). The immense variability of the area's river systems and the apparent paradox of wetlands in the desert were central to the promotion of the campaign for listing; phrases such as 'Lake Eyre Basin: land of paradox' (Puckridge 1992), 'Bright Water, Red Sand', and 'World class wetlands in our deserts' (Friends of the Lake Eyre Basin n.d.) played on this paradox (see for example Friends of the Lake Eyre Basin n.d.; Reader 1985; Puckridge 1992; Reid 1994).

Figure 4.1 Front of brochure published by the Friends of the Lake Eyre Basin promoting World Heritage listing of parts of the Basin. Source: Friends of the Lake Eyre Basin n.d.

Braun and Wainwright (2001) examine the way in which the forest is constructed through 'The Royal Commission Report on the Forest Resources of British Columbia', written by Justice Gordon Sloan in 1945. According to Braun and Wainwright Sloan 'posits the forest as an entirely "natural" entity—a domain that existed separate from the people and

communities that were in part constitutive of it'. Sloan 'drew upon widely held assumptions about what constituted the "forest" ' (Braun & Wainwright 2001: 53). Similarly, the World Heritage proposal drew upon widely held assumptions about what constituted the 'desert'. The preliminary proposal, jointly submitted by the Conservation Council of South Australia and the Australian Conservation Foundation (Reader 1985) presents the Lake Eyre Basin environments as 'largely dehumanised' and as 'desert wilderness' (Jenkin 2001: 34): 'Today, 150 years after European settlement, the area remains sparsely populated, with marginal pastoral industry around the fringes and significant wilderness in the heart of the area' (Reader 1985: 5).

Jenkin characterises the depiction of place by conservationists as 'threatened wilderness' (2001: 34). The term 'wilderness' is consistent with recent conservation ideas and a broad environmental awareness (as discussed in chapter 3). While attempting to preserve 'world class wetlands in our desert' or a 'threatened wilderness', the World Heritage campaign was, as Cronon (1995) described 'getting back to the wrong nature'. By presenting the Lake Eyre Basin as 'natural', the proponents of World Heritage listing excluded human relationships with water and water places, and denied the hybrid nature of place (Castree & Braun 2001; Whatmore 2002). The construction of the Lake Eyre Basin as wilderness was closely connected to the support the campaign gained from urban Australians, who responded to remarkable, distant wilderness environments. Bernice Cohen, Senior Policy Officer in South Australia's Department of Water, Land and Biodiversity Conservation, suggested: 'There was recognition by city people that the area was of high conservation value. The World Heritage proposal was symbolic of this' (field notes, Cohen 4.03).

This ecological focus is perhaps not surprising as the promoters of the World Heritage proposal were ecological scientists and environmental conservationists. Emphasis on the

'natural' elements of place is consistent with their worldviews. Had the proposal been put forward by historians, archaeologists, social scientists or local residents, or proposed at a different time, the promoters may have emphasised different values (that may also have met World Heritage conditions).

In constructing the water and water places of the Lake Eyre Basin as 'natural' the campaign excluded human agency, with two exceptions: the historical presence of Aboriginal peoples, and the destructive influence of non-Indigenous Australians. Aboriginal peoples' presence in the campaign was primarily through the 'archaeological record' (Puckridge 1992: 20), and the 'treasury of Aboriginal culture' (Friends of the Lake Eyre Basin n.d.) present in the Basin. While the occupation of the Basin by Aboriginal people at some time in the past was presented positively through the campaign, it was clearly historical: 'Out on the gibber you feel as remote from human contact as if you were on Mars, yet the river floodplains are littered with the bones, stones and shells of a banished people' (Puckridge 1992: 18). Jim Puckridge, aquatic ecologist at the University of Adelaide and the CCSA's representative for the South Australian section of the Lake Eyre Basin, discusses the rich Aboriginal heritage of the region and the importance of history to Aboriginal and non-Aboriginal people (Puckridge 1992). However, present relationships that Aboriginal people nurture with the places of the Lake Eyre Basin received little attention in the campaign. The Friends of the Lake Eyre Basin referred, in their campaign brochure, to 'Aboriginal people ... at last coming back to their places on these shores, and taking up again their role in caring for this country' (Friends of the Lake Eyre Basin n.d.). Yet this comment does not refer to specific groups or relationships with particular places.

Non-indigenous human involvement was characterised as 'damaging'. European contact with these places was largely framed in terms of 'impacts': 'European exploration of the

Basin brought with it devastation of the Aboriginal population and an unrestrained exploitation of its natural resources. This exploitation continues today' (Puckridge 1992: 20). 'Natural' places were presented as being threatened by human activity. Discussion of non-Aboriginal involvement was framed in terms of the practices of industries—pastoralism and mining. Individual people, families and their relationships with place were made invisible. This construction of non-Indigenous people as destructors is consistent with broader debates and struggles over who and what 'belongs' in the outback, which have gained primacy since the rise of environmentalism in the 1980s (Gill 2005b).

The World Heritage debate gained a high public profile in April 1993, in the lead-up to the Australian Federal election. In his pre-election address, Paul Keating announced his intention to assess the environmental values of the Lake Eyre Basin for World Heritage listing:

Once the necessary survey work is complete, I am confident that a World Heritage nomination will proceed this year. If eventually accepted by the World Heritage Committee, this will represent a major step onward for the conservation of our fragile arid regions (Keating 1993: 5).

In 1995 the World Heritage Unit of the Department of the Environment, Sport and Territories commissioned three assessments of World Heritage values of the proposed area: natural heritage, undertaken by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Morton *et al.* 1995); Indigenous cultural heritage, undertaken by the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) (Ward 1997); and non-indigenous cultural heritage, undertaken by heritage consultant Duncan Marshall (1995). Although the IUCN call for assessment of World Heritage values applied to the entire Lake Eyre Basin, the proposed World Heritage area was restricted to South

Australia, due to vehement opposition by the Queensland and Northern Territory Governments (Jenkin 2001: 22).

The structure of the World Heritage Convention separates 'natural' and 'cultural' heritage, through separate assessment and listing. This structural separation reinforced the construction through the campaign of water and water places of the Lake Eyre Basin as 'natural'. In 1992 the World Heritage Convention introduced the concept of 'cultural landscapes', which demonstrate significant interactions between people and the environment (UNESCO 2005b), but at the time of the Lake Eyre Basin World Heritage proposal, this form of heritage was very new and very few sites were considered under the category. As such, 'nature' and 'culture' were considered separately.

The CSIRO report found 'several surface aquatic features of the South Australian section of the Lake Eyre Basin [to] possess World Heritage natural values. They are the Cooper and Warburton Creek drainage systems, Coongie Lakes, Goyder Lagoon, and Lake Eyre' (Morton *et al.* 1995: 102). Morton *et al.* found these sites, in combination, to fulfill three, and possibly four, of the criteria for World Heritage properties: (i) outstanding examples of physiographic features; (ii) outstanding examples of significant on-going ecological and biological processes; and (iii) superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance. The study claimed 'the features may meet Criterion (iv), significant natural habitats for in-situ conservation of biological diversity including threatened species, but with less certainty than that with which they appear to meet the first three Criteria' (Morton *et al.* 1995). World Heritage listing requires only one criterion be met, as well as satisfying several conditions of integrity (Jenkin 2001: 8). In addition, the South Australian mound springs were found to possess significant natural heritage values, but were deemed unable to be assessed against World Heritage Criteria

without a simultaneous assessment of the mound springs in Queensland. As the assessment had been limited to South Australia, this was not possible.

The report on non-indigenous cultural heritage values found 'a rich heritage of historic places' associated with several themes of outstanding universal value including European exploration, pastoralism, Missionary activity, Afghan migration, the Overland Telegraph Line, mining and remote settlement (Marshall 1995: 36). However, the report concludes: 'While many places in the study area related to the themes of outstanding universal value are significant at a national or regional level, none of the places are either essential or integral to those themes. Rather, the places are peripheral to the themes'. As such, Marshall found 'no places of outstanding universal value worthy of nomination for World Heritage listing' (1995: i).

The AIATSIS report on the Lake Eyre Basin as an Indigenous cultural landscape (Ward 1997) was not publicly released, and remains confidential, in part in consideration of the secret and sacred nature of the places and relations it describes. The need for the report to be confidential contributed to the marginalisation of Indigenous issues. Without a public assessment, Indigenous heritage became invisible through the conflict. The World Heritage Convention itself presents difficulties for assessing the 'value' of places and interactions with places that are strongly based on links between people and place and transport of materials across great distances, due to the requirement for cultural World Heritage values to be located wholly within a proposed area. This problem has been partially addressed through the introduction of the category of 'cultural landscapes' since the Lake Eyre Basin World Heritage proposal (which I discuss in chapter 5, section 5.5.1). The World Heritage process made it difficult for Aboriginal people to contribute on their own terms. As in Clayoquot Sound, Aboriginal people 'needed to present an *intelligible* image of reality that

“made sense” ’ in the context of the conflict (Braun & Wainwright 2001: 59). Aboriginal values, meanings of place, and relationships with place were largely left out of the World Heritage assessment process. Attention of the media and public discourse focused on pastoralism, science and conservation.

4.2.2 The opposition

While Prime Minister Keating’s promise was welcomed by the conservation and scientific communities, it generated strong opposition from the pastoral community and the two mining companies in the South Australian part of the Lake Eyre Basin, WMC and Santos.

Faced with the proposal for World Heritage listing of the South Australian portion of the Lake Eyre Basin, pastoralists, mining industry representatives and the South Australian government argued that current mechanisms for land management could effectively protect heritage values in the region (Reid 1994: 282; Fergie 1996: 133). Intervention in state-based land management was viewed and promoted as limiting access to lands and natural resources currently used by the pastoral and mining industries, both of which contributed significantly to the domestic market and to South Australia’s export earnings (Fergie 1996: 132). A prominent brochure published by the Lake Eyre Community Alliance—established in response to the World Heritage proposal—claims that in Australia the World Heritage Convention had become: ‘a political device by which the Australian Federal Government can over-ride the States and individuals in controlling land use, access and management without compensating landowners for the loss’ (Lake Eyre Community Alliance n.d.) (Figure 4.2). Intimately connected to the perceived lack of access were loss of jobs and loss of income and investment of individuals and the state of South Australia (Lake Eyre Community Alliance n.d.; Reid 1994).

THE CONSEQUENCES OF WORLD HERITAGE LISTING OF THE LAKE EYRE BASIN

Unfortunately, in Australia the World Heritage Convention has become what it is nowhere else in the world - a political device by which the Australian Federal Government can override the States and individuals in controlling land use, access and management without compensating landowners for the loss.

This has led to World Heritage being badly regarded in many parts of Australia. Local communities and State Governments have felt excluded from the World Heritage process. And often, they feel as if World Heritage is something that has been dumped on them, by a Federal Government which has the sole power to nominate properties and virtual control over its management.

**LOST JOBS, LOST INCOME,
LOST EXPORTS, LOST INVESTMENT!**

**NO COMPENSATION, NO APPEAL,
UNCERTAINTY!**

Figure 4.2 Front of brochure published by the Lake Eyre Community Alliance, opposing the World Heritage listing of parts of the Basin. Source: Lake Eyre Community Alliance n.d.

The perceived threat of federal, and even international, intervention in state affairs became a major theme of opposition to the World Heritage proposal (Lake Eyre Community Alliance n.d.; Reid 1994; Jenkin 2001). Under the Australian constitution, heritage protection is complicated by a division of powers between the Commonwealth and States.

Each of the States and Territories has legislation and administrative structures to identify and protect heritage items and values within their state borders, and the Federal government has comparable legislation with respect to the nation as a whole (Fergie 1996: 129-130). The *World Heritage Properties Conservation Act 1983* enables the Commonwealth to intervene in heritage and environmental management that would otherwise be under the jurisdiction of State or Territory governments (Fergie 1996: 144; Jenkin 2001: 9-13). Australia is unusual in that World Heritage nominations are not dependent on the consent of the owner of the area, be that State government, local government or private property owner. Neither does legislation require consultation with or compensation to those with an interest in the area, though the *World Heritage Operational Guidelines* provide for some consultation to occur (Barnett 1996: 46).

One of the factors inspiring the original World Heritage proposal in 1985 was the potential effects of water extraction from the Great Artesian Basin on the South Australian mound springs (Fergie 1996: 132). As described in chapters 2 and 3, the pastoral and mining industries in South Australia are dependent on the Great Artesian Basin for water. They perceived World Heritage to present a threat to their businesses and livelihoods, by limiting their access to the Great Artesian Basin. Hugh Morgan—then Managing Director of Western Mining Limited—claimed:

if the World Heritage listing for the Lake Eyre Basin proceeds then we can be justifiably apprehensive at the prospect of the drawing of water from the artesian basin being declared illegal, either for stock watering purposed or for supplying the mining and smelting operations at Olympic Dam (1993: 27).

According to anthropologist Deane Fergie, the South Australian Minister for Mines' opposition to the World Heritage proposal was 'no doubt deeply affected by the importance of Roxby Downs uranium mine', Olympic Dam (1996: 132). The mining lobby

was also concerned about the threat World Heritage posed to other mineral and gas resources including the Santos' Moomba gas fields (Fergie 1996). This perceived threat to access to ground water united the interests of mining and pastoralism, forming a strong lobby against the World Heritage proposal.

Lack of information about the World Heritage proposal and poor communication featured strongly in the conflict. Jenkin suggests that 'World Heritage was thrust on a community that was largely unaware of both its meaning and the past events linking World Heritage with the [Lake Eyre Basin]' (2001: 29). Effective consultation with community members did not take place at any point during the proposal (Reid 1994: 284; Puckridge 4.03). While the Australian constitution enables World Heritage nominations to be made with minimal local consultation, Fergie suggests that the way the proposal was announced and handled 'served to fuel conflict, suspicion and anxiety at the local level and to galvanise an effective campaign of opposition by some stakeholders' (1996: 135).

After fruitless attempts to obtain information about the World Heritage proposal from state or federal governments, 'pastoralists embarked on a remarkable community-based information gathering exercise' (Jenkin 2001: 30). Within one month of Keating's April 1993 announcement, the local pastoral community, along with other industry and community supporters, had created a well-organised opposition in the form of the Lake Eyre Basin Protection Group. In May, they organised a meeting in Birdsville that attracted several hundred participants. Opposition to World Heritage spread quickly. Fergie describes the 'energetic campaign' of the local pastoral industry as 'a significant cultural development in its own right' (Fergie 1996: 132).

Lake Eyre Basin pastoralists sought advice from pastoralists in other World Heritage areas, including Shark Bay in Western Australia, Queensland's Wet Tropics and Willandra Lakes in New South Wales. The experiences of people from Willandra Lakes became particularly important in drawing attention to the Commonwealth government's inability to effectively manage these places effectively and to the financial implications for local landowners (Fergie 1996: 132-133). Fourteen years after World Heritage listing of Willandra Lakes, a management plan had still not been adopted for the region (Fergie 1996: 132; Jenkin 2001). The stories told by pastoralists in other World Heritage areas added fuel to the fire of local opposition to World Heritage listing of the Lake Eyre Basin.

Throughout the campaign, the largely pastoral opposition constructed the Lake Eyre Basin as 'home'. In stark contrast to the 'threatened wilderness' constructed by the conservationist promoters of World Heritage, language and imagery used in the opposition campaign referred to the community, family lives, and work of the residents of the Basin (Lake Eyre Community Alliance n.d.; Jenkin 2001). Where the promotional material presented images of empty 'wilderness' landscapes, material produced by the opposition depicted peopled places. Pastoralists described implications of World Heritage listing in terms of their own lives, livelihoods and lifestyles (see Figure 4.2). Images of proud pastoral families overlooking wide, distant horizons are consistent with historic and contemporary constructions of brave settlers and outback life. One outcome of the construction of the desert as 'natural' or as a 'threatened wilderness' was the strong opposition from the people whose lives were made invisible by that construction. While promotional material referred to 'better protection, more jobs!' (Friends of the Lake Eyre Basin n.d.), it described a future of jobs in ecotourism, not pastoralism, in this way over-riding the lives and lifestyles of pastoralists and others living and working in the Basin.

In the South Australian state elections held in December 1994 the Labor Government was replaced by the Liberal party under Dean Brown. Brown's government was vocal in its opposition to the World Heritage proposal. Cross-party politics between State and Federal governments saw conflict over the proposal escalate once more. In 1998 Liberal Federal Environment Minister Robert Hill announced that the Federal Government would not forward a World Heritage nomination. Although natural World Heritage values had been identified, the lack of community support and ensuing conflict prevented the Australian government from making the nomination.

4.3 Currareva cotton

In 1995, in the midst of the World Heritage debate, the people of the Lake Eyre Basin first heard of a proposal for a major cotton irrigation development on the banks of Cooper's Creek, just upstream of Windorah. The proposal to extract water from the Cooper would be the first major irrigation scheme in the Lake Eyre Basin. Cotton irrigation requires large quantities of water from a reliable source, but as the flow on Cooper's Creek is highly variable, water extraction would focus on flood times, reducing flood peaks and therefore significantly altering the patterns of variable flow downstream, in the Channel Country. Pastoralists expressed strong opposition to the proposal on the basis that the reduced flow during floods would have a detrimental affect on the floodplain pastures upon which their properties rely. Scientists and conservationists quickly joined the campaign against the proposal on the basis that any reduction in flow, or in the variability of flow, would damage the ecological systems that are reliant on variable patterns of flooding. The two groups fought against the proposal on this common ground.

On one level, this conflict can be read as being over water use and allocation of a scarce resource. On another level it was about the construction of water and water places. The irrigators constructed water as a resource and water places as generic. Scientists, conservationists and pastoralists constructed water as a source of life, and water places as unique and characterised by variability—the very process under threat.

According to historian Tom Griffiths, the battle over the Cooper is highly significant in Australian environmental history, but has received far less attention than other environmental disputes. Angus Emmott told me: ‘I’ve been talking to Tom Griffiths who’s one of our major ecological historians ... and he likens this whole history of the World Heritage and what’s happened subsequent to that as being as important in ecological history in Australia as the Gordon below Franklin’ (Emmott 5.03). Griffiths wrote:

The debate about irrigation on the Cooper is a revealing moment in the catchment’s history and it made locals articulate their history and their pride, and to see the political as well as environmental advantages of talking ‘sustainability’. In the face of corporate cotton, pastoralists mobilised in defence of their social as well as natural environment (2001: 58).

4.3.1 The Proposal

In March 1994 the Queensland Department of Primary Industry released its ‘Water Harvesting Policy Barcoo River’. This policy would allow ‘harvesting’ of floodwaters from Cooper Creek for irrigation development, and set the context for the Currareva proposal, making such a development legal (Noonan 1996a: 63). In 1995 a consortium of cotton irrigators from the Macquarie Valley in northern New South Wales submitted a water licence application for a major cotton irrigation project on Cooper Creek at the property

Figure 4.3 Cooper's Creek, showing the location of the proposed cotton irrigation development at Currareva. Source: Walker *et al.* 1997.

'Currareva Station', 10km upstream of the town of Windorah (Noonan 1996a: 63; Walker *et al.* 1997: 64; Fullerton 2001: 124-126). The 'Currareva Agricultural Development Project' was only possible under the new Queensland policy (Figure 4.3).

The proposed irrigation project sought to extract 42 000 ML of water from Cooper Creek each summer to irrigate 3 600 hectares of cotton (Walker *et al.* 1997: 64). The irrigators claimed that this figure represented only 2.5% of the median annual flow 1.7 million ML. Two 15 000 ML storage ponds would be constructed as reservoirs for dry years, which would be filled by pumping water from the river during floods (Kingsford *et al.* 1999). The project would also involve intensive floodplain agriculture and an aquaculture fish-farming venture (Noonan 1996a: 64).

An estimated 13 000 farm dams and a number of small irrigation projects exist in the headwaters of the Lake Eyre Basin rivers—upstream of Currareva—and the cumulative effects of these small dams are poorly understood (Puckridge 4.03). However, the Currareva Agricultural Development Project would be the first major irrigation project on Cooper Creek, and in the Lake Eyre Basin. While the rivers of the Lake Eyre Basin are currently largely unregulated, the development at Currareva, combined with the new government policy, would provide a precedent for further extensive irrigation development in the Lake Eyre Basin (Noonan 1996a: 64; Walker *et al.* 1997: 66).

The Currareva irrigation proposal constructed water as an economic good, and the Queensland Government's Water Harvesting Policy provided the context for this construction. In a practical sense the new policy enabled water to be taken from the river and used for agricultural purposes. In a discursive sense, it opened possibilities for thinking about water as an object separate from the river and its co-constituents—vegetation, animal life, human life, landscapes and water places. Use of the term 'harvesting' in relation to water likens river water to produce, available for human consumption. Speaking of water in terms of megalitres reduces water to a measurable resource. The combined policy and development application constructed water as a resource to be used efficiently through cotton irrigation, as opposed to being 'wasted' in the desert lakes and floodplains (Walker *et al.* 1997: 6).

Neil Smith's (1984) thesis of the 'production of nature' is helpful in understanding the practical and discursive transformations inherent in the Currareva Agricultural Development Project. Smith 'alerts us to how capitalism constructs and reconstructs whole landscapes as exchange values under the profit imperative' (Castree & Braun 1998: 8). Such constructions relate to prior constructions of water as a resource, as seen in the irrigation

developments of the late 19th and early 20th centuries in Australia (as discussed in chapter 3), and elsewhere (chapter 1). In contrast, the construction of water as a resource is not consistent with the emerging environmental awareness and sustainable development discussed in chapter 3. In constructing water as a resource, and physically and conceptually separating water from its constituent parts, water and water places become generic. The specificity of place is overwritten. Braun and Wainwright discuss the historical separation of British Columbian landscapes into two separate domains—‘primitive culture’ and ‘nature’—asserting that: ‘The effect was to separate “resources” from their cultural relations and from the communities who relied on them’ (2001: 54). As discussed in chapter 1, resources are *defined* by cultural relations.

According to Braun and Wainwright, Sloan’s report on British Columbia’s rainforests framed the forest ‘in particular ways, while at the same time placing on the margins other cultural and political understandings of these landscapes’ (2001: 51). Similarly, the Currareva cotton development framed the water and water places of the Lake Eyre Basin in particular ways, and placed on the margins understandings held by scientists, conservationists, Aboriginal people, pastoralists and other residents, who quickly organised strong opposition to the proposal.

4.3.2 The opposition

The Currareva cotton irrigation proposal was met with immediate opposition from members of the scientific and conservation communities and the local pastoral community. Ecological scientists opposed the proposal on the basis that the regular water extraction required for the irrigation project would damage the river ecosystems that are reliant on variable flow. They challenged the assertion by the developers that the figure of 42 000 ML

of water per year represented only 2.5% of annual flow. Flow measurements taken at the gauging station at Currareva between 1939 and 1986 reveal the extent of flow variability on Cooper Creek: annual flow varies between 0 and 13.1 million ML; monthly flow varies from 0 to 6.5 million ML (Walker *et al.* 1997: 67). Such ranges highlight the inappropriateness of basing an irrigation project on a figure of 'median annual flow', particularly in rivers characterised by variability.

The median annual flow figure became an important theme in the conflict and a key concept upon which scientists waged their opposition:

Claims by developers that vast volumes of 'surplus' water exist, only to be wasted in the desert lakes and floodplains, are unsupportable because infrequent, unpredictable flooding is vital for the growth and reproduction of the regional aquatic plants and animals (Walker *et al.* 1997: 66).

Scientific publishing by ecologists involved in the conflict came to focus increasingly on the characteristic of variability. Ecologists Walker, Puckridge and Blanch described the ecological response to variability as a 'boom-and-bust ecology', comparing desert ecosystems to boom and bust behaviour in economics:

Pattern and process are governed by a capricious climate; species of plants and animals dependent on *seasonal* resources are comparatively few and the biota is dominated by opportunists able to endure harsh conditions and to respond quickly when favourable conditions return (Walker *et al.* 1997: 64).

Walker and colleagues drew on the 'Flood Pulse Concept' described by Junk *et al.* (1989), which recognises, among other things, 'that riverine communities respond to variations in the rates of rise and fall and the amplitude, duration, frequency and regularity of floods' (Walker *et al.* 1997: 69). Responses to this variability by fish populations (Puckridge *et al.*

2000), waterbirds (Kingsford *et al.* 1999; Roshier *et al.* 2002) and plant communities (Capon 2003) have been well documented in recent years (for general ecological response to variability see also Puckridge *et al.* 1998; Sheldon *et al.* 2002), and challenges in managing for variability are receiving increasingly attention (Friedel *et al.* 1990; Walker *et al.* 1995; Thoms & Cullen 1998; Boulton *et al.* 2000; Kingsford 2000).

Local community members and pastoralists in the region first learned of the Currareva cotton irrigation proposal in September 1995, at a public meeting in Windorah (Morrish 5.03). Bob Morrish, owner and manager of Springfield Station, explained the community response to the proposal:

I went to the first public meeting where they announced this plan, and the plan of course was met with horror and some degree of anger from the locals who immediately recognised that here was a river that had sort of existed without any major water extraction at all for the last hundred years of white history, and of course for thousands of years before that for the original Aboriginal people who were in this country. And suddenly people wanted to change the whole nature both of land use and water use in the country (Morrish 5.03).

Grazing in the Channel Country depends on major flows, which stimulate floodplain growth and refill waterholes. The Currareva cotton irrigation project would extract very large quantities of water during those major flows, severely limiting the extent of inundation. In addition, irrigation represented a major land use change from beef cattle grazing to intensive agriculture, a significant departure from land use and lifestyle. Bruce Scott, Mayor of the Barcoo Shire and owner and manager of Moothandella Station just east of Windorah, explained:

the intensive nature of the proposal was the reason that we were able to say no, and public opinion was the other one. There was a huge opposition publicly in our Shire, but publicly throughout the state of Queensland and Australia as a whole. ... I guess we took the adage that the Cooper wasn't ours to give away. And the issue that I had with it, and Council as well, was that our one local authority could be vested in a way that ... people below it or above it could be affected from the decision we made in Council. That impact could have been horrific for downstream users of the resource, the environment being one of those users, but also the people who derive very sustainable—economically and environmentally—businesses that rely on the natural flow regime of the river (Scott 5.03).

The pastoral industry and the livelihoods of pastoralists in the Channel Country are dependent on river flow feeding the immense floodplains of Cooper's Creek. Withdrawal or diversion upstream would have significant impacts on individual properties and on the industry. However, opposition to the Currareva cotton irrigation proposal was based on a more nuanced suite of concerns than industry dependence. John and Helen Rickertt, managers of South Galway Station in the Channel Country, spoke with me about the reasons for their opposition to the proposal. 'A lot of people assumed pastoralists were against the cotton proposal for financial reasons—because water extraction would damage pastoralism financially' (field notes, Rickertt 5.03). The Rickertts told me that they were against the proposal 'because of the impacts it would have on the river'. Many pastoralists in the region opposed the development for the sake of the river rather than simply for personal financial reasons. According to Bruce Scott:

A lot of the passion over the river is not all economic. It's about that retention of its natural values and about the ... historical stories ... There's so much interest in

inland Australia, and there's so much in this country that's so variable and so harsh, but at the same time so beautiful (Scott 5.03).

Many of the pastoralists I met and interviewed expressed an attachment to the river and to particular water places associated with the river. Bob Morrish shared his observations about the social and cultural significance of water and Cooper's Creek:

What it means particularly say in the Windorah district and to most of the people I've met in the Cooper, first of all partly some sort of pride in the fact that they're on this river that is such an icon of the outback, first of all. Secondly, in the pastoral industry the notion that their actual livelihoods depend on it. In fact, we developed a poster of the Lake Eyre Basin, and particularly the Cooper in the Lake Eyre Basin, and it said 'Water: the lifeblood of the inland'. Anything that is so basically biologically important, biologically important to your own existence, has got to then figure in your whole social and cultural patterns. The people of Windorah for instance, the large waterhole that the cotton growers where proposing to irrigate from, that becomes a focus for their recreational activity most weekends through the summer. You'll find a half to three quarters of the whole Windorah population down on the bank of that river, socialising and having a few beers or whatever they do. Doing a bit of fishing, and generally all sorts of aquatic sport: swimming around and hooning around and just generally having fun. But it's interesting that the river is second only to the pub, I suppose, as a focus for social interaction, and that waterhole (Morrish 5.03).

Bob Morrish continued:

Half of the population of Windorah are of either largely Aboriginal descent or part Aboriginal descent. Now I couldn't really guess too much about just how deeply

significant that is. But I do know that to the Aboriginal community that river has very strong significance both in terms of material culture, like in terms of fishing and stuff, and possibly some other significance. I don't know about the, unfortunately it's not documented, the actual religious significance of that river. I'm sure that it is there (Morrish 5.03).

Bob Morrish spoke to me in detail about the importance of the river. He spoke about the connection between water's role in satisfying people's material cultural needs, and fulfilling social obligations and supporting social systems. He summed up by saying: 'I think the social fabric of river communities is destroyed by large-scale water extraction' (Morrish 5.03).

In contrast to the attachments local people have with the river, the developers were perceived as outsiders. Angus Emmott of Noonbah Station explained: 'The Currareva cotton was ... the first major attempt by outside interests to come in and set up a large-scale intensive agriculture in the Channel Country' (Emmott 5.03). Local people saw the developers as lacking a relationship with the river, an attachment to place and an interest in 'looking after the river' (Rickertt 5.03).

Further opposition to the proposal from scientists, conservationists, pastoralists and other residents of the Lake Eyre Basin grew as people learnt about the extensive use of chemicals involved in growing cotton. Cotton requires chemical fertilisers, pesticides, and herbicides used to defoliate or burn the leaves off the plant, enabling the cotton fibre to be more easily removed. Many people were concerned about the introduction of large quantities of these chemicals into the Cooper catchment. Of particular concern was the potential impact on the certification of organic beef—a growing industry in the Lake Eyre Basin that covers large areas of south-west Queensland and north east South Australia. While chemical use

was an important factor in the campaign, the focus, and issue that ultimately won the debate, was water (Morrish 5.03; Rickertt 5.03).

Immediately following the September 1995 public meeting in Windorah, local people who were opposed to the irrigation proposal formed the Cooper's Creek Protection Group. Bob Morrish was elected Chair. The group largely comprised of pastoralists—both owners of independent family owned stations and managers of stations owned by some of the largest cattle companies in Australia, in particular Stanbroke Pastoral Company and Kidman Holdings. The aims of the Cooper's Creek Protection Group were to stop the Currareva proposal and to ensure both pastoral and ecological security in the Cooper catchment (Morrish 5.03).

Pastoralists understood that their businesses and lifestyles were dependent on a healthy river system. Through the Cooper's Creek Protection Group they quickly discovered that they had an ally in the scientific and conservation communities, who also opposed the irrigation proposal on the grounds that it posed threats to river ecosystems. Together, the two groups formed a strong alliance against the proposal. This was perhaps an unlikely alliance in the context of the aftermath of the World Heritage debate. Many of the same people were involved in both conflicts, first opposing each other, and later working together. Changing allegiances required individuals to reconcile their past experiences of perceived threat, misunderstanding, and other consequences of the heated conflict. This reconciliation is perhaps the most significant outcome of the two conflicts, as it paved the way for constructive relationships and the first community-driven catchment management process in the Lake Eyre Basin, considered in detail below (section 4.4). Although others were involved, throughout the campaign the opposition remained largely an alliance of two groups: pastoralists and ecological scientists.

Figure 4.4 Campaign sticker opposing the proposal for cotton irrigation development at Currareva, on Cooper's Creek.

A sticker produced during the campaign clearly expresses the unity of opposition. It reads: 'Get your cotton pickin' hands off Cooper's Creek. Let the water flow free & clean' (Figure 4.4). The first part of the statement refers to the opposition to change in the dominant land use, water use, and industry of the region—a shift from pastoralism to intensive agricultural production. The second statement 'Let the water flow free & clean' refers to the ecological arguments for unregulated and unpolluted rivers, and to the interests of both ecological scientists and pastoralists in maintaining a river with minimal water extraction or diversion.

The alliance between pastoralists and scientists had significant ongoing effects. Ecologist Jim Puckridge, who was closely involved in the campaign, spoke about the ongoing implications of the conflict for relationships between scientists and pastoralists:

it seems to me that the pastoralists have become more receptive to the scientific perspective, to scientists ... It was a bit of a mile-stone for those relationships, which I think would still be sustained. The fact that pastoralists were willing in the recent Coordinating Group meeting in Birdsville ... to recommend that the Aridflo project be extended, was staggering, really unthinkable a decade ago. So I think there have been some major advances, cooperation (Puckridge 4.03).

In September 1996 the Cooper's Creek Protection Group hosted a scientific workshop on the banks of the Cooper at Windorah. The aim of the workshop was to present the state of ecological and hydrological knowledge of Cooper Creek, review the ecological impacts of water diversion from the river, and provide a forum to critically examine the process for application, assessment, and approval or rejection of applications to divert water from dryland rivers for irrigation (Kingsford *et al.* 1998: 371-372). Over one hundred people attended the workshop, including scientists and conservationists from around Australia, local Windorah community members, pastoralists from surrounding properties, and irrigation proponents. The workshop provided a forum for sharing information, knowledge, and life experiences of the river, and an opportunity for a diverse range of perspectives to be aired.

According to John and Helen Rickertt (5.03) and Michael Good (4.03), of the Department of Water, Land and Biodiversity Conservation of South Australia, there was a pre-existing desire on the part of pastoralists for better knowledge of the river systems. The Windorah workshop provided a forum for pastoralists to learn from scientists about their knowledge of the river system, and for scientists to learn about the understandings and perspectives of people who live and work on the river (Kingsford *et al.* 1998; Kingsford 2000). In addition to providing a forum for information exchange, the Windorah workshop played an important role in improving relations between the scientific and pastoral communities. John Rickertt (5.03) of South Galway Station told me 'both sides'—pastoralists and scientists—'took their blinkers off a bit' as a result of the Windorah Workshop.

The workshop also attracted media attention, contributing to the profile of water issues in the arid zone. Ecologist Richard Kingsford participated in the Windorah workshop, and has since been intimately involved with community processes and water resource decision-

making in the Lake Eyre Basin and elsewhere¹. Kingsford *et al.* discuss the importance of the workshop being held in Windorah rather than in 'the distant capital cities on the coast' (1998: 371). The local setting enabled far greater community participation, and contributed to developing confidence among community groups who had 'an inherent distrust of central Government', and negative past experiences with ecological scientists and conservationists. Bob Morrish told me how the media campaign attracted broader public interest:

somehow it caught the imagination of Australians generally. The issue of preserving the natural features of the Cooper. ... We had fantastic support from the Australian public. 'Cause it seemed to me that somewhere along the line—it seemed to a lot of people—that Cooper's Creek is an icon of the Australian outback. I think it probably dates back to the days of the great explorers like Sturt and Burke and Wills and so on. And the drama and the tragedy of Burke and Wills, and of Sturt and so on, and the finding of the Cooper. And I think it is helped by the fact that it's been immortalised in poetry by people like Banjo Paterson and so on like that. And that even a lot of city Australians who have never been to the Cooper like to know it's out there and it's still being looked after and it's still a relatively pristine river, naturally (Morrish 5.03).

In an open letter to the Minister for Natural Resources Howard Hobbs, the workshop participants recommended that the Queensland Government reject the application for the 'Currareva Agricultural Development Project'; reject all future applications for intensive agriculture involving cultivation or irrigation on Queensland Lake Eyre Basin rivers; legislate to improve the process of dealing with water allocation and other natural resource

¹ A similar workshop was held in Hungerford on the Paroo River (Murray Darling Basin, northern New South Wales) in 1997, in response to another major irrigation proposal (Kingsford *et al.* 1998).

management issues; and take a lead role in developing an interstate catchment management structure to ensure long term protection of the ecological integrity of the Basin (Noonan 1996b: iii).

Soon after the Windorah workshop, The International Association for Ecology (INTECOL) held its 5th International Wetlands Congress in Perth, Western Australia. The 430 international participants endorsed the open letter from the Windorah workshop. Likewise, the Australian Society for Limnology supported the letter at their 35th Congress in Berri, South Australia (Walker *et al.* 1997: 64). These endorsements lent significant weight to the campaign.

Two weeks after the Windorah workshop, and only days after the INTECOL Congress, the Cooper's Creek Protection Group held a horsemen's parade in Windorah, coinciding with the Windorah races. The parade was attended by supporters from around Australia, including pastoralists from the Macquarie Marshes in New South Wales, who had been involved in an ongoing campaign against large-scale irrigation. Bob Morrish describes:

Windorah is normally 65 people, and there were 128 people just riding horses that day. All the way from the South Australian border, right through to Windorah, and every Stanbroke station in the Channel Country brought their horses in. Tanbar [Station] alone brought two truckloads. All the stations were carrying banners. It must have been quite a sight, 128 mounted protesters marching through the main street of Windorah. Not surprisingly, it attracted national media (quoted in Fullerton 2001: 130).

On 29th October 1996 the Queensland Minister for Natural Resources announced that the Currareva Agricultural Development Project would be rejected, citing the 'overwhelming

weight' of ecological evidence (Walker *et al.* 1997). Undoubtedly the alliance between ecological scientists and the local pastoral community greatly strengthened the campaign against the irrigation application.

Through the campaign, scientists and conservationists constructed water and water places as ecologically significant, just as they had constructed them during the World Heritage debate. However, in this campaign they were not constructed as 'threatened wilderness', but as complex ecological systems that are vulnerable to change, and that are not well understood.

In contrast to the generic water of the development proposal, the opposition campaign constructed specific water and water places: characterised by and dependent on variability; intimately connected with people's lives and livelihoods. The pastoral industry of the Channel Country was designed around that variability, being reliant on floodplain growth, and therefore also dependent on it. This contrasted with the irrigation development that sought to cut across that specificity.

Through the development proposal, water and the river were constructed as economic entities, 'rather than infused with culture and politics' (Braun & Wainwright 2001: 54). This construction hides from view important meanings and values associated with the river. The Windorah Workshop played an important role in constructing water as living and life-giving: a source of life to human and non-human river communities, the cattle industry, and the people of the Lake Eyre Basin. Water and water places were constructed as sources of life, livelihood and lifestyle; as simultaneously—and connectedly—as social, cultural, economic and ecological.

Constructions of water as living and life-giving contrast dramatically with prior constructions of water in Australia. Irrigation has long represented a utilitarian priority in land and water management in Australia, and has historically been considered an essential tool for developing the nation (as discussed in chapter 3). Opposition to the Currareva irrigation proposal was part of a broader movement challenging this strong and long-established official and public attitude equating irrigation with nation-building. People opposing Currareva cotton were fighting not only irrigation development in their catchment, but also the deeply ingrained patterns of interacting with land and water that irrigation represented. A broader process of social change was certainly underway—as exemplified by the strengthened environment movement discussed in chapter 3—and the campaign against Currareva contributed to the shift from irrigation as the dominant model of human interaction with water in Australia.

The conflict over irrigation on the Cooper had important implications for future processes in the Basin. Don Blesing, who later became the Chair of the Lake Eyre Basin Coordinating Group, told me that as a result of the conflict: ‘people have had to make decisions ... understanding the issues in some cases improved decision-making’ (Blesing 4.03). Events like the Windorah Workshop, and the ongoing relationships between pastoralists and scientists as enabled improved understandings of the issues about which all parties are concerned. Angus Emmott, of Noonbah Station, describes the Windorah Workshop as ‘a major turning point’:

I think the community stood up for what they believed in and actually carried the day. But these sort of things don’t go away, so you need these community processes so people can be fully informed and involved and that’s the best protection the catchment’s had (Emmott 5.03).

4.4 Lake Eyre Basin Coordinating Group

The conflicts over World Heritage and Currareva cotton were very unsettling for many people involved (field notes 4.03–5.03). Yet, people living and working in the Lake Eyre Basin repeatedly spoke to me about the positive outcomes of the conflicts. Most significantly, they led directly to the first catchment management process in the Lake Eyre Basin—which eventually took the form of the Lake Eyre Basin Coordinating Group.

As Fergie (1996) and Griffiths (2001) suggest, these two conflicts over water are significant cultural events. In particular, they had important implications for the future of the Lake Eyre Basin. Prior to the conflicts over World Heritage and Currareva cotton, the policy and practice of water and land management did not cross state and territory borders. Catchment-based natural resource management in the Lake Eyre Basin was community-driven, and attracted legislative support in the form of the Lake Eyre Basin Heads of Agreement (1997) and Lake Eyre Basin Agreement (2000) (discussed in chapter 3, section 3.4). The development of catchment management was influenced by historical attitudes and constructions (discussed in chapters 2 & 3), and marked a departure from previous development-based management approaches. The series of events from World Heritage, through Currareva cotton, to catchment management saw dramatically shifting relationships. Through these shifting relationships, people came to articulate more holistic understandings of water.

4.4.1 Developing a catchment management process

Concern over resource use in the Lake Eyre Basin—particularly in light of the World Heritage proposal—led to a public meeting in Birdsville in May 1995, conducted by the National Parks Far North Consultative Committee (South Australia). Notably, this meeting was held before the September 1995 Currareva proposal, indicating that it was stimulated

Table 4.1: Timeline of events leading to the formation of locally-driven catchment management in the Lake Eyre Basin.

1985	Initial World Heritage proposal.
1990	World Heritage campaign gains international conservation support from IUCN conference.
April 1993	Keating's promise to assess the environmental values of the Lake Eyre Basin for World Heritage listing.
May 1993	Birdsville meeting and establishment of the Lake Eyre Basin Protection Group.
March 1994	Queensland Government's <i>Water Harvesting Policy Barcoo River</i> .
December 1994	Liberal government elected in South Australia. Leader Dean Brown openly opposes World Heritage proposal.
May 1995	Birdsville meeting and establishment of the Lake Eyre Basin Steering Group.
September 1995	Windorah public meeting and announcement of Currareva proposal. Establishment of Cooper's Creek Protection Group.
September and November 1995	Natural World Heritage and Non-Indigenous Cultural World Heritage assessment documents published. Indigenous cultural World Heritage report undertaken.
September 1996	Windorah Scientific Workshop. Opposition to Currareva proposal gains international support from INTECOL conference. Windorah horsemen's parade.
October 1996	Queensland Minister for Natural Resources rejects Currareva cotton irrigation proposal.
May 1997	Lake Eyre Basin Heads of Agreement signed, indicating intention to develop a formal inter-jurisdictional agreement.
November 1997	Birdsville meeting. Lake Eyre Basin Steering Group disbanded; transition taskforce established under Professor Peter Cullen.
March-April 1997	Meetings conducted throughout the Lake Eyre Basin to discuss and establish catchment committees.
April 1998	Liberal Federal Environment Minister Robert Hill officially announces that the Federal Government will not forward a World Heritage nomination.
October 1998	Lake Eyre Basin Coordinating Group and two Catchment Committees (Cooper's Creek and Georgina-Diamantina) established.
January 2000	<i>Aridflo</i> begins.
October 2000	Lake Eyre Basin Agreement signed and Ministerial Forum established.
October 2002	Lake Eyre Basin Ministerial Forum and Biennial Conference held in Birdsville.

primarily by World Heritage (Table 4.1). The meeting was attended by pastoralists, conservationists, representatives of ATSIC (the Aboriginal and Torres Strait Islander Commission), local government, representatives of the mining and petroleum industry, and government agencies, and was driven by the concerns of those opposed to the World Heritage proposal (Andrews 1999: 2). Ecologist Jim Puckridge described:

the pastoralists themselves felt that they had to counteract what they saw as the threat of the World Heritage listing ... So what they did was to put together—it

was something else we'd been arguing for anyway—was to put together a catchment management process. A series of workshops in Birdsville, Innamincka, and then ... the federal government and the state governments—Queensland and South Australia—agreed to put together a catchment management process [that became] the Lake Eyre Basin Coordinating Group, an overarching coordinating body and catchment management bodies (Puckridge 4.03).

Angus Emmott, of Noonbah Station, explains the connection between World Heritage and the catchment management processes:

the World Heritage debate was very strongly opposed by the rural community. We looked around Australia at where else it had happened and there appeared to be very poor management with lots of flow-on effects for the whole catch of the areas that were affected. And it also appeared as though outside interests were making management decisions. And that's what the whole Lake Eyre Basin process grew out of—people got together and decided: well, we can actually manage our own resources better than anyone from outside can, we need a process to do it (Emmott 5.03).

The meeting in Birdsville formed the Lake Eyre Basin Steering Group, which brought together people from across state borders—in particular Queensland and South Australia. Kate Andrews, who became Project Officer of the Steering Group in September 1996, explained: 'community members wanted to do something constructive and bring together the different interests to work towards the sustainable use and management of the natural resources in the Basin' (Andrews 1998: 15). The Steering Group aimed to determine whether catchment management was an option for the Basin, and if so, what form it should take. As scientists and conservationists involved with the World Heritage proposal

had been calling for catchment management since at least 1992 (Puckridge 1992), they offered their support. The explicit tasks of the Steering Group were to: 1. prepare an information paper on the present management and resources of the Basin; 2. consult with the community and interest groups about options for catchment management; and 3. prepare a discussion paper on those options (Bennett 1997: 6; Andrews 1998: 15).

The Steering Group identified several key concerns relating to resource management, including surface water management, weeds and pests, and security of tenure. Andrews explained:

Issues identified [during the community consultations] are not all specifically resource management issues. They also reflect social and economic concerns. Environmental, economic and social issues are interrelated, and in this process we will inevitably have to deal with all three (1998: 16).

It is curious that 'social and economic concerns' are not immediately recognised as 'resource management issues', considering the clear connection between economics and 'resources', the human reliance on natural resources and the economics thereof, and the social construction of nature as a 'resource'. However, Andrews explicitly described environmental, economic and social issues as 'interrelated', marking a departure from the development approach in natural resource management towards a more holistic approach.

In the intervening period between the establishment of the Lake Eyre Basin Steering Group and its second scheduled meeting—18-months later in November 1997—the people of the Lake Eyre Basin dealt with the entire Currareva conflict: the announcement of the proposal, the campaign, and news of the proposal's rejection. Currareva cotton presented an additional threat to the water and water places of the Lake Eyre Basin, and the lives and livelihoods of its people, and this had implications for the catchment

management process. As described above, the Currareva proposal united earlier foes, and 'led South Australia, Queensland and the Commonwealth to deal with cross-border issues, which led to the Intergovernmental Agreement' (field notes, Cohen 4.03), (discussed in chapter 3, section 3.4.1). As a result, catchment management processes were simultaneously being developed at the community level and the state and federal government levels. According to Don Blesing, independent Chairperson of the Lake Eyre Basin Coordinating Group between 1998 and 2002:

Currareva provided a threat that resulted in improved understanding of the issues, improved decision-making structures and management structures ... where multiple stakeholders are at least recognised. They mightn't be well represented but they're recognised (Blesing 4.03).

Although the Currareva proposal presented immediate implications only for Cooper's Creek, people throughout the Basin perceived a larger threat of water development and loss of local control in natural resource management.

At the meeting in Birdsville in November 1997 the Lake Eyre Basin Steering Group was disbanded, and in its place a 'transition taskforce' was formed, led by Professor Peter Cullen, Director of the Cooperative Research Centre for Freshwater Ecology (Lake Eyre Basin Coordinating Group 2000: Appendix A). Its job was to establish the agreed framework for natural resource management in the Basin (Andrews 1998: 16). A two-level structure was decided upon, involving five catchment management groups working across State and Territory borders, and an over-arching Basin-wide coordinating group, which would communicate with government and deal with issues that spanned more than one catchment (Cohen 2000).

The transition taskforce organised meetings throughout the Basin during March and April 1998 to establish individual catchment committees and to discuss structures, functions and other issues. The Cooper's Creek Catchment Committee and the Georgina-Diamantina Catchment Committee were established at this time, reflecting the largest, most populated and most intensively grazed catchments in the Basin. The other three regions identified for future catchment committees were: 'Desert Rivers', incorporating south-east Northern Territory and Alice Springs; 'Western Rivers', incorporating the catchments west of Lake Eyre, and the town of Oodnadatta; and 'Lake Frome', incorporating the sub-catchments of Lakes Gregory, Blanche, Callabonna and Frome, the rivers south of Lake Eyre, and the town of Marree (Lake Eyre Basin Coordinating Group 2000). Although planned, active committees in these three regions did not emerge².

The Lake Eyre Basin Coordinating Group was formally established October 1998, with the aims:

to provide a forum to deal with Basin-wide issues, develop a Basin-wide vision, lobby governments, encourage investment and establish partnerships within the Basin, and help educate people within and outside the Basin about natural resource management and catchment issues (Lake Eyre Basin 2005).

Catchment management gained legislative support when, in May 1997, the South Australian, Queensland and Commonwealth Governments signed the Lake Eyre Basin Heads of Agreement (described in chapter 3, section 3.4.1). The Agreement was signed in

² One person I interviewed questioned the need for Catchment Committees in these areas, pointing to the pre-existing organisations, the Marree Soil Board and the Arid Areas Catchment Water Management Board. This person suggested that people in these regions will support the structures, but they don't consider themselves part of the Basin (field notes 5.03).

the context of these broad catchment management processes, and during the period of the Steering Group's existence. Prior to the conflicts over World Heritage and Currareva cotton, there was little incentive to develop a cross-jurisdictional agreement for the Lake Eyre Basin. Yet, 'In the absence of a formal agreement between states there is no effective mechanism for managing rivers and catchments which span state borders' (Cohen 2000: 3). Bernice Cohen suggested that World Heritage, Currareva and the growing public interest in the region as an 'outback' tourist destination were catalysts for the Lake Eyre Basin Agreement (Cohen 4.03, 2000).

4.4.2 Rethinking relationships: listening and learning

'It was not only the 'forest' that was remade through these struggles. In the crucible of environmental politics ... all manner of identities and relations were remade'.

Braun & Wainwright 2001: 59

The Lake Eyre Basin catchment management process has provided opportunities for people to listen to and learn from other perspectives. It has enabled people to develop understandings of the perspectives, needs, aspirations and values of others. According to Sharon Oldfield of Cowarie Station:

one of the best things that developed out of the whole [World Heritage] thing was these communication lines, these ... communication networks that have developed throughout Queensland and South Australia, the Territory and New South Wales ... people becoming more aware of issues upstream, downstream, not in your local patch. Things that we didn't think were an issue are quite an issue to other people (Oldfield 4.03).

People involved in the catchment management process repeatedly spoke to me about this important outcome of the conflicts in the Basin (field notes 4.03–5.03). Some of the relationships formed through the process have become trusting relationships that have enabled people to work more cooperatively on catchment management and other projects, including Aridflo. Angus Emmott spoke of the relationships formed through the Lake Eyre Basin processes:

I think it was a starting point in the actual local community realising that they could work with scientific and environmental groups. And that formed lasting relationships, which are still continuing, and hopefully will grow. So yes, I think ... that whole period initiated a working relationship between science, environmentalists and the pastoral industry. There's still mistrust there—on all sides—but it's a lot less, and people are working together (Emmott 5.03).

These relationships have continued in more recent processes, including Aridflo and WISE.

Bob Morrish talked about interactions around these projects:

they've been almost universally very positive in terms of breaking down barriers and prejudices. I think the people of this region are in many ways delighted that there's an ongoing interest in this country from the scientific community. And that they didn't just fly in, get their results, fly out, and we've never heard from them again. There is actual ongoing relationships developing between people here. When people see Richard [Kingsford] every year, or some of the people from Aridflo, like Vanessa [Bailey] ... I think ... it's continuing to let people know that the friendships they made earlier on are not going to be forgotten just because people have got their results and gone away (Morrish 5.03).

By listening to others, people have been able to learn about the meanings and values other people associate with water, which at times may overlap with their own. At other times, different ways of knowing water might present challenges. Through local participation in catchment management, a larger set of meanings and values has been brought into the natural resource management discourse of the Basin. The two conflicts and the Lake Eyre Basin catchment management processes led to an expanded 'water conscience' (Powell 1989: 13) for all involved.

The constructions of water and water places discussed in this chapter have had consequences for catchment management. The proposals for World Heritage, and the proposal for Currareva cotton largely wrote out human agency. However, the World Heritage proposal and the *opposition* to Currareva emphasised the complex and living elements of water places. They acknowledged the significance of particular water, not detaching it from its constituent parts or specific places. And they embraced water's variability. The Lake Eyre Basin catchment management processes that emerged from these conflicts emphasised this living component: the lives of humans and non-humans, and the living and life-giving qualities of water and water places. This 'living' component of water was further emphasised by the close involvement of *people*—those living, working and with interest in the Basin—in the process.

4.5 Silenced waters

Despite the broadened set of meanings and values brought into natural resource management discourse in the Lake Eyre Basin, and an expanded water conscience for people involved in the processes, some important silences remain.

Patrick McCully's *Silenced Rivers* (2001) presents a detailed account of the ecological and political costs of dams around the world. 'Silenced Rivers' refers to the physical silencing of rivers by large dams. In addition, it alludes to the silencing of the voices, needs, aspirations and values of the people whose lives lie in the way of the 'progress' of hydro-developments, and those opposed to them. In India, where much of McCully's work focuses, many of these people are Adivasi—indigenous or tribal peoples—whose homelands, ways of life and knowledge systems are devastated by the flooding of their country and their subsequent 'relocation' (McCully 2001).

In using the phrase 'silenced waters', I borrow from McCully this sense of waters, peoples and ways of knowing being silenced by the actions of water 'resource management'. As explored above, the Lake Eyre Basin catchment management processes and the Lake Eyre Basin Coordinating Group in particular, led to an expanded water conscience. However, some people, aspects of water and ways of knowing, remain silent, or have been silenced by the processes.

Indigenous peoples around the world face marginalisation and displacement as a result of resource management activities, as illustrated through McCully's accounts of the Adivasi. Involvement of Indigenous peoples in resource management, and the implications of resource management activities for peoples and communities, is well documented (Langton 1988; Burger 1990; Howitt 1991, 1997, 1998, 2001; O'Faircheallaigh 1991, 1996; Gedicks 1994; Jacobs & Mulvihill 1995; Howitt *et al.* 1996; Suchet 1996, 2002; Gibbs 2003). While formal relations between Indigenous and non-Indigenous peoples are ostensibly improving in many parts of the world—following developments such as the *Native Title Act 1993*, the Mabo decision (1992) and the reconciliation movement in Australia—the legacy and ongoing effects of colonialism continue to be felt by many peoples and communities.

Postwar decolonisation and the rise of postcolonial discourse have challenged many aspect of colonial domination (Jacobs 1996; Rose 1996, 1999; Howitt 1997, 1998, 2001). Regardless of intent, however, efforts to address the impacts of colonisation on indigenous peoples often serve to perpetuate or further entrench colonial patterns of power inequality and disadvantage (Gibbs 2003: 17). Institutions and processes such as the Lake Eyre Basin Coordinating Group aim to involve all stakeholders, however this research reveals that Aboriginal people continue to be silenced in land and water management. Arabanna man Reg Dodd told me that water management institutions are often afraid to talk to Aboriginal people because they don't know how. Aboriginal people are not involved in discussions and they are not provided with appropriate information. Management decisions impact on Aboriginal society, not just the individual. He says people need to sit down and talk to Aboriginal people to learn—they might need to sit down for two or three days. People need to respect one another and respect differences (field notes, Dodd 5.03)

Lake Eyre Basin catchment management processes have formally acknowledged the importance of Aboriginal people's involvement in water management. The Lake Eyre Basin Intergovernmental Agreement states that 'there will be appropriate representation of Aboriginal interests', and recognises the role of Lake Eyre Basin Aboriginal communities in determining that representation:

In appointing members to represent Aboriginal interests the Ministerial Forum will have regard, as a fundamental element of its decisions, to such recommendations as the Aboriginal communities of the Lake Eyre Basin Agreement Area may choose to make (Australian Government 2000).

However, several people involved in the processes question the effectiveness of these guidelines. Former Independent Chair of the Lake Eyre Basin Coordinating Group, Don Blesing, describes Aboriginal involvement in the Lake Eyre Basin processes as 'poor':

We've had strategies. ... A couple on the Coordinating Group said it had to be better. And I supported them. ... [they] employed an Indigenous Land Management Facilitator to [facilitate] exchange [of] cultural knowledge ... the Lake Eyre Basin Coordinating Group developed a strategy for involvement, proper indigenous involvement, and was part of the way down the track (Blesing 4.03).

Don Blesing's words indicate that the Coordinating Group recognised involvement of Aboriginal people in the process as important, but the Group also acknowledged that meaningful involvement of Aboriginal people remained poor.

Birdsville resident Don Rowlands is a member of the Georgina-Diamantina Catchment Committee and the Board of the new state-based natural resource management body, Desert Channels Queensland. He spoke to me about his dissatisfaction with the way Aboriginal people and Aboriginal issues are currently represented in the Basin:

Aboriginal issues are the most important part that is left out of all studies. We know it's one of the major key issues, but we don't like to address it. If you look at meeting agendas you would think it is one of the biggest issues discussed. Every time you put your hand up you become a bigger radical. ... The last thing they want to talk about is anything Aboriginal. 'Aboriginal issues' is just a dot point. They just want a rubber stamp. It takes a while to realise you're just there for a rubber stamp. It doesn't address Aboriginal connection to the land, Aboriginal water uses, sacred waterholes. Nobody even wants to know what all that means. When you mention Native Title that's time for squirming on seats. When we go to meetings we are always out-numbered; how can you win? (field notes, Rowlands 4.03).

I asked Don Rowlands how he thinks the 'dot point' of Aboriginal issues should be expanded:

It should be expanded like it is for pastoralists. Why water is important to us. It should include the story lines, trading lines from one water hole to another. If they wrote up our stories it would open up the country so much. For tourism, for pastoralism, to help people learn how Aboriginal people understand connections. Nobody wants tokenism. ... It is hard to understand how these groups don't consider Aboriginal people—Aboriginal uses and Aboriginal people as stakeholders (field notes, Rowlands 4.03).

Jimmy Crombie, a Wangkangurru man from Birdsville, chooses not to be involved in the catchment management processes. He says 'They come and pick up mum [Senior Traditional Owner, Auntie Linda Crombie] and take her out. Don and Lyn Rowlands talk to them. I think that's enough' (field notes, J. Crombie 5.03). Like Don Rowlands, Jimmy Crombie attributes the failure to consider Aboriginal issues in a meaningful way, at least in part, to a fear of Native Title:

The Aboriginal movement is the first movement they come to. Aboriginal issues might be put together, but people might not accept them. They're going to have to. Some people understand the issues enough; some of the local property owners do. But with Native Title some of them are frightened they might lose a bit of dirt, or their stock might miss out on a bit of feed. I won't see stock dying—the stock can go there. People are very frightened. They should come and talk to Aboriginal people more and learn about the issues (field notes, J. Crombie 5.03).

At the second face-to-face meeting of 'Desert Channels Queensland' held in Longreach in May 2003, there was a long discussion about involvement of Aboriginal people in the process. A small number of Board members expressed concern that Aboriginal members were not participating regularly in meetings, and were therefore not committed to the

organisation or the process. Other members of the Board clearly and carefully articulated the importance of Aboriginal involvement and some possible barriers presented by the current structure, including Aboriginal 'representatives' being unable to speak for country other than their own, and the possibility that the structure of meetings was not appropriate for all members. The debate was lively and informed. People defending Aboriginal involvement clearly had some understanding of the issues affecting Aboriginal participation in the process, and made efforts to explain these issues to the other Board members (field notes 5.03).

Angus Emmott—who is actively involved in Lake Eyre Basin process and Desert Channels Queensland—spoke to me about Aboriginal participation:

it's a big issue right across Australia—giving true and meaningful representation to Aboriginal groups. Because our processes don't fit the way they do business. ... it's a difficult one. I think we need to actually talk to the Aboriginal people and try and get some answers from them as well ... how they see they can fit in, rather than us just telling them how to fit in (Emmott 5.03).

Effective participation of Aboriginal people in Lake Eyre Basin natural resource management is limited. However, the issue is not going unnoticed. Involvement—or lack thereof—attracts detailed discussion. Formal requirements for Aboriginal representation may be fulfilled but people involved do not consider this as an adequate measure of inclusion.

While the catchment management process has led to an expanded water conscience, and has provided opportunities for listening and learning, the process has failed to effectively listen to and learn from Aboriginal people. As a result, the perspective of the Lake Eyre

Basin catchment management process remains narrow. John McEntee, owner and manager of Erudina Station near Lake Frome, speaks about what he perceives as the narrow perspective of the current process:

Their perspective is not broad enough. They are only looking at one perspective. ... You need to look after what you've got by developing an understanding of the full picture of your place. ... In terms of understanding the landscape and influences on the landscape, we're not talking one or two years, we're talking thousands. Government structures are only talking about the short term. ... It takes a lifetime, or longer, to learn everything about this place. I have learnt a great deal from Aboriginal ways of thinking, and have changed as a result. Aboriginal ways of thinking involves grouping things together and looking at the whole overview. Scientists, on the other hand, like to compartmentalise. ... The Lake Eyre Basin processes involve different interest groups, but this is still not enough. The interest groups and perspectives have to intermesh (field notes, McEntee 4.03).

4.6 Thinking beyond resource allocation

Thinking about conflict over nature and natural resources in terms of social construction is helpful in developing an understanding of tensions in land and water, and it is also useful for natural resource management. When resource conflict is presented as conflict over an object, natural resource management discourse is led to focus on a range of possibly competing interests in that object, and to determine a way of allocating scarce resources among those interests. Considering natural resource conflict as conflict over *ideas*—in this case ideas about water and water places—is enabling. It enables different ways of thinking about 'nature' and therefore natural resource problems. It lets us get away from attempting to resolve a perceived problem of allocation—to think beyond resource allocation—and it

frees us from the confines of attempting to *resolve*. Thinking about natural resource conflict as conflict over ideas, firstly, opens possibilities for discovering common ground in meanings and values associated with a 'natural resource', and secondly, presents possibilities for listening to and learning from others and developing broader understandings of water.

Thinking beyond resource allocation invites us to consider the values that lie behind conflict over nature and natural resources. In the next chapter I consider current approaches to thinking about value and water. At present, thinking about values in natural resource management is dominated by a limited 'valuation' approach. In chapter 5 I argue the need to go further.

CHAPTER 5

VALUING WATER

5.1 Introduction

Angus Emmott, owner and manager of Noonbah Station on the Thompson River—a tributary of Cooper Creek in south-west Queensland—spoke to me about the difficulty in grasping the intrinsic values associated with water:

The systems are totally unique and we've got no right to compromise them. The intrinsic values are very hard, because you can't actually put a dollar figure on them, but they're so crucial. ... you've got all the ecological, cultural, social issues come into that. But they're very hard to actually quantify the value. We know they're valuable, but it's very hard to put dollar figures on them (Emmott 5.03).

I asked him how we might start to do that.

Well maybe we need to stop putting dollar figures on everything and look at things from a different perspective. ... I think we've got to start—instead of this whole 'maximum productivity' thing, we need to start looking at quality of life, rather than

this whole thing of pushing for maximum return from everything we touch. ... But that stems from the whole Christian and capitalist system that we're in and I don't know how you change that. We have to ... change it somehow. Our whole concept of how we co-exist with the environment (Emmott 5.03).

The term 'value' has a wide range of meanings. Angus Emmott expressed some of the difficulties in reconciling economic value—prioritised in natural resource management—with a more challenging notion of value he terms 'intrinsic value'. He spoke about values associated with water, the river, and the local ecosystem that are not encapsulated by the value concept used in natural resource management discourse.

In this chapter, I examine meanings of the concept of value and practices of valuing, as applied to water. Angus Emmott's words indicate the complexity of the concept value, and the difficulties in identifying and attributing value to water, ecosystems and nature. The term value is frequently used in reference to water within natural resource management, but the concept is contested. 'Value' is the subject of immense and diverse discourse. In the first section of this chapter I provide a broad outline of the historical development of the concept of value. In particular, I focus on the elements of thinking about value that contribute to current concepts and practices of valuing water.

The concept of value is considered within many separate disciplines—philosophy, economics and ecology, among others. While dialogue exists between some disciplines—in particular economics and ecology in the case of ecological economics and ecosystem service valuation—the literature concerning value remains largely contained within separate disciplines. In the first section I bring together some of these disparate discussions about the value concept and valuing practices. As such, this review is interdisciplinary. First I

trace the development of the concept of value and practice of valuing through philosophy, economics and environmentalism. I then explore in more detail two current, prominent methods of valuing water and nature: non-market valuation and ecosystem service valuation. In the final section I examine how water is being valued in the Lake Eyre Basin through two examples—namely, the World Heritage Convention, and locally driven catchment management processes. The difference between current, dominant approaches to value and the ways in which people in the Basin value water forms the point of departure for the next chapter, which considers a new approach to valuing water that embraces change, diversity and uncertainty; that is inclusive and anti-reductionist.

5.2 Value as ‘amoeba word’

An underlying problem in the question of the values of water is the ambiguity of the term ‘value’. Value has become what Esteva describes as an ‘amoeba word’. According to Esteva, an amoeba word is a word that:

circulates without any precise meaning; it is a vague but positive-sounding term which is assumed to be readily understood and accepted by everyone but whose definition is left in the hands of experts. When they are consulted, the experts find no difficulty in reducing the expression to a mere algorithm which acquires meaning depending on the context in which it is used (1987: 145).

According to Esteva, the more varied and contradictory the definitions of a word become, the stronger that word’s connotation. Such a term can be used to exert power over nature and people. By prioritising a particular definition of ‘value’, other definitions are marginalised. In the case of values associated with water, I argue that market-based utility values are prioritised, marginalising values that are less readily quantifiable. Hornborg has

suggested that the decontextualising cosmology of economics engulfs local systems of meaning, and opens local communities and ecosystems to exploitation (1994: 263).

In the context of contemporary efforts to value nature in theory and practice, prominent environmental economists Costanza and Farber have described a 'lack of consensus about the very meanings of the terms "value" and "valuation", implying the need to define these important concepts more carefully and to further examine their uses and limitations' (2002: 370). Costanza and Farber ask 'what do we mean by the value of nature?' (2002: 368). Farber *et al.* (2002) seek to clarify the definitions of the terms 'value system', 'value' and 'valuation'. Philosopher John O'Neill argues:

To hold an environmental ethic is to hold that non-human beings and states of affairs in the natural world have intrinsic value. This seemingly straightforward claim has been the focus of much recent philosophical discussion of environmental issues. Its clarity is, however, illusory (1992: 119).

The meaning of value requires reflexive and inclusive theoretical attention.

In the following section I explore the major developments in meanings of value that contribute to current thinking and practice of valuing water. By considering value in the context of discourses of philosophy, economics and environmentalism, we might shift value from its amoebic state as a 'vague but positive-sounding term' to an idea with a history that informs its current meanings and applications.

5.3 Value in theory and practice

5.3.1 Value in philosophy

Philosophers describe four main types of value: intrinsic, instrumental, inherent and relational value (Audi 1999: 948-949). Intrinsic value is the basic type, and instrumental, inherent and relational values are defined in terms of intrinsic value. The most important distinction in considering values associated with nature, is between intrinsic value and instrumental value. Many philosophers, including George Moore (1873-1958), have distinguished between that which has value or is desirable for its own sake—not dependent on anyone having an interest in it—and that which is instrumentally valuable (Audi 1999: 950), that is, valuable for its utility.

Environmental philosopher J. Baird Callicott has discussed this important divide between intrinsic and instrumental value with reference to species preservation:

Any argument for species preservation which is addressed to human welfare or human happiness (whether material or spiritual) is essentially utilitarian in the received sense of the term. There are, in general, two kinds of value: (1) intrinsic value and (2) instrumental value. A utilitarian or homocentric argument for species preservation either explicitly or implicitly assumes that human beings (or, more abstractly, human welfare or happiness) are intrinsically valuable and that all other things, including other forms of life, are valuable only as means or instruments which may serve human beings (or facilitate human welfare or happiness) (1989: 130).

According to Callicott:

Something is intrinsically valuable if it is valuable *in* and *for* itself—if its value is not derived from its utility, but is independent of any use or function it may have in relation to something or someone else. In classical philosophical terminology, an intrinsically valuable entity is said to be an ‘end-in-itself’, not just a ‘means’ to another’s ends (1989: 131).

A second view of intrinsic value, favoured by Franz Brentano (1838-1917), is defined in the following way: ‘X has intrinsic value (or is intrinsically good) if and only if X is *worthy of desire* in and for itself’ (quoted in Audi 1999: 948, my emphasis). Although based on the worth of a thing ‘in and for itself’, not on its utility, this second interpretation of intrinsic value is dependent on ‘desire’; i.e. a thing has value if it is desired by a human. This second definition of intrinsic value is inherently anthropocentric: ‘X’ is valuable in and for itself, but it is determined to be so only if it is perceived as such *by humans*. In contrast, the former definition is not dependent on human perception. Callicott considered this an important distinction:

I concede that, from the point of view of scientific naturalism, the *source* of all value is human consciousness, but it by no means follows that the *locus* of all value is consciousness itself or a mode of consciousness like reason, pleasure, or knowledge. In other words, something may be valuable only because someone values it, but it may also be valued for itself, not for the sake of any subjective experience (pleasure, knowledge, aesthetic satisfaction, and so forth) it may afford the valuer (1989: 133).

According to O’Neill, discourses of environmental ethics suffer from ‘a conflation of these different senses’ (1992: 119). He has identified three senses in which the term ‘intrinsic

value' has been used. First, intrinsic value is used as a synonym for 'non-instrumental value'. O'Neill—and other defenders of an environmental ethic—hold that non-human beings have such value. Second, intrinsic value refers to 'the value an object has solely in virtue of its "intrinsic properties"' (O'Neill 1992: 120), or its 'non-relational properties'; in other words, properties that a thing holds, which are not dependent on relations with others. Third, intrinsic value refers to 'value that an object possesses independently of the valuations of valuers'. O'Neill defines this third sense as 'objective value' and argues that it denies the notion that the source of all value lies in the attitudes and perceptions of valuers.

Audi (1999) considers the other three types of value—instrumental, inherent and relational—in terms of intrinsic value. X has *instrumental value* if it is a means to, or causally contributes to, something that is intrinsically valuable: 'If Smith's experiencing pleasure is intrinsically valuable and his taking a warm bath is a means to, or causally contributes to, his being pleased, then his taking a warm bath is instrumentally valuable'. Instrumental value is the form most often considered in economics, discussed below. X has *inherent value* if the experience, awareness or contemplation of X is intrinsically valuable. 'If the experience of a beautiful sunset is intrinsically valuable, then the beautiful sunset has inherent value'. Finally, X has *relational value* if X has value in virtue of bearing some relation to something else. Instrumental and inherent value may be considered as forms of relational value (Audi 1999: 948-949).

Value also refers to personal or societal 'values'—the set of normative precepts, held by a person or society, that guides human action. Value theory, or axiology, is concerned with the nature of value and what kinds of things have value. According to Audi 'value theory is concerned with all forms of value, such as the aesthetic values of beauty and ugliness, the ethical values of right, wrong, obligation, virtue, and vice, and the epistemic values of

justification and lack of justification' (1999: 949). While axiology and philosophical discourses of value consider a wide and inclusive definition of value, within economics value is predominantly considered in the far narrower sense of instrumental value.

5.3.2 Value in economics

Within economics, the theory of value is predicated on the 'value' of a commodity or product. In this sense, economists consider value in the sense of the philosophers' 'instrumental value'—which in the language of economics becomes 'utility value'. Economic theory of value is explicitly concerned with anthropocentric utility.

Aristotle (384-322 B.C.) first distinguished between 'use value' and 'exchange value', arguably the most significant distinction in economic value theory. The distinction is illustrated by the often quoted 'water-diamond paradox'. Water has enormous value in use, being a necessity for life, but it has low exchange value, as illustrated by price. Conversely, diamonds are non-essential objects with little use value, but a very high exchange value (Farber *et al.* 2002: 376; Nicholson 2002: 9). It is interesting to note that water was invoked in this early defining stage of economic value theory; values associated with water have long been elusive.

Adam Smith's *The Wealth of Nations*, first published in 1776, is widely thought to have heralded the beginning of modern economic thought (Nicholson 2002: 9). Smith maintained the distinction between use and exchange (or value and price), but did not consider use value as the basis for exchange value. Instead, he formulated a cost of production theory of value in which wages, profit and rent were the three sources of exchange value (Farber *et al.* 2002: 376). Smith was the first to popularise the idea of

valuing commodities in terms of the labour used to manufacture them (Sheppard & Barnes 1990: 31).

For classical economists of the 18th and 19th centuries—most prominent among them David Ricardo and Karl Marx—value became one of three central concepts. The other two were production and reproduction, and distribution of income among social classes (Sheppard & Barnes 1990: 2-3). The political concern for labour and distribution shifted the work of Ricardo and Marx from purely economic to social and political analysis; leading to the study of ‘political economy’. According to Ricardo and Marx, determination of value was not encapsulated solely by economics. The incorporation of social and political analysis in the investigation of value has significant resonances for current efforts to attribute value to water and nature. Economics alone—understood in its narrowest sense—cannot determine value; social, political and cultural factors are also crucial.

By the late 19th century, labour theories of value had begun to wane, partially in response to ‘the logic of the utilitarians, such as Menger, Gossen, Jevons and Walras, who argued that exchange value was based on both utility and scarcity’ (Farber *et al.* 2002: 377). This ‘neoclassical economics’ is not concerned with produced goods and the conditions of their *production and reproduction*, but with scarce non-produced goods and the conditions of their *exchange* (Sheppard & Barnes 1990: 5). The neoclassical model presumes the existence of a set of rational individuals who are endowed with an allocation of natural resources and who possess well-defined utility preferences; they know what they like and dislike (Sheppard & Barnes 1990: 5). In this way, neoclassical economics emphasises the individual and their preferences. Unlike political economy, where value is created within the production process, the neoclassical scheme presumes value to be created by the mental desires and preferences of individuals as they exchange goods and services. Unlike political

economy, neoclassical economics invokes no political aspect of value, but rather, locates the process of income distribution entirely within the realm of the economic (Sheppard & Barnes 1990: 6-7).

The paradox of value in use—illustrated by the water-diamond paradox—became important in the ‘marginal’ revolution of the late 19th and early 20th centuries. Economists became increasingly concerned with constructing an alternative to the labour theory of value and recognised that this would require overcoming the paradox of value in use. The marginal approach to value introduced the concept of scarcity to draw a distinction between the usefulness of a commodity and the usefulness of the *last unit* of that commodity consumed. Once again calling on the example of water, water is clearly useful, but because it is often (in wealthy nations) relatively plentiful, consuming one unit of water has relatively little value to people. However, the last unit available for consumption has a very high value, as a result of its scarcity. The marginalists defined value in terms of a marginal, or incremental, usefulness: the usefulness of an additional unit of a commodity (Nicholson 2002: 10). Scarcity remains a central precept in modern economic theories of value, and in determining value in natural resource economics. Economic theories of value are highly influential in contemporary natural resource management, and frameworks and methods derived from economics are widely used in natural resource decision-making.

5.3.3 Environmental values

The phrase ‘environmental values’ circulates in contemporary environmental debates with far less precise meaning than the varieties of value discussed above. Within the discourse of environmentalism, and in the context of heightened awareness of environmental and ecological issues over the past three decades, ‘environmental value’ has come to refer to a

wide array of concepts. First, the term is used to refer to broad normative precepts such as 'ecological sustainability', 'social justice', 'economic equity' and 'cultural diversity' (Howitt 2001: 10), or 'conservation of species', 'preservation of wildness' and 'animal rights and welfare' (Walsh 2005). These 'environmental values' form guiding principles or ethics upon which environmental decision-making may be based. Second, 'environmental value' is encompassed within the realm of environmental economics, which brings together the fields of economics and ecology within a largely economic framework. The area of environmental value is a discursive intersection between value concepts and practices developed in philosophy, economics and ecology.

Environmental economics borrows heavily from the discipline of ecology, and arguably particularly from conservation biology. Michael Soulé's influential 1985 paper—'What is Conservation Biology?'—presented a suite of normative postulates that have informed and directed conservation biology, which have in turn informed environmental economics and the area of environmental value more broadly. Soulé's four normative postulates were: 'diversity of organisms is good', 'ecological complexity is good', 'evolution is good', and 'biotic diversity has intrinsic value'. According to Soulé this last normative postulate is the most fundamental. He argues:

In emphasizing the inherent value of nonhuman life, it distinguishes the dualistic, exploitative world view from a more unitary perspective: Species have value in themselves, a value neither conferred nor revocable, but springing from a species' long evolutionary heritage and potential or even from the mere fact of its existence (1985: 731).

These postulates correspond with the core values proposed by both Howitt (2001) and Walsh (2005), and relate to societal values or value systems. Following Soulé, ecologists primarily consider value in the context of biodiversity (see Wilson 1988). Gaston and

Spicer (2004) present a summary of values related to biodiversity and ecosystem functions, including direct-use, indirect-use, and non-use values. Farber *et al.* define the ecological concept of value as ‘the degree to which an item contributes to an objective or condition of a system’ (2002: 381-382). Significantly, this definition emphasises the role of the *ecosystem* in determining value; the value of a thing relies—in part, at least—on its interconnections with the rest of the world, an idea consistent with the philosophers’ ‘relational value’. The focus on an ecosystem also marks a departure from the prioritisation of the individual (I will return to this important idea in chapter 6 and 7).

‘Value’ is in its most amoebic state in this field of environmental value. Within the broad area of environmental values, value has come to incorporate both quantifiable instrumental elements, and normative and deontological aspects. Arguably, *ecological economics* has become the most powerful variety of environmental economics in directing the practice of valuing nature.

Ecological economics attempts to integrate ecological and economic perspectives on value (Masood & Garwin 1998; Costanza & Farber 2002). While collaborative research between economists and ecologists is well established, Masood and Garwin assert that early efforts were characterised by an unwritten hierarchy of ‘environmental and resource economists’ framing a problem, and ecologists providing data (1998: 426). Ecological economics attempts to redress that hierarchy, with ecologists playing an active role in setting environmental goals.

According to a definition proposed by Daly, Costanza and Norgaard, ecological economics ‘aims to provide a framework for the equitable distribution of resources and property rights within the present generation of humans, between current and future generations and

between humans and other species' (Masood & Garwin 1998: 427). Masood and Garwin suggest 'To some, this sounds more like a political programme than the definition of a standard academic discipline, and suggests that ecological economics—of one variety at least—has a clear social agenda' (1998: 427).

Environmental economist Clive Spash explores the role of deontology—or a rights-based approach—in environmental decision-making: 'human value formation with respect to the environment combines ethical and economic aspects in a more complex way than most economists have assumed' (Spash 2000: 1433). Dominant approaches to economic valuation of nature are challenged by an assumption that people make decisions based on a sense of responsibility or duty (see Spash 1997, 2000; Sagoff 1998, 2000).

In their review of economic and ecological concepts for valuing ecosystems, Farber *et al.* distinguish between value, valuation and value system:

'Value systems' refer to intrapsychic constellations of norms and precepts that guide human judgement and action. They refer to the normative and moral frameworks people use to assign importance and necessity to their beliefs and actions. Because 'value systems' frame how people assign rights to things and activities, they also imply practical objectives and actions (2002: 375).

However, the concept of 'value system'—as defined by Farber *et al.*, and which bears some relation to the concept of 'worldview', which I return to in chapter 6—is not easily incorporated into methods of valuing the environment. 'Valuation' is the preferred method for valuing the environment.

While Farber's 'value system' is not readily incorporated into the practice of valuing nature, the concept of value in environmental and ecological economics is broader than a neoclassical economic definition. Costanza and Farber have suggested that value can be defined in a number of ways. First: 'If we define value as "the contribution of something to a condition or state of the system", then structures and functions of natural systems, by definition, have value'. Then, they argue, 'we can speak of a relative "value" ... without reference to human perceptions or preferences'. Second, if value is defined as 'a contribution to a goal', then 'natural systems have value insofar as they contribute to that goal. A major goal of human interaction with natural ecosystems is the support of human welfare, including the sustainability of that welfare and its distributional fairness' (Costanza & Farber 2002: 368). Ecological economics includes both instrumental value, or anthropocentric utility value as illustrated by the goal of supporting human welfare, and a non-anthropocentric definition demonstrated by the goal of contributing to the state of a natural system.

5.4 Environmental valuation methods

'Turning a mountain into gravel is facilitated by first breaking it down conceptually'.

Alf Hornborg 1994: 251

While discourses of environmental values incorporate ideas from both philosophy and economics, economic value theory dominates the practices of valuing nature. Although philosophical discourses of value consider inclusive definitions of value, opening possibilities for understanding complex 'natures', environmental valuation methods are limited by a narrow definition framed by economic value theory (Gibbs *in press*). In this

section I consider two prominent approaches to valuing water in natural resource management: non-market valuation and ecosystem service valuation. Both of these methods attempt to move beyond traditional economic valuation by incorporating aspects of water that are not easily quantifiable, nor readily incorporated into traditional economic frameworks. However, despite efforts to consider water as more than an economic 'resource', I argue that these two methods still fall short of fully capturing the values associated with water.

5.4.1 Non-market Valuation

Economist Jeff Bennett asserts: 'The benefits of extractive uses of water are relatively straightforward to estimate' (2003: 240). He goes on:

More problematic is the estimation of the non-market values associated with the environmental benefits of water use. Without recourse to market data on these benefits, their estimation in monetary terms to enable a direct comparison with the marketed extractive use values presents a stumbling block to economic analysis. The challenge has been the development of techniques to *generate dollar estimates* where no direct relevant market data are available (2003: 240, my emphasis).

Bennett is a leading proponent of non-market valuations, a group of methods designed to determine the value of non-market 'goods and services' by attributing *monetary value* to them.

The principle techniques for monetary valuation of non-market or indirect market values are of two broad types: 'revealed preference techniques', including the travel cost method and hedonic pricing; and 'stated preference techniques', including choice modelling and contingent valuation. Bennett defines 'revealed preference techniques' as relying on data

about people's preferences for non-marketed goods or services that are revealed in markets for related goods or services (2003: 240). The travel cost method is particularly used to 'value' outdoor recreation (Chee 2004: 554), and uses the costs individuals expend on travel in order to use recreation sites to infer monetary values for those sites (Bennett 2003: 240). Hedonic pricing 'relies on the proposition that the value an individual places on a service is based on the attributes it possesses' (Chee 2004: 555). This method has been used primarily in real estate markets to estimate the contribution of environmental amenities to land and housing values.

'Stated preference techniques' involve 'questioning a sample of those people who are potentially affected by a policy change regarding the preferences for the alternative outcomes' (Bennett 2003: 240-241). The choice modelling method relies on stated preferences of individuals. In this method respondents to questionnaires are asked to choose their preferred option from an array of alternatives. The alternatives are differentiated by a range of attributes, which attempt to capture the non-market value outcomes of a particular decision, and a financial cost of that decision to the individual (Bennett 2003: 241). The best known of the stated preference techniques—and indeed of all non-market valuation methods—is contingent valuation. Contingent valuation is based on the notion of an individual's 'willingness-to-pay' or 'willingness-to-accept compensation'. For example, people may be asked if they are willing to pay a pre-assigned amount, in a hypothetical market, to secure an environmental improvement or avoid some environmental harm (Bennett 2003: 241; Chee 2004: 555). Chee suggests that contingent valuation has been widely used for valuing ecosystem services because it is capable of eliciting monetary values for goods that have no exchange value, and is applicable to ecosystem services in practically any context (2004: 555).

Spash notes that of these methods, contingent valuation is the only method able to assess non-use values such as option, bequest and existence values (1997: 406). 'Option value' refers to options to preserve an environmental amenity for future use or non-use, of practical or heuristic significance. 'Bequest value' is closely related to option value but refers specifically to the value of passing on a resource to future generations. 'Existence value' is the value placed on an object simply for its existence, with no reference to any direct or indirect use (Goulder & Kennedy 1997: 34-35; Postel & Carpenter 1997: 206-207; Gaston & Spicer 2004: 103-104). In the case of water, non-use values may be substantial (Postel & Carpenter 1997: 206).

Non-market valuation moves beyond considering nature as an economic entity of 'resource': the methods are explicitly concerned with values not presently represented in markets; and by considering people's preferences non-market valuation makes some effort to incorporate 'value systems' as defined by Farber *et al.* (2002: 375). However, these efforts are confounded by the priority of quantifying value and representing the value of water or nature by a monetary figure. In so doing, non-market valuation greatly over-simplifies both nature and the concept of value.

Bennett dismisses any ethical dimension to the issue of non-market valuation, stating:

Some regard the concept of assigning monetary values to environmental impacts as immoral (Sagoff 1988). The notion prevails that environmental values are held on a different plane and should not be compared with values that are exchanged in markets (2003: 247).

But he argues 'the comparability of environmental values with the values of marketed goods and services can be addressed without recourse to ethical argument' (Bennett 2003: 247). As evidence he draws on 'casual observation' of people's behaviour:

By driving cars, switching on lights, flushing the toilet, buying phosphate-free laundry detergent or subscribing to 'green' power schemes, for example, we all make decisions that impact on the environment. In making those decisions we implicitly decide that the values to us of transportation, power and sanitation are worth the environmental damage or enhancement we cause through our actions. We may not explicitly estimate a value for the marginal benefits and costs involved but we still make choices that trade-off market and non-market values (2003: 247-248).

Bennett fails to acknowledge the significance of the social, economic, political and cultural contexts within which these decisions are made. His 'casual observations' represent choices made by individuals within pre-existing contexts and limitations; they do not represent the full value of a thing, nor capture all aspects of value.

Environmental economists often refer to the importance of making the process of valuing nature explicit. According to Goulder and Kennedy, 'Societies cannot escape the value issue: whenever societies choose among alternative uses of nature, they indicate (at least implicitly) which alternative is deemed to be worth more' (1997: 23). Bennett suggests that while people may not explicitly estimate value, they do make decisions about environmental impacts that trade off between market-based and environmental values (2003: 248). The question remains whether the methods currently employed are effective tools for incorporating the broad suite of market and non-market values associated with nature.

There are numerous critiques of the *methods* involved in these valuation techniques (see Costanza *et al.* 1997; Spash 1997; Sagoff 1998; Ludwig 2000; Costanza & Farber 2002; Chee 2004; *inter alia*). Less attention has been paid to the assumptions underwriting market and

non-market valuation. Significantly, there is an assumption that money represents, or can accurately quantify, value. Central to all non-market valuation methods is the attribution of a *monetary value* to an object or process that does not have a market value. According to Bennett, dollar estimates are applied to non-market values of water for the purpose of comparing them to identified market values of water. While this process may have some discrete function in the context of markets, trade-offs people make between market and non-market items and the resultant estimated *dollar value* does not capture the full value of water. It represents only one interpretation of value, and in so doing reduces the value of water to one perspective on value, and therefore only captures a limited range of the multiple values associated with water.

Non-market valuation methods fail to recognise the living quality of nature. Determining an individual's willingness to pay for a function or service provided by nature does not equate to determining the total value of nature. Attributing a quantity-based value to nature through monetary valuation measures a proxy for value, not value itself. This act reflects Whitehead's (1925) 'fallacy of misplaced concreteness' whereby abstract or theoretical accounts of phenomena are equated with the phenomena themselves. In the case of non-market valuation of nature, an abstract, partial and reductionist method of determining value is mistaken for an account of a living system. Non-market valuation methods promote false assumptions about the nature of value and the value of nature, and provide an inadequate account of a living system to facilitate environmental decision-making. Measurement of discrete aspects of nature assumes that nature can be divided into units and that those units are comparable and interchangeable. This assumption is inconsistent with a nature that is interconnected, non-interchangeable and non-substitutable.

Spash (1997, 2000) and Sagoff (1998, 2000) discuss environmentalism in terms of deontology—the study of duty, moral obligation or ethics. Spash (2000) argues that the ethics of some individuals preclude them from considering substitution of environmental quality with commodities or payments. He asserts that ‘human value formation with respect to the environment combines ethical and economic aspects in a more complex way than most economists have assumed’, and that ‘policies and instruments based upon the application of neoclassical utility theory will then be neither optimal nor provide the socially desired outcome’ (2000: 1433). According to Sagoff (2000), willingness-to-pay ‘fails to correlate with any independently defined concept of value and cannot serve as a criterion for assessing the values that typically motivate environmental decisions’. Rather, he argues for political and deliberative processes to capture ‘the ethical, religious, scientific and political factors that lead people to support or oppose a particular social or environmental policy’ (Farrow *et al.* 2000: 1382).

By dismissing ethical arguments against non-market valuation methods, proponents of non-market valuation, such as Bennett, deny the complexity of value. He considers ‘ethical argument’ as something that can be easily avoided. Rather, the Lake Eyre Basin study suggests that ethical conversation can be thought of as a process that will offer opportunities to better understand both the theory of value, and the interconnected relationships between people and the living and non-living world.

5.4.2 Ecosystem service valuation

Ecosystem service valuation offers a relatively new, yet extensive body of literature concerned with valuing ‘ecosystem services’ (see Costanza *et al.* 1997; Daily 1997a, 1999; Masood & Garwin 1998; Limburg & Folke 1999; Costanza 2000; Daily *et al.* 2000; Farrow

et al. 2000; Pearce *et al.* 2000; Costanza & Farber 2002; Farber *et al.* 2002; Chee 2004 *inter alia*). Ecosystem services are defined as ‘the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life’ (Daily 1997b: 3). Much of the recent debate has been stimulated by a paper published in the scientific journal *Nature* in 1997 by Costanza *et al.* entitled ‘The value of the world’s ecosystem services and natural capital’ (1997: 253-260). Ecosystem services was a theme in economic and ecological research prior to this seminal work, but the paper aroused great controversy, and in so doing inspired more extensive and broad-based interest in the theme than had previously existed. According to ecologist and prominent proponent of ecosystem service valuations, Gretchen Daily, although the concept of ecosystem services is not new, contemporary environmental issues provides a new context for the approach (Daily 1999).

In their influential work, Costanza *et al.* defined ecosystem functions, goods and services in the following way:

Ecosystem *functions* refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem *goods* (such as food) and *services* (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions (1997: 253, my emphasis).

In their evaluation of the world’s ecosystems, Costanza *et al.* identified seventeen ecosystem services (1997: 254) (Table 5.1). Their list includes market and direct-use values—such as food, medicine, biological control, industrial materials, recreational harvesting, ecotourism—and it attempts to incorporate non-market value, indirect-use value (eg. biodiversity and ecosystem function), non-use value (eg. option, bequest, existence, intrinsic) and intangible forms (eg. information stored in individual human brains, species and ecosystems) (Costanza *et al.* 1997: 254; Gaston & Spicer 2004: 91). Each of these

Table 5.1: Ecosystem services according to Costanza *et al.* (1997: 254).

1.	Gas regulation
2.	Climate regulation
3.	Disturbance regulation
4.	Water regulation
5.	Water supply
6.	Erosion control and sediment retention
7.	Soil formation
8.	Nutrient cycling
9.	Waste treatment
10.	Pollination
11.	Biological control
12.	Refugia
13.	Food production
14.	Raw materials
15.	Genetic resources
16.	Recreation
17.	Cultural

seventeen items contains complex, intangible and interconnecting aspects. However, items 15. 'genetic resources', 16. 'recreation', and 17. 'cultural', in particular, do not lend themselves to simple measurement, using previously available methods. They are arguably unmeasurable. Chee adapted a classification designed by Daily (1999) that groups ecosystem services together and clearly expresses some of the intangible, non-use values under the headings 'life-fulfilling services' and 'preservation of options' (Chee 2004: 550) (Table 5.2). Significantly, Costanza, Daily and other proponents of ecosystem service valuations explicitly aim to identify and assign a measurement to these 'unmeasurable' values, and assess them beside tangible items such as food, pharmaceuticals and industrial products, which hold direct-use value and a firmly established place in financial markets.

Ecosystem service valuation is an important approach for valuing water, as water is a key aspect of ecosystems and the goods and services they provide. It also represents a prominent way in which water is currently constructed within natural resource

Table 5.2: A classification and examples of ecosystem services (Chee 2004, adapted from Daily 1999).

Production of goods

- Food: terrestrial animal and plant products, forage, seafood, spice
- Pharmaceuticals: medicines, precursors to synthetic drugs
- Durable materials: natural fibre, timber
- Energy: biomass fuels, low-sediment water for hydropower
- Industrial products: waxes, oils, fragrances, dyes, rubber, precursors to synthetic products
- Genetic resources: the basis for the production of other goods

Regeneration services

- Cycling and filtration services: detoxification and decomposition of wastes, renewal of soil fertility, purification of air and water
- Translocation services: dispersal of seeds necessary for revegetation, pollination of crops and native vegetation

Stabilizing services

- Partial stabilization of climate
- Moderation of weather extremes (eg temperature and wind)
- Regulation of the hydrological cycle
- Maintenance of coastal and river channel stability
- Compensation and substitution of one species for another when environments vary
- Control of the majority of potential pest species

Life-fulfilling services

- Provision of aesthetic beauty, cultural, intellectual and spiritual inspiration
- Existence value
- Scientific discovery
- Serenity

Preservation of options

- Maintenance of ecological components and systems needed for the future
 - Supply of goods/services awaiting discovery
-

management. While this approach ostensibly moves beyond water as a ‘resource’, it separates water from its constituent parts and processes.

Ecosystem service valuation is a controversial and hegemonic way of placing a value on nature. While certain ‘products’ of nature are relatively easy to attach a monetary value to within existing markets—such as agricultural products, fuel, fibre—others are more difficult to quantify and thus do not easily lend themselves to market-based valuation. For

example, 'aesthetic value' is a label that appears more frequently in natural resource management documents since the popularisation of the 'triple-bottom-line' of economic, ecological and social sustainability. Yet, there is not a widely agreed-upon definition of aesthetic value, let alone a method for determining what its 'value' might be in monetary terms. Important questions are raised by any attempt to determine the value of such a thing: Value to whom? In what context? At what time? And in what place? Yet elements such as 'aesthetic value', 'Aboriginal heritage value', and 'recreation value' are increasingly included in management documents. Dominant natural resource management strategies endeavour to include these non-market and intangible values in decision-making, yet discussions about their nature and importance have not taken place broadly or inclusively. Specific interactions in particular places are over-written by these generic and universalising categories. Important ethical discussions about how non-market and intangible values might be evaluated are currently marginalised. As are conversations about the appropriateness of setting them beside values that have a firmly established place in markets. While there are various debates about the *methods* used in ecosystem service valuations, there is less discussion about whether separating these possibly incommensurable values and setting them side-by-side is an appropriate way of incorporating them into decision-making processes.

While ecosystem service valuation has worth in that it has led to some positive environmental outcomes, I have three major, interrelated concerns, each of which I discuss below. The approach and methods are, I contend:

1. reductionist;
2. inherently anthropocentric; and
3. culturally specific.

'The value of the world's ecosystem services'

In their influential paper, Costanza *et al.* (1997) attempted to determine a total value of the world's ecosystem services; they calculated a minimum value of US\$33 trillion per year (global gross national product is around US\$18 trillion per year). The authors themselves described the task of estimating values for ecosystems as fraught with 'many conceptual and empirical problems' (Costanza *et al.* 1997: 253). In their opening paragraph they stated: 'The economies of the Earth would grind to a halt without the services of ecological life-support systems, so in one sense their total value to the economy is infinite'. According to Daily *et al.* 'putting a price tag on nature' is 'an act seen by many as risky at best' (2000: 395). Yet, the authors emphasised their desire to determine 'crude lower bound estimates'. In order to make such estimates, unmeasurable values must at some stage be measured. How is it possible to reconcile an interpretation of infinite value with a pragmatic requirement to 'put a value on' aspects of ecosystems?

Recognition of the limitations of ecosystem service valuation is central to many discussions about the approach. Proponents of the approach are explicit about its limitations. Costanza *et al.* (1997) provided an extensive list of 'sources of error, limitations and caveats' to their valuation of the world's ecosystem services. Daily *et al.* have presented a succinct account of scope and major limitations, stating 'valuation of ecosystem assets involves some of the oldest problems in economics: revealing and aggregating preferences, and addressing uncertainty' (2000: 396). Many of the identified limitations are based on poor understanding of ecosystems, or the incommensurability of economic methods and uncertain, changing ecosystems and social systems. Further, ecosystem service valuation often relies upon the problematic quantitative methods of 'contingent valuation' and 'willingness-to-pay', discussed in the previous section. Proponents of the approach are

explicit about its limitations, but they maintain its usefulness on the basis of the *environmental* benefits that may be achieved through its application.

Despite these limitations, proponents maintain the worth of ecosystem service valuations. Costanza *et al.* have emphasised the value in determining 'a crude, initial magnitude', in order to make clear the contribution ecosystem services provide to human welfare, stating 'we must begin to give the natural capital stock that produces these services adequate weight in the decision-making process, otherwise current and continued future human welfare may drastically suffer' (1997: 258-259). Daily *et al.* have stated: 'Valuation is a way of organizing information to help guide decisions but is not a solution or end in itself. It is one tool in the much larger politics of decision-making' (2000: 396). The figure of US\$33 trillion sensationalised the issue of ecosystem services, stimulating enthusiastic debate at a time of great and growing interest in global environmental issues (as discussed in chapter 3). In this way, the figure represented more than a mere 'end'.

Proponents argue that identifying and measuring ecosystem services is an essential exercise in order to: make the range of ecosystem services more apparent; establish the relative magnitude of value of services provided by ecosystems; identify areas in most need of further research; and stimulate additional research and debate (Costanza *et al.* 1997: 253).

Chee provided the following summary:

Proponents of ecosystems service valuation believe that valuations can: (i) improve understanding of problems and trade-offs; (ii) be used directly to make decisions; (iii) illustrate the distribution of benefits and thus facilitate cost-sharing for management initiatives and (iv) spur the creation of innovative institutional and market instruments that promote sustainable ecosystem management (2004: 550).

While these benefits have worth in terms of resource decision-making, they contribute little towards developing an understanding of a complex world. Benefits of the approach are expressed in terms of established market-based valuation methods and decision-making processes.

Two case studies are often cited in defence of ecosystem service valuations; both pertain specifically to water. A study by Wilgen *et al.* (1996) found removal of introduced plant species in South Africa's fynbos ecosystem¹ to be a more cost-effective method for ensuring water production and delivery than dam construction, effluent treatment or desalinisation. Additional fynbos ecosystem services—such as wildflower harvest, genetic storage and tourism opportunities—strengthened the argument for introduced plant removal (Cowling *et al.* 1997; Chee 2004: 550).

In New York, ecological restoration of the Catskill Mountains watershed, 160km from New York City, was determined to be more economically viable than constructing a new water filtration plant (PCAST 1998; Daily 1999: 5; Chee 2004: 550). In both cases, appropriate site-specific catchment management was found to be economically preferable to development-based alternatives. Daily *et al.* use these examples to demonstrate the worth of ecosystem service valuation.

The rapid institutional change presently under way is inspiring for several reasons.

It shows that the most important decisions to get right are those where benefits

¹ The fynbos ecosystem exists in the Cape Floristic Region at the south-west tip of South Africa. It is a small and extremely highly diverse ecosystem, occupying approximately 90 000km², and supporting some 8 500 plant species, 68% of which are endemic. The fynbos is a shrubland characterised by hard-leaved and fire-prone vegetation. The combination of its diverse flora and a number of threats to it, lead it to be considered 'the world's "hottest" hot spot of biodiversity' (Cowling *et al.* 1997: 345; see also Myers 1990 for discussion of the concept of biodiversity 'hot spots').

greatly outweigh costs or vice versa, and in such cases, complete accuracy is unnecessary. For example, by constructing crude lower bound estimates for the value of natural water purification services, municipalities worldwide are determining that preserving or restoring natural services is often preferable to constructing a water filtration plant (2000: 396).

Daily *et al.* claim that 'To establish sound policy, the "production functions" describing how ecosystems generate services need to be characterized, and the interactions among these functions quantified' (2000: 395). While there is some worth in identifying the character of ecosystem services in order to facilitate better-informed decision-making, Daily's conclusion that interactions should be quantified represents a leap of faith that raises considerable practical, ethical and ontological dilemmas, which I discuss below. While those involved in ecosystem service valuation set aside the limitations of the approach in order to pursue ecological goals, I argue in this section that the approach fails to capture some vital aspects of nature and value, and that as a result it requires some fundamental rethinking.

Both ecosystem service and non-market valuation methods are plagued by reductionism, anthropocentrism, and cultural specificity. Ecosystem service valuations however, offer greater hope for valuing the environment than do the non-market valuation methods considered above, due to their theoretical base in ecology. The discipline of ecology—the study of living organisms and their environments—has as a central premise, the importance of interconnection. Whereas, in the non-market valuation methods, components of nature may be considered as discrete entities, and interconnections are therefore undervalued. The ecological humanities takes this hope further, by embracing interconnections and

complexity, and looking beyond Eurocentric and anthropocentric perspectives on place (Rose 2004b).

The theoretical emphasis on interconnection, based in an ecological tradition, provides a major strength of ecosystem service valuations. The firm grounding in ecology sharpens the focus on organisms and their interrelationships with the surrounding environment. This focus on interconnections limits possibilities of over-simplifying by separating out discrete elements of the environment and attempting to place a value on those single items, with no consideration for the direct or indirect effects and implications at multiple scales. A second benefit of the approach is the acknowledgement of and attempt to incorporate non-market, non-use and intangible qualities of nature. However, the effectiveness of the incorporation of these qualities is highly controversial and intensely debated. Thirdly, proponents of ecosystem service valuation explicitly discuss its limitations; these discussions are central to the development of the approach. They encourage debate and analysis, and reduce potential abuse of the method.

Reductionism

Despite its base in ecology and resultant theoretical emphasis on interconnection, ecosystem service valuation forces values of nature into a pre-existing market system. The methods available necessarily reduce complex, interconnected ecosystems by separating and measuring discrete values (for example the seventeen ecosystem services proposed by Costanza *et al.* 1997).

In the methods employed in ecosystem service valuation, the meaning of 'value' is reduced to a measurable quantity for the convenience of comparison with established market

values. In many cases, unmeasurable qualities (or qualities that are not readily measurable) are reduced to measured *quantity*. In an attempt to compare values, complex and important qualities and processes are left out, because they are not measurable. In this reductionist approach a monetary or gigalitre figure is often attributed to social and cultural interactions with water. Such a figure cannot reflect the value of, for instance, story and memory associated with a specific water place.

In her work in the Daly River region of Australia's Northern Territory, Sue Jackson has found that 'cultural values' are the values that most preoccupy people. While Jackson considers that values are not easily separated, she uses the term 'cultural values' to refer to those values relating to emotional and spiritual wellbeing, and to qualities that do not have immediate market value. She asserts:

Cultural values should not receive less attention because they are either beyond quantification or difficult to capture in traditional utilitarian calculus of market transactions. Jepson and Canney [2003] refer to such social values as ones which promote a sense of 'groundedness', security, self-expression, belonging, identity and spirituality (2004: 21).

This 'groundedness' is inherently connected to specific water and water places.

David Harvey discusses the reductionism inherent in attributing monetary value to nature, and the separation of components of nature from their contexts that this entails:

Money prices attach to particular things and presuppose exchangeable entities with respect to which private property rights can be established or inferred. This means that we conceive of entities as if they can be taken out of any ecosystem of which they are a part. We presume to value the fish, for example, independently of the water in which they swim. The money value of a whole ecosystem can be arrived at,

according to this logic, only by adding up the sum of its parts, which are construed in an atomistic relation to the whole. This way of pursuing monetary valuations tends to break down when we view the environment as being construed organically, ecosystemically, or dialectically, rather than as a Cartesian machine with replaceable parts (1996: 153).

Harvey goes on to assert the importance of the ontological assumptions behind environmental economics:

While the point of environmental economics (in both its theory and its practice) is to escape from a too-narrow logic of resource/environmental valuations and to seek ways to put money values on otherwise unpriced assets, it cannot escape from the confines of its own institutional and ontological assumptions (which may well be erroneous) about how the world is ordered as well as valued (1996: 155).

In addition to its ecological roots, ecosystem service valuations are based in economic traditions. While ecology emphasises interconnection, economic notions of value presuppose anthropocentric utility, and prioritise finding a metric for measuring utility value. Although ecosystem service valuation—and ecological economics more broadly—makes visible what was invisible in previous methods, it relies on a too-narrow worldview to determine the full ‘value’ of nature.

In his discussion of sacred places, Hornborg (1994) explores the idea of ‘embeddedness’—a concept that is helpful in understanding the limitations of the reductionism inherent in ecosystem service valuation. Hornborg draws on Giddens’ notion that the phenomenon of ‘disembedding’ is central to modernity. He asserts that modernity’s project of emancipating the individual involved the disembedding of selves and social relationships. It involved decontextualisation as a strategy for transcending local identity. Hornborg explains: ‘By

“local identity”, I mean a profound and experience-near identification with a particular and irreplaceable *place* or set of social relationships’ (1994: 258, emphasis in original). He goes on: ‘modernity implied a shift from concrete to abstract reference-points. Specific places and people had to be detachable from, rather than constitutive of, the conception of self’.

This process of disembedding is apparent in hegemonic approaches to valuing water. Specific meanings, values and relationships associated with particular water and water places are silenced by the powerful drive to attribute (reduced) universal value to abstract water. Specific interactions in particular places are reduced to universalised experience of a generic place. This is a form of what Haraway refers to as the ‘god-trick’; a relativism that is ‘a way of being nowhere while claiming to be everywhere equally’ (1991: 191).

Ecosystem service valuation is limited by reductionism: whole is reduced to part (whole systems to components thereof); specific places are reduced to generic placelessness; relationships are reduced to service; living things to humans; and humans to a vision of the Western individual. Value is further reduced through the anthropocentrism and cultural specificity inherent to the approach, discussed below.

Anthropocentrism

In her review of ecosystem service valuation, Chee defines ecosystem services as:

the conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfil *human* life. The concept of ecosystem services encompasses the delivery, provision, production, protection or maintenance of a set of goods and services that *people perceive to be important* (2004: 549, my emphasis).

Daily *et al.* define the world’s ecosystems as ‘capital assets’:

If properly managed, they yield a flow of vital services, including the production of goods (such as seafood and timber), life support processes (such as pollination and water purification), and life-fulfilling conditions (such as beauty and serenity). Moreover, ecosystems have value in terms of the conservation of options (such as genetic diversity for future use). Unfortunately, relative to other forms of capital, ecosystems are poorly understood, scarcely monitored, and (in many cases) undergoing rapid degradation and depletion (2000: 395).

Human-centeredness is central in these descriptions. The emphasis on humans is explicit: 'benefits human populations derive' from ecosystem functions (Costanza *et al.* 1997: 253); goods and services 'that people perceive to be important' (Chee 2004: 549); and conceptualisation of ecosystems as 'capital assets' (Daily *et al.* 2000: 395). Anthropocentrism is a central axiom of ecosystem service valuations.

The primary motivation for conducting ecosystem service valuations is a concern that 'goods' and 'services' provided by ecosystems are often undervalued in resource decision-making. While the approach attempts to address the inadequate weight given to ecosystems in resource decision-making, the impetus for readdressing the balance is expressed in terms of the implications for human welfare:

Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions. This neglect may ultimately compromise the sustainability of humans in the biosphere (Costanza *et al.* 1997: 253).

Actions that treat resources, the environment, or ecosystems as if they were 'free' when they are not, or do not recognize the adverse consequences of their use, can only lead to reductions in potential human welfare or increased real costs of maintaining flows of ecosystem services in the long run (Costanza & Farber 2002: 367-8).

Farber *et al.* explicitly articulate the anthropocentrism inherent in the method:

the basic notion of value that guides economic thought is inherently anthropocentric, or instrumental. While value can generally mean the contribution to a goal, objective, desired condition, etc., the mental model used by economists is that value is based on want satisfaction, pleasure or utility goals. Things have value insofar as they propel individuals toward meeting pleasure and need objectives (2002: 379).

Value is defined—in economics—in terms of people. This economic thinking currently dominates efforts to value nature, including ecosystem service valuation. However, when considering values associated with 'ecosystems' or 'nature' there are other living (and non-living) things that must be taken into account. A single-species focus reduces the complexity of particular places.

Considering the needs and desires of people is not enough; other living things also have needs. According to Callicott:

A utilitarian or homocentric argument for species preservation either explicitly or implicitly assumes that human beings (or, more abstractly, human welfare or happiness) are intrinsically valuable and that all other things, including other forms of life, are valuable only as means or instruments which may serve human beings (or facilitate human welfare or happiness) (1989: 130).

Such an approach does not recognise the right of other species to exist, nor that humans have no right to cause their extinction (Callicott 1989: 130).

The idea of a thing having value in or for itself—as expressed in philosophical understandings of value—cannot be incorporated into an anthropocentric model. Despite the current trend to include an ‘intrinsic value’ factor in non-market and ecosystem service valuations, efforts to consider the value of a thing ‘in or for itself’ are bound to fail when this aspect of value is treated as a function within a framework that is explicitly anthropocentric.

Cultural specificity

Ecosystem service valuation is culturally specific. Cultural and ontological difference is not taken into account. The range of values is determined by one—Western scientific—culture, and the ‘valuation’ is undertaken through one perspective. It represents one culture having a conversation with itself about its own values. For example, the methods used, including stated- and revealed-preference techniques, emphasise the values and preferences of individuals. This emphasis on the individual is particular to a Western scientific worldview. Similarly, the reductionism and anthropocentrism discussed above are not culturally universal.

In his study of sacred places and the conflict over mining of Kelly’s Mountain in Nova Scotia, Hornborg asserts:

A predictable problem ... is how an assessment instructed to conceptually break down Kelly’s Mountain into ‘Valued Ecosystem Components’ will be able to deal

with holistic perspectives such as are embodied in the Mi'kmaq view that the mountain is sacred (1994: 250).

The Terms of Reference for the Environmental Assessment Review of the mining project, he says, 'immediately defines the proper relationship to the mountain as one of analysis, fragmentarization [sic] and objectification, rather than holism and participation' (Hornborg 1994: 251).

The cultural specificity of ecosystem service valuation is particularly damaging in cross-cultural settings where different cultures are highly visible—as in the cases of Kelly's Mountain, for example. However, the cultural specificity of much natural resource management, including ecosystem service valuation, has broader implications. All people whose cultures, worldviews and values are not represented by the management approach are marginalised. By prioritising the perspective of a single culture, the multiplicity of relations, meanings and values associated with a particular place are over-written by a universalised, generic place constructed by the dominant culture. Finally, an approach emerging from a single cultural perspective does not benefit from the wealth of culturally diverse knowledge.

5.5 Valuing water in the Lake Eyre Basin

There have been numerous attempts to value water in the Lake Eyre Basin. In the final section of this chapter I consider two²: the World Heritage proposal of the mid-1990s, discussed in chapter 4, and the efforts to value water within local natural resource management processes in the Lake Eyre Basin.

² Others include (but are not limited to) the Ramsar listing of the Coongie Lakes wetlands (DEHAA 1999) and the assessment of environmental and social benefits of bores drain wetlands (CERM 2002).

5.5.1 World Heritage values

Arguably the most high profile effort to officially 'value' the natural and cultural heritage of the Lake Eyre Basin was the unsuccessful World Heritage proposal. Water was a central focus of the proposal and featured prominently in the heritage assessment reports. The sites identified as potentially fulfilling the criteria of the World Heritage Convention centred around water: the Cooper and Warburton drainage systems, Coongie Lakes, Goyder Lagoon, the South Australian Mound Springs, and Lake Eyre itself. Furthermore, the heritage paradigm has influenced theory and practice of determining 'environmental values' (Byrne *et al.* 2003). Where discussion of World Heritage in chapter 4 focused on the controversial process in the Lake Eyre Basin, and the ways in which water was constructed through that process. In this section I discuss the way value is conceptualised within the World Heritage Convention, and the implications for the LEB and water places elsewhere.

The *Convention Concerning the Protection of World Cultural and Natural Heritage* (referred to as the 'World Heritage Convention') was adopted at the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Stockholm on 16th November 1972. A number of key events stimulated the formation of the World Heritage Convention. The first was the proposal to build the Aswan High Dam on the River Nile in Egypt. The proposed dam was to flood the sites and monuments of prehistoric, Pharaonic, Christian and Muslim Nubia, including the rock-cut temples of Ramses II at Abu Simbel and the Philae temple complex dedicated to the Goddess Isis (Säve-Söderbergh 1987; Smith 1987: 564). In 1959, following international concern and appeals from the governments of Egypt and Sudan, UNESCO launched a campaign that resulted in the Abu Simbel and Philae temples being excavated, dismantled, transported to dry ground and reconstructed. Several other monuments were similarly re-sited. Other campaigns were initiated by UNESCO, including the restoration of central Florence

following flooding in 1966, and addressing the problem of the annual winter flooding in Venice. Following these campaigns, UNESCO and the International Council on Monuments and Sites (ICOMOS), drafted a Convention on the protection of cultural heritage.

At a time of increasing international awareness of environmental issues, several international conferences, including UNESCO's Man and Biosphere Programme, the United Nations Environment Programme, and international conferences on national parks, involved discussion of a 'world' convention for the protection of the world's heritage (Pocock 1997: 260). In 1965 a White House Conference in Washington D.C. called for a World Heritage Trust 'that would stimulate international co-operation to protect 'the world's superb natural and scenic areas and historic properties for the present and the future of the entire world citizenry' (UNESCO 2005b). The International Union for the Conservation of Nature (IUCN) developed similar proposals in 1968, building on the earlier International Union for the Protection of Nature established in 1946.

Importantly, these events led to 'natural' and 'cultural' heritage being considered together; a significant development in attempting to bridge the 'nature/culture' divide. The website of the World Heritage Convention states:

The most significant feature of the *Convention* is to link together in a single document the concepts of nature conservation and the preservation of cultural properties. Nature and culture are complementary and cultural identity is strongly related to the natural environment in which it develops (UNESCO 2005b).

Table 5.3: Articles 1 and 2 of the World Heritage Convention (UNESCO 2005b).

Article 1

For the purposes of this Convention, the following shall be considered as ‘cultural heritage’:

monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;

groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;

sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

Article 2

For the purposes of this Convention, the following shall be considered as ‘natural heritage’:

natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view;

geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation;

natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

By regarding heritage as both cultural and natural, the Convention reminds us of the ways in which people interact with nature, and of the fundamental need to preserve the balance between the two (UNESCO 2005b).

Although the Convention seeks to ‘link’ concepts of natural and cultural heritage, its structure reinforces the strong demarcation between the two realms. From its outset, the World Heritage Convention sought to identify and protect sites of ‘Natural Heritage’ and ‘Cultural Heritage’, as outlined in Articles 1 and 2 of the Convention (Table 5.3). ‘Natural Heritage’ and ‘Cultural Heritage’ are considered separately at all points: assessments of Natural Heritage are undertaken by the IUCN, and those of Cultural Heritage by the ICOMOS; and separate criteria are used for the assessment of proposed sites (Table 5.4). Pocock (1997: 261) attributes the dichotomous conception of heritage within the World Heritage Convention to two distinct initiatives: firstly, the desire on the part of UNESCO to seek recognition and protection of the world’s outstanding historic monuments and

Table 5.4: World Heritage criteria for selection (UNESCO 2005b).

Cultural heritage should:

- (i) represent a masterpiece of human creative genius, or
- (ii) exhibit an important interchange of human values over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design, or
- (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or has disappeared, or
- (iv) be an outstanding example of a type of building or architectural or technological ensemble, or landscape which illustrates a significant stage or significant stages in human history, or
- (v) be an outstanding example of a traditional human settlement or land-use which is representative of a culture of cultures, especially when it has become vulnerable under the impact of irreversible change, or
- (vi) be directly or tangibly associated with events or living traditions, with ideas or with beliefs, or with artistic and literary works of outstanding universal significance (a criterion used only in exceptional circumstances, and together with other criteria).

Equally important is the authenticity of the property and the way it is protected and managed.

Natural properties should:

- (i) be outstanding examples representing major stages of the earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features, or
- (ii) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals, [or]
- (iii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance, or
- (iv) contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The protection, management and integrity of the property are also important considerations.

Mixed properties have both outstanding natural and cultural values. Since 1992 significant interactions between people and the natural environment have been recognized as cultural landscapes.

buildings; and secondly, the desire on the part of the IUCN to obtain international recognition for national parks. Pocock identifies this separation as more deeply entrenched however, mirroring the separation of humankind and nature in Western Enlightenment philosophy (1997: 261).

Despite the demarcation between nature and culture in the World Heritage Convention, the division is a messy one. The original *Operational Guidelines* of 1977 contained significant

overlap between natural and cultural heritage. For example, criteria (ii) included 'geological processes, biological evolution and man's interaction with his natural environment'; the example cited was terraced agricultural landscapes (Operational Guidelines 1977, cited in Pocock 1997). Accompanying the two categories of 'natural' and 'cultural' properties is a third: 'mixed sites'. 'Mixed sites'—those exhibiting both outstanding natural and cultural value—currently account for 24 sites of a total 812 (following the 29th session of the World Heritage Committee) (UNESCO 2005a). While a small proportion, this group is indicative of the complex and varied interactions between 'nature' and 'culture'. Geographer Lesley Head asserts: 'the fact that natural areas and sites are valued, protected and managed in terms of something called 'world heritage' makes them also cultural landscapes. They are brought into the human realm by being interpreted and classified in a certain way' (2000a: 89).

In 1992 the World Heritage convention recognised significant interactions between people and the natural environment as 'cultural landscapes' (UNESCO 2005b), and the *Operational Guidelines* were amended to reflect the change (Table 5.4). Cultural landscapes came to be valued 'as much for what they represent as what they present, for meaning as much as material, for history as much as scenery' (Droste *et al.* 1995; Pocock 1997: 262). The introduction of cultural landscapes demonstrates 'a shift away from emphases on monuments and buildings, towards considering the physical and social contexts in which structures are found' (Head 2000a: 83). According to Lesley Head:

the attempts of the World Heritage Committee to come to terms with changing conceptions of landscape illustrate the influence of ... academic debates ... and show how they play out in management strategies on the ground. These changing conceptions have been influenced not only by academic processes, however, but

also by the political voices of non-Western and indigenous people in international fora (2000a: 83).

The World Heritage Convention is concerned with protecting heritage sites of ‘outstanding universal value’. The convention defines ‘outstanding universal value’ as follows: ‘Outstanding universal value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity’ (UNESCO 2005c: 14). The phrase reveals assumptions central to the Convention: first, the universalising assumptions made in the assessment of sites and claim of ‘universal value’; and second, the explicit anthropocentrism of the Convention. Like current efforts in non-market valuation and ecosystem service valuation, the World Heritage Convention is concerned with qualities perceived to be of value *to humans*. In its opening remarks, the Convention states that it seeks to ‘encourage the identification, protection and preservation of cultural and natural heritage around the world considered to be of *outstanding value to humanity*’ (UNESCO 2005b, emphasis in original). The inclusion of ‘human values’ in the criteria for Cultural Properties (Table 5.4, point (ii)) raises some ambiguity around the notion of value in the World Heritage Convention. Values attributed to sites are conflated with the normative precepts that guide human action. This concept of value is markedly different from the ‘universal values’ upon which the Convention focuses.

Despite these difficulties, the World Heritage Convention has a number of notable strengths. Firstly, the Convention attempts to recognise the value of cultural and non-market qualities of places. In order to do so, it does not rely on a method that reduces these values to market value, nor does it require that they be compared to other values firmly entrenched within markets. Sites and properties are assessed and prioritised, and

protection granted (or not) under the auspices of the World Heritage Convention, but these sites are not compared with incommensurable market values. As we have seen through the examples of ecosystem service and non-market valuations, recognition of value without such comparison is rarely achieved.

Secondly, the World Heritage Convention acknowledges multiple 'points of view'. For example, Article 1 (Table 5.3) considers value 'from the point of view of history, art or science', and 'from the point of view of science, conservation or natural beauty', among others. This recognition of multiple 'points of view' is significant in that it rejects the notion of a single authoritative vantage point. This multiplicity is somewhat confounded, however, by the claim of the Convention to identify 'outstanding *universal value*'.

Thirdly, the World Heritage Convention has been adaptive. From its beginnings the World Heritage Convention focused explicitly on material heritage. This took the form of either the 'natural environment', or 'humankind's sculptural action within the environment' (Pocock 1997: 261). This focus on material heritage caused difficulties in recognising non-material cultures, or cultures that have left minimal clearly visible material traces on the landscape. For example, Australian Aboriginal cultures have altered Australian landscapes dramatically, in particular through burning practices. In some cases sites are marked by art—such as is recognised at the Kakadu World Heritage area, or by archaeological remains—such as at the Lake Mungo World Heritage area. In many other cases, few such 'material' traces remain. Material culture is not the sole indicator of significance, attachment or maintenance of relationships with place (see Macfarlane 2005a). Archaeologist Isabel McBryde (1997, 2000) considers long distance exchange systems in the Lake Eyre Basin. She argues that to ignore cultural landscapes:

is to ignore significant aspects of Aboriginal culture. It also exposes us to the risk that we create in our registers a representation of Aboriginal culture, as exemplified in place, that is predominantly monumental, conforming to our European traditions of 'heritage', rather than the values and practices of the creating culture. If our registers are to be 'representative' with all that this implies, then we must address the complexities attendant on assessing such entities and include within their confines the storied landscapes of the long-distance exchange system (McBryde 1997: 14).

Isabel McBryde was instrumental in achieving the inclusion of 'cultural landscapes' in the World Heritage Convention (Truscott 2005).

The 1992 recognition of cultural landscapes enabled sites such as Uluru – Kata Tjuta National Park in central Australia, and Tongariro National Park in Aotearoa/New Zealand to be recognised as cultural sites. Both had previously been identified as sites of natural heritage; the cultural landscapes amendment allowed the two sites to be reinscribed, acknowledging 'the continuing living relations between Aboriginal people and the natural environment, including the latter's social, religious and symbolic value' (Pocock 1997: 264). According to Lesley Head 'where living peoples express a connection to the land ... the description is more in terms of local attachments than universal ancestors' (2000a: 93). The inclusion of cultural landscapes has stimulated a new emphasis on the specificity of place.

Through the addition of cultural landscapes, the World Heritage Convention recognises cultural, non-market and intangible values. The late addition of cultural landscapes illustrates the comparative difficulty in recognising values associated with intangibles. Places without monuments or other material evidence are difficult to categorise, and to attach value to. By embracing cultural landscapes, the World Heritage Convention is

perhaps demonstrating an increasingly phenomenological approach to landscape—‘an approach that understands that people create a sense of place through movement, through attachment, through wrapping stories and memories around places, through using not just the visual but all the senses’ (Harrison *et al.* 2004: 440). This approach to landscape better reflects what people in the Lake Eyre Basin value about water than does an approach that attempts to separate nature from culture, economic from environmental from social and cultural, and ‘use’ from ‘non-use’.

5.5.2 Stories from Birdsville

To start thinking about how water is currently being valued in the Lake Eyre Basin, we will go briefly to Birdsville—a small town of around 100 people on the edge of the Simpson Desert. In October 2002 I travelled to Birdsville for the Lake Eyre Basin Ministerial Forum and Biennial Conference. The event was attended by pastoralists, policy-makers, ecologists, community representatives, industry representatives, academics, and others involved or interested in catchment management in the Basin. The conference was divided into three sessions: ‘water for making a living’, ‘water for wildlife and nature conservation’ and ‘water for society and culture’. These three categories fit neatly into the ‘triple-bottom-line’ management framework of economic, environmental and social sustainability. I had a strong sense that the organisers were attempting to identify and weigh up the ‘*values of*’ water. However, the triumvirate was far from evenly represented.

Economic understandings were shown to be well documented and were presented by Greg Campbell, General Manager of Kidman Holdings Limited—one of Australia’s largest pastoral companies. In the session ‘water for making a living’, attendees heard impressive accounts of the 1765 pastoral holdings in the Lake Eyre Basin carrying 3 million beef cattle

(10% of Australia's total herd) and 2 million sheep (2% of Australia's present flock), producing, in 2002, around \$700 million dollars in 'farm gate produce'. In his presentation, Greg Campbell mentioned the importance of 'the quality and supply of surface water for drinking, washing and growing gardens for cooling effect, dust control, fresh produce and also visual amenity'. He went on to say: 'There are many unspoken benefits to station life on a river or creek' (Lake Eyre Basin 2002: 24; field notes 10.02). These benefits remained unspoken in his presentation.

The session 'water for wildlife and nature conservation' was presented by Professor Stuart Bunn, of the Cooperative Research Centre for Freshwater Ecology and the Centre for Catchment and In-Stream Research at Griffith University in Queensland. This session focused on aquatic ecosystems in the Lake Eyre Basin. Bunn described the aquatic ecosystems, provided an account of the health of these ecosystems in the Lake Eyre Basin, and spoke about information gaps. His presentation made it clear that ecological and environmental values are becoming increasingly well understood and recognised in the Basin through projects such as Aridflo and WISE—discussed in chapter 3—and a project entitled 'Dryland Rivers' undertaken by Bunn and colleagues.

There were two further presentations concerning ecological knowledge in the Lake Eyre Basin: 'WISE on the Cooper' and a 'Summary of Aridflo results'. Both presentations summarised the findings of these ongoing projects, providing a forum for two-way feedback between researchers and participants at the conference. While primarily concerned with ecological knowledge, Aridflo, and particularly WISE, involve local knowledge (as discussed in chapter 3). These three ecology sessions—'water for wildlife and nature conservation', 'WISE of the Cooper', and 'Summary of Aridflo results'—were presented by well-respected scientists with long-standing relationships with people living in

the Basin. The neat divide established in the conference structure between 'water for making a living', 'water for wildlife and nature conservation', and 'water for society and culture' were cross-cut in these presentations.

In the designated session, social and cultural 'values of water' were limited to familiar historical accounts, and suggestions that values are poorly understood and documented. 'Water for society and culture' was dominated by a formal presentation by historian Dr Peter Bell. His was a settler and contact history of the Lake Eyre Basin well known to many conference participants for whom the Basin is home. General comments about the settler history of inland Australia—settlers contending with extremes of flood and drought; contact between settlers and Aboriginal people; personal hardship; challenges in securing water—were followed by descriptions of the history and development of the Oodnadatta, Birdsville and Strzelecki Tracks. The three tracks had different functions, and water was secured by different means. Bell asserted that water played an important role in shaping social relations in Lake Eyre Basin.

Following this presentation was a brief (twenty minute) panel discussion involving a diverse group of experts involved in various issues defined at the conference as 'society and culture'. These included Aboriginal culture and language, rural and environmental sociology, psychology, and tourism. The panel members had interesting and important things to say, but their stories and thoughts were marginalised by the structure of the conference session. In twenty minutes they fielded complex and disjointed questions concerning historical omissions; the difficulties of incorporating cultural values into decision-making processes; differences in meanings of place for European and Aboriginal people; the problematic attitude that 'money will solve everything'; impacts of tourists and

tourism; exclusion of Aboriginal people from Lake Eyre Basin processes; and broader natural resource management process issues (Lake Eyre Basin 2002: 14; field notes 10.02).

In small group discussions following the presentations, conference attendees identified numerous values of water 'for society and culture', including 'life-sustaining', 'economic production', 'aesthetics', 'family continuity and heritage', Aboriginal 'story-lines' and 'sites', 'trade routes', 'law' and 'language'. People described 'the importance of the LEB river systems in maintaining social, spiritual and quality of life to the community' as a 'key feature', 'deeply important', 'number one in maintaining values', and claimed 'rivers of the catchment still shape society' (Lake Eyre Basin 2002: 16). Participants readily expressed the significance of social and cultural values associated with water. People were thinking more broadly than the conference program would suggest. Their understanding of the role and importance of water, expressed through the group discussions, was far more nuanced than the formal presentation. But discussion was limited by the formal structure of the conference.

The most striking feature of the Birdsville conference was the division of proceedings into three themed sessions. The conference demonstrated that attempting to separate social and cultural aspects of water from economic and ecological aspects (or separating 'water for society and culture' from 'water for making a living' and 'water for wildlife and nature conservation') is a flawed method for thinking about complex and interconnected issues. The structure of the conference structured discussion in a specific way. While people were able to list a suite of 'values of water', the conference structure represented a false separation and over-simplification of values, and is likely to have influenced the ways in which people expressed the values they perceive.

It became clear over the course of the conference that these divisions were arbitrary. While the sessions were divided, presentations overlapped. Greg Campbell spoke about the importance of water and gardens for 'visual amenity'; Stuart Bunn discussed the ecological implications of economic decision-making and management actions. And yet, the conference provided no space for examining the complex interconnections between the three separated elements. Values attributed to water were separated, and there was no process or forum for reintegration. Vital interconnections and mutual embeddedness were marginalised.

The three separated conference themes are mutually constituted. What is 'making a living' if not social? How can we talk about 'nature' without talking about cultural constructions of nature? What is 'conservation' if not socially and culturally determined; what should be conserved, why, how, by and for whom? How can people 'make a living'—particularly in pastoral country—without 'nature'? And how can we think of 'making a living' without thought for the related effects on a 'nature', 'society' and 'culture'?

Recent discourse of environmental value offers possibilities for thinking about interconnections by returning to value theory to consider aesthetic, ethical and epistemic value, as well as considering economic notions of value. However, value in natural resource management—including non-market and ecosystem service valuation—is dominated by a narrow and limiting utility-based framework. As a result, the ecological and ethical understandings of value, which prioritise interconnection, are marginalised. Castree and Braun (2001)—among others—argue for a 'social nature'. Geographical research on social nature, they argue, has 'allowed geographers to move away from asking worthy, if limited, questions about what society "does" to nature (and vice versa), towards more fundamental questions such as "who constructs what kinds of nature(s) to what ends and with what

social and ecological effects?” (2001: xi). The three themes of the Birdsville conference are not discrete, as the structure would suggest. Attempting to consider them separately ignores interconnections, mutual influence and embeddedness.

Finally, the divisions made at the Birdsville conference are culturally specific. The distinctions between ‘making a living’, ‘nature’ and ‘society and culture’ are particular to the paradigm of natural resource management. These divisions are not cultural universals. Just as the division and separation of ‘ecosystem components’ in ecosystem service valuation is culturally specific, so too is the division and separation seen in the ‘triple-bottom-line’ to which the Birdsville conference responds. For example, such divisions are not made within Australian Aboriginal cultures, which, like the Mi’kmaq of Nova Scotia, tend to have a holistic perspective on the world. Through my interviews I found that Aboriginal and non-Aboriginal people in the Lake Eyre Basin held more subtle understandings of the values of water than these divisions would suggest. A holistic approach to valuing water would avoid the clichéd triple-bottom-line of sustainability, and nurture more nuanced understandings of value.

While the term value has a rich and varied history, hegemonic efforts to identify and attribute value to water within natural resource management favour a narrow utilitarian definition of value, manifested in the term ‘valuation’. Valuing water is plagued by reductionism, anthropocentrism, and cultural specificity; marginalisation of interconnections; and assumption of separation and substitutability seen in the trend of measuring the unmeasurable. In the next chapter I propose embracing *variability* as a new framework for valuing water that embraces and celebrates inclusiveness, complexity and cultural diversity. Valuing variability embraces multiple meanings of value, acknowledges

non-human values, multiplicity of human values, changing values, and diversity of human worldviews. The model I propose makes a return to ecology, or an *ecosystem* approach, by emphasising the living and interconnected character of water. The theme of variability provides a valuable framework for thinking about water—embracing some of its crucial qualities such as change, difference and uncertainty—for understanding relationships between water, people, place, and the non-human world, and for imagining new more just and sustainable ways of living with water.

CHAPTER 6

VALUING VARIABILITY

6.1 Introduction

Current dominant approaches to valuing water are at odds with the ways that many people in the Lake Eyre Basin value water. I propose *valuing variability* as a new framework for valuing water that better accounts for diverse knowledges (Gibbs *in press*). The limitations of dominant approaches identified in chapter 5—reductionism, anthropocentrism and cultural specificity—stem from a Eurocentric or Western modernist epistemology, which is characterised by separation, utilitarianism, universality, focus on the individual, and colonialism. I show that these problematic ways of thinking about water are accentuated by the discourse of ‘natural resource management’. The approach I propose here addresses these limitations, and challenges the epistemological and ontological assumptions behind them. It provides an alternative viewpoint on the range of values associated with water in the specific places of the Lake Eyre Basin. Valuing variability broadens understandings of both water and value.

Value and variability are connected in two ways: first, the variability of water in the Lake Eyre Basin is valued; and second, the values associated with water are characterised by variability. This chapter examines both of these ways and is structured around these two points of connection. Section 6.2 examines the ways that variability is currently considered with regards to water; that is, largely as a characteristic of water's physicality. Section 6.3 then outlines how the concept of variability is expanded by the approach of *valuing variability* from a physical concept to incorporate more holistic understandings of water. In section 6.4 I explore the two ways that value and variability are connected. This exploration is broken into two sub-sections: 6.4.1: 'Water's variability is valued'; and 6.4.2: 'Water's values are characterised by variability'. Though connected, these two aspects of the approach are distinct and warrant separate consideration.

My proposed framework of valuing variability emerges from the place being studied here—the Lake Eyre Basin. Variability is a key characteristic of water in the Lake Eyre Basin. This is reflected in my field research regarding the values associated with water in this place. I draw on a multi-disciplinary body of literature focused on place and the core aspects of variability—diversity, change and complexity—to support the framework and address some aspects of water and of value that are marginalised by current approaches to valuing nature. Two important aspects of complexity are interconnectedness and the living and life-giving qualities of water. Interconnections exist between established categories of the triple-bottom-line, and between water and the rest of the (human and non-human) world. By prioritising 'living' qualities, valuing variability fosters a more complete and complex understanding of water, instead of reducing values to fit generic categories.

The universalising tendency of dominant approaches to valuing water—including the Queensland Water Resources Act (chapter 3), the World Heritage Convention (chapters 4

& 5) and ecosystem service valuation (chapter 5)—overrides the specificities of particular places. In his study of the commodification of wetlands, Robertson discusses the ‘messy uniqueness of the physical site’ (2000: 473). ‘Messiness’ refers not to a lack of order, but to the complex, multi-faceted, interconnected and tangled relationships that make particular places. Embracing messiness acknowledges this complexity, and prevents complex, place-specific relationships from being marginalised. Castree calls for critical geographers to ‘acknowledge the messiness of real or intended place projects’, asserting that ‘this messiness often cannot be fitted into the diagnostic and evaluative boxes otherwise well-intentioned critics are wont to use in examining it’ (2004: 137-138). By focusing on the specific places of the Lake Eyre Basin, and challenging universalising generic categories, valuing variability explicitly embraces the messy uniqueness of place.

Variability provides a useful framework for thinking about water, embracing some of its key qualities. The term variability has its root in the Latin *varius*, meaning changing, diverse and variegated—marked or characterised by variety. Diversity and change are two major themes emerging from the definition; in addition, definitions of *varius* and its derivatives refer to conflict, uncertainty, multiplicity, relation, time, place, scale, simultaneity and subtlety (Oxford English Dictionary, 2nd edition, 1989).

Water provides an exciting opportunity for valuing variability. Anthropologist Veronica Strang proposes the thesis that ‘the formal qualities and characteristics of the object—whatever it is—are crucial in that they provide a common basis for the construction of meaning’. She considers ‘how the meanings that emerge in the ethnographic data reflect the qualities of water’ (Strang 2005: 97). In the Lake Eyre Basin water is characterised by a variability that is widely valued. Strang goes on to consider the ‘common themes of meaning [that] recur in so many cultural contexts’ (2005: 94; see also Strang 2004). By

focusing on variability I do not intend to ignore the important common meanings of water. Rather I aim to highlight the tendency of current approaches to valuing water to marginalise the very quality—variability—that characterises Lake Eyre Basin water and its values.

6.2 Water and variability

The term ‘variability’ is widely used in ecology and geomorphology to describe the water regimes—rainfall and river flow—of arid and semi-arid landscapes such as the Lake Eyre Basin. But it is less frequently used outside this context. Water’s variability is both spatial and temporal (Sheldon *et al.* 2002). It has a temporal element referring to the quantity of rainfall and river flow over time; in the Lake Eyre Basin there is no regular or predictable seasonal water pattern or regime. Rather, rivers are characterised by long periods of low or no flow followed by periods of extreme flooding (Knighton & Nanson 1994, 2002; Puckridge *et al.* 1998; Kingsford 2000).

Variability has a spatial component referring to differences in the upper and lower catchment. While temperate rivers tend to have increasing flow downstream due to input from tributaries, in the Lake Eyre Basin and other dryland river systems flow *decreases* downstream; as rivers flow into more arid areas, evaporation rates rise and tributaries deliver minimal—if any—flow. In such a large basin, local rain can contribute significant amounts of water to discrete parts of the basin, further contributing to spatial variability. At another spatial scale, the very flat landscapes through which the rivers cut cause them to flow slowly and change their paths often, shaping and re-shaping the landscape as they go.

In ecological terms, variability refers to the responses of living things to both the temporal and spatial variability of water: 'Extreme variability of flows, from floods to droughts, dictates the structure of aquatic communities and ecological processes in dryland rivers' (Kingsford 2000: 3). Variability provides a focus of scientific research. Its specific forms, the patterns of life it creates, and interconnections at specific sites are themes of research projects such as Aridflo and WISE. Puckridge *et al.* (1998) suggest individual rivers appear to have their own 'signature' of variability, making them ecologically distinctive. Water and its variability create the landscapes of the Lake Eyre Basin and other arid and semi-arid regions.

Australian dryland rivers and the physical variability of their water regimes—both spatial and temporal—have attracted scientific attention in recent years. Physical variability is slowly being recognised as an important scientific idea in Australian natural resource management. In the Lake Eyre Basin, recent work by geomorphologists, hydrologists and ecologists has increased scientific understanding of these landscapes, the significance of variability in them, and the important ways in which they differ from better understood temperate environments (Finlayson & McMahon 1988; Knighton & Nanson 1994, 2002; Walker *et al.* 1995; Puckridge *et al.* 1998, 2000; Kingsford *et al.* 1999; Boulton *et al.* 2000; Kingsford 2000; Sheldon *et al.* 2002; *inter alia*). For example, the projects Aridflo and WISE (discussed in chapter 3) specifically focus on the variability of the Lake Eyre Basin rivers, and these projects are supported by pastoralists and policy-makers who have strong influence on management decisions. In a broader context, physical variability in the form of biodiversity is becoming widely accepted in ecological and conservation sciences, and biodiversity is an increasingly powerful political tool in natural resource management (Wilson 1988; Escobar 1996). Cultural theorists are beginning to turn towards ecosystem thinking in order to develop better understandings of the world. I return to biodiversity,

and the implications of an ecosystem approach for valuing water in the Lake Eyre Basin, at the end of this chapter.

Water policy geographer David Ingle Smith suggests that Australia's water variability necessitates rethinking the wisdom and methods of hydrological assessment derived from mid-latitude, temperate, northern hemisphere places (Smith 1998: 16). He considers that in recent years Australian water scientists have met that challenge. However, compared to temperate regions of the world, research on arid-zone rivers remains poor (Kingsford 2000: 9), and according to Sheldon *et al.* (2002) scientific data on dryland rivers remains limited, hampering efforts to manage and conserve these regions. Social studies of water in arid regions are even rarer.

6.3 Expanding the variability concept

In research into water's variability, the nature/culture divide is strong. While physical variability is gaining attention and acceptance in both the academy and natural resource management, the 'variability' of social, cultural and ontological qualities of water—meanings and values associated with water and water places, and ways of knowing and living with water—has elicited less discussion. The complex roles and interactions of these aspects of water are poorly understood in the Lake Eyre Basin and elsewhere.

Expanding the variability concept involves building on Soulé's (1985) normative postulate that 'diversity of organisms is good'. If we are to embrace diversity in nature, it follows that we should embrace diversity in human experiences and perspectives. Acknowledging variability means acknowledging social and cultural as well as physical variability. The influence of the heritage paradigm on approaches to valuing nature has led to the popular

inclusion of categories such as 'Aboriginal heritage value' and 'tourism value' in management frameworks. While these ostensibly 'social' and 'cultural' categories recognise different uses and users of water, they are commonly presented as universal and static values. There is no facility for considering the variability—diversity, change and complexity—of meanings, values and worldviews that comprise these categories. Within the heritage conservation paradigm, there is a dominant assumption that the conservation ethic is universal (Byrne 1995). However, researchers in the area of heritage management are developing ways of articulating a multiplicity of values and significance (e.g. Byrne *et al.* 2003). Water has a variety of forms and functions, meanings and values, and people and other non-human entities interact with water in a diverse, changing and complex range of ways.

Toussaint *et al.* discuss 'the considerable variation that exists in beliefs, practices, values and laws associated with water', and explain how 'Aboriginal people, lands and waters are in a continual and interconnected process of mutual transformation' (2005: 61). According to Strang:

Water's diversity is, in some respects, a key to its meanings. Here is an object that is endlessly transmutable, moving readily from one shape to another ... It has an equally broad range of scales of existence ... This process of transformation never ceases: water is always undergoing change, movement and progress. ... The ways in which humans experience these fluid qualities are as diverse as the contexts in which this interaction occurs (2005: 98).

Diversity of forms and functions leads to diverse meanings and values. Yet insights from this work are not widely incorporated into natural resource management strategies. While there is some recognition of the diversity of values of water within natural resource management, as illustrated by the range of participants at the Birdsville conference, other

aspects of variability—change and complexity—are not widely embraced; values are assumed to be static and simple (discrete and readily categorised), not changing and complex.

By applying the concept of variability to value, I hope to expand the ground already covered by physical scientists in developing understandings of Australian water that incorporate diversity, change and complexity. I build on the work of those who consider variability of meaning, and draw it into the discourse of natural resource management. Just as physical variability incorporates both the spatial and temporal, so too does valuing variability. By drawing together physical and social-cultural variability, *valuing variability* goes some way to reconnecting the nature-culture divide, and engaging with current discourse within and beyond human geography concerned with the ways in which nature and culture are interconnected and co-constituted (Castree & Braun 2001; Braun 2002; Whatmore 2002; Strang 2005; Toussaint *et al.* 2005 *inter alia*).

6.4 Valuing variability

6.4.1 Water's variability is valued

Variability is one aspect of water in the Lake Eyre Basin that many people interviewed in this research value highly. Variability is a defining characteristic of Lake Eyre Basin waters. The variability of specific waters—in particular place and time—creates patterns that give rise to patterns of plant, animal and human life. These patterns influence human interaction with water and water places and shape lifestyle and livelihood. People living and working in the Lake Eyre Basin value the variability of specific waters, and the patterns of water created by this variability.

Variability of rainfall and river flow influence pastoral practice. Pastoralism in the Channel Country—the extensive floodplains of the Lake Eyre Basin—is reliant on floodplain growth, stimulated by episodic flooding. Throughout the Basin, the ways water transforms the landscape shapes pastoral practices such as moving cattle between floodplain paddocks, sand-dune paddocks and stony-country paddocks, and reducing and increasing stock numbers in those paddocks. Floodplain and sand-dune paddocks hold water and fodder episodically; stony-country or gibber-country paddocks grow perennial grasses and other feed and are the sites for Artesian bores and permanent watering-points. Gibber country is sometimes referred to by the ‘old-timers’ as ‘dry-time country’, and forms the ‘back-bone’ of a property (Oldfield 4.03).

People value variability for both utilitarian and non-utilitarian reasons. Pastoralists are not simply interested in flow levels and quantities of rainfall for production; they speak with passion about their relationships with the river and its variable flows. Station Manager Peter Weston describes observing flood waters at Clifton Hills Station on the Warburton River, Goyder Lagoon and Cooper’s Creek (north-east South Australia). He talks about using pegs on the floodplain to mark levels reached by the flows of different floods. He tells me previous managers also put in pegs to measure flood levels, but only irregularly. It would be good to have a flood marker, he tells me; ‘no two floods are the same’ (field notes, Weston 4.03).

Specific waters

When people in the Lake Eyre Basin talk about water they talk about specific water, not an abstract or generic water, as is invoked in dominant approaches to valuing water, discussed

in chapter 5. People develop understandings of and attachments to specific waters and water places.

Sharon Oldfield of Cowarie Station on the Birdsville Track talked to me about the importance of water to people living in the Lake Eyre Basin. She spoke of people coming together around ephemeral water in arid country and of local human responses to water. Variability is central to the particular water place she describes:

there's nothing like when the Cooper ran in 89-90-91. When that Cooper hit the road, it had been the first time in thirteen years that that happened and we had The Great Cooper Splash, and everyone in the country went down and we just had a fantastic time. ... we would drive down from here every couple of days and see where the water is, ... how far across the road is it now, and it's the most mind-boggling thing to see, ... three ks and it's just under water. ... you go out and you can see it and it just lifts your heart, like you've got no idea (Oldfield 4.03).

The specific water place she talks about is tied to family and social life, and to stories and memories. The floods of 1989-1991 stimulated social gatherings of local people—referred to as 'The Great Cooper Splash'—that were focused around ephemeral water. It is specific water, in a particular place and time, that shapes these events.

Jim Puckridge, the aquatic ecologist, worked on the Murray River before working on Cooper Creek. When we spoke he briefly described his involvement in the Basin as scientific and then went on to talk about the temporal and spatial variability of Lake Eyre Basin water:

I feel quite fond of the Murray—sort of dreamy, lazy life, and its quiet. But I also felt some sadness about it, some grief even I think, about the misuse of the river; the trash on the riverbanks and the domination of exotic species in the water, carp.

And the violation of what seems to me the essential quality of the river—its quietness—the violation of that by motorboats and speedboats and ski boats, bogus modern day paddle-steamers. It was depressing. The source of some grief. And when I was going to the Cooper it was an extraordinary delight because it was such a contrast. ... particularly striking how free of that corruption and intervention and damage there was. Teeming with fish, incredible density of living things. Almost no sign of modern human change. Some impacts of tourism. And some are more incessant I guess, but nothing like the deep damage that was felt on the Murray. ... It was a revelation for me. Particularly that paradox that everyone remarks on—that impresses everyone—was the extraordinary burgeoning of life in the river in the middle of the Simpson Desert. Particularly striking when you travel a thousand kilometres or more through hot dusty roads, particularly if it's summer. The first trip I went on was a summer trip—December—so it was a torrid trip up there, and you find these places; such an oasis. Very special (Puckridge 4.03) (Figure 6.1).

Jim Puckridge and Sharon Oldfield describe attachment to specific water and specific water places; waters characterised by spatial and temporal variability. They do not describe generic water, but the water to which they have an attachment, its places, the specific water they have experienced. The things they value about water are not encapsulated in the reduced three-themed concept of value represented at the Birdsville meeting. Neither does the current practice of valuing water in natural resource management easily incorporate the values they express. In this way, important values are marginalised by current practices because they are difficult to incorporate into existing frameworks.

Figure 6.1 Sunrise, Coongie Lake. May 2003.

People talk about water with subtlety. Specific forms and patterns of rain and river flow are known intimately. People use water to describe places. Sharon Oldfield, for example, describes Cowarie Station in terms of its waters. Water influences grazing practice, and determines where pipe-lines are laid, bores drilled and watering points established. Places are described by how long water exists at a particular water site. ‘Waterholes’ are variously described as ‘six to nine month’ or ‘three month’ waterholes; a ‘permanent water’ is ‘a pipe line running off an Artesian bore’ to a trough (Oldfield 4.03). Inherent in this language is an understanding that water is ephemeral in this landscape. Pastoral practice on Cowarie Station, and elsewhere in the Basin, is designed around this impermanence, this variability.

Similarly, rain is not known in an abstract or generic way; its varieties and their effects are well-known by people living in the Basin: ‘ “it was a beautiful soaking rain”. Have you heard that? ... “A beautiful soaking rain”. But you know, it’s good to have the good

soaking rain, but you've gotta have a big heavy rain in there somewhere to run the water.' (Oldfield 4.03). This level of detail is important for production. At the same time the language used to describe rain signifies value beyond utility.

Focusing on specific waters challenges hegemonic natural resource management strategies by moving beyond the universal. It also challenges the assumption of substitutability inherent in the act of quantifying water that is central to, for example, water trading. By thinking about relationships with specific water it becomes clear that one 'gigalitre' of water cannot be substituted for another.

Water patterns

Specific waters provide patterns to lives. Variability at particular places creates particular patterns. These specific patterns of water give rise to patterns of animal, plant and human life. They determine human interaction with water, water places and country, and shape life style and livelihood.

Many people living and working in the Lake Eyre Basin demonstrate a love of and curiosity about specific patterns created by water's variability. At South Galway Station in the Channel Country, station managers John and Helen Rickertt show me John's photographs of the property on display in the homestead. One in particular catches my eye: a flood front. Taken from the air, the photograph clearly shows the line of water—the 'front' of the flood—making its way down the dry network of channels of the Cooper and across the floodplain. Such an image is only possible in an ephemeral river. This photograph marks the transformation from dry to wet.

Helen Rickertt recalls images of huge cracks in the mud. When the river is coming down you can watch the water flowing between the cracks beneath you. She tells me the kids used to love jumping from one section to another. They would love watching where the water would come up above ground between the cracks. The patterns created by water's variability have an important place in people's family life and memories and shape people's experiences of place (H. Rickertt 5.03).

For people living in this country, the patterns of water's variability affect family life. Variability shapes social events (also Gill pers. com.). Sharon Oldfield describes the coming of rain and its effects on her family life:

it's like it's a cleanser. Especially if it's been a bit dry, it's been a few months and you haven't had rain and everything sort of looks a little grey, and the dust is flying up and stuff. And after the rain you go out in the morning and everything's clean and sparkling, ... the kids are happy, everyone's happy ... The kids say 'is the creek running? The yabbies are out there, the crabs are out there', 'we'll be able to crab, and catch the good fish ... we can put the canoe in'. And when the waterhole's getting drier and drier and drier and drier and we have to start carting water, we're all going 'oh this is bad, the waterhole's just about dried up', ... Makes a big difference. Water makes a huge difference (Oldfield 4.03).

Birdsville artist Wolfgang John describes attempting to navigate his boat among trees during big floods. He knows this country well when it is dry. The water is disorienting, the tracks are hard to find. Later he tied pink survey tape in tree-tops to help him find his way during the next flood. I asked Wolfgang how the patterns of wet and dry affect his painting.

I have a lot of trouble with the wet. I mean there are some times when the whole country is green and underwater. It's unusual. I'm more here for the desert up here, you know? I have trouble painting that, to make it plausible—people don't believe it. For one thing, the Goyder Lagoon was flooding for two years; it was underwater. It slowly recedes, the water ... it dried up and I went down there ... I was driving on a purple road. A flower came out called *Mimulus prostratus*. I'll show you a photo. It's unbelievable; the whole country was purple (John 4.03).

Water in the desert presents surprises for Wolfgang John, and for the people who view his art. The patterns formed by water's variability are a point of fascination and wonder. The patterns people describe emerge in specific times and places that they know, and shape their life experiences.

Tourists are attracted to water sites (Schmiechen 2004), and variability affects their interactions with place. They come to see ephemeral wetlands such as Coongie Lakes, and bird life attracted to occasional water in Lake Eyre. Tourist numbers increase dramatically during wet times (Figure 6.2). Jimmy Crombie, a Wangkangurru man from Birdsville, takes tourists out into the Simpson Desert and teaches them about Country. He thinks tourists are 'pretty good—really great. And they're getting better ... tourists have the attitude "keep Australia clean", and they do' (field notes, J. Crombie 5.03). Don and Lyn Rowlands, also from Birdsville, agree that tourists are 'pretty good'. Don Rowlands believes it would be better with centralised tourist operators who would know what areas to visit at what times (field notes, Rowlands 4.03). Others think the lack of understanding of place is a major problem. Tourists want to visit water places when water is present to see the bird life, desert flowers, and the water itself, but this is often the most difficult time to travel; rain and flood often make roads impassable. At Clifton Hills Station, tourists and bird-watchers

Figure 6.2 Sign in Marree advertising scenic flights over Lake Eyre. The presence of water is used as an additional attraction. April 2003.

are attracted to Kooncheri waterhole, the Warburton Road and Walkers Crossing. Peter Weston, property manager of Clifton Hills, explains:

Tourists will phone from 5am to 10pm. People will phone 12 months in advance to find out about the roads. There is a real ignorance. If they're told the road is closed they will go anyway. Individual incidents cause the real problem. The majority of people are more educated. But some of the tourists really have a lack of understanding about the country (field notes, Weston 5.03).

Sharon Oldfield shares Peter Weston's concern about tourists' lack of understanding of the country. She tells me that a large percentage of tourists don't have a 'working understanding of the water resources in this area' (Oldfield 4.03). An understanding of water becomes important in the context of growing tourism in the region, and increasing impacts on water resources.

However, ignorance is not solely the domain of tourists. Local knowledge does not guarantee behaviour that demonstrates understanding of country. One of Jimmy Crombie's major concerns is over-fishing in the waterhole on the Diamantina River at Birdsville. It is a particular concern in drier times when the river's waterholes are disconnected so the fish cannot come from upstream and fill them up. He says 'the tourists don't really fish. The locals are over-fishing' (field notes, J. Crombie 4.03).

Water's patterns influence social practice. People value their lifestyle and livelihood. Water is valued for its role in giving pattern to life. The proposal for a major cotton irrigation project at Currareva threatened that. The proposal was inconsistent with variability as cotton irrigation requires a permanent, reliable water supply (Kingsford *et al.* 1998: 361). As detailed in chapter 4, pastoralists, Aboriginal people and scientists living and working in the Lake Eyre Basin opposed the proposal on the basis that a major irrigation development would damage the river system. David Noonan, of the Australian Conservation Foundation, describes the support city people offered to the campaign (field notes 9.02). Despite distance and unfamiliarity, they believed irrigation would destroy landscape and livelihood by disrupting the river's variability. Elsewhere, similar stories can be heard. In her account of cultural impacts of intensive irrigation on the Darling River floodplain, Heather Goodall contends 'The flow of waters is the basis of the order which [pastoralists]

bring to working their properties, it is the foundation on which they have built their social, financial and political structures' (2002: 43). She goes on:

The irregularity of flow and the occurrence of flooding, to which not only fish and aquatic and land plants but also the grazing industry are adapted, is not seen as holding any order at all for the cotton industry. The irrigators have set about imposing a new pattern to water flows (2002: 43).

People objected to the Currareva proposal because it would compromise the variability of the river. But the irrigation proposal at Currareva did more than threaten livelihoods by taking away water that could otherwise have been put to productive use. It also threatened to affect the river's variability, which gives patterns to place and to the lives of people and non-humans.

Reliable waters

While many people living and working in the Lake Eyre Basin value variability, it is only one aspect of water that is valued. Another is reliability. While people express value for the specific variability and the patterns of rainfall and river flow in the places they know, both people and industry are dependent on water. Water is essential for all life, it is vital for personal wellbeing, and it is central to the industries in the Basin. In dry and changeable country, variability is not universally valued. Artesian bores feature prominently in the landscapes of the Lake Eyre Basin. The towns of Birdsville and Marree rely on artesian bores; Windorah, Jundah, Stonehenge and Longreach rely on river water from Cooper's Creek and its tributary, the Thomson River (Scott 5.03). Each station I visited has at least one artesian bore for watering stock; many use bore water or river water, if available, for domestic purposes, reserving precious rainwater for drinking.

Figure 6.3 J.D. Jansen beside bore water pool at camping ground, Strzelecki Track. May 2003.

Bores, boredrains and boredrain wetlands have become 'permanent' or reliable water places, which tourists and local people alike have come to value (Figure 6.3). Several pastoralists I spoke with suggested that the wetland on their property has 'ecological significance' because birds and other 'wildlife' can be found there. It is interesting to hear the use of scientific language, particularly at a time when arid zone and aquatic ecologists are discussing the notion of the ecological significance of Great Artesian Basin wetlands. While it is widely recognised that plant and animal life is concentrated at these waters, the 'ecological significance' of the sites is disputed (eg. CERM 2002).

The use of scientific language to talk about water places may reflect people's efforts to protect the values they associate with boredrains at a time when there is little alternative language for, or opportunity to speak about, values that are not market-driven, and when economic values are widely perceived to be the most powerful in natural resource

management. Environmental and ecological values have also gained currency in natural resource management and policy circles. I suggest that the language of science may be working as a surrogate for expressing social, cultural or ethical values in this context. The current bore-capping project reveals values beyond utility; while a capped and controlled bore fulfils the requirements for stock and domestic water supply, opposition to bore-capping is expressed in terms of social values and potential or perceived environmental values associated with bores and wetlands.

6.4.2 Water's values are characterised by variability

The range of ways in which people living and working in the Lake Eyre Basin value water is marked by variability. Values are diverse between individuals, and between people who hold different worldviews. Water has value in and of itself, independent of human needs and desires (O'Neill 1992), and it has value to non-humans. Values change over time and across space. They are complex, and often uncertain, contested or in conflict. One important aspect of this complexity is that values are interconnected, not fitting neatly into prescribed categories. The existence of a variability of values is currently not adequately acknowledged in natural resource management strategies for valuing water. Water as a commodity—as illustrated by CoAG water reforms (chapter 3), the Lake Eyre Basin Ministerial Forum (chapter 5) and ecosystem service valuation (chapter 5)—is only one perspective on water, yet it dominates water management discourse and practice. While 'social' and 'cultural' values are ostensibly included in these strategies, my research demonstrates that people in the Lake Eyre Basin do not think that they are adequately represented.

People in the Lake Eyre Basin recognise that current natural resource management strategies do not capture the variability of values associated with water. Sharon Oldfield speaks about the inability of natural resource management policy to incorporate intangible values—those not easily categorised as economic or environmental—associated with water.

Despite the triple-bottom-line, economic values are privileged over others:

government policy can't cope with things that aren't tangible. I mean how do you write government policy about something somebody feels? How do you do that? And then take it to cabinet and want funding for it. I mean how do you argue that? How do you get a government bureaucrat to go down there and stand and argue how I feel about having water in my waterhole? And how I feel about when it rains. And how a bloke can stand up and say 'hey, the station's just blown away, it's just destroyed, but my god, if we'd got three inches of rain it wouldn't be anywhere near as bad'? How do you explain that to someone? 'We had 60 miserable points of rain. Bloody cyclone, blew half the station away, but if we'd had three inches it wouldn't be anywhere near as bad' (Oldfield 4.03).

Current natural resource management strategies capture only a partial understanding of such values associated with water.

Having explored the variability of water itself and the ways in which that variability is valued, I now consider the variability of the values associated with water. Again, I do so by drawing on my fieldwork in the Lake Eyre Basin and a multidisciplinary body of literature concerned with place and human relationships with the non-human world. While not a discrete body of literature, this work shares an assumption that places, meanings and worldviews are: 1. diverse; 2. changing; and 3. complex. I discuss each of these in turn in this section, bringing the literature and my fieldwork into conversation.

Diverse values

Dominant natural resource management practice seeks to incorporate diversity to the extent that multiple ‘stakeholders’—ostensibly holding diverse values—are frequently ‘consulted’. ‘Consultation’ varies in extent and nature. For example, stakeholders may be consulted for comment on policy, or they may be closely involved in ongoing processes, such as the Lake Eyre Basin Coordinating Group. The theme of diversity is also represented by a range of values described in management documents, such as ‘recreation value’, ‘Aboriginal heritage value’ and ‘aesthetic value’ (as discussed in chapter 5). Yet these interpretations of diversity often fail to address the diversity of meanings and worldviews that underlie the categories.

In my field research I learnt that values associated with water in the Lake Eyre Basin are diverse. Water is used for a range of purposes, in a range of ways, and so attracts a diversity of meanings. The people I have interviewed have diverse backgrounds, histories and livelihoods. Some people have lived in the Lake Eyre Basin all their lives, others moved to the Basin for work or love, others visit the Basin infrequently, studying or dreaming about it from afar. People’s values are as diverse as their histories.

The nature of ‘place’—its meanings and interpretations—provides fertile ground for a multitude of studies within the discipline of human geography and outside it. The concept of ‘meanings of place’, or ‘senses of place’, asserts that places are not static physical locations to be objectively described from a single, authorised perspective (Gibbs 2003: 18). Rather, they are rich in meaning and culturally specific knowledge; they are sites of power and conflict; they are multiple, simultaneous, contested, changing, subtle and uncertain.

The humanist geographers of the 1970s, including Yi-Fu Tuan, conceptualised place as being subjectively defined. Tuan used the terms *topophilia* and *topophobia* to refer to the desires and fears people associate with specific places (Tuan 1974). Since that early recognition and expression of the subjectivity of place, discourses of place have been as diverse as the meanings of place that they seek to explore. Human geographers—from multiple theoretical traditions—have focused on the relational and contingent, multiple, contested, fluid and uncertain character of place. For Doreen Massey place is a locus of complex intersections and outcomes of power geometries that operate across many spatial scales, from the body to the global (Hubbard *et al.* 2004). Considering Lake Eyre Basin places in this way provides a framework for understanding the diversity of meanings of place.

In the Australian context, Lesley Instone presents a vivid image of the existence of multiple, simultaneous meanings of place in the deserts of central Australia:

On the road between Alice Springs and Tennant Creek the notion of an unfixed and multiple landscape was all too apparent. Here was the harsh and empty land of the explorers, the homelands of Aboriginal peoples, the wilderness of contemporary environmentalism, and the economic landscape of cattle country. And the role of the traveller in ‘making’ the landscape through which they travel further diversifies the country (2004: 134).

Within geography, analyses of the sources of difference in meanings of place relate to factors including (but by no means limited to): gender (eg. Haraway 1991; G. Rose 1993, 1997; Massey 1994); race (eg. hooks 1990; Anderson 1991, 2001); class (eg. Massey 1984; Harvey 1996); colonialism (eg. Said 1978; Watts 1983; Jacobs 1996); and indigeneity (eg. Jacobs 1996; Head 2000; Howitt 2001; Howitt & Suchet-Pearson 2003; Castree 2004;

Jackson 2004; Jackson *et al.* 2005). The latter two themes—colonialism and indigeneity—have particular significance for colonised nations such as Australia, where points of difference in meanings of place are often stark.

Different meanings of place also emerge from diverse worldviews that exist simultaneously.

‘Worldview’ refers to an outlook upon the universe that is characteristic of a people.

According to Kalu:

People ... construct a world order, with a certain rhythm, in order to explain, predict, and control life situations in their ecosystems. This view of the world is a mental construct that empowers peoples’ actions and endows both rhythm and meaning to life processes. It is the foundation of customs, social norms, and law. Worldviews are embedded in the people’s experience and then expressed or re-enacted in their cultures (2001: 228-229).

According to Redfield, *worldview* ‘differs from culture, ethos, mode of thought, and national character’:

While ‘national character’ refers to the way these people look to the outsider looking in on them, ‘world view’ refers to the way the world looks to that people looking out. Of all that is connoted by ‘culture’, ‘world view’ attends especially to the way a man, in a particular society, sees himself in relation to all else (Redfield, cited in Hallowell 2002: 19).

The difference between the worldviews of Aboriginal and non-Aboriginal Australians may provide the clearest example of diversity, but all peoples hold worldviews, which are influenced by their culture and history, and in turn influence their perspectives, attitudes, expectations, actions and values.

During my fieldwork, many people talked to me about the values of water to humans and to non-humans. Some spoke of the values of water to cattle, dependent on drinking water delivered by the river to waterholes or by pipes to troughs; others spoke of the value of water to fish reliant on floods to recharge and refresh waterholes; others spoke of the value of water to migratory birds dependent on semi-permanent lakes for recuperation during long migrations, or as breeding grounds. All expressed concern about the non-human-beings with whom they share place.

While the status of non-humans and relationships between human and non-human beings and place has long been a major focus of the discipline of anthropology—through studies of hunting, totemism, kinship and worldview—the status of non-human animals has elicited far less discussion in geography until recently. Noel Castree asserts that ‘in a cognitive and political sense, the “otherness” of the non-human has barely featured in the research of contemporary geographers’ (2003: 207). According to Wolch *et al.* (2003) animal geographies have been an active but small part of geography since the first part of the twentieth century. Early research followed one of two strands: zoögeography, which focused on animal distribution and contributed to the emerging science of ecology; or animal cultural geography, which focused on animal domestication.

The 1990s saw a revival of animal geographies, that was inspired by practical and theoretical concerns: ‘Growing concern about environmental degradation, habitat loss and species endangerment, and the plight of animals relegated to the killing zones of shelter, lab, factory farm and slaughterhouse, served as central contexts motivating a renewed focus on animals’ (Wolch *et al.* 2003: 187). These practical concerns were coupled with theoretical ones, in particular ‘the encounter between human geography and social theory, cultural studies, selected natural sciences and environmental ethics’, and fundamental questions

emerging from this nexus regarding the rethinking of culture and subjectivity (Wolch *et al.* 2003: 187). The emerging field of the new *animal geographies* (Anderson 1995, 1997; Whatmore & Thorne 1998; Wolch & Emel 1998; Philo 1995; Philo & Wilbert 2000; Suchet 2001, 2002; Whatmore 2002; Wolch *et al.* 2003 *inter alia*) shifts the analysis of place in academic '*human* geography' from the human to include non-humans (Philo 1995: 655). It is concerned with questions of animal subjectivity and agency, the role of animals in place-making, and the role of animals in the moral landscape (Wolch *et al.* 2003: 189). This discourse opens possibilities for non-anthropocentric thinking about meanings and values associated with places, including water places. Animal geographies challenge persistent binaries of nature/culture and human/non-human. The sub-discipline questions constructions of nature as separate, external and pure. It considers the concepts of sentience, ethical responsibility and the 'other', and it investigates multiple ways of understanding nature—in particular, relationships between humans and non-humans. In this way animal geographies presents an avenue for better understanding places in the Lake Eyre Basin, and elsewhere, that acknowledges a diversity of living things, and challenges the anthropocentrism of current water resource management approaches.

Embracing diversity requires concern for the 'other'—other humans and non-humans.

Cultural theorist Stephen Muecke argues:

Concern for the other necessarily means openness to different kinds of 'logic'. If listeners perceive what they think are 'contradictions' in Aboriginal discourses, hearing a voice composing an argument in which the premises shift and change so that the logic appears not to hold, then these shifts can also be read as the workings of cultural difference. These could be responses to a logic based on environmental variability, on shifting relations (1999: 51).

Embracing diverse meanings, values and worldviews leads to an openness to other ways of knowing the world, and enables natural resource managers to look beyond a narrow worldview of resource management, and imagine new, more sustainable and just ways of living with water.

Changing values

In the short time-scales of much natural resource management policy and practice, change is often overlooked. Adaptive management (Walters & Hilborn 1978), which is gaining popularity in ecology and discourses of natural resource management, explicitly seeks to incorporate change into management. But where natural resource management considers *value*, values are predominantly represented as static.

Change in values is manifested at multiple temporal scales; values associated with water vary seasonally and historically. Seasonal change is illustrated by water's patterns. Historical change is demonstrated by broader social processes of changing understandings and attitudes and social movements, as discussed in chapters 3 and 4. In the context of Australia and other settler societies (and in different ways, *colonising* societies) colonisation is an important agent of change.

Artesian waters provide a salient illustration of changing human relationships with water places. These water sites are variously known as 'boredrains', 'bore drain wetlands', 'artificial wetlands', and 'GAB wetlands' (or 'Great Artesian Basin wetlands'). The use of language is significant; it reveals changing attitudes to these water sites. The addition of the term 'wetlands' to boredrains indicates a new meaning: no longer is this simply the place where a bore drains; it has gained the positive connotations of the 'wetland', established over the

last three decades. The Ramsar Wetlands Conference held in 1974 was instrumental in this shift towards positive valuing of wetlands, and away from the language of the 'swamp' and all of its negative connotations (Giblett 1996). The more recent biodiversity conservation movement has continued the positive association with wetlands (see Soulé 1985). Changing water regimes have created new water places, and thus new meanings which have been influenced by broader social processes. Places that were once waterless are now visited by humans and other animals as 'oases' in the desert.

The presence or absence, drilling or capping of a bore affects the surrounding landscape and ecology, and human way of life. Don and Lyn Rowlands recount some of the changes that took place in Birdsville when the bore was drilled in 1965:

Before the bore was drilled all water had to be carted from the river. You had to manage it. Very little water was wasted. What you carted you used for drinking, cooking, and bathing. If there were 5 kids they'd all use the same water. When you carted your water you set your own restriction: how much you wanted to cart. A 200 litre drum would last you a week. The river wouldn't suffer from that sort of extraction; you couldn't cart that much. Carting water was fun. As kids we didn't have toys, so carting water with a wheelbarrow was fun. A lot of bathing would happen in the river (field notes, Rowlands 4.03).

Once the bore was drilled, people no longer carted water from the river, and people's relationships with the river changed, as did their attitudes to water. Lyn Rowlands told me that: 'In Longreach they had water restrictions over summer. Birdsville didn't have anything, because of that bore. Some people in town didn't want those water restrictions. They say "we pay our rates, where's our water?"' (field notes, Rowlands 4.03). The bore has changed people's practices of water use and their attitudes towards water, in a place

where water is variable. People are relating less to the specificity and variability of local water and more to water as a generic resource.

Much of the work that is influential in my research considers the historic and ongoing processes of colonisation in its varied and subtle forms. Colonisation dramatically impacts on peoples' relationships with place, often with devastating effects. Meanings of place, knowledge systems intimately connected to place, and ways of knowing and being in the world, are changed dramatically for both the colonised and the coloniser, through processes of displacement, dispossession, invasion, migration and settlement. Postcolonial theory presents a framework for thinking about the ways that meanings, worldviews and values undergo complex and varied change over time.

Luise Hercus writes of the implications of displacement from Country for the Wangkangurru of the Simpson Desert, in the Lake Eyre Basin:

one of the first effects of white occupation was the abandonment of the prohibitions regarding entry into other people's country. There was large scale migration in the Lake Eyre Basin. Wangkangurru people left their country altogether, and people from throughout the area congregated at Killalpaninna, and to a lesser extent at Marree and at Andrewilla in Yarluyandi country south of Birdsville. This meant that people became dissociated from their own 'country' and hence from their History (Hercus 1989: 113).

The term 'History' here refers to the Dreamings and creation stories that form landscapes, determine relationships, kinship and law, and in so doing, form meanings and worldviews. For the Wangkangurru, and other groups of the Lake Eyre region, colonial displacement had devastating effects for people's knowledge of place, language and ways of knowing and

being in the world. Social and cultural practice underwent dramatic change as a result of this dissociation from Country and History.

Colonialism is not simply an historical or singular event. Its legacy is ongoing, and its complex processes are continuing. Many peoples and places around the globe face ongoing colonisation. Indigenous peoples in particular experience continuing displacement, dispossession and marginalisation that are colonial in character. Specific manifestations of colonialism vary across time and space, but hegemonic Western systems of production, governance and thinking maintain, reinforce and renew processes of colonisation (Gibbs 2003: 17).

Deborah Bird Rose uses the term 'deep colonizing' to describe one aspect of ongoing colonialism, and to 'communicate some complex ideas about our contemporary period':

While it is demonstrably the case that many formal relations between Indigenous people and the nation-states that encompass them have changed in recent decades, as have many of the institutions which regulate these relations, it is also the case that practices of colonization are very much with us. In Australia, as in other settler societies, many of these practices are embedded in the institutions that are meant to reverse processes of colonization. Colonizing practices embedded within decolonizing institutions must not be understood simply as negligible side effects of essentially benign endeavours. This embeddedness may conceal, naturalize, or marginalize continuing colonizing practices (1999: 182).

In my previous research in Western Australia, I explore the interface between decolonising processes and deep colonising (Gibbs 2003). I use Rose's term 'deep colonising' to refer to efforts to address impacts of colonisation that, irrespective of intent, serve to perpetuate or

further entrench patterns of marginalisation and relationships of domination established in early stages of colonisation. I describe this interface as a tension, rather than a progression or dichotomy. Actions *intended* to decolonise may not be easily categorised as either decolonising or deep colonising; that which is decolonising for one person or group may be deep colonising for others. At Placer Dome's Granny Smith gold mine in the eastern goldfields of Western Australia, 'cross-cultural awareness workshops' aim to foster cultural understanding in the workplace by exploring the complex historical and contemporary cultural context that provides the setting for the company's mining activities. Several company employees spoke very positively about their experiences of the workshops. However, members of the local Wongatha Wonganarra Aboriginal Corporation have criticised the workshops for not involving local people, thus further entrenching the disempowerment and dispossession inherent in the colonial relationship (Gibbs 2003). Effects of colonisation change over time and through space; outcomes are subject to locally specific conditions, and carry unique implications.

Colonisation affects change for both the colonised and the coloniser, and processes of colonisation are ongoing, affecting continual change. Historian Peter Read considers the complex notion of belonging in a colonised country for the colonisers and their descendents. He asks 'How can we non-Indigenous Australians justify our continuous presence and our love for this country while the Indigenous people remain dispossessed and their history unacknowledged? (Read 2000: 1). Read seeks to learn about the 'emotions and intuitions that are part of a deep belonging' felt by non-Indigenous Australians, and how non-Indigenous Australians place themselves in relation to the Indigenous past and present. In his contemplation, Australia's colonial history plays a central role in meanings of place and sense of belonging. In her analysis of decolonising and ethics, Deborah Bird Rose considers at length the role of responsibility and the 'weight of history' in the colonial

context. She argues: 'A moral engagement between past and present must acknowledge violence, and having done so, must acknowledge the moral burden of that knowledge' (Rose 2004c: 13).

Gelder and Jacobs (1998) describe Australia as having become 'uncanny' to both Aboriginal and non-Aboriginal Australians through processes of colonisation. They use the term 'uncanny' to explore 'one's sense of place in a modern, changing environment'. They describe how 'An "uncanny" experience may occur when one's home is rendered, somehow and in some sense, unfamiliar; one has the experience, in other words, of being in place and "out of place" simultaneously' (Gelder & Jacobs 1998: 23). The 'unfamiliar familiarity' explored by Gelder and Jacobs is not unique to contemporary Australia (1998: 25); however, Australia's colonial history provides fertile ground on which to explore the subtleties of colonial relationships. Gelder and Jacobs take this 'unsettlement' as 'a productive feature of the postcolonial landscape':

It incites discourses and counter-discourses; it produces alignments and realignments; most of all, it reminds us that (whether we like it or not) 'all of us' are implicated to greater or lesser degrees in this modern predicament. In other words, we want to give unsettlement an activating function (1998: xvi).

Colonisation also has significant impacts on landscape, the non-human world and place. According to Rose 'Settler societies are built on a dual war: a war against Nature and a war against the natives. Each has been devastating' (2004c: 34). In Australia, and elsewhere, colonial expansionism and development has set in train institutions and patterns of interaction between people, place, and the non-human world (as discussed in chapter 3). In ecological terms, control and domination of land and water has dramatically altered habitat

for humans and non-humans alike. In her book *Second Nature*, Lesley Head explores 'the history and implications of Australia as Aboriginal landscape' (2000b). She argues that:

The colonial heritage is more deeply embedded in contemporary environmental attitudes and debates than we have acknowledged; many of our own attitudes can be shown to derive from exactly the same dualistic cultural history for which we berate our forefathers. If *terra nullius* (land belonging to no one) was a myth to be discarded in discussions of the ownership of the continent, then it must be similarly discarded when we create and preserve landscapes (2000b: 6).

Environmental historian George Main contends that: 'Since the beginning of British colonisation, settler efforts to master dynamic rural terrains blocked close learning. Powerful relationships tend to be monological. Understanding does not easily flow both ways' (2004). Drawing on his research in the agricultural country of the south-western slopes of New South Wales, he goes on to say:

Responses to dryland salinity often demonise the salinisation process itself. Attention is directed away from causes: the industrial farming practices and global economic dynamics straining rural places. Responses focused on symptoms shield the dominant model of primary production and agricultural trade from critique (Main 2004).

Complex values: interconnected, living and life-giving waters

In their critique of contested waters, Sneddon *et al.* consider the connectivity of water in ecological and social systems:

Water is unique in the ways it supports, links, and is embedded within complex networks of physical and ecological processes, and in the ways it is configured and

reconfigured through political, discursive, economic, and technological processes. It is arguably the most salient element of connectivity in the local to planetary continuum of ecological and social systems. Yet despite the universal characteristics of water, the precise path of its transformation and use by human societies is highly contingent on historical and geographical context (2002: 664).

In an effort to develop achievable management goals, and to fit the world into the confines of natural resource management discourse and practice, complex systems and processes, meanings and values are often over-simplified. There is an important role in certain circumstances for reduction of complexity to an essence. For example, aggregated figures of water consumption for a cattle property over a given time period *may* be more useful, for the purpose of determining a station's water needs, than the precise amounts consumed by each animal, each day. However, this process of reduction is damaging when it is undertaken inappropriately, and when it marginalises important aspects of complexity. In current natural resource management practice, value is frequently reduced in a manner that marginalises particular individuals and groups, meanings and significances (as discussed in chapters 4 & 5).

In the Lake Eyre Basin the complexity of water and value includes diversity and change, the specificity of place, patterns that emerge in place, and apparent contradictions such as the paradox of people valuing both variability and reliability simultaneously. In this research I have found that a crucial aspect of the complexity of values and water, currently marginalised in natural resource management, is interconnection. Interconnection can be seen in two ways. Firstly, established categories of meaning and value are not discrete—as they are so often presented—but interconnected. Secondly, water is connected with the rest of the world. Ignoring these interconnections erroneously simplifies values,

marginalises humans and non-humans alike, and denies the living and life-giving qualities of water.

In my interviews I asked people about water and what it means to them. I came to understand that meanings are interconnected; what people value about water crosses the established categories of value described in sustainable development discourse and reinscribed at the Birdsville meeting. At the simplest level, water is valued for its uses: watering stock, drinking, washing, fishing, to cool down in summer. Even at this level, something more than utility is elucidated: 'to cool down in summer' is about a state of mind as well as body temperature; 'fishing' is a pastime and social occasion as well as a means of obtaining food.

I quickly came to learn that water isn't just water. River water, rain water, bore water, all have different values, and at a more subtle level, in-channel flow and overland flow; soaking rain, light steady rain and follow up rain; Mungerannie bore water and South Galway¹ bore water, all have different values (Figures 6.4 & 6.5). This level of description of water in the Lake Eyre Basin reveals connections between water, place, temporality, scale, change, difference and the intimate locally specific knowledge of water and its affects held by people in the Basin. Rainfall and river flow have dramatic social effects. I was told in one interview that 'if it's dark outside and you walk into a pub you'll know if it's good times or bad' (field notes, Rowlands 4.03). In another, that government employees engaging in community consultation have been told 'if it hasn't rained, don't go' (field

¹ Mungerannie and South Galway are two pastoral properties in the south-eastern Lake Eyre Basin. The quality of the drinking water from the two bores differs dramatically. Mungerannie is also the location of the pub on the Birdsville Track between Marree and Birdsville, next to which is a boredrain wetland and a 'spa' (see Figure 6.5).

Figure 6.4 Marked river water tap, Birdsville. April 2003.

Figure 6.5 The ‘spa’ beside Mungerannie pub and the boredrain wetland beyond are fed by a hot artesian bore. This water place is valued highly by tourists and local people. While staying at Mungerannie I was struck by the strong sulphurous smell of the bore water, and preferred to use other water for drinking. In contrast, bores in other parts of the Basin—such as the house bore at South Galway—provide good drinking water for human consumption.

notes, Leek 4.03; field notes, Brake 4.03). Water is tied up with local histories, local cultures and local states of mind. Water is essential for pastoralism—not just for the economic benefit brought by flow and feed, but for pastoral and family way of life, history and culture.

The values people in the Lake Eyre Basin describe do not readily fit into the framework of the triple-bottom-line. While the triple-bottom-line creates categories of economic, environmental and social value, people value water in complex ways that cross over these categories. Sharon Oldfield tells me ‘Social or moral commitment requires economic commitment; you can’t separate them’ (fieldnotes, Oldfield 4.03). According to Reg Dodd ‘You can’t separate land from people. They are one’ (field notes, Dodd 5.03).

Sue Jackson contends, of Aboriginal cultural values, ‘Cultural values cannot easily be separated from other social values of a landscape or riparian environment. The cultural element relates to a distinctive and preferred way of life of a group or groups of people’ (2004: 20). My research shows that Jackson’s observation of the inseparability of values applies to both Aboriginal and non-Aboriginal people, and that *all* values (those commonly labelled social, cultural, economic, environmental) are interconnected.

A more holistic approach to valuing water would nurture more nuanced understandings of value and water. In addition to interconnections between the established categories of value (as discussed elsewhere, including chapter 5, section 5.5.2), water is interconnected in the world, and this interconnection imbues water with living and life-giving qualities. In her analysis of the cotton industry and river communities on the black soil plains of northern New South Wales, historian Heather Goodall asserts:

The cotton industry does need the river's water but it does not believe it needs all the additional elements of the river, its biota and its silt, which simply clog up the pumps and filters. ... So flow and its silt and biota are now separable, and the old order of replenishment of pastures on the black soil has been undermined (2002: 44).

If water's interconnections in the world are valued, destructive practices and processes of separation are no longer possible, and the specific interconnections that characterise, form and reform particular places are prioritised.

In order to explore the ways that water is interconnected in the world I draw on three concepts: the Australian Aboriginal concept of 'Country', social nature, and an ecosystem approach.

Country

In her book *Nourishing Terrains: Australian Aboriginal views of landscape and wilderness* (1996), Deborah Bird Rose describes 'country' in the following way:

Country is not a generalised or undifferentiated type of place, such as one might indicate with terms like 'spending a day in the country' or 'going up the country'. Rather, country is a living entity with a yesterday, today and tomorrow, with a consciousness, and a will towards life. Because of this richness, country is home, and peace; nourishment for body, mind, and spirit; heart's ease (1996: 7).

Rose uses Levinas' term to describe one's 'country' as a 'nourishing terrain': 'a place that gives and receives life'. Australian Aboriginal ontologies incorporate humans, non-human animals, other living and non-living sentient and non-sentient beings, spirits and Dreamings, in dynamic interrelations that are vastly different to Eurocentric and scientific

ways of knowing and categorising the world. Rose describes this as a 'non-human-being-centred' view of the cosmos (1992). Listening to and learning from Aboriginal people provides opportunities to challenge dominant and oppressive worldviews, and begin to understand the diverse, changing, complex and interconnected nature of meanings and ontologies.

Developing an understanding of country—a fundamental concept in Aboriginal Australia—requires acceptance of epistemological and ontological multiplicity. Howitt and Suchet-Pearson describe ontologies as 'ways of knowing, being-in-place and relating to complex, often contested cultural landscapes at various scales' (2003: 557). In Aboriginal English, 'country' challenges some often taken-for-granted assumptions about relationships in the world. Binaries that have become entrenched in western thought through Enlightenment thinking and Judeo-Christian beliefs, such as nature/culture, mind/body, man/woman, living/dead, and past/future, are revealed as ontological assumptions. 'Country' challenges established knowledge about sentience, agency, and responsibility toward others; 'others' include humans and non-humans, sentient and non-sentient beings.

Boundaries between categories such as human/animal are artefacts of Eurocentric knowledges—knowledges that Suchet suggests are 'strongly influenced by Enlightenment science, industrial revolution technologies, Judeo-Christian beliefs, European philosophical traditions and dominant academic approaches to the construction of knowledges' (2002: 141). Drawing on her work with the Aboriginal community at Napranum on the Cape York Peninsula, she elaborates:

Through the Dreaming, Aboriginal people know that specific animal species and humans were, are and will be interrelated at personal and social scales. Distinct,

external boundaries are breached as Dreaming stories inform a responsibility to country based on a common heritage and kinship (Suchet 2002: 144-145).

In Suchet's ethnographic work, Napranum elders explain: 'Animals, they're related to us ... Animals were human before' (Napranum elders quoted in Suchet 2002: 144-145).

In her critique of wildlife management, Suchet questions taken-for-granted categories:

Specified boundaries and external relationships do not naturally occur between culture and nature, humans and animals. People make meaning in multiple, shifting ways depending on context, focus and position. Constructing complex worlds as culture and nature, human and animal, is not universal, true or 'natural' but is particular to Eurocentric knowledges. For those trapped in a universalising framework, acknowledging this specificity can be challenging and unsettling. However ... the spaces opened up by this acknowledgement can also be exciting and transformative (Suchet 2002: 144).

Rose describes how 'for Yarralin and Lingara people [of the Victoria River district of the Northern Territory], all animals are spoken of and treated as moral agents; so too are some natural phenomena such as sun, moon and rain' (1988: 381). Western science defines some animals, rocks, trees and water as non-sentient, producing very different ideas about mutual respect and responsibility to those described by Australian Aboriginal people. In discussing Country and Dreaming creation, Rose states:

In these terrains, consciousness and responsibility are manifested by all the participants in living systems. Subjectivity, in the form of consciousness, agency, morality and law, is part of all forms and sites of life: of non-human species of plants and animals, of powerful beings such as Rainbow Snakes, and of creation

sites, including trees, hills and waterholes. Nourishing Terrains are sentient (1999: 178).

Water has a significant place in Aboriginal ontologies. 'Living water', says Deborah Bird Rose, 'is the term frequently used to describe permanent waters. It conveys the sense of water having its own life, and also of offering life to others' (Rose 2004a: 39). Marcia Langton explains:

These Aboriginal waterscapes are construed not only as physical domains, but also as spiritual, social and jural spaces, according to the same fundamental principles as our affiliations to places in the landscapes. The dialogic relationship in indigenous thought between the ancestral past and its effect on human existence derives from the Aboriginal understanding of the transformative powers of the spiritual beings that inhabit those places. Their legacy to us is both the nature of our being and the nature of our relationship to place, be it a waterscape or a landscape (2002: 44).

In the Lake Eyre Basin, rain water, river water and ground water hold deep significance. Dean Ah Chee is a Senior Ranger with National Parks and Wildlife South Australia; his cultural links are with the Southern Arrente and Pitjantjatjara Yankunytjatjara groups (Ah Chee 2002). He lives and works at Witjira National Park on the western edge of the Simpson Desert, which incorporates the large mound springs complex, Dalhousie Springs. He discusses the significance of this water and water place:

This unique watercourse is now called the Great Artesian Basin but in my language, the main springs, Dalhousie Springs, is known collectively as Irrwanyere or 'the healing spring'. Well before my elders' time, it provided more than just a source of

water for Indigenous people. For it was and remains a travel path, which connects many Indigenous groups within the trail of the GAB and is our Tjukurpa².

We have a holistic approach to water. For this water is a source of healing when we are sick, and it provides us with many spiritual and cultural interests. It is our lifeblood, which we need to survive. It allows us to continue our ceremonies, which incorporate our rich and unique culture that is still strong today. It is these sources of water that provide an adequate and valuable food source rich in fish and other foods for my people. As one of the traditional elders of this country Mr Bingy Lowe says: 'We are in the middle of kwatye (water), it is all around us, we have to look after this place' (Ah Chee 2002: 20).

Research elsewhere in Australia draws attention to the symbolic significance of water to Aboriginal people. Fiona Magowan draws on her work with the Yolngu of north-east Arnhem Land in her writing about *ganma* (2002) and Yolngu sea cosmology (2001). *Ganma* (or 'garma') is the point of mixing of fresh and salt waters. It is also the point of mixing of the two moieties *Yirritja* and *Dhuwa*, the two halves of the Yolngu world into which all things belong. *Ganma* represents the active interrelationships between all things within Yolngu worldview. *Ganma* is more than a physical mixing of waters; 'in the concept of *ganma*, ancestral waters come together as a foaming, frothy substance—the embodiment of new life and ideas' (2002: 18). 'Waters ... are ancestral subjects with their own recognised active agency' (2001: 27). Magowan writes of a senior Yolngu woman's crying-song for her recently deceased uncle:

² The term 'Tjukurpa' does not have a simple English translation, but refers to spiritual connection, law, culture, heritage, and the stories associated with the land. 'It contains the reasons for how and why things such as water, fire and the landscape exist' (Ah Chee 2002: 20).

She was singing his spirit and essence out to sea, to his ancestral waters. The words of her song spoke of the river's rushing floodwaters—of the bubbling, frothing foam that builds as the river rushes towards the sea, eventually mixing with the salt water of the incoming tide in a swirling whirlpool known as *ganma* (or *garma*) (2002: 18).

Magowan describes: 'In her mournful singing, as in all Yolngu songs, there was no clear separation between the environment and the person; waters have moral, social, and spiritual consequences' (2002: 18).

While the concept of Country belongs to Aboriginal Australia, and explains a central aspect of Australian Aboriginal worldview, it has relevance in a far wider context. Lesley Head suggests that the term country is a good starting point in the search for new sustaining and sustainable myths. She asserts that: 'Its multiple meanings flag the many ambiguities that attend the human presence in Australia, and it also provides the ground for a meeting of Aboriginal and non-Aboriginal aspirations' (2000b: 233). In addition to its connotations in Aboriginal English, country signifies 'an affection for the rural' and for the local for many non-Indigenous Australians. A third understanding of country is 'the nation state, and the responsibility of this particular nation state for an entire continent encompassing great bio- and geodiversity'. Head claims: 'Although each of these meanings [of country] is interesting and relevant, it is perhaps the interplay between them that is most important; this very ambiguity prevents any one view becoming authoritarian and ideological' (2000b: 234). The term 'country' alerts us to the established assumptions that inform and structure current natural resource management discourse and practice. The separation and compartmentalisation that characterise natural resource management approaches to valuing water are culturally specific. But more than that, they are artefacts of *one way* of knowing and structuring the world; one way amongst many simultaneously existing ways.

Social nature

Recent discourse of 'social nature' presents a second avenue for examining the interconnections between the ostensibly 'separate' realms of 'nature' and 'culture'. At its core, social nature is concerned with challenging the notion of a nature–society dichotomy. Broadly speaking, social nature considers 'how theory can explain, in practice, the ways nature is (re)constituted and with what social and ecological outcomes' (Braun & Castree 2001: xiii). Social nature as a broad 'plurality of related positions and arguments' (Castree 2001: 2) considers the variety of ways in which society and nature are co-constituted. A social approach to society–nature relations provides a critical perspective on efforts to value nature. It points to the ways nature is transformed through capitalism: 'how capitalism constructs and reconstructs whole landscapes as exchange values under the profit imperative' (Castree & Braun 1998: 8), and how discourse affects thinking and practice towards nature. According to Escobar 'the discourse of biodiversity conservation produced mostly by Northern NGOs and international organizations in the 1990s achieves an important transformation in our consciousness of and practices towards nature' (1996: 58). In these analyses, the separated realms of 'nature' and 'society' are interconnected in self-perpetuating loops of cause and effect; 'nature' and 'society' are interconnected in the sense that they form and reform one another.

According to Instone 'poststructural, cultural themes such as non-linearity, non-closure, fluidity, contingency and multiplicity are also the language of the "new ecology"' (2004: 136). Related to social nature discourse, political ecology is concerned with 'the ways in which resource degradation and conflicts are derived from particular political and economic processes' (Sneddon *et al. in press*). In addition to its primary concerns of power relations and ecological effects of global political economy, Sneddon *et al.* contend that:

Political ecologists also stress the need to take seriously recent insights from ecological theory, particularly those associated with nonlinearity and complexity ... and undertake research that seeks to link a rigorous characterization of ecological transformation to the local, national and global processes (cultural, political-economic) that are driving such changes (*in press*).

While I do not promote an eco-centric—or ‘nature first’—approach (Castree 2001: 3), I argue that looking towards an ecosystem framework presents significant insights into how living things and their surrounds are interconnected. An ecosystem approach provides a third connected avenue for examining water’s interconnections.

An ecosystem approach

Ecology is the study of living organisms and their interactions with their surroundings. An ecosystem approach specifically assumes interconnections between living and non-living things, and examines these interconnections in particular places. In this conceptualisation of interconnected living and non-living things, the ecosystem and each component of it is presumed to be both living and life-giving. Where animal geographies has brought non-human living things into the discourse of meanings and values associated with place, a focus on ecosystems offers further possibilities for non-anthropocentric thinking about place-based interconnections, enabling consideration of living and non-living things, and larger, more complex entities such as ecosystems and ‘Country’.

Landscape ecologist Adrian Manning draws on Uexküll’s (1926) concept of *Umwelt* as a way of understanding complex, multi-faceted landscapes. *Umwelt* is defined as ‘the “phenomenal

world” or “self world” of an organism”³ (Manning *et al.* 2004: 622). Manning *et al.* use this concept to analyse the diversity of perceptions and responses to the environment, or habitat, as experienced by different species. ‘The continua-*Umwelt* approach reflects processes and change through time, while the [dominant] fragmentation model reflects the present and a human-based perception of the landscape’ (2004: 626). Their analysis challenges dominant concepts of habitat fragmentation, in which ‘habitat’ is a static physical reality perceived by humans. Instead, *Umwelt* provides a conceptual framework for recognising the existence of multiple, simultaneous patterns of perception and response to place. Uexküll’s *Umwelt* is gaining renewed attention in the humanities (e.g. Roepstorff *et al.* 2003). For Hornborg, the concept of *Umwelt* illustrates that ‘even for animals the world exists as a meaningful place’ (2003: 102). But these authors expand the concept of *Umwelt* from its roots in theoretical biology, applying it to studies of the subjectivity of human sense of place. Recognition of this subjectivity is a crucial step in developing sustainable and just ways of living with water, and with the world.

While ecology is concerned with living organisms and their surrounds, much ecological research removes humans (intentionally or unintentionally) from the ecosystems they seek to describe. For example, biological conservation efforts focus on conservation areas or reserves (Diamond 1975; Margules & Pressey 2000), from which the intensive and insistent human pursuits of broadscale agriculture, irrigation, land-clearing and construction are often excluded. Human activity within these areas is often limited to management and recreation (which can themselves have significant effects). Despite the dominance of reserve-based research in conservation biology, some ecologists are beginning to incorporate humans and human agency more fully into their studies of ecosystems. The

³ The concept of *Umwelt* was developed by Estonian biologist and semiotician Jakob von Uexküll in his 1926 ‘Theoretical Biology’.

growing focus on conservation outside reserves, or 'conservation in modified landscapes' provides a salient example (Daily 2001; Fischer *et al. in press*). This research recognises the domination of production landscapes, and human dependence on ecosystems, as well as the role biodiversity plays in human wellbeing, and the role humans can play in conserving biodiversity and therefore enhancing the resilience of ecosystems (Fischer *et al. in press*).

Another example of inclusion of humans in ecosystem research includes Daniel Janzen's call to reconceptualise 'wildland nature' as gardens—places that humans might care for and negotiate partnerships with:

The details of constructing any wildland garden—the application of concepts—are guided and frameworked by the details of the site, its ecology, and its society. Fire is a disaster here, essential there. Reintroduction is right here, wrong there. People can walk all over this, stay out of that. Sometimes a scalpel is called for, sometimes a bulldozer. What matters is the goal of wildland survival into perpetuity—the specific actions are place-based, time-based, society-based (1998: 1313).

While Janzen's concept of wildland gardens leaves open a myriad questions about human control and domination over place, it explicitly considers the specificities of place and time—acknowledging variability—and writes humans into the ecosystem, as agents of change and as social context. 'A wilderness' Janzen portends 'faces certain annihilation as a battlefield' (1998: 1313).

Some landscape ecologists are reconceptualizing ecosystems to include a more complex understanding of human agency and the role of humans in ecosystems. Within geography, the discourse of social nature challenges the established binaries of natural/social and nature/culture, and examines the ways in which they are co-constituted. Political ecology examines the ecological effects of global political economy. In the Australian Aboriginal

concept of Country humans are part of a deeply interconnected world comprising humans, and non-human living and non-living, sentient and non-sentient beings. Drawing on these currently disparate but connected discourses—Country, social nature, and ecosystem thinking—valuing variability seeks to develop more nuanced understandings of the ‘value of water’. It moves beyond the universal to the specific, emphasising the significance of particular places and the patterns that shape lives; it offers a framework for incorporating the diversity, change and complexity of values associated with water; and it marks a shift towards understandings based on the interconnected, living and life-giving character of water.

CHAPTER 7

CONCLUSION

7.1 Valuing variability beyond the Lake Eyre Basin

My research demonstrates that values associated with water are subject to change, are diverse and complex, and are place specific. Current hegemonic approaches to valuing water and nature within natural resource management do not adequately capture these complex aspects of either water or of value. As a result, they establish management policies and practices that are culturally specific, anthropocentric, and that reduce the inherent complexity of water and its associated values. Valuing variability presents a framework for thinking about value that overcomes these limitations to valuing water in ways that are appropriately dynamic and multiple.

The framework of valuing variability is significant at multiple scales of what I term a 'nested hierarchy' of discourse and practice. This includes:

1. the Lake Eyre Basin;

2. natural resource management in general (and the project of rethinking natural resource management);
3. discourse of social nature; and
4. discourse and practice of ethics beyond the human world.

I now consider each of these scales in turn, in order to expand the concept of valuing variability within and beyond the Lake Eyre Basin, while not universalising these values.

7.2 The Lake Eyre Basin

To focus on the processes through which local experience is fragmented and absorbed by modernity would be a step toward the protection and resurrection of place.

Hornborg 1994: 264

Place is an essential dimension of the framework of valuing variability that I promote in this thesis. A close study of a particular place is an important element of moving beyond the universalising tendency of much natural resource management practice, which marginalises diverse ways of knowing and living with water. In the Lake Eyre Basin value and variability are interconnected concepts: water's variability is widely valued, and variability characterises values associated with water (as discussed in chapter 6). The framework of valuing variability that I advocate emerges from the specific water places of the Lake Eyre Basin, and from the interplay between this particular place and an interdisciplinary place-based literature.

People living in the Lake Eyre Basin are actively involved in 'managing' water 'resources'. They also live with water and its variability. While current efforts within natural resource

management are unable to fully capture the values associated with water in the Lake Eyre Basin, people living in the Basin think about water, the values associated with water and water places, and they consider how these values might be better acknowledged.

Valuing variability provides an approach for acknowledging the diverse, changing and complex values associated with water in the Lake Eyre Basin. It presents a challenge to narrow and limiting categories such as 'water for making a living', 'water for wildlife and nature conservation' and 'water for society and culture', as established at the Lake Eyre Basin Ministerial Forum held in Birdsville in October 2002. By prioritising diversity, change and complexity, valuing variability encourages genuine incorporation of diverse values, including those marginalised by current management structures. It acknowledges changing values that come with new understandings of water, such as new scientific knowledge, new attitudes to 'flood' and 'drought', and new priorities for listening to and learning from others that are increasingly a part of natural resource management discourse and practice (as discussed in chapter 3 & 4). Rather than forcing complex and interconnected values into prescribed categories, valuing variability fosters understandings of specific local values.

The knowledge and ideas that emerge from the people of the Lake Eyre Basin must be central to the process of developing more just and sustainable ways of living with water. Values associated with water are particular to place, and as such it is vital that the specificities of place are part of any process of identifying values. This involves the people in a place having a part in the process. During this research I have listened carefully to people in the Lake Eyre Basin, and listening has contributed significantly to my learning and understanding of Lake Eyre Basin waters. In turn, I hope this study of specific waters will contribute to developing new ways of living with water that are driven by the specific waters and associated values in the Basin.

Several people I interviewed during this research articulated the importance of listening.

We can come back to the age-old banner-waving thing, you know, listen to the community, consult with the community, which is wearing pretty thin. It's one thing to do that, it's another thing to listen, it's another thing to utilise the information. It's another thing to realise that the community is vastly under-resourced, under-staffed, vast distances to cover. Assistance possibly would help in people getting there and all the rest of it, but it's still a lot of time. It's a huge amount of commitment (Oldfield 4.03).

Under the current natural resource management regime, the required investment of time and commitment is not rewarded by an adaptive management process. A number of people told me that they do not participate in management processes because, while some natural resource managers will listen to different perspectives, often 'they've already got it worked out' (field notes, Weston 4.03), or 'in the end they'll do what they want' (field notes, McEntee 4.03).

During this research many people spoke to me about the limitations of current management strategies, and how the values they associate with water might be better acknowledged. While people have ideas about water and how natural resource management might better acknowledge values, the issues with which they are grappling—the values associated with water—are complex:

Some of those things people can't even describe. They can't even describe them themselves properly. Which makes it even harder. Maybe we just have to listen to what people don't say, not only what they do say, to try and pull that together, till in some way, maybe you have to relate it back to them (Oldfield 4.03).

Sharon Oldfield asked the question of both me and herself: 'Does *recognising* that water has a social value give it value, or do you need to quantify it?' (fieldnotes, Oldfield 4.03). In

posing this question, she was questioning the priority in natural resource management of quantifying water needs, including recent efforts to allocate a quantity of water to fulfil social and cultural needs—described as ‘cultural flows’. She was also questioning the role that quantifying values might have in affecting the valuing process. My research indicates that current management frameworks for valuing water do affect the values that are articulated and prioritised in management strategies. Those values that fit into prescribed categories are represented; those that lie outside, cross over or do not easily fit the categories are often marginalised or discounted.

Similarly, Angus Emmott spoke to me about current governmental priorities in water resource management. In particular, he questions the federal government approach to prioritising crisis areas through the ‘National Action Plan’, which overlooks regions that are not at ‘crisis’ point. The preoccupation with quantifying benefits from the river is highly problematic, as many of the ‘returns’ from the river are not quantifiable:

When you’ve got a system in good order, it’s hard to quantify what you’re actually doing to keep it that way. But the actual community processes and all that flow from that is actually doing that. But you can’t actually write it down with a pen and paper and quantify it in dollars and cents and actual results. ... this whole business plan concept of providing money and having returns. But we go back to the same thing of a lot of the returns are not really quantifiable. And actually they’re even more important, but because they’re not quantifiable, they don’t fit the guidelines (Emmott 5.03).

I asked Angus if he could identify some of these things that he describes as ‘not quantifiable’:

Oh well just the fact of having a community process where people from up and down the catch get together to discuss issues sensibly and rationally and bring in pro-developers and conservationists in that process, and state and different—South Australia, Queensland, New South Wales, the Territory and Commonwealth—government people. They all sit down together and what grows from that is just amazing. But how do you quantify that? It's just that spirit of cooperation and the understanding that the whole system is interdependent, and there are all these other social, cultural, ecological values, but to actually sit down and write that down and put dollars and cents results on that is very very hard (Emmott 5.03).

The people of the Lake Eyre Basin have begun to develop understandings of complex waters and values, and they are resistant to returning to the reductionism that quantification represents.

My research has significance for the Lake Eyre Basin as it articulates the concerns and priorities of the Basin's people. By listening to and learning from people and place I have found that the ways water is valued do not readily fit into current categories or management strategies. My research can contribute to the efforts in the Lake Eyre Basin by providing an analysis of current approaches to value and water, and by relating the theoretical insights I have gained through this research back to the specific places of the Lake Eyre Basin. My work can have positive implications for the future management and understanding of the Lake Eyre Basin by bringing these ideas back to people and processes—as Sharon Oldfield suggests: 'to relate it back to them'. Listening and reflecting are part of a broader process of effectively articulating previously unarticulated themes and ideas.

Valuing variability provides a means of articulating and developing an understanding of specific values associated with water in a particular place, instead of simplifying local reality and reducing understandings of value to fit into generic categories that are often developed elsewhere. In this way, valuing variability is concerned not with a generalised idea of water, but with particular water in specific places. Through valuing variability it becomes possible to work with these complexities, rather than marginalising the values that characterise a place.

By emphasising specific places, and the complex interconnections in particular places, the framework of valuing variability challenges universalisms, and offers potential for understandings in other settings. My research points towards the likelihood that current approaches are also inadequate in other places, for different reasons. In Australia, the nation's colonial history provides a very important context for relationships between people, water and water places (as discussed in chapters 3 and 4). The specific histories of relations between people and places and other living and non-living things (animals, plants, landscapes, waters) are likely to be equally important elsewhere.

This detailed study of place enables an understanding of the specific context of place—including the historical, social and ecological contexts—that will affect ways of managing and living with water. For example, within the area of heritage management, the idea of 'cultural landscapes' is being widely discussed. The concept of cultural landscapes is currently being used as the basis for the protection of places in which human influence or relationships are significant. The framework of cultural landscapes could provide opportunities for managing the Lake Eyre Basin that would acknowledge a range of human relationships with place. However, the history of conflict over World Heritage in the 1990s—which remains acute—and the continuing animosity of many local people towards

the notion of 'heritage', must be taken into account. While managing for cultural landscapes presents opportunities for acknowledging diverse human relationships with place elsewhere, it may not be effective in the Lake Eyre Basin. Imposition of such a management approach would be insensitive to local experience.

A place-based study entails a responsibility to place. Respecting this responsibility, I intend to continue the project of valuing water in the Lake Eyre Basin. Returning to discuss the findings of this research with people living and working in the Lake Eyre Basin is an important part of this. My research has identified a range people who are marginalised by current management processes; most notably, Aboriginal peoples of the Basin. Extending my research to better articulate their concerns would overcome a significant limitation of current management strategies. Bringing the results of this research, and any continuation of it, into discourse with current efforts to value water would enable my research to articulate some of the values that are currently marginalised, and support the significance and validity of values that do not readily fit into established natural resource management frameworks.

This research could contribute in a practical way to the design of guidelines for living with water that are based on the significance of water to people in the Lake Eyre Basin. Past and existing structures—such as the Lake Eyre Basin Coordinating Group, Desert Channels Queensland, and the South Australian Interim Natural Resource Management—have begun the process of identifying values, and provide social and professional networks that could be built upon. I will ensure that these groups receive a copy of my thesis. Developing guiding principles that acknowledge those values currently marginalised will extend the practical relevance of this research. Such principles—based on a framework of valuing

variability—might then be tailored for use in other places, where a different suite of variable values will apply.

7.3 Rethinking natural resource management

Zimmerman's 1933 definition of a 'resource'—discussed in chapter 1—encapsulates the way that *value* is being considered in hegemonic natural resource management. Rather than referring to an object, Zimmerman's 'resource' is 'the function or operation of *attaining a given end* such as *satisfying a want*. In other words, the word 'resource' is an abstraction reflecting *human appraisal* and relating to a *function or operation*' (Zimmerman 1964: 8; my emphasis). This definition of a resource captures the way that nature is valued in hegemonic natural resource management: water and nature are constructed as resources. In order to develop more just and sustainable ways of living with water, broader thinking with regard to water, nature and value is required, because water and nature are *more than* resources.

Richard Howitt's approach to 'rethinking resource management' (2001) has been highly influential in the approach taken here to analysing water and value. My research responds to Howitt's call for rethinking resource management in several ways. Firstly, it has emphasised a specific place, thereby moving beyond the generalisations and universalisms prevalent in 'resource management' discourse. Secondly, it considers water beyond the confines of a 'resource' definition. Thirdly, it prioritises listening to and learning from people, consistent with Howitt's and others' prioritisation of multiple perspectives.

In my research I extend current rethinking of resource management by focusing on theory and practice of *natural* resource management. In particular, I do this by critically analysing

nature and water—often constructed in management discourse as ‘natural resources’ and ‘water resources’—and by examining current methods of valuing water. Using variability as an analytical framework, I extend the prioritisation of multiple perspectives, to incorporate diversity, change and complexity, thereby recognising both spatial and temporal components of nature, water and value.

My research shows that in natural resource management in the Lake Eyre Basin the construction of water as a resource is dominant. Through this place-based study, I have been able to identify some of the specific limitations of current natural resource management in the Lake Eyre Basin. This in turn draws attention to possible limitations of natural resource management more broadly. In my research I found that natural resource management currently separates values associated with water, consistent with the triple-bottom-line management framework of ecological, economic and social sustainability. I found that the imposition of this structure has enabled prioritisation of one category of value—namely the economic—and has marginalised other voices and values. Further, attempting to fit the diverse, changing and complex values associated with water into three categories does not adequately represent values in the Basin. I suggest that it is likely that the framework of separation and compartmentalisation of values has similar implications for other places.

My research considers current popular methods of ‘valuing’ water, nature and the environment. As an example, I analyse ‘ecosystem service valuation’—a prominent and influential method of managing resources at an ecosystem scale (chapter 5). Through its emphasis on ecosystems, this method presents a way of managing water not just for humans, but for a more than human world. Through its focus on living things and complex relations, it provides an opportunity for moving beyond managing water as a ‘resource’.

While ecology is inherently concerned with the relationships between living things and their environments, ecosystem service valuation stops short of considering the social and cultural aspects of human life. Proponents of ecosystem service valuation (including Costanza *et al.* 1997; Daily 1997a; Daily *et al.* 2000) recognise that the method currently sets aside much of the complexity of human interactions with, and as part of, ecosystems.

While ecosystem service valuation can provide clear ecological, economic and socio-cultural benefits (e.g. Wilgen *et al.* 1996; Ricketts *et al.* 2004), efforts to identify and acknowledge values associated with water must not be limited by it. Through my research I argue for a more holistic ecological approach that considers people and their diverse, changing and complex social and cultural systems in a particular place.

Ecosystem service valuation—as a method of natural resource management—also requires some rethinking. While it provides some hope of acknowledging complex interconnected systems, its proponents attest to its current failure to adequately address much of the socio-cultural complexity of ‘ecosystems’. Despite considering value—in many ways a social and cultural phenomenon—the method continues to separate ecology from society and culture. Through the framework of valuing variability I take an approach that is holistic, interconnected, and hybrid: a genuine ‘*ecosystem*’ approach. My research does not shy away from the ‘messy’ aspects of human life; it engages with them explicitly. I argue that these aspects should not be separated from the ‘neater’ ecosystem services and functions. By valuing variability I aim to consider the significance of water more holistically, and to question the hegemonic separation of nature and culture, and environment, economics and society.

7.4 Social nature

Whatmore's 'Hybrid Geographies' considers the implications of 'taking hybridity seriously' in order to disrupt the 'purification of (human) society and (non-human) nature' (2002: 158-159). Braun's analysis of 'The Intemperate Rainforest' of British Columbia works to 'focus more attention, rather than less, on the culture of nature' (2002: 257); he does so by examining a particular place and the specific constitution of social nature in that place. My research follows in this tradition by critiquing the social nature of water. By examining water's social and natural constitution in a specific place, my research reveals the specific ways in which water is constituted through social and natural processes. By setting up a discussion between social nature, a broader place-based literature, and a particular place, I have drawn out the interconnections between humans and non-human others that are present in particular places, but are not generally well articulated. Through this analysis, my research points to some of the specific limitations of current water resource management practice in the Lake Eyre Basin.

My analysis of variability, and expansion of the concept to explore and articulate values associated with water, is inherently a project in analysing social nature. Valuing variability takes a concept (variability) widely used to describe physical 'nature' and considers its implications for social and cultural aspects of water. By applying the idea of variability to the cultural realm of value my research has identified some of the key aspects of values associated with water that are marginalised by current natural resource management.

Other researchers who have presented analyses of water as a nature-culture hybrid include Erik Swyngedouw, who explores the role of water politics and water ecology in forming and reforming Spanish society, and the ways that they have 'infused and embodied the myriad tensions and conflicts that drove and still drive Spanish society' (1999: 443). Karen

Bakker (2000) examines natural, social and discursive elements of water scarcity in her analysis of the 1995 Yorkshire drought. In her study, Bakker finds that water provides a focus for debates over environmental crisis and climate change, and water industry privatisation. Sneddon *et al.* (2002) take an interdisciplinary approach to construct water as an 'aquatic socioecological system' in order to explore the multiple causes of conflict at various spatial and temporal scales.

A common theme emerging from these studies is the importance of a hybrid analysis to understanding conflicts over water and its management, which—as discussed in chapter 1—is becoming increasingly important at many sites and scales around the world. My critique of valuing water in the Lake Eyre Basin works in concert with these efforts to disrupt and unsettle the established separation of culture and nature in a particular place. In a practical sense, this analysis provides direction for challenging current natural resource management discourse and practice and devising new ways of living with water that are based on justice and sustainability.

7.5 Ethics beyond the human world

A significant underlying concern of this thesis is the ways in which people interact with non-human others—not just animals, but whole landscapes. In addition to the scales of influence that I have discussed throughout this thesis—the Lake Eyre Basin, natural resource management, and social nature—valuing variability has significance for ethics beyond the human world.

Ethics towards non-human others is the subject of much debate. Environmentalist efforts to extend ethics beyond the human often follow one of two schools of thought: 'animal

liberation', championed by Peter Singer (eg. Singer 1990); and an environmentalism based on the 'deep ecology' of Arne Naess (Naess 1973). Animal liberation is built on utilitarian and Kantian arguments reliant on the foreshadowing of the individual. This work considers non-human animals as individuals, and much of it focuses on non-human animals that are 'like' humans. Whatmore asserts that animal liberation, 'might be termed moral extensionism and is associated with longstanding concerns with animal rights'. Animal liberation 'transports the liberal figure of the individual rights-bearing 'person' wholesale to a range of non-human creatures' (Whatmore 2002: 156). In this model some non-human creatures are prioritised over others. In particular, animal liberationist projects are often based on linguistic capability or sentience, leading to work on primates (eg. the Great Ape Project (Great Ape Project n.d.)), and cetaceous mammals (whales, dolphins and porpoises).

The second approach—'deep ecology'—is based on the principle that 'the flourishing of human and non-human life on Earth has intrinsic value' (Naess 1989: 29). Deep ecology does not limit ethical consideration to non-human animals, but extends it to all life on Earth. It prioritises the 'health and continued viability of the biosphere' (Foundation for Deep Ecology n.d.), and in this way perceives the world as an interconnected system. Deep ecologists consider humans to be embedded within this system, but construct human agency primarily as a destructive force. According to Castree deep ecologists 'too often invoke the language of an unmalleable nature' (2001: 8). Castree and MacMillan (2001) criticise the tendency of deep ecology to promote a romanticised notion of 'getting back to nature'; a nature that is 'wild' or 'pure'. The World Heritage debate in the Lake Eyre Basin (discussed in chapter 4) illustrates the problems of constructing lived-in places as 'wilderness'; the people who hold relationships with those places are marginalised by such a construction.

Much place-based literature in environmental ethics provides more valuable analyses for ethics beyond the human world. In particular, analyses of Country (eg. Rose 1996, 2004c; Magowan 2001; Suchet 2002), and animal geographies (eg. Wolch & Emel 1998; Philo & Wilbert 2000)—both discussed in chapter 6—demonstrate ways of living more ethically with non-human others—as individuals and as interconnected, living and life-giving systems. Drawing on these discourses, and on social nature and ecosystem thinking, my research points towards an ethics for a more than human world. My study of water in a particular place provides a valuable case study for investigating ethics towards non-human others that are not individuals. Rather, water—and its constituents—represents a dynamic community.

The framework of valuing variability—the focus on diversity, change and complexity—connects back to Michael Soulé's normative postulates (Soulé 1985), discussed in chapters 5 and 6. In large part Soulé's normative postulates provide guiding principles for human interaction with the non-human world, including other living things and ecosystems. They speak of the value of non-human others—a value 'neither conferred nor revocable' (Soulé 1985: 731). They also speak of the value of 'ecological complexity'; Soulé moved beyond considering the value of individual species to focus on ecosystems and the complex relations that they comprise. Into this picture I place humans—their agency and the complex relations they have with the rest of the world. Soulé argued for biotic diversity; I present a case for extending this diversity to include the diversity of human experience, worldviews and values.

In 1949 Aldo Leopold—in his seminal *A Sand County Almanac*—made a call for a 'land ethic'. Leopold's land ethic constructed 'land' as a 'community of interdependent parts'. He writes:

All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. ... The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land (Leopold 1989 [1949]: 203-204).

He continues: 'In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such' (Leopold 1989 [1949]: 204).

Deborah Bird Rose asserts that the kind of land ethic Leopold proposed already existed among Aboriginal Australians (and other Indigenous peoples around the world). Rose's own work has been with Ngarinman and Ngaliwurru people in the communities of Yarralin and Lingara in the Northern Territory. For the Ngarinman and Ngaliwurru people:

human life exists within the broader context of a living conscious cosmos. Humans' responsibility lies in actions that nurture and enhance human life, the life of other species (plants and animals) and the relationships among humans and between humans and others (1988: 379).

In this way, Leopold perhaps overlooked the existence of a land ethic in cultures other than his own. However, Rose also articulates the inherent problem of one culture seeking 'to transplant another culture's ethical system into their own':

Every culture is the product of particular beings living particular lives within the particular options and constraints of their own received traditions, their mode of production and so on, none of which can be readily transplanted. Furthermore, the attempt to appropriate another culture's ethical system is self-defeating because it is self-contradictory: the act of appropriation is so lacking in the respect which is the basis of the desired ethic that the appropriation becomes annihilation (1988: 378).

In an analysis of Western natural resource management regimes, it is crucial that we devise ethical relationships beyond the human world that do not appropriate the knowledge of others, but that seek to understand and respect the peoples, places, and non-humans about which we are concerned.

Leopold himself was both environmental philosopher and natural resource management practitioner. His idea of people as citizens of the land community has interesting implications for natural resource management practice. In a model that presupposes people to be part of a 'water community', people, water and other water-dependent entities (living and non-living) are understood to be interconnected, in the sense of a community, and the specificities of a particular water place—and the specific interactions that form and reform that place—must be taken into account.

I resist developing a parallel 'water ethic', as this would reinstate a separation between land and water that I have attempted to overcome in this research; one of many modernist separations that have had negative implications for water places and water-dependent communities—human and non-human—in the Lake Eyre Basin.

Leopold saw the role of conqueror as inevitably self-defeating. The conqueror assumes s/he knows 'just what and who is valuable, and what and who is worthless, in community life. It always turns out that he knows neither, and this is why his conquests eventually defeat themselves' (1989 [1949]: 204). In this role of all-knowing conqueror, humans are prevented from listening to and learning from human and non-human others. Similarly, historic modes of control and domination prevent such learning.

Through my research I have listened to and learned from the people and places of the lake Eyre Basin. Doing so has provided a new understanding of place, and of the diverse, changing and complex values associated with water and water places, that informs more just and sustainable ways of living with water in the Lake Eyre Basin and beyond.

7.6 'The Great Cooper Splash'

In October 2002 I drove across a dry Cooper Creek where the Birdsville Track crosses the river (Figure 7.1). At that time the Cooper Crossing looked a lot like the surrounding landscape. You had to look hard to realise that you were driving on a river bed. There was a change in vegetation, with more coolibahs attracted to the water that flows just beneath the surface more often than it flows on it. Deposits of vegetation could be spotted backed up against the upstream side of some trees. And of course there was a slight depression in the ground that marked the river's banks; but the river is wide, and this depression could be mistaken for some other form of topography.

For three years from 1989 through 1991, this site was the location of 'The Great Cooper Splash', mentioned in chapter 6. Sharon Oldfield talked to me about The Great Cooper Splash with great enthusiasm and fond memories. During this time, the Oldfield family and some of their neighbours on the Birdsville Track regularly drove from their homes to the Cooper Crossing to see how far the river had spread from its ill-defined 'banks'. The flooding Cooper was the site of social outings and recreation in and beside the water. The flood provided relief from dry country. The rising and falling waters of Cooper's Creek were the topic of much conversation within the community.

Figure 7.1 Cooper Crossing, October 2002. Site of 'The Great Cooper Splash' of 1989–1991.

Cooper's Creek at the Birdsville Track crossing is neither a wet nor dry place. It is not definable as either an isolated or intensely social place. It is not readily classifiable as either of these things, because it is both. It challenges categorisation. It holds diverse meanings to many different people who have complex relationships with this place that change with time. Meanings and values associated with this water place change with the coming and going of water, with the patterns of people's lives, and with broader processes of social change. But all of these values are shaped by specific water in this particular place.

List of Interviews

Undertaken in April and May 2003

Vanessa Bailey – Coordinator, Aridflo Queensland

Sharon Bell – Owner and manager, Dulkaninna Station, South Australia

Don Blesing – past Independent Chair, Lake Eyre Basin Coordinating Group

Lynn Brake – Presiding Member, Arid Areas Catchment Water Management Board, SA

Jenny Bourne – South Australian National Parks and Wildlife Service

Mike Chuk – Department of Natural Resources, Queensland

Bernice Cohen – Senior Policy Officer, Department of Water, Land & Biodiversity
Conservation, South Australia

Jimmy Crombie – Resident, Birdsville, Queensland

Auntie Linda Crombie – Resident, Birdsville, Queensland

Reg Dodd – Marree Arabunna People's Committee, and Marree resident, South Australia

Angus Emmott – Owner and manager, Noonbah Station, Queensland

Michael Good – Project Manager, Aridflo, Department of Water, Land & Biodiversity
Conservation, South Australia

Genevieve Hammond – Publican, Mungerannie Hotel, South Australia

John Hudson – Santos Moomba, South Australia

Wolfgang John – resident and local artist, Birdsville, Queensland

David Leek – Executive Officer, Arid Areas Catchment Water Management Board, SA

John McEntee – Owner and manager, Erudina Station, South Australia

Malcolm & Colleen Mitchell – Owners and managers, Muloorina Station, South Australia

Bob Morrish – Owner and manager, Springfield Station, Queensland

Maree Morton – Manager, Innamincka Station, South Australia

Darren Niejalke – Environmental Scientist, WMC Roxby Downs, South Australia

Sharon Oldfield – Owner, Cowarie Station, South Australia

Jim Puckridge – Aridflo ecologist

John & Helen Rickertt – Managers, South Galway Station, Queensland

Don & Lyn Rowlands – Residents, Birdsville, Queensland

Joc Schmiechen – Heritage Tourism Coordinator, Lake Eyre Basin Coordinating Group

Bruce Scott – Owner and manager, Moothandella Station and Mayor Barcoo Shire,
Queensland

Peter & Danielle Weston – Managers, Clifton Hills Station, South Australia

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