

Who cares about land degradation neutrality? Exploring the rift between global discourses and local perspectives in far west New South Wales

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Who cares about land degradation neutrality?
Exploring the rift between global discourses
and local perspectives in far west New South Wales

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A thesis in fulfilment of the requirements for the degree of
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As narratives about the 'global crisis' of land degradation persist, despite a lack of conclusive evidence, this thesis questions whether such narratives are connected to local experiences of the phenomena. To avoid constraining solutions because of narrow or misled understandings, there is a need for contextually-tailored investigations, recognising social, ecological and political interactions.

Through a discourse analysis of publications and programs about 'land degradation neutrality' (LDN), this study dissects modern versions of the degradation crisis narrative and proposals for its resolution. Given recent prominence in the United Nations' Sustainable Development Goals, LDN approaches are expected to 'counterbalance' land degradation through sustainable land management and restoration. The narratives emphasise economic incentives to repair degraded land, quantified top-down assessments, and win-win partnerships – but appear to be more appealing for business interests than for local land managers. Neutrality as 'no net loss' conveys inflexibility rather than resilience, and the current LDN approach abstains from normative considerations of how people are connected to land.

A literature and interview-based case study in the far west region of New South Wales – rangelands commonly affected by droughts, floods and episodic degradation – explores the relevance of LDN within a particular context according to local knowledge and experiences. Significant discrepancies arise, presenting a number of conundrums about how degradation should be characterised and consequently approached. Conflicting convictions reveal both positive and negative impacts of grazing regimes, wind erosion, 'pests', 'weeds', climate variability, and community-based self-reliance, leading to contrasting responses to sustainable land management and restoration recommendations, such as the need to let the environment restore itself. The case study confirms that land degradation depends on how the problem is framed, and that multiple perspectives need to be considered.

This thesis makes contributions to knowledge by critically engaging with the implications of the international LDN discourse and providing insights about the complexity of capturing the dynamics of dryland degradation, to inform alternative narratives based on better understandings of the careful contextual management of marginal lands.

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Thesis Abstract

As narratives about the ‘global crisis’ of land degradation persist, despite a lack of conclusive evidence, this thesis questions whether such narratives are connected to local experiences of the phenomena. To avoid constraining solutions because of narrow or misled understandings, there is a need for contextually-tailored investigations, recognising social, ecological and political interactions.

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A literature and interview-based case study in the far west region of New South Wales – rangelands commonly affected by droughts, floods and episodic degradation – explores the relevance of LDN within a particular context according to local knowledge and experiences. Significant discrepancies arise, presenting a number of conundrums about how degradation should be characterised and consequently approached. Conflicting convictions reveal both positive and negative impacts of grazing regimes, wind erosion, ‘pests’, ‘weeds’, climate variability, and community-based self-reliance, leading to contrasting responses to sustainable land management and restoration recommendations, such as the need to let the environment restore itself. The case study confirms that land degradation depends on how the problem is framed, and that multiple perspectives need to be considered.

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List of Acronyms and Abbreviations

ACRIS	Australian Collaborative Rangelands Information System
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CBD	United Nations Convention on Biological Diversity
DDP	Dryland Development Paradigm
FAO	Food and Agriculture Organisation of the United Nations
GEF	Global Environment Facility
GGWSSI	Great Green Wall for the Sahara and the Sahel Initiative
GLADA	Global Assessment of Land Degradation and Improvement
GLASOD	Global Assessment of Human-Induced Soil Degradation
IISD	International Institute for Sustainable Development
IPBES	Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change of the UNFCCC
IUCN	International Union for Conservation of Nature
IWG	Intergovernmental Working Group of the UNCCD
LADA	Land Degradation in Drylands
LDN	Land degradation neutrality
LDN Fund	Impact Investment Fund for Land Degradation Neutrality
LLS	Local Land Services
MA	Millennium Ecosystem Assessment
MDBA	Murray Darling Basin Authority
NAP	National Action Programme
NDVI	Normalized Difference Vegetation Index
NGO	Non-government Organisation
NPP	Net Primary Productivity
NRM	Natural Resource Management
NSW	New South Wales
NSW EPA	New South Wales Environmental Protection Agency
NSW DPI	New South Wales Department of Primary Industries
NSW OEH	New South Wales Office of Environment and Heritage
PES	Payments for Ecosystem Services
REDD+	Reducing Emissions from Deforestation and forest Degradation
SDG	Sustainable Development Goal
SES	Social-ecological system
SLA	Soil Leadership Academy
SLM	Sustainable Land Management
TGP	Total Grazing Pressure
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa
UNCED	United Nations Conference on Environment and Development
UNCOD	United Nations Conference on Desertification

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSW	The University of New South Wales
USD	United States dollar
WBCSD	World Business Council for Sustainable Development
WOCAT	World Overview of Conservation Approaches and Technologies
ZNLD	Zero Net Land Degradation

1 Introduction

1.1 Dryland degradation narratives

Land is fundamentally important to people. Drylands in particular (arid, semi-arid and dry sub-humid areas) support 38% of the world's population (Stavi & Lal, 2015). Consisting of soil, vegetation and fresh water, land can be seen as a resource to be managed for food security, cultural connections and political strength. The importance of land degradation is commensurate; however, it remains an elusive concept. Different implications for analysis and management have resulted from hundreds of different definitions to identify land degradation, such as a decline of the land's usefulness, capability, resilience (Jones, 1996), or more recently, ecosystem services (Reed et al., 2015). The official definition of land degradation by the United Nations Convention to Combat Desertification (UNCCD, 1994) refers to a reduction or loss in the land's 'productivity and complexity', due to 'various factors, including climatic variations and human activities' in drylands. While vaguely referring to any environmental decline, it is an essentially anthropogenic notion, regarding land in terms of its value *for* people and its decrease in value typically caused *by* people.

Defining what constitutes a negative process of degradation depends on the moral values and various interests of its observers (Warren, 2002; Williams, 2006), so "almost inevitably, 'degradation' is in the eye of the beholder" (Hobbs, 2016, p. 154). What might be good for biodiversity conservation may be 'degradation' for a pastoralist, and what may be beneficial for one type of food production may restrict the land's capability for other produce, such that "much depends on the angle one looks at the problem" (Zdruli et al., 2010, p. 4). Determining land degradation through objectives of land use gives it a political aspect, and the question of 'whose angle' shapes the narratives of land changes.

Dryland degradation narratives have emerged out of 'crisis narratives' of desertification (Davis, 2016). Alarming assessments of African soils were made by agronomists in the 1930s, which some have linked to colonial ambitions and rising international concerns from the American Dust Bowl (Koning & Smaling, 2005). The Sahelian droughts during the '70s and '80s reinvigorated scientific debates on desertification, culminating at the United Nations Conference on Desertification (UNCOD) in Nairobi in 1977 and launching it further into the political arena (Herrmann & Hutchinson, 2005). In 1979, the Deputy Executive Director of UNEP said that "desertification... is probably the greatest single environmental threat to the future wellbeing of the Earth" (quoted in Adger et al., 2001, p. 689). Amid this context, the UNCCD became one of three Rio conventions out of the 1992 UN's environment and development conference (UNCED), and is still the global authority on land degradation. While desertification has been discussed as a scientifically contentious issue at length

(Thomas, 1997), and despite contrary evidence, the rhetoric of desertification has continued (Behnke & Mortimore, 2016; Jones, 2008), and is embraced by several UN agencies (Davis, 2016). Despite its definition as ‘degradation in drylands’, to avoid problematic implications of the term ‘desertification’ as land turning into desert (Herrmann & Hutchinson, 2006), I have preferred to remain with the term ‘land degradation’ even within a drylands context.

An undercurrent of counter-narratives has challenged the crisis narratives, often from the perspective of local land users and through the contribution of political ecology. Such studies have often sought to highlight how the dominant discourses about land degradation may be contested by local land managers, who are able to exhibit extensive and intimate awareness of the land’s biophysical features and changing trends. For example, Zimmerer (1993) argues that the explanations of land degradation from the “little voices” of Cochabamba peasants in Bolivia differ from conservation-oriented development institutions because of their livelihood experiences. Jones (1996) demonstrates how in the Uluguru Mountains of Tanzania, outsiders’ (scientists and administrators) assessments of land degradation were “filtered through a lens of assumed technological superiority” (p. 196), a view which was not shared by the local people who were unable to contribute their interpretations and refute dominant beliefs. Similarly, Davis (2005) found that ecological evidence did not support the ‘expert’ claims of overgrazing in southern Morocco, instead suggesting that this knowledge had been prioritised over indigenous knowledge for political and economic motivations.

While the dominant narrative of desertification asserts that degradation is widespread, caused by local land uses and requiring top-down solutions, the counter-narrative often suggests that degradation is insignificant, and that local land users are victims of power imbalances due to centralised systems (Stafford Smith, 2016). Stafford Smith (2016) reflects that realistically, neither narrative captures the complexity of dryland social-ecological systems. Acknowledging the criticisms of past assessments which instead show the complexity of agricultural and environmental changes, it is salient for land degradation researchers to recognise “that soils evolve in a complex way, that farmers play a key role, and that attempts at improvements should be linked to their knowledge” (Koning & Smaling, 2005, p. 5). ‘Participatory’ scholars in African rangelands have since attempted to manage conflicting perceptions between local and scientific stakeholders through promotion of integrated, two-way approaches (for example, Kolawole, 2013; Reed et al., 2007; Stringer et al., 2009).

1.2 The new paradigm of land degradation neutrality

In recent years, the UNCCD has developed and given prominence to the concept of ‘land degradation neutrality’ (LDN) as an organising principle and a goal for addressing land degradation worldwide. LDN first achieved international agreement at the United Nations Conference on Sustainable

Development (Rio+20) in 2012, as a vague term. The now formally adopted definition of land degradation neutrality, developed by the UNCCD's Intergovernmental Working Group (IWG), is:

“... a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems” (UNCCD Secretariat, 2015, p. 10).

Three premises form the basis of LDN as ‘zero net land degradation’ (Chasek et al., 2015). Firstly, it is not feasible to stop land degradation entirely (achieving ‘zero land degradation’). Secondly, a significant proportion of global lands are already considered to be degraded. Thirdly, the productivity and ecosystem services of degraded lands are capable of being restored or rehabilitated. These assumptions offer dual pathways to the achievement of neutrality, through a shift to sustainable land management (SLM) to prevent further degradation, while counterbalancing ‘unavoidable’ degradation through restoration or rehabilitation (Welton et al., 2015). In 2015, the concept of LDN became solidified in the United Nations’ sustainable development agenda for 2016-2030, in which countries voluntarily commit to globally agreed targets. The LDN target is included in the Sustainable Development Goal (SDG) 15.3:

“By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and *strive to achieve a land degradation-neutral world*” (United Nations, 2015, emphasis added).

1.3 The application of LDN globally and locally

A ‘land degradation neutral world’ would be the result of the achievement of LDN at each specified scale/ecosystem and added together worldwide. For the UNCCD, SDG 15.3 is their new “roadmap” and recognised as a strong vehicle for continued implementation of the UNCCD (UNCCD, 2016b). Just as the SDGs are designed to be relevant for all countries, the goal of LDN is said to be applicable everywhere, asserting LDN as the new dominant framing to counteract degradation.

However, Adger et al. (2001, p. 683) argue that “since global discourses are often based on shared myths and blueprints of the world, the political prescriptions flowing from them are often inappropriate for local realities”. The intention of this thesis is to explore this argument in the case of LDN as a global discourse, and through the perspectives of a particular local case study in the drylands of New South Wales (NSW) in Australia.

Despite its limited involvement with the UNCCD, Australia’s drylands are extensive, mostly in the form of rangelands (81% of Australia’s land area – Bastin & the ACRIS Management Committee, 2008). It is popularly known as a land of droughts and flooding rains, mythicised in stories of colonial

history and the Aussie battler in the Outback. Stafford Smith (2016, p. 542) observes that the typical crisis narrative of desertification did not take root in Australia because of a “(supposed) absence of land use”, rather than its misuse by the indigenous populations. Nonetheless, a strong historical narrative exists of Australian dryland degradation caused by settlers and pastoralists, where an analysis in 1942 declared the menace of erosion to be responsible for “Australia’s dying heart” (Pick, 1942), while in 1990, land degradation was lamented as the “insidious disease... threatening to kill Australia” (Beale & Fray, 1990, p. ix). The far west of NSW in particular had a Royal Commission in 1901 to inquire into its land degradation problem and it is widely known to have had severe periods of land degradation through pastoral land use throughout the past century (Stafford Smith et al., 2007). Lessons of its management could be an area of interest for the worldwide land degradation agenda.

1.4 Research principles, questions and objectives

This research is based on the following guiding principles:

- At least in part, land degradation is a social science problem, and drylands can be seen as social-ecological systems (complex, uncertain systems in which humans are considered an integral part of the landscape, conceptually expanded upon in section 2.1).
- Different types of knowledge about land degradation and land management produce different results. Further, knowledge types are not clear-cut: local knowledge can be indigenous and dynamic, while local knowledge can also be practical and scientific (Berkes et al., 2003). By recognising the validity of different types of knowledge, ‘formal’ (institutional) knowledge should not necessarily be prioritised over ‘informal’ (experiential) knowledge. In combination, local and scientific knowledge can provide more comprehensive and relevant understandings for environmental solutions (Reed, 2008).
- Given the nature of land degradation, it is important to consider whose perspective is being used to view the problem, and who wins and who loses from certain narratives of land degradation and the means in which it is addressed.

These principles have informed the approach to the two main research questions:

- 1) What are the major narratives imbued in ‘land degradation neutrality’?
- 2) How do the perceptions of land degradation by local land managers in far west NSW reflect or challenge the dominant narratives of land degradation neutrality?

All aspects of the research are developed through a review of the literature, with the first research question also addressed through discourse analysis and the second research question approached

through an interview-based case study. In answering the research questions, the following objectives are sought to be addressed:

- To explore and critically evaluate the implications of a ‘land degradation neutral’ approach;
- To examine the current land management situation in Australian drylands from the perspective of local stakeholders;
- To reflect on the influence of discourses on land degradation and land management.

1.5 Thesis outline

The first chapter has served to set the scene and introduce the areas of interest that will be examined throughout the thesis. Chapter 2 presents the conceptual frameworks and expands on ideas represented in the guiding principles. Chapter 3 explores the literature about land degradation, sustainable land management and restoration/rehabilitation, in order to develop a better understanding of the ‘problem’ and the ‘solutions’. Chapter 4 delves into the concept and discourse of land degradation neutrality, with insights about the problematic approach of ‘no net loss’ towards social-ecological systems. It critically explores the programs proposed by the UNCCD for implementation of land degradation neutrality, finding a predominantly business-oriented approach as suggested by the narratives of LDN.

Chapter 5 commences the thesis’ approach to the second research question with an explanation of the methodology undertaken, including considerations of positionality for the interpretation of data. Chapter 6 presents the findings of the case study in the far west, with discussion interspersed throughout. It is broken into five key sections about land degradation, sustainable land management and restoration, related environmental issues, environmental governance and initial perceptions of LDN. Finally, Chapter 7 presents recommendations and relates the findings to the bigger picture of approaches towards land degradation neutrality. It concludes with a call for new narratives of drylands, based on understandings of contextual factors, local land managers’ perspectives and a greater recognition of change.

2 Conceptual Frameworks

Central themes of this thesis include the complexity of interactions between the environment and society; the prevalence of uncertainty and variability; and how understanding and responses to problems are affected by the angle from which the problem is perceived. Theoretical concepts that contribute to these themes include recent conceptualisations of social-ecological systems (especially in the case of drylands) and resilience thinking in particular. These concepts can be strengthened by interpretations through the lens of political ecology, where power relations and scales of analysis affect the predominance of certain types of knowledge, perceptions and narratives of causes and consequences. Discourse analysis is used to make these overall perceptions and narratives more apparent. These theoretical foundations are outlined with awareness that different conceptual perspectives can result in vastly different environmental assessments of drylands degradation (Whitfield & Reed, 2012).

2.1 Drylands as social-ecological systems

The relationship between the environment and societies has been theorised in terms of “social-ecological systems” (SESs), which are understood to be dynamic, complex, multi-scalar and explicitly acknowledging unpredictability and uncertainty (Berkes et al., 2003). Rather than developing singular-discipline, universal ‘solutions’ that are likely to fail, an SES approach for sustainability involves learning “how to dissect and harness complexity” rather than simplifying or ignoring it (Ostrom, 2009, p. 420). SESs are often conceptualised in terms of adaptive capacity and resilience, where the ability of a system to maintain essential functions while incorporating change is prioritised. The term emphasises the idea of “humans-in-nature”, deeming the distinction between social and ecological systems “artificial and arbitrary” for effective management decisions (Folke, 2006, pp. 261-262). Understanding SESs in this way necessitates management to be adaptive, learning by doing and responding to perceived changes through careful responses (Allen et al., 2011).

Drylands in particular have been conceptualised from a social-ecological perspective, especially because they are typically agroecosystems of which humans are an integral part (O'Connell et al., 2015). Whitfield and Reed (2012) propose a framework of drylands highlighting several essential characteristics of drylands. Rather than just ‘assuming away’ the social aspect, they explicitly conceptualise the political, cultural and economic elements of drylands and their implications for how the land is experienced and managed: politically, through institutional regulations and resource access; culturally, through aesthetic, recreational and spiritual values; and economically, through recognising the influence of markets, financial incentives and constraints and opportunity costs. Additionally, they emphasise the idea of drylands as complex resilient systems, as well as the notion that they are

‘temporally-embedded’, which recognises how “the contemporary environment has been shaped by the management decisions of the past” (Whitfield & Reed, 2012, p. 5) as well as how the future management, experiences and interactions will in part be shaped by current practices. The framework also advances the idea that the participation of stakeholders is necessary for accurate dryland environmental assessments, given their intricate, adapted knowledge, as well as the opportunity for empowerment. According to Whitfield and Reed (2012), integrating different knowledge systems and gaining relevant insights through participatory approaches is likely to bring about more sustainable management for land managers and policy makers.

The ‘Drylands Development Paradigm’ (DDP) was developed by Reynolds et al. (2007), with principles of human-environment interactions to show how SESs are dynamic, affected by ‘slow’ and ‘fast’ variables, hierarchical, nested and reliant on local environmental knowledge. Stafford Smith et al. (2007) applied this framework to an analysis of degradation events in Australian rangelands, finding common interactions within and between the human sub-system and environmental sub-system (see Figure 2.1). The DDP highlights how mental models shape narratives which influence decision-making (Stafford Smith, 2016).

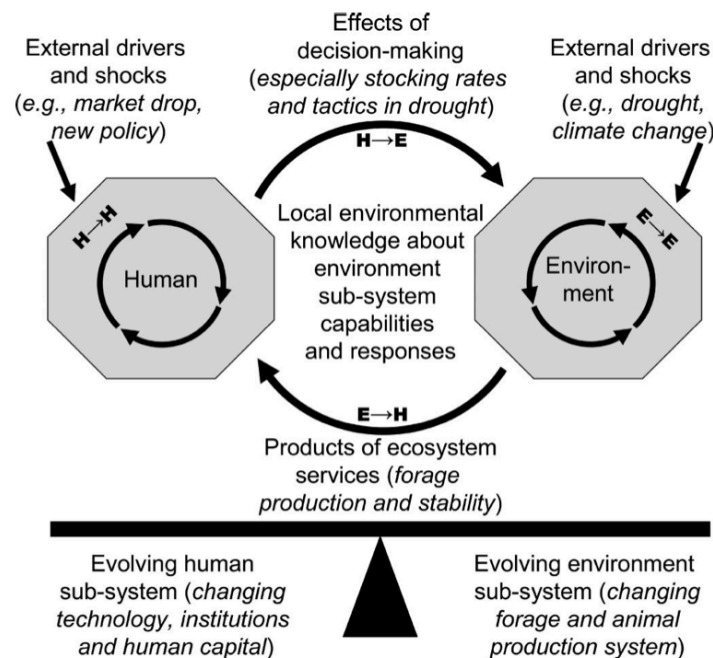


Figure 2.1 Stafford Smith et al.’s (2007, p. 20692) model of human-environment interactions (with specifics for their analysis in *italics*), highlighting the key linkages of ecosystem services and decision-making (moderated by local environmental knowledge), and how changes affect the functioning and evolution of human and environmental systems.

2.2 Resilience

Closely related to the concept of SESs, much has been written on the concept of resilience since its emergence in ecological studies about ecosystem interactions in the 1960s. The concept has now influenced other fields of study, including social sciences and human geography, and the adaptive management of natural resources (Folke, 2006). Resilience is understood to be the ability of a social-ecological system to respond to shocks and stresses and recover from such disturbances (such as droughts, floods or altered management regimes), with the capacity to self-organise (O'Connell et al., 2015). While resilience thinking tends to focus on this robustness from disturbance, Folke (2006) asserts that a key part of resilience is that disturbances present opportunities for systemic renewal, re-organisation and new processes. Integrated resilience looks at both social and ecological interactions, which affect and adapt to changes, including social networks, social memory, biodiversity and the diversity of ecosystem functional groups across scales (Folke, 2006).

Resilience is often theorised in relation to vulnerability or adaptive capacity, but there is an increasing number of interpretations as the term becomes more popular for sustainable goals and initiatives. For instance, resilience in agro-ecological systems is a major objective of SLM (Cowie et al., 2011). Despite this, resilience and sustainable development differ considerably, with Abel et al. (2006) suggesting that sustainable development aims more for stability whereas resilience embraces change and adaptation. However, like sustainable development, the concept of resilience has been able to be co-opted for different projects by various interest groups that actually run the risk of resulting in weaker SESs (Béné et al., 2012).

Rose (2004) distinguishes between three different types of human actions for achieving resilience. “Anti-resilience” takes the form of dams or monocultures, or features which “seek to suppress Nature’s own resilience” in order to support human aims (Rose, 2004, p. 48). Selecting key attributes of natural resilience seen as valuable for people (to make ecosystems behave as humans want them to behave for the sake of efficiency and predictability) is termed “engineered resilience”, such as fire suppression or “efforts to reclaim damaged places in order to put them in the service of human efforts”. Alternatively, “facilitated resilience” involves “observing Nature’s own processes and then working to facilitate the conditions under which Nature’s resilience can flourish”. While this may involve protectively ‘letting nature be’ or intentional modifications to the place, this form of resilience requires human engagement as a moral duty. Like the idea of SESs, facilitated resilience actively acknowledges the connectivity between humans and nature, but takes it further to seek mutual benefits and counteract negative forces. Some researchers have likened resilience and adaptive management to indigenous ecological management (cited within Muir et al., 2010), but it is this form of facilitated resilience that

best represents the indigenous worldview that good social relationships are needed for good ecological relationships (Muir et al., 2010).

If resilience is strived for without considering the political interactions and consequences, it runs the risk of neglecting whether the SES is just or desirable – for example, an oppressive system may be resilient while continuing to marginalise underprivileged peoples. Theoretical input from political ecology is able to embellish resilience thinking and more explicitly address the fundamental question of “resilience for whom?” (Ingalls & Stedman, 2016, p. 3).

2.3 Political ecology

Although of mixed origins, one of the foundations of political ecology is considered to be Blaikie and Brookfield’s (1987) seminal book *Land Degradation and Society*, which highlights the role of the economy and the state in changing relations between resources and users. By highlighting the linkages between politics, ecology and policy, political ecology recognises that attention needs to be given to the role of power and power structures (Andersson et al., 2011). In terms of the nature-society nexus, power can be taken to signify “a social relation built on an asymmetrical distribution of resources and risks...[located in] the interactions among, and the processes that constitute, people, places and resources” (Paulson et al., 2003, quoted in Ingalls & Stedman, 2016, p. 1). Through examining differences in power, political ecology studies have often challenged the dominant narratives of degradation as created by the perspectives of the most powerful, instead observing and interpreting alternative narratives through the contextualised perspectives of local stakeholders.

Political ecology developed through studies linking political economy to land degradation in drylands, and yet as an approach it has had relatively little attention in this field (Jones, 2008), although there continue to be several examples engaging with the approach (such as Andersson et al., 2011; Lanckriet et al., 2015). By linking neo-Marxist concerns about inequality and exploitation with environmental deterioration, political ecology has often focussed on the ‘developing’ world (Jones, 2008); however, some studies have considered the disempowering effect of overriding power structures upon those typically considered to be privileged (for example, Willow, 2014). Political ecology now draws upon and emerges in a heterogeneous range of disciplines, including geography, sociology, anthropology, biology and ecology (Brown & Purcell, 2005), but a significant branch of political ecology uses a post-structural approach to examine how language asserts power structures and shapes policies (Jones, 2008).

The effect of scale is an important consideration in political ecology, and Blaikie and Brookfield (1987) assert that the scale of decision-making rarely matches the appropriate geographic scale. A political ecology approach can explore the environmental and political connections between global and

local phenomena (Adger et al., 2001). Although it has been criticised for being overly guided by the local/regional scale (Engel-Di Mauro, 2009), it has shown how differing scales of analysis give different results about the causes, extent and consequences of environmental damage.

2.4 Linking political ecology and the resilience framework

The interactions between society and nature are central to both political ecology and resilience thinking, and both oppose simple notions of ecological equilibrium (Turner, 2013). However, political ecology has tended towards qualitative, place-based studies examining different relationships between people and resources, whereas resilience theorists have generally taken an approach more aimed at studying the interactions of the system. Political ecology can give this research a more explicitly normative basis, considering the social dimensions and equity to determine desirable states for adaptive management goals (Beymer-Farris et al., 2012).

By including political ecological thinking in a resilience framework, Ingalls and Stedman (2016) suggest that political ecology will be better engaged with “the hurly-burly of the messy world of policy prescription and programmatic action” instead of the relatively isolated realms of academia in which it is usually found. Indeed, there is evidence of practitioners understanding and taking into consideration some of these ‘social science’ objectives in regards to resilience thinking, particularly in terms of governance, equity and participatory social values, despite their absence from resilience theoretical literature (Béné et al., 2012).

2.5 Discourse analysis

Discourse analysis is a common tool for political ecologists. Discourses are understood to be shared ways of making sense of the world (Dryzek, 2013). They are words and symbols that depict meanings, based on particular assumptions and judgements. Discourses are important because they affect how environmental problems are perceived and interpreted, influencing views on how they should be resolved (Hajer, 1995). Analyses of discourses through a political ecological lens have discussed how “discourses are words, but they are not merely words. They are political constructs of power” (Ingalls & Stedman, 2016, p. 5) that materialise in policy prescriptions and outcomes, meaning that care needs to be taken in asking who wins and who loses from such words. Post-structural political ecologists study how different stakeholders shape reality in discursive struggles (Jones, 2008).

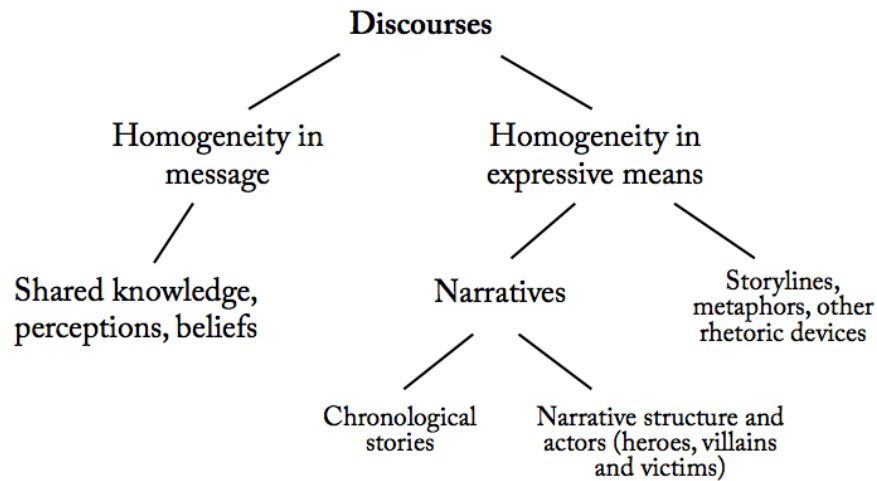


Figure 2.2 Analysis of discourses (based on explanations from Adger et al., 2001, p. 685).

Adger et al. (2001) discuss how discourses are made up of homogeneity in message and in expressive means, such as narratives (see Figure 2.2). Shared perceptions and narratives are of particular interest for this thesis. Perceptions are influenced by other factors, such as individuals' worldviews, personalities, ethics, experiences and interpretations of information (Harding et al., 2009), but they also feed into and are fed by discourses (Dryzek, 2013). Although Foucault and his followers have done much to develop the concept of discourses and their power over people's thinking, like Dryzek (2013), I take the view that people are able to compare and entertain a variety of environmental discourses. For Dryzek, this capacity to reflect on discourses is "actually vital when it comes to thinking about effective societal response to environmental issues" (2013, p. 22).

Shared discourses held by different stakeholders (including those who may have differing values) form 'discourse coalitions', and may result in the institutionalisation of certain discourses over others (Hajer, 1995). Participatory research approaches rely on stakeholders' perceptions, with the knowledge that they are most intimately reflective of system functions and sensitive to changes within the context (Whitfield & Reed, 2012). Narratives, typically containing heroes, villains and victims, offer stories that inform decision-making and are implicitly laden with values. Stafford Smith (2016, p. 553) observes that drylands are predominantly associated with a "deficit" narrative, despite many positive aspects, which has presided in the absence of a powerful alternative. In this thesis, particular attention is paid to the institutionalised discourses and narratives within the UNCCD's 'land degradation neutrality' discourse, compared to the discourses of dryland degradation and recovery from the perspective of local stakeholders in the far west of NSW.

3 Literature Review

Central to the concept of land degradation neutrality are the interrelated concepts of land degradation, sustainable land management and restoration. This section presents a review of the academic research regarding these concepts, particularly in terms of challenges and uncertainties. As LDN is a global goal, concepts are discussed in a global sense, with a focus on dryland areas and reference to Australia where appropriate.

3.1 Land degradation

3.1.1 The many faces of land degradation

In everyday language, land degradation appears simple to communicate: a reduction in the capacity of land to be useful, because of human activities or a combination of human activities and natural factors (see section 1.1). While the typical focus of land degradation research has been agricultural, this can apply to any land use, such as mining, urban expansion and waste management. Typically, land degradation is viewed in terms of its manifestations, such as soil erosion by water and wind, soil contamination, fresh and ground-water deterioration, nutrient depletion, reduced organic matter, compaction, sedimentation, acidification, salinisation and alterations to vegetation composition and structure. Some manifestations of land degradation, like water- and wind-erosion, can occur naturally; others, such as soil acidification and salinization, are most likely symptoms of unsustainable land management. Sometimes, the effects of certain types of land degradation are serious because they can be long-lasting, widespread, difficult to reverse and of high impact to those most vulnerable.

Complications abound when the concept of land degradation is viewed more closely. Biophysical processes such as drought and climate variability interact with the multifaceted socio-economic processes in complex ways (Fleskens & Stringer, 2014). As raised in section 1.1, different definitions and ways of analysing land degradation reveal different perceptions of what should be prioritised and neglected, stemming from different relationships to the environment. Research approaches are products of particular worldviews, also influenced by the angle used to examine the problem. Three main streams of research-derived narratives about land degradation are summarised in Table 3.1 (based on Biot et al., 1995).

Table 3.1 Typical characteristics of main approaches to land degradation (adapted from Biot et al., 1995, p. 8)

Variable	Classic	Populist	Neo-liberal
Farmer behaviour	ignorant, irrational, traditional	virtuous, rational community-minded	rational, egocentric
Diagnosis of environmental problem	environmental solutions	socio-political solutions	economic solutions
Immediate causes of environmental problem	mismanagement by users	mismanagement by state, capitalists, transnational corporations, big business	poor government policies and bureaucratic rules and regulations
Structural causes of degradation	over-population, backwardness, lack of foresight, ignorance	resource distribution, inappropriate technologies	inappropriate property rights, institutions, prices, and rapid population growth
Institutional prescription	top-down centralised decision-making	bottom-up participation	"market" policies, property rights, resource pricing, self-targeting safety nets
Academic discipline; profession	science; bureaucratic	sociology; activist, NGOs	economics; development professional
Gender orientation	gender blind	virtuous but victimised women	gender myopia
Research framework	systematic empiricism	rapid/participant rural appraisal, community as unit of analysis	methodological individualism
Orientation to market	not considered	exploitation	Pareto optimality and externalities
Models of farmer society	conservative, paternalistic	egalitarian	democratic / liberal
Views of collective action	deficient	essential and unproblematic	conditional rationality /political entrepreneurs

The classic approach represents the predominant crisis narrative, where land degradation is assumed to be a widespread encroaching disaster largely caused by mismanagement and overpopulation, requiring technical solutions derived from experts. The populist approach strongly feeds into the counter-narrative of land degradation, requiring bottom-up solutions. The neo-liberal approach can be discerned as a “counter-revolution against the populist approach” (Biot et al., 1995, p. 12), often aligning with the crisis narrative, but with a greater focus on economic solutions for “win-win”

policies and interventions. Drawing from and directing scientific paradigms, these narratives persist and often have more institutional strength than others.

The study of dryland degradation emerged based on a scientific paradigm that asserts that drylands are in a natural stable balance that is maintained until it is affected by an external disturbance, such as its management and bioclimatic drivers. The disturbance of equilibrium then triggers off a devastating ‘downward spiral’ of productivity loss that increases poverty that in turn causes further degradation in an irreversible negative feedback loop (MA, 2005). Population growth, migration, the poor and those most reliant on the land have been blamed for the continuation of this downward spiral (Way, 2006), influencing a multitude of land degradation studies on deforestation, over-cultivation and overgrazing as key pressures. Such understandings suggest transitions in rangelands are linear and reversible (if overgrazing is an issue, reducing livestock pressure will restore the ecosystem), whereas alternative models suggest that regeneration depends on the dynamics between different drivers, such as rainfall (Easdale & Domptail, 2014).

Non-equilibrium or disequilibrium ecological models suggest that drylands are dynamic and fluctuating, affected by inherent variability, and gradually shifting between regimes as a result. Anthropogenic changes are more challenging to distinguish, although mounting bodies of evidence have demonstrated that the poor are not necessarily responsible for degradation (Jones, 2008; Scherr, 2000) and that the impacts of population growth are more nuanced and contextual (Blaikie & Brookfield, 1987; MA, 2005). Despite these ecological developments, the downward spiral and degradation-for-survival discourses still pervade initiatives tasked at addressing land degradation (for example, see Liniger et al., 2011; UNCCD, 2013a) leading Herrmann and Hutchinson to assert that “we have a non-equilibrium world that is saddled with an overriding equilibrium mindset and policies that reflect it” (2005, p. 552). Bestelmeyer et al. (2015) suggest analysing dryland degradation in terms of state changes and corresponding land use changes, allowing for equilibrium, non-equilibrium and threshold dynamics.

3.1.2 A comparison to what? Baselines and indicators

Fundamentally, an understanding of degradation as a decline in land condition implies that a comparison needs to be made with a baseline state of non-degradation. Prince (2016, p. 238) argues that without such a comparison, land condition differences could just be an indication of variations in other characteristics (such as soil fertility and rainfall patterns), saying that “no measure of ‘degradation’ is useful unless the condition in the absence of degradation is known with which to compare degraded sites”. For example, comparing different plots of rangelands with different stocking

rates can be problematic, given the amount of ‘noise’ in climatic fluctuations and soil variability that affects vegetation growth, let alone native grazers already present in the ecosystem.

So far, attempts to select a baseline state – such as the land’s condition 10–50 years ago – have been largely arbitrary, particularly when ecosystems are understood to be dynamic. An influential example is that of Lamprey’s UN-sponsored aerial survey of the Sahel in 1975 (conducted after a severe drought) compared to a 1958 vegetation map (conducted after a wet decade); this comparison was used to inaccurately say that the desert was advancing because of poor land management (Adger et al., 2001; Verón et al., 2006). A short-term ahistorical snapshot of erosion may be misleadingly identified as degradation, when it may in fact be part of a longer process of degeneration and regeneration, meaning that an understanding of the land’s history is required (Biot et al., 1995).

An alternative conceptualisation of land degradation was presented in the landmark Millennium Ecosystem Assessment (MA) report, which viewed land degradation as the process by which the provision of primary production is degraded, “compared with its provision prior to human pressures” (MA, 2005, p. 636). Similarly, recent correspondence in *Nature* proposed to assess land degradation by “using an ecosystem’s pre-degradation state, also known as its natural state... This state has no human-caused loss of biodiversity or of ecosystem functions” (Kotiaho et al., 2016, p. 37). However, an emphasis on human activity as a primary degrading force risks denying a historical and ecological place of humans within ecosystems, continuing a philosophical divide between humans and nature. In contrast, the concept of pristine ‘naturalness’ is questioned when humans’ influence since prehistoric times is acknowledged (Robertson & Roshier, 1999). Australia’s indigenous land management provides an illustrative example.

Through over forty thousand years of indigenous land management, the entire Australian environment is a man-made result – “carefully made” and “unnatural” (Gammage, 2011, p. 4). Primary productivity and biodiversity have been constantly manipulated through Aboriginal practices, such as the use of fire to replace some plant communities with others (Gammage, 2011). Some burning practices are part of the land’s ecological history, with some flora and fauna requiring certain amounts of fire for germination and the creation of habitat (Clarke, 2008), while large bushfires in Australia can still be a cause of degradation (Bradstock, 2008). This suggests that drivers of land degradation are not necessarily distinguishable because they are undertaken by humans; rather they are drivers because they are particular types of activities occurring in a certain context and at a certain extent or degree. Comparisons to non-degraded reference states need to be specific about what changes have occurred. Nonetheless, a lack of sufficient reference sites continues to be an issue for degradation assessments (Verón et al., 2006).

Because the concept of land degradation is vague and all-encompassing, Prince (2016, p. 255) recommends comparing specific conditions and components of land degradation, while acknowledging that this can be “only suggestive at best”. This approach to land degradation has led to a focus on trends from measurable indicators, although their selection is still perspective-dependent. The broadness in the scope of what constitutes land degradation leads to an array of indicators through different analytical lenses. Biophysical interpretations often focus on changes to ecological functions and abiotic features, using methods based on ecology, soil science and remote sensing, whereas socio-economic conceptualisations typically focus on changes to the productive capacity of land for human use, generally using economic indicators and stakeholder opinions to measure ecosystem services (Reed et al., 2015). The results produced by these different analytical methods do not have a linear relationship, making it difficult to compare or aggregate studies based on different methodologies (Reed et al., 2015). Because method selection can legitimise particular voices over others, interdisciplinary methods and multi-stakeholder participation are well suited to anticipating, assessing and adapting for analytical differences. As land degradation is inherently complex, dynamic and variable, some argue that it can only be judged by its context – scientifically, politically, socially and economically (Warren, 2002).

3.1.3 Contested measurements and lingering unknowns

Temporal and spatial scales of analysis are a key factor in assessing land degradation. In dryland ecosystems, natural and anthropogenic pressures can produce similar effects over short time scales (Herrmann & Hutchinson, 2006). Reynolds et al. (2011) discuss how drylands are characterised by significant fluctuations in biophysical conditions and precipitation, making it difficult to accurately determine short- and long-term changes, including changes that might be temporary or permanent. Variability is also extremely high on a fine spatial scale, with Warren finding that land degradation’s “impact varies more from field to field than from village to village, let alone from region to region” (2002, p. 454). Additionally, land management decisions occur simultaneously at different levels – individual farmers may be destructive or negligent but also large-scale administrative policies may be injudicious or ineffective (Fleskens & Stringer, 2014), so it becomes not just a task of extricating human from biophysical causes, but also peeling off layers of various overlapping management decisions, and seeing how they change and cause changes over time.

Since the assessment of land degradation at larger spatio-temporal scales is highly dependent on observers’ judgements and analysis methods, the use of indicators should be treated carefully. Although Stavi and Lal (2015) call for uniform criteria and standard methodology, land degradation does not lend itself well to de-contextualisation. Several global assessments analysed by Vogt et al.

(2011), including GLASOD, LADA and GLADA¹ amongst others, were found to have significant limitations concerning indicators and integration of human and ecological aspects. GLASOD's findings were limited to soil rather than land (thereby excluding consideration of vegetation, water and climate) and were found to be subjective (Grainger, 2015), inconsistent and not reproducible (Andersson et al., 2011). Forming the basis of GLADA, Bai et al. (2008)'s findings have been criticised for their misleading methods and flawed results (Wessels, 2009). Such studies have relied on the use of Normalised Difference Vegetation Index as a proxy for net primary productivity (NPP), which does not necessarily correlate with land degradation because an increase in the production of vegetation in rangelands may indicate undesirable bush encroachment, which can be seen as a form of land degradation (Vogt et al., 2011) and other signs of degradation – such as overuse of fertilisers – are not represented by the indicator (Verón et al., 2006).

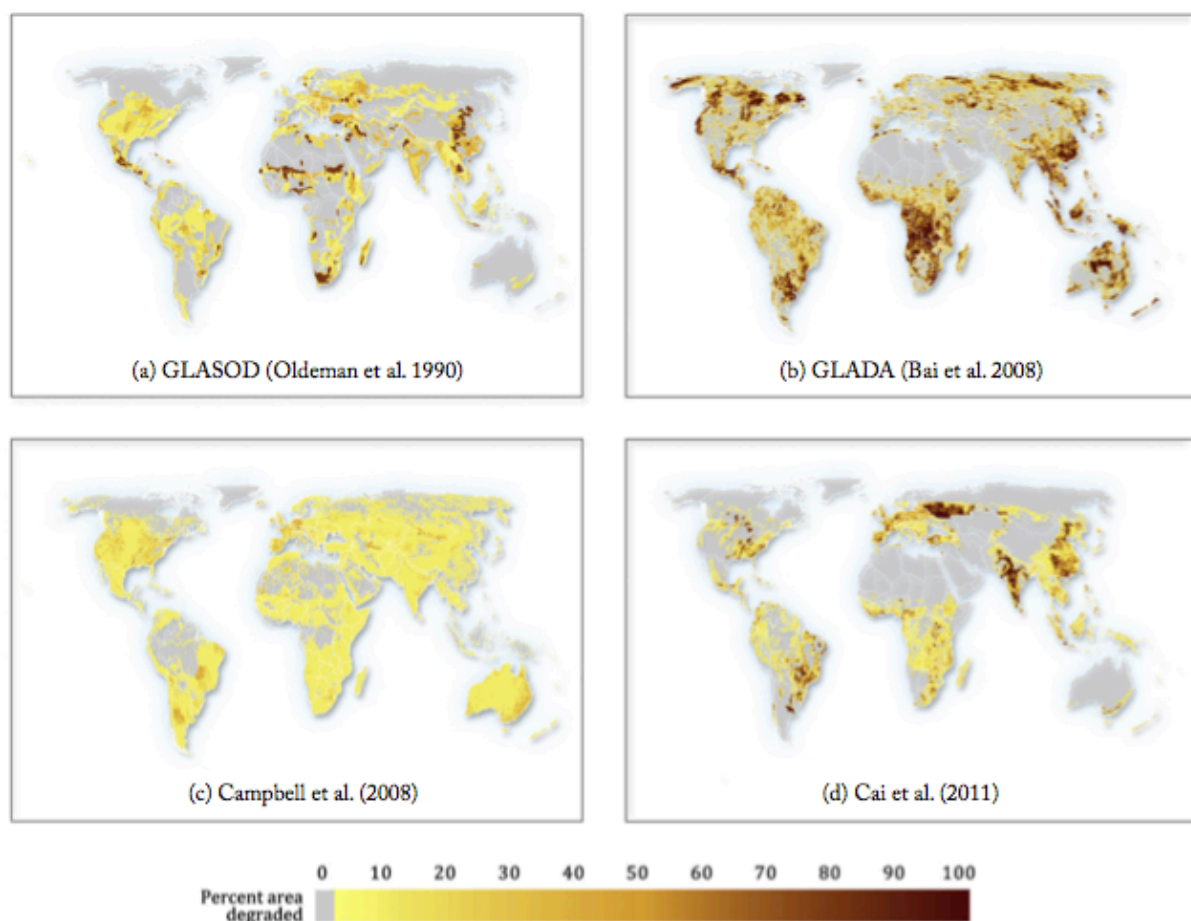


Figure 3.1 Comparison of major global estimates of land degradation, based on: (a) expert opinion, (b) remotely sensed satellite information, (c) calculations of abandoned agricultural land, and (d) biophysical models (adapted from and citations within Gibbs & Salmon, 2015, p. 17).

¹ GLASOD (Global Assessment of Human-Induced Soil Degradation), LADA (Land Degradation in Drylands), GLADA (Global Assessment of Land Degradation and Improvement).

Conflicting analyses of land degradation are demonstrated by the significant discrepancies and uncertainty surrounding its seriousness, extent and distribution on a global scale (Figure 3.1). Gibbs and Salmon (2015) highlight these discrepancies, observing that disagreements occur more often about land that is degraded than land that is not, that the social and environmental costs of using such land is frequently ignored, and that most global estimates are “likely too high” with consequent overestimations of their potential recoverable productivity. Global land degradation has been estimated between 15-63%, and 4-74% for global dryland degradation (Safriel, 2007). The figure of 70% degradation in drylands is more commonly used than other estimates (Safriel, 2007), feeding into the urgency of the desertification crisis narrative and authority of institutions combatting degradation (Jones, 2008), despite this figure being calculated through weak information based on “anecdotal accounts, research reports, travellers’ descriptions, personal opinions, and local experience” (MA, 2005, p. 637). More recent attempts at assessing global degradation rely on remote sensing techniques, however, according to Prince, “assessments of severity are limited and generally not adequate beyond the local, and certainly not the global scale” (2016, p. 255).

Remote sensing is limited in that it observes degradation symptoms (and emphasises the features of land degradation that can be observed remotely), requiring a greater understanding of the processes which cause these symptoms (Biot et al., 1995). However, remote sensing can offer value for studies over a large scale when its evidence is backed up with local-scale investigations. This was well demonstrated by the Australian Collaborative Rangelands Information System (ACRIS), which had nested scales of integrated data with firsthand ground-truthing – thanks to members of ACRIS management living in the rangelands they were monitoring and therefore able to see their models’ limitations (Stafford Smith, 2016).

3.2 Sustainable land management

Sustainable land management (SLM) is described as being diametrically opposed to land degradation, as its ‘antithesis’ (Stringer & Dougill, 2013) and its ‘antidote’ (Liniger et al., 2011). While SLM can be simply thought of as “people looking after the land”, it is often discussed as practices and approaches that maintain long-term land use (Liniger et al., 2011). TerrAfrica’s definition of SLM is “the adoption of land use systems that, through appropriate management practices, enables land users to maximise the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources” (in Liniger et al., 2011, p. 19). With its environmental, economic and socio-cultural dimensions, Gnacadja (2015) promotes SLM as deserving a place ‘centre-stage’ in the world’s sustainable development agenda, and it is widely acknowledged to be able to achieve multiple ‘wins’ (Cowie et al., 2011; Reed & Stringer, 2015).

3.2.1 The uptake of SLM practices

Practitioners, governments and scientists have developed and promoted a variety of transferable ways to overcome land degradation, such as in the World Overview of Conservation Approaches and Technologies (WOCAT), a global online database of standardised tools, approaches and case studies which are made available for improved decision-making and adaptation. Tools are fundamentally based on soil and water management (concerning grazing, terracing, low tillage, water harvesting and cover crops, among others) and soil fertility management (such as composting, manure, agroforestry, integrated land management) (Bisaro et al., 2014). Approaches are methods for land management technologies to be introduced and implemented, including community mobilisation, local initiatives, project/program development, subsidies and external support (Liniger & Critchley, 2007).

SLM usually implicitly refers to agriculture-based practices, but as it is also about the sustainable use of all land, Barkemeyer et al. (2015) argue that other important sectors such as mining are often overlooked. Andersson et al. (2011) mention that with changing climates and global demands for products, rural livelihoods are increasingly becoming diversified rather than being simply about agriculture, which may contribute to difficulties in implementing SLM if narrowly conceived.

Indeed, despite its people-centred principles to involve land users, SLM's "alarmingly low" uptake is a common frustration (Liniger et al., 2011, p. 43). Blame is often placed on contextual factors and the lack of financial backing (see ELD Initiative, 2013), with a tendency for advocacy for more investments and credit access schemes (for example, Liniger & Critchley, 2007). In this regard, some advocates of SLM stress the importance of first evaluating the total economic value of land in monetary terms which then allow them to frame SLM in terms of 'investment opportunities' (ELD Initiative, 2013), following a neo-liberal narrative towards land management.

Other suggestions are proposed to support the uptake of SLM, including raised land degradation awareness, improved market access and secured land tenure (Kong et al., 2014; Nkonya & Anderson, 2015). However, various contextual factors are required because previous studies have shown how knowledge and awareness of land degradation issues may not be the "decisive factor when farmers decide to invest in land management" (Adimassu et al., 2013, p. 997). Bisaro et al. (2014) find that no potential enablers of SLM have unambiguous or universal links to the prevention of land degradation. Instead of promoting characteristics of particular SLM practices, Price and Leviston (2014) suggest that farmers' attitudes and beliefs need to be considered. Biot et al. (1995) recommend shifting from the question of non-adoption to instead asking why farmers' current practices are pursued.

SLM's focus on practices to address the state and impacts of land degradation has risen from the notion of inappropriate practices of land users. However, the focus on counteracting the state and

impacts of land degradation risks obscuring the greater social-economic and policy context in which land management decisions are made (Nkonya et al., 2011b). Through the contributions of political ecology, there been acknowledgements that “primary drivers of degradation may occur at levels beyond the land user” (Gisladdottir & Stocking, 2005, p. 105). Although there is a danger for SLM solutions to be oversimplified blueprints for individuals to implement better practices, a more complex understanding of SLM recognises that changes need to take place at all levels of decision-making (Liniger et al., 2011).

3.3 Restoration

As opposed to SLM (which is aimed at preventing degradation), restoration is the process in which already degraded lands are repaired. In discipline, land restoration has progressed quickly over the last three decades (Aronson & Alexander, 2013), producing a considerable body of generic knowledge and guidelines (Abensperg-Traun et al., 2004). However, significant questions remain about what exactly is meant by ‘restoration’, and different discourses reveal different goals of stakeholders and the associated environmental consequences.

3.3.1 Restoration, rehabilitation, reclamation: conflicting goals for restorative works

While ‘restoration’ is often used to refer to any work aimed at repairing degraded land, there are significantly different connotations by the terms restoration, rehabilitation and reclamation (among others). Restoration implies that altered land should be brought back to its historical or former state – imbuing a sense of fidelity and biotic integrity (Bradshaw, 1996). Jordan argues that although people benefit from participating in recovering ecosystems, restoration should attempt to return *all* of the landscape’s features, “with a studied disregard for human interests” (2003, p. 22). In comparison, rehabilitation signals a return to previously existing biogeochemical processes or health. While restoration reinstates species, rehabilitation reinstates functions – even if that involves the introduction of new species (Callicott, 2011). Rehabilitation is more oriented to the future, looking at what functions are needed, without the constraints of strict historical fidelity (Choi, 2007). Alternatively and often used in industry, reclamation aims not to return degraded land necessarily to any previous state but instead, to a state that is deemed ‘useful’ (Bradshaw, 1996).

Philosophical questions arise from the aims of restoration and rehabilitation to return to previous ecological conditions – similar issues to defining a relevant, comparable non-degraded reference condition (see section 3.1.2). Callicott (2011) discusses the significance of different potential end points and argues that paradigmatic shifts in ecological understandings make our reference systems problematic. He argues that the aim to restore the land’s original and natural condition is founded on two myths. Firstly, because a non-equilibrium understanding of ecosystems indicates that they are

gradually changing as organisms come and go, “any serious attempt to define the original state of a community or ecosystem leads to a logical and scientific maze” (Soulé, 1995 in Callicott, 2011, p. 306). Secondly, the idea that land can be restored to its pre-settlement ‘natural conditions’ reflects the colonial idea of wilderness, where in fact indigenous (and therefore anthropogenic) influences have manipulated landscapes for thousands of years. The difficulties in achieving previous conditions can also be argued on technical, social and political grounds, but for Callicott the crux of the issue comes down to an appropriate ecological consideration of temporal and spatial scales. Ecological scales enable some anthropogenic conditions to be justified and others to be rejected. Callicott (2011) asserts that preindustrial human disturbances should be incorporated into recovery plans, and targets and goals should be adjusted as needed through adaptive management.

However, challenges still arise when circumstances have changed (through climate change, for example) to the extent that returning land to a past condition is not a valid option (Stafford Smith, 2016). In an Australian context, such challenges have motivated a restoration approach where “absolute concepts of naturalness be abandoned in favour of management for specific objectives” (Beeton et al., 2006, p. 44), and such objectives are not able to be fulfilled in public lands alone (Saltzman et al., 2011). In what are typically seen as ‘productive landscapes’, the needs and aspirations of current land users need to be taken into account because they are also part of the landscape (Abensperg-Traun et al., 2004; Robertson & Roshier, 1999).

Suding et al. (2015) offer four key principles to inform any restoration project, factoring in such considerations. These are: (1) increase ecological integrity, in terms of complexity and ecosystem functions; (2) ensure long-term sustainability, through resilience and relevance; (3) consider the past and future, for guidance and flexibility; and (4) engage society, by supporting direct participation and strengthening communities. Very few papers in Wortley et al.’s (2013) review of restoration literature included socio-economic attributes, or only included information about community involvement and resource inputs without the consideration of other costs and benefits.

3.3.2 Large-scale restoration in practice

Implementation is now seen as the top priority for restoration activities, revealing widespread trust in its achievements and practitioners’ abilities, and highlighting its co-benefits for a range of global environmental programs and agreements covering land degradation, biodiversity, climate change and sustainable development among others (Aronson & Alexander, 2013). The UN’s climate summit in 2014 hailed “restoration of degraded ecosystems as an auspicious solution to climate change” (Suding et al., 2015, p. 638). Carbon sequestration is often promoted alongside other benefits of restoration. While promoting the stance of ‘nothing ventured, nothing gained’, Aronson and Alexander (2013)

also warn against overpromising on the science front. The fact remains that restoration is “not a magic bullet” and should not be regarded simplistically (Menz et al., 2013, p. 527), and restoration projects rarely achieve everything they set out to achieve (Suding et al., 2015). As a method to combat land degradation, investments have focussed on funding rehabilitation and reclamation action, even though understanding what does or does not work is “hardly known nor investigated” (Nachtergaele et al., 2011 in Prince, 2016, p. 255).

Methodological uncertainty has not halted the impetus of large-scale restoration initiatives, notably the ‘Great Green Walls’ of China and the Sahelian region. To address dryland degradation from 1978–2050, China’s Great Green Wall (also known as the Three North Shelterbelt) is a 7000-km-long tree-planting program driven through state intervention (Andersson et al., 2011). It is more accurately classified as reclamation because it is mainly afforestation – creating new ecosystems and land uses by planting forests where there were once savannahs (Xu, 2011). However, in spite of being hailed as successes by government officials and Chinese researchers, Wang et al. (2010) found little evidence to substantiate these claims. In fact, Cao et al. (2011) suggest that by ignoring climatic and other contextual factors, the Great Green Wall has led to increased deterioration of the regions’ environmental values. As an example, the poplar plantations’ water demands exceed supply, requiring unsustainable groundwater irrigation which exacerbates water shortages (Wilske et al., 2009). Low survival rates and biodiversity losses suggest to Jiang (2016, p. 530) that the wall is more like a costly, ineffective ‘green desert’, representing “an astounding case of an ecological mismatch”. Nonetheless, it is frequently valorised by the media and aggressively pursued for political purposes (Jiang, 2016). Behnke and Mortimore (2016) liken it to the desertification crisis narrative, characterised by guilty locals, and top-down technological policy responses that are disconnected from science.

Clear inspiration from China’s program can be seen in the more recently proposed ‘Great Green Wall for the Sahara and the Sahel Initiative’ (GGWSSI), a “very controversial megaproject” (Andersson et al., 2011, p. 306) funded by African governments, the UNCCD through the Global Mechanism, the European Union, and several others. Toulmin and Brock (2016, p. 47) discuss how the initial communications described the project as a buffer zone of reforestation to protect the Sahel from the perceived threat of encroachment, “literally, a great green wall of trees to ‘stop the spread of the desert’”, but the rhetoric has since changed to one more of contemporary goals like carbon sequestration and climate resilience, through a “mosaic” of SLM interventions (for example, see UNCCD, 2016a). Reenberg (2012) warns of potential negative impacts of the initiative, including the disruption of local livelihoods, migration patterns, competing water demands and limited attention paid to the drivers of degradation. Toulmin and Brock (2016) see little evidence of local outcomes of

the Great Green Wall so far, nor an impression that local people and institutions will be recognised and empowered.

Alternative approaches to large-scale restoration exist. Instead of the Great Green Wall of China, Jiang (2016) points out that allowing sands to move actually allows greater rainfall infiltration which nurtures the land around the sands, and that natural recovery can be an effective way to restore degraded drylands. Jiang's alternative is more resemblant towards 'facilitated resilience' (see section 2.2), particularly in her argument that addressing dryland degradation requires "shifting to an attitude of respect for both nature and culture" (2016, p. 514). Holl and Aide (2011) refer to several examples where active restoration (direct human interventions) is not necessarily needed or actually slowed or strongly altered recovery, as well as effective examples of passive restoration (removal of non-ecological disturbances and allowing natural recovery). Their framework suggests that the selection of active or passive restoration methods should depend on the ecological and social context of degraded sites, and that patience should guide projects and allow land managers to see the possibilities of the natural recovery process.

The Australian Landcare movement is another very different approach to large-scale SLM and restoration. It is unique in its grassroots, community-based approach to natural resource management (NRM) being linked to tiers of government institutions, characterising it as a hybrid of a social movement and government program (Wilson, 2004). However, it has significantly changed over time. In the 1980s it was initially focussed on the shared benefits of community self-reliance – "landholders working in their own local social group to solve their own local land conservation problems in their own way" (according to Poussard, 1992 in Curtis et al., 2014, p. 177). Coinciding with major funding changes, there has been a noticeable shift towards a neoliberal and managerialist approach (Tennent & Lockie, 2013) which is more interested in "instrumentalising communities... as on-ground implementation agents of NRM strategies endorsed at higher levels" (Curtis et al., 2014, p. 190). Despite this shift and various challenges (including volunteer and leader retention, minimal ability to shape policies and its 'budgetary shackles'), Landcare has a proven record of cost-effective NRM success, improving land management practices and the environmental condition of degraded areas through the promotion of sustainable attitudes and enhancement of adaptive capacity (Curtis et al., 2014; Wilson, 2004). Particularly through farm visits, workshops, trials and meetings, Landcare is an example of the beneficial impacts of locally raised awareness about land degradation and land management.

4 LDN and the UNCCD approach

Because they also have particular views on the environment and how its degradation should be defined, measured and managed, “scientists and policy-making and implementing institutions should also be made the subject of study” as much as the states and land users (Biot et al., 1995, p. 24). As previously introduced (section 1.2), LDN is primarily championed by the UNCCD to become the world’s goal to target land degradation. It should be noted that the UNCCD is not the sole organisation working on LDN or encouraging SLM and restoration to counteract degradation – other examples include IUCN (2015), FAO (2015) and ELD Initiative (2013). However, the UNCCD has been instrumental in the development of LDN while harnessing such discourses, and is therefore an appropriate subject of study. While LDN has been particularly promoted through personal efforts by members of the UNCCD Secretariat (such as Luc Gnacadja, Executive Secretary 2007-2013, and Monique Barbut, Executive Secretary from 2013), my approach has been to mainly examine the publicly available information produced by the UNCCD as a whole.

This section first describes the background to the UNCCD in order to understand the context in which LDN has been developed. It then discusses the narratives about LDN that form a particular depiction of the problem and its solutions. These narratives are then observed within an analysis of the three LDN-based programs introduced by the UNCCD, and wider implications are drawn.

4.1 Background of the UNCCD

Examining the UNCCD’s context and challenges reveals financial and political potential motivations for their conceptualisation of LDN in response to global degradation. Launched in 1992 at the UNCED Rio Earth Summit, along with two other ‘Rio conventions’, the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention on Biological Diversity (CBD), the UNCCD came into force in 1996. By this time, Andersson et al. (2011, p. 306) observe that degradation “policy was seriously disconnected from science”. 195 UN member states (194 countries and the European Union) are parties to the UNCCD, which means there is a nearly global requirement for countries to report their proposed strategies to address the challenges of land degradation and drought through the creation of National Action Programmes (NAPs) (Reed et al., 2015). However, some have typified UNCCD as the ‘neglected cousin’ of its related conventions (Chasek et al., 2015).

Grainger (2015) observes that one of the reasons why the UNCCD is seen as largely ineffective relates to the conflict between its parties’ expectations – developed countries mostly regarding it as an environmental convention whereas developing countries support its status as more of a convention for

development. Its unofficial status as the convention for development might have contributed to its relatively little interaction with ‘developed’ countries like Australia (Stringer, 2008).

Although global institutions are characterised by international coordination, the UNCCD’s principles also favour local empowerment and decentralisation. Stringer and Dougill (2013) observe the acknowledgement in the UNCCD’s text of the need for top-down and bottom-up integration. However, the ‘participatory ethos’ contained within the UNCCD’s normative framework has been hard to carry out, with imprecise legal directions that do not specify parties’ national obligations (Stringer et al., 2007), leading to the criticism of NAPs as “irrelevant to mainstream policy making” (Chasek et al., 2015, p. 6), and no mechanism to ensure that local and traditional knowledge is considered in UNCCD processes and discussions (Reed & Stringer, 2015). By focussing on mainly the state and impacts of degradation, Nkonya et al. observe that the UNCCD’s 2008-2018 strategy neglects causal factors, particularly in terms of socio-economics and policy, such that the dynamics of the Dryland Development Paradigm (see section 2.1) are “not strongly represented within the current UNCCD” (2011b, p. 241).

Access to funding in support of activities advancing its goals is an ongoing challenge for the UNCCD, relying on the facilitation of funding through the Global Mechanism. The Global Environment Facility allocates roughly 4% of its funding to land projects (compared to 62% for climate change and biodiversity, in Chasek, 2013). Of the three Rio Conventions, the UNCCD has been the most eager for the conventions to work in synergy (Grainger, 2009), potentially related to its comparatively limited funding. Scientific links between land degradation, climate change and biodiversity loss can be clearly found (Cowie et al., 2011), but this approach has been found challenging in practice at national levels because of a lack of coordination and skills, inter-ministerial competition, and implementation inconsistencies (Andersson et al., 2011).

The UNCCD has a mandate to address drylands – particularly marginal lands affecting marginalised populations – and as such has had trouble engaging powerful interest groups and maintaining robust financial and political support (Chasek et al., 2015). Its focus is increasingly now on land degradation in general, with the UNCCD angling to promote sustainable land management in all climatic zones, regardless of their (potentially changing) aridity status (Vogt et al., 2011). By turning its attention to land degradation instead of dryland degradation, the UNCCD is broadening its scope to encompass more biologically diverse and carbon-rich lands, while possibly diluting its attention on livelihoods (Welton et al., 2015). While the UNCCD remains enthusiastic about this expanded scope (for example, Gnacadja, 2015), its capacity to deliver such supervision on its own is questioned (see Chasek et al., 2015; Welton et al., 2015).

4.2 A closer look at land degradation neutrality: the narratives

Initially endorsed in the UN's "The Future We Want" outcome document (United Nations System Task Team, 2012), the concept of LDN is the UNCCD's centrepiece to its new approach to land degradation, with ripple on effects throughout the land degradation policy and research arenas. However, the notion of a 'land degradation neutral world' has been one of the most contested conference agenda items for UNCCD member parties, with some arguing that it is too broad and undefined for legally-binding agreements (IISD, 2013). Proponents of LDN support its aspirations to unify global efforts against land degradation and its ethos of 'not giving up' on degraded land (UNCCD, 2013d).

In her foreword to a recent UNCCD publication, Executive Secretary Monique Barbut described LDN as a "revolutionary idea" that "may come to redefine our relationship with the nature" (UNCCD, 2016b, p. 1). She has also described that one of LDN's 'vital principles' is that "the people and communities whose everyday decisions and actions determine the condition and use of land resources must take part in designing and implementing the measures to restore the land" (Barbut, 2015). Because of inseparable links to food security and sustainable livelihoods, LDN measures are promoted as delivering benefits beyond land quality (Fleskens & Stringer, 2014). Chasek et al. suggest that a land degradation neutral world will inspire discussions that "capture the attention of stakeholders at all levels, and thus breathe new life into land degradation theory and practice" (2015, p. 7). Using LDN-focussed UNCCD publications as a basis for discourse analysis, I explore this new paradigm and the narratives that are told.

4.2.1 The Villains and the Victims

(i) The desertification crisis continues and expands

The classic narrative of desertification as a crisis is continued in UNCCD publications: "Desertification is a silent, invisible crisis that is destabilizing communities on a global scale" (UNCCD, 2014, p. 2). Desertification is depicted as the anonymous villain with an unquenchable thirst for expansion. The crisis has expanded beyond poverty and desertification is centrally connected with many sustainable development issues, including food and water insecurity, climate change, biodiversity loss, conflicts and environmentally forced migration (see Figure 4.1).



Figure 4.1 “The far reaching impacts and downward spiral” of desertification, land degradation and drought (UNCCD, 2013a, p. 6).

Several decades ago, the classic narrative frequently described a ‘downward spiral’ or ‘vicious cycle’ between degradation of the environment and poverty (as discussed within Adger et al., 2001; Scherr, 2000; Way, 2006) (and see section 3.1.1). Subsequent scientific analyses have questioned this simple feedback loop (such as Reynolds et al., 2007), showing situations to be much more complex and often related to abuse of power by the powerful, ineffective policies, and marginalisation and exclusion of land users rather than poverty as the predominant cause (Scherr, 2000; Way, 2006). Despite this, the UNCCD publications continue to use these phrases, for example:

“...degraded drylands are less able to store water and, in a vicious cycle, the impact of climate change on water availability further threatens these fragile communities and ecosystems.” (UNCCD, 2015a, p. 14)

Reenberg (2012) discusses how desertification narratives shifted from concerns about deserts spreading, to sustainable NRM, and now to climate change adaptation. She observes that repeated key words become ‘cemented’ in such narratives, regardless of the data.

(ii) Alarming (but attractive) extent of degradation

Accordingly with the crisis narrative, the extent of degradation is widespread and defined on a global level. 2 billion hectares across the world are said to be already degraded (the size of South America; a relatively high estimation – see section 3.1.3). Often this land is described in economic terms, as

“underperforming assets” (Gnacadjia, preface to UNCCD, 2013a), but rather than this being a grim story, the land is said to have “potential” (UNCCD, 2013a, p. 11). For example:

“The private sector needs to be encouraged to see the two billion hectares which still hold the potential for restoration and rehabilitation as a market opportunity.” (UNCCD, 2015d, p. 17)

There is a risk that this framing of degraded land fails to distinguish between the capacity and availability of the land to be restored, where ‘physical suitability’ is a matter of its current and potential condition, whereas ‘actual availability’ depends on a number of factors, including optimal land uses, economic feasibility and social and political circumstances (Grainger, 2015).

One of the most frequently used statistics in the UNCCD publications is that globally, 12 million hectares of land are degrading each year (UNCCD, 2012c, 2014, 2015a, 2016b). Sometimes there are small rhetorical embellishments to this statistic, such as that it is a “conservative estimate” (UNCCD, 2015a, p. 18) or that “this is equal to 23 hectares of land transformed into man-made desert every minute!” (Gnacadjia, 2012). On the rare occasion that it is cited, the references used are subsequently uncited (such as UNCCD, 2012a) or do not mention the ‘12 million hectares’ rate. For instance, Scherr (1999) contains one of the earlier found instances of the statistic and references Lal and Stewart (1990), who actually say that “the current rate of soil degradation is estimated at five to seven million hectares per year, and the annual rate may climb to ten million hectares by the turn of the century” (p. xiv), referencing guidelines produced by the FAO and UNEP in 1983.

Whatever the origin of this ‘12 million hectare’ figure, its accuracy comes into question when considering that scientists are still ill-equipped to make global assessments of land degradation today (Prince, 2016, and see section 3.1), let alone around 30 years ago, and that many previous global assessments are likely to be overestimated (Gibbs & Salmon, 2015). This may be a case where through repetition, numbers become facts, which Davis (2005) suggests enables urgency for funding and policy changes. Gisladdottir and Stocking (2005, p. 103) discuss how the UNCCD have reinforced questionably extrapolated soil loss data that have fed exaggerated debates and “alarmist propaganda”. Biot et al. (1995, p. 59) observe that “both the classic and neo-liberal approaches have answers to complexity that do not involve understanding it”, which appears to apply in this circumstance.

(iii) The self-inflicting victims

Degradation is depicted as being caused by its own victims, as a result of “poor land management” (UNCCD, 2015d, p. 4) made by communities who “squander” the valuable resource of land (UNCCD, 2013d, p. 4). Other influencing factors are sometimes mentioned but they are spurred by this mismanagement, fitting squarely with the classic narrative:

“The principal cause of land degradation and desertification is the unsustainable exploitation of land productivity by pastoral, farming, and agro-pastoral land uses. This is often exacerbated by misguided or missing policies. ... Overpopulation and livestock are often seen as the culprits of land degradation and desertification. But they are ultimately the consequence of poor decisions and mismanagement.” (UNCCD, 2012c, p. 8)

This message is reinforced by the imagery used in the UNCCD publications, showing suffering members of ‘developing’ countries (see Figure 4.2) in contrast to pictures of sustainable land management. Additionally, land degradation victims are not described as the only people affected but indeed there are global effects because “victims turn into refugees, internally displaced people and forced migrants or they turn to radicalization, extremism or resource-driven wars for survival” (UNCCD, 2014, p. 2). This implies that the global actors therefore have an obligation to combat desertification before such problems are dispersed.

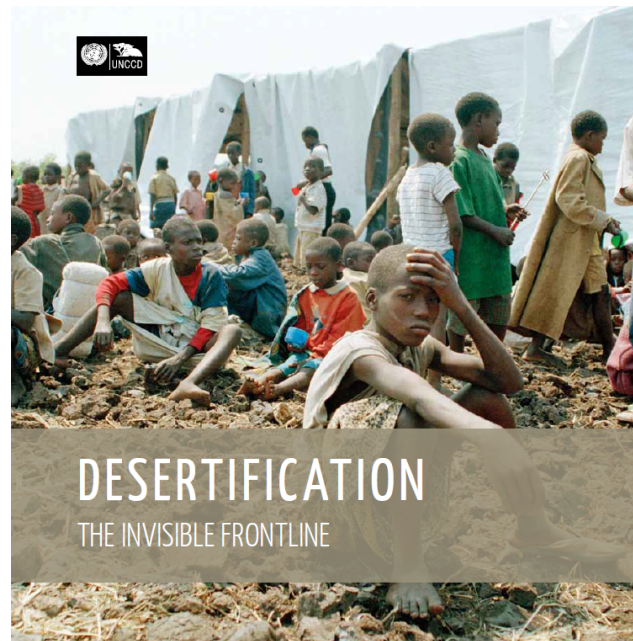


Figure 4.2 “Farming ourselves into extinction” according to Desertification: The Invisible Frontline (UNCCD, 2014, p. 3 and cover image).

This issue of poor land stewardship and consequent migration is frequently mentioned in the UNCCD publications as requiring a particular paradigm shift:

“In many countries, achieving land degradation neutrality will require a paradigm shift in land stewardship: from ‘degrade-abandon-migrate’ to ‘protect-sustain-restore’.” (UNCCD, 2013d, p. 14)

The phrase “from ‘degrade-abandon-migrate’ to ‘protect-sustain-restore’” is often repeated (also found in UNCCD, 2013a, 2016b, 2016d). It is used to call for greater investments from all sectors, to alleviate poverty, enhance efficiency and consequently contribute to economic growth. It is here that there is a transition from the classic narrative of desertification by user mismanagement to the neoliberal narrative of economic solutions (according to Table 3.1).

4.2.2 The Heroes and their Solutions

(iv) SLM and restoration up-scaled by the LDN framework

Because 12 million hectares are considered to be degraded globally each year, LDN is translated into SLM where possible as well as the restoration/rehabilitation of 12 million hectares each year (UNCCD, 2015a). Addressing the drivers of land degradation is rarely mentioned. SLM, as “the vaccine to land degradation” (Gnacadjia, 2012), is described as being cost-effective, readily available, and a builder of resilience. For example:

“We already have proven technologies and good practices that contribute to a more stable and resilient world. Now it is just a matter of scaling them up and scaling them out...” (UNCCD, 2016d, p. 7).

Such good practices and technologies are depicted as terraces, productive crops, and other green landscapes, and are most often implemented by hardworking women (see Figure 4.3), as SLM is associated with gender rights for sustainable development (UNCCD, 2016d). While visually acknowledging women’s responsibility for land management, it is unclear how they will be specifically brought into future discussions. Secured land tenure, extension services and knowledge transfer and market mechanisms are also promoted as necessary for SLM (UNCCD, 2013a, 2015d), which will enable investment as well as benefits for those affected by land degradation. Such interventions risk focussing too much on spreading technologies and practices (which is a characteristic of the global managerial discourse, according to Adger et al., 2001) when effective SLM acknowledges greater social and political complexities. Observing the UNCCD’s assumptions that scaling up SLM should be a straightforward task, Grainger warns “there is a big difference between local success stories and being successful at higher scales” (2015, p. 15).



Figure 4.3 A montage of SLM as women from developing countries bending over in fields (images from Global Mechanism & Mirova, 2015, p. 11; UNCCD, 2013d, p. 21; 2014, pp. 12, 15; 2015a, p. 10; UNCCD, 2016b, p. 18)

For achieving LDN, particular emphasis is placed on large-scale restoration/rehabilitation. Questionable implementation and impacts (see section 3.3.2) have not discouraged the powerful visions and rhetoric of the Great Green Wall programs. The UNCCD has used China's Great Green Wall as one of the world's "best practice" examples to combat desertification (UNCCD, 2012a, p. 16), and praises the initiative's recovery of productive land, restoration of groundwater, sequestration of carbon and anticipated elimination of dust storm hazards (UNCCD, 2014). In a specific publication about its 'hope for the Sahel', the UNCCD also pitches the Sahelian Great Green Wall as the next "8th wonder of the world" (UNCCD, 2016a, p. 18). In turn, the wall helps to build up the LDN discourse, where the "GGWSSI is Africa's flagship programme for meeting the Rio+20 objective of a land degradation-neutral world" (GGWSSI, undated). However, indigenous and forest peoples' organisations have expressed distrust and pessimism about the wall's ecological and socio-economic impacts (IRIN, 2011).

(v) The invaluable role of global institutions and investors

The UNCCD describes itself as being well positioned to facilitate SLM and restoration/rehabilitation for a land degradation neutral world (see Figure 4.4). Indeed, the UNCCD has a mandate to assist affected countries (particularly in Africa, and others at member countries' discretion).

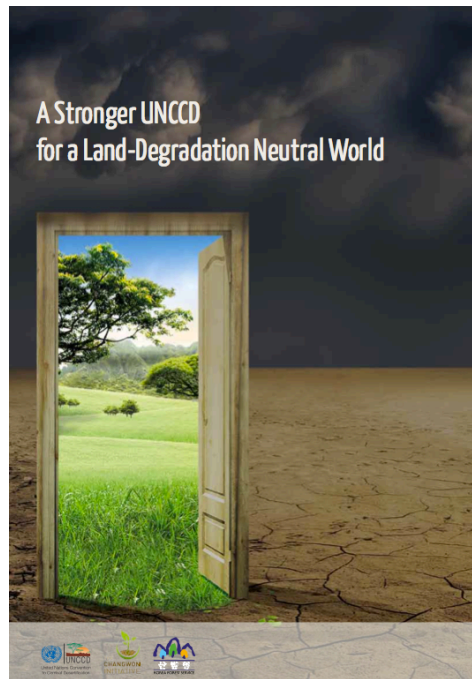


Figure 4.4 The UNCCD opening the door to land degradation neutrality's supreme vision (UNCCD, 2013a, cover image)

In this narrative, partnerships and coordination with international organisations and corporations are also necessary, principally through investment:

“To optimize existing financing, the full spectrum of private and public financial institutions needs to be activated.” (UNCCD, 2015d, p. 17)

Governments, donors and philanthropists are described as being able to provide the right enabling environment through public expenditure, reforms and grants, while the private sector, banks and equity funds can invest in assets which generate profits while meeting sustainable development goals (UNCCD, 2015d). It is argued that a focus on land degradation investments “would be a smart investment that will generate multiple benefits” (UNCCD, 2013a, p. 13).

Utting (2000, p. 4) describes the UN’s “difficult position” in that its regulatory approaches towards transnational corporations have suffered limitations, and it has work within a neoliberal world while increasingly crippled by funding shortages to the extent that public-private partnerships could be seen as a pragmatic response.

(vi) Bold synergies and win-wins

In contrast to the far reaching impacts of desertification, the multiple benefits that LDN is said to achieve enables bold synergies and ‘win-wins’ across conventions, objectives and stakeholders.

According to a UNCCD publication, “SLM and ecosystem restoration represent ‘win-win’ investments benefiting multiple sectors and stakeholders operating within the nexus of food and water

security” (UNCCD, 2013d, p. 7). Again, the existence of win-wins is a key concept of the neoliberal discourse (Adger et al., 2001; Biot et al., 1995), masking a potentially more accurate paradigm of “who-wins-what and who-loses-what?” (Richter, 2003, p. 7).

The successful push to get LDN into the SDGs was seen as a win for the UNCCD and the mindset that land needs to be better valued. Now, Barbut argues that LDN should be prioritised because it is “a pragmatic pathway to slice into the other SDGs” (2015). To highlight its far-reaching significance and to show how land-based solutions are holistic, one of the UNCCD’s publications is dedicated to outlining the importance of LDN for 10 out of the 17 SDGs (see UNCCD, 2016d). According to the UNCCD, the UN’s SDG decisions “have placed the UNCCD at the centre of the global sustainable development agenda, not only through SDG target 15.3 but also through a greater understanding of the Convention’s relevance beyond arid lands and the relationship between LDN and climate change” (UNCCD, 2016b, p. 5). The synergies facilitated by the pursuit of LDN can be seen as an attempt to more fully engage with countries out of drylands and an attempt to assert the convention’s significance.

Land degradation’s synergies with climate change are especially targeted. SLM and restoration/rehabilitation are described as “the missing piece of the puzzle in our struggle against anthropogenic climate change” (UNCCD, 2015a, p. 19). As well as holistic outcomes, funding is indicated as a potential reason for the UNCCD’s aspired connection with the momentum of climate change action:

“The identified land-climate interlinkages will help identify critical entry points to more effectively tap into climate finance, for instance, from the Green Climate Fund.” (UNCCD, 2016b, p. 12)

Grainger et al. (2000) elaborate on how greater research and monitoring of both climate change and desertification would improve knowledge of both phenomena. However, some researchers have pointed out that while there are connections between land degradation and climate change, combatting one will not necessarily combat the other. For example, Herrick et al. (2013) argue that because the effects of climate change and land degradation occur at different spatial and temporal scales, different solutions are often required. Although they may not necessarily be synergistic, it is indicative of steps taken through LDN to facilitate connections between land degradation and climate change, of which carbon is a “key linchpin” (Cowie et al., 2011, p. 249).

4.3 What is meant by ‘neutrality’?

The term ‘neutrality’ harks of the latest trends in climate mitigation strategies, which aim to be ‘carbon neutral’ through offsetting. There has been an evolution in how the UNCCD relates LDN to

offsetting, in reference to compensation schemes and as the more general idea of a balance between losses and gains. Initially, this connection was clear and unambiguous when LDN was proposed as a twin concept with ‘zero net land degradation’ (ZNLD). In a UNCCD policy document made in advance of the Rio+20 conference, ZNLD is said to be “the achievement of land degradation neutrality, whereby land degradation is either avoided or offset by land restoration” (UNCCD, 2012c, p. 7). Also according to the UNCCD, “neutrality implies ... a zero net loss in the amount of healthy and productive land” (UNCCD, 2013a, p. 9), showing the closely related meanings between ZNLD and LDN. The ZNLD concept spurred a number of researchers to explore its feasibility (such as Chasek et al., 2015; Salvati & Carlucci, 2014; Stavi & Lal, 2015; Tal, 2015). Over time, ZNLD has been dropped from UNCCD communications in favour of LDN on its own, as it became apparent that LDN was “a more politically suitable concept” (Gnacadjia, 2015, p. 2).

Proponents of LDN have since become adamant that it does not provide a ‘licence to degrade’ or a rationale for market-based compensation schemes (for example, UNCCD, 2013a), but rather that it is a vision of improved ecosystem services, prevented losses and incentivised action. Nonetheless, parallels to offsetting mechanisms can still be drawn – and indeed the perspective of the World Business Council for Sustainable Development (WBCSD) regarding LDN is that “compensation for impacts may be a solution” (2015a, p. 17). Drawing from literature, some relevant challenges are raised about how neutrality could be calculated as ‘no net loss’, or alternatively through target-setting, the currently favoured approach pursued by the IWG.

4.3.1 Neutrality as ‘no net loss’

An increasing number of zero net loss environmental strategies are cropping up throughout the world, including management of forestry, fisheries, wetlands in the United States and biodiversity offsetting particularly in the context of mining in Australia and Germany (Tal, 2015). LDN’s definition specifies that the amount and quality of land resources should ‘remain stable or increase’, following a ‘maintain or improve’ discourse that biodiversity protection offset systems have long held (Burgin, 2008), and yet biodiversity loss has continued to worsen (UNEP, 2012). It is important to note that the idea of no net loss is intimately tied up in neoliberal discourses of capitalism and commodification (Robertson, 2000), and this framing favours certain approaches to land degradation, masking complex decision making about the boundaries that are defined.

By relying on a measuring system where positives and negatives are weighed against each other in order to assess performance, the extent of action to combat land degradation therefore depends on contested estimations of the extent and degree of land degradation (section 3.1.3). Given that there are “no credible historical baselines” of national or global-level degradation, feasibly measuring gains

and losses would be additionally challenging because of the lack of empirical measurements over large scales for the multiple and continually changing attributes of degradation (Grainger, 2015, p. 18). Measuring and monitoring improvements is guaranteed to be difficult and values-based, which adds uncertainty to assessments (Gardner et al., 2013; Welton et al., 2015). It is also in stark contrast to understanding of nature as complex and constantly changing itself with or without other intervention (Sullivan & Hannis, 2015). Welton et al. (2015) question whether the aim of a land degradation neutral world is to maintain the same global quantities of land types as they currently occur, with the knowledge that climate change will affect ecosystems in ways out of land management's control. Even if neutrality is achieved on paper, the question of whether it is scientifically achieved will remain.

Hillman and Instone (2010) contend that the notion of balance in 'no net loss' reflects a point of view where "incommensurable facts and values are patched together, inconsistencies and differences are smoothed away" (p. 424). Metrics used to determine neutrality must capture what is being measured in the abstract. Although carbon or sulphur dioxide can be quantified in comparable units, the task becomes much more complicated for complex values like land. By structurally assuming that there is substitutability between degraded and offset lands, it may result in treating ecosystems as homogenous or fixed commodities in order to achieve consistency and certainty. This removes land from considerations of context, circumstances and significance as a place for particular people and ecological communities – taking the 'social' out of social-ecological systems.

To account for uncertainties, sometimes ratios are used as buffers, where if one hectare of degradation is anticipated, ten hectares are restored elsewhere (Tal, 2015). However, the choice of multiplier is largely arbitrary, cannot address critical shortages at any given moment and still cannot replace irreplaceable values (Walker et al., 2009). An asymmetrical gains to losses ratio suffering from time lags could cause ecological bottlenecks or time-delayed cascade effects that are not immediately obvious (Gardner et al., 2013). Some biodiversity schemes have sought to factor in different variables, such as condition, ecological function and integrity, but compound metrics have been difficult to assess (Gonçalves et al., 2015). An alternative – securing the success of SLM and restoration projects before counting them in a tally of averted degradation, that is, using 'matured' credits – would need to be meticulous and therefore unlikely to be popular with investors (Tal, 2015). Such banking schemes can fall prey to additionality and leakage problems, where voluntary activities cash in on their successes even though doing so indirectly warrants losses elsewhere (Maron et al., 2012). Metrics cannot fully represent why and how land is valued and any intrinsic values that are not included in the selected metrics can only be protected unintentionally, or lost obliviously (Walker et al., 2009).

Walker et al. argue that 'no net loss' slogans are "political diversions", creating "an illusion that crumbles under scrutiny from ecological and political science" (2009, p. 154), while at the same time

being supported by politicians, developers and officials in charge of such strategies because of vested interests. Based on the track record of ‘no net loss’ schemes around the world, neutrality as ‘no net loss’ seems unlikely to deliver on the sustainable development objectives of LDN.

4.3.2 Neutrality as meeting targets

Disregarding the challenges implied by the term neutrality meaning a ‘no net loss’ target, the IWG’s approach to LDN highlights the importance of target-setting according to a variety of indicators. The UNCCD (2013a) refers to a UNEP study which suggested that more progress is made with specific, measurable targets. To achieve the SDG 15.3 target of LDN by 2030, the proposed indicator is “Proportion of land that is degraded over total land area” (UNCCD, 2016b). This comes with three biophysical sub-indicators²: trends in land use and land cover change; trends in land productivity; and carbon stocks above and below ground. These indicators are to be included in the preparation of voluntary national LDN targets, to determine countries’ different levels of ambition.

The available data for these indicators is from global, and some national, datasets (UNCCD, 2015c), making it a focus on top-down data analysis. The trends in land use and land cover expresses changes from types like forests, shrubs and grasslands to urban and artificial surfaces, used as an expression of ‘ecosystem exploitation’ (UNCCD, 2015c). The land productivity trend relies on remotely-sensed net primary productivity (NPP) data, despite its limitations acknowledged by the UNCCD, in that a reduction in NPP may signal less intensive agriculture which may improve the land in the long-term, while an increase in NPP may in fact indicate an overuse of fertilisers or bush encroachment, which according to land uses may be considered degradation (as discussed in section 3.1.3). NPP data is not globally available at a fine scale, which is another technical challenge for accurate assessments of change. Although the inclusion of Soil Organic Carbon levels is indicative of soil fertility, it is only globally available through static model-derived data (UNCCD, 2015c) – without trends of change it cannot be indicative of ‘degradation’ or improvement.

The selection of indicators neglects some key processes of interest to degradation, such as the management of water resources – an important issue for both land use change and climate change (Cowie et al., 2011). Such indicators also give little evidence of the drivers of negative trends, and miss crucial social-economic, governance and policy dimensions. Relying on abstract remote sensing data (to the exclusion of other data sources) removes people and social-ecological relationships from

² The UNCCD’s progress indicators for its strategic objectives include these three indicators as well as trends in population living below the relative poverty line, trends in access to safe drinking water, and trends in the abundance and distribution of selected species (UNCCD, 2013b). However, at the 12th Conference of the Parties, the trends in land use and land cover, productivity and carbon stocks indicators were adopted as the progress indicators for LDN.

the picture, as the data cannot show the intentions that land users have with their land, while furthering the discourse that there is abandoned ‘marginal land’ which is able to become commoditised (Nalepa & Bauer, 2012).

For years, the UNCCD has attempted and struggled to select appropriate indicators, facing difficulties from a lack of available scientific knowledge and the overwhelming variety of existing indicators used in sustainable development across the world (Berry et al., 2009; Grainger, 2015). However, it is unclear how a combination of the three chosen aspects of land will capture the heterogeneity of land degradation. In practice, the IUCN asserts that “it is essential that these high-level indicators are complemented with local-level indicators to provide a much more informed insight into the actual situation” (2015, p. 4).

4.4 How the narratives are represented in practice: three UNCCD programs supporting LDN

The narratives about LDN in the previous sections have been largely drawn from UNCCD marketing material and issue briefs. To see how these ideas are applied, and to further elucidate the framing and implementation challenges of LDN, the following section analyses how the discourse of LDN is represented and shaped in three programs established by the UNCCD in their efforts to facilitate LDN.

4.4.1 The Soil Leadership Academy

The Soil Leadership Academy (SLA), announced in 2013, was launched as a public-private partnership at the UNCCD’s 12th Conference of the Parties in October 2015. As a “special initiative of the UNCCD”, its aim is “to energize and support public and private decision-makers on their journey to land degradation neutrality” (UNCCD, 2015e). It continues the LDN discourses by suggesting that SLM is ready to be massively scaled up and that LDN is “a daring, ambitious vision, yet unquestionably achievable” (Soil Leadership Adademy, 2015). As a capacity building tool, the SLA is aimed at national ministers and administrators to facilitate better decision-making through the dissemination of SLM knowledge (that is, a top-down approach). This knowledge in the SLA’s curriculum is derived from the inputs of its “consortium of partners” (Soil Leadership Adademy, 2015), which includes other UN institutions but notably the WBCSD³ and its major partner Syngenta (UNCCD, 2013c).

³ The World Business Council for Sustainable Development’s members include Monsanto, Bayer, Proctor and Gamble, Coca Cola, Nestlé, BP and Shell among about 200 others - <http://www.wbcsd.org/about/members/members-list-region.aspx> [<https://perma.cc/8KXG-ZE94>]

Public-private partnerships are distinctly within the neoliberal approach (Richter, 2003). These partnerships in particular raise concerns about the nature of the SLA coursework and its land management recommendations. The WBCSD is a lobbyist for business proudly amassing a combined revenue of more than \$8.5 trillion (WBCSD, 2015b), and Syngenta is a multinational crop production and agrochemical company, the world's second largest supplier of pesticides and the third largest seed supplier, specialising in genetically modified products. For its corporate social responsibility, Syngenta has released a six-point Good Growth Plan, where one of the goals will "rescue" farmland through the spreading of soil management knowledge through the UNCCD's SLA (Syngenta, 2014). In an analysis of the Good Growth Plan, Lebrecht and Meienberg (2014) discuss how one such contribution of knowledge to soil fertility management is to encourage pesticides instead of soil disturbance. The excessive reliance on herbicides due to the uptake of 'zero-tillage' has led to extremely harmful environmental and human health consequences (Ketabi, 2009). Lebrecht and Meienberg show how agro-ecological farming methods instead "would cause considerable harm to Syngenta's core business" (2014, p. 5), and find that the plan is primarily about public relations. Smallholder farmers' "empowerment" is measured in the plan by the number of farmers reached through the sale of the company's products (as outlined in WBCSD, 2015a), which is suggestive of their approach to sustainability (of revenue margins).

Syngenta's products, such as pesticides and chemical fertilisers, have been linked with human rights abuses, water contamination, and violence (Dinham & Malik, 2003; Ketabi, 2009). Civil society organisations have been strongly opposed to mega agrochemical companies including Syngenta, such as the Permanent People's Tribunal 'indicting' them for human rights violations (Simm & Byrnes, 2013). It is therefore unsurprising that civil society's reaction to Syngenta's involvement with the Soil Leadership Academy was critical, with demonstrations held at the UNCCD's conference, and activists saying that the company "only cares about profit" and that it harms the land, farmers and public health (Namibia Press Agency, 2013).

Despite others' criticisms, corporate partners of the SLA are able to continue to shape the LDN discourse. WBCSD says that the SLA's training will "[demonstrate] that LDN does not amount to trade-offs in other sectors, but in reality strengthens them" (2015a). Such statements and partnerships undermine the scientific integrity of LDN.

In contrast to evidence of farmer-led sustainable land management and restoration, there is a history of exacerbated problems that have arisen from the transferral of Western environmental management approaches to drylands in affected countries, and an "LDN scheme would ignore such experiences at its peril" (Grainger, 2015, p. 17). In this sense, the coursework of the SLA requires careful scrutiny.

4.4.2 The LDN Project with pilot countries

Launched in January 2015 and presented at the 12th UNCCD Conference of the Parties in October 2015, the UNCCD's 'LDN Project' is an initiative that provides technical assistance to the introduction of LDN in 14 volunteer pilot countries (UNCCD, 2013d). This is LDN as a targets-based approach at a national level and integrated into the countries' NAPs, with the intention of inspiring other countries with its demonstrated benefits of successfully upscaled SLM. It includes countries out of the drylands, and is not exclusively 'developing' countries, reflecting the expanded scope pursued by the UNCCD.

A commissioned independent evaluation of the LDN Project⁴ observed that there was "a clear political intent" (Smith, 2015, p. 4) to show that LDN can be implemented, with a short deadline for it to contribute to LDN momentum at the UNCCD conference. The countries' reports⁵ were developed independently with the UNCCD's instructions and supply of data, based on the three biophysical sub-indicators of LDN (discussed in section 4.3.2). Smith's evaluation and some of the country reports (such as Algeria, Costa Rica and Turkey) signal issues with the use of these indicators, so that "measuring against the three indicators is not without problems even before the question of their use as a composite for LDN" (Smith, 2015, p. 6). Such problems include the low resolution of land cover data, the not necessarily accurate correlation between degradation and net primary productivity, and the ability only to create a static baseline of soil organic carbon (as opposed to a trend). Additionally, within a short timeframe, most countries did not have time to corroborate with their own national datasets (although discrepancies were noticed), let alone conduct ground-truthing for validation or consult with other stakeholders. The LDN Project appears to have been conducted more for political than scientific motivations – a trait shared with the discourse of desertification.

⁴ The UNCCD Evaluation Office commissioned a report to assess the effectiveness of the LDN Project, authored by Smith (2015). Smith's sources of data include a document review, attendance at the project's final meetings, and interviews with representatives from 12 of the 14 participating countries.

⁵ The countries' reports are available for download from the UNCCD website (UNCCD, 2015b), or can be permanently accessed from:

- Algeria: <https://perma.cc/L75R-T8Z7>
- Armenia: <https://perma.cc/TYB6-M8RZ>
- Belarus: <https://perma.cc/E83A-RVTN>
- Bhutan: <https://perma.cc/R3MG-BKMK>
- Chad: <https://perma.cc/H4G5-XXNE>
- Chile: <https://perma.cc/NLS3-F8W4>
- Costa Rica: <https://perma.cc/6EJG-LX6A>
- Ethiopia: <https://perma.cc/H5AB-9SRF>
- Grenada: <https://perma.cc/U97L-RZEJ>
- Indonesia: <https://perma.cc/2DM5-A9JW>
- Italy: <https://perma.cc/4U82-CMYX>
- Namibia: <https://perma.cc/ZE4V-23TY>
- Senegal: <https://perma.cc/6AVD-P9ET>
- Turkey: <https://perma.cc/C32U-3UJF>

The targets presented in the countries' reports are heterogeneous and not compatible (see Table 4.1), which would indicate a shortcoming seeing as the LDN Project was envisioned to “produce a series of standardized country progress reports” (UNCCD, 2013d, p. 19). Half of the participating countries include target years beyond 2030, so their contribution to the SDG target of achieving LDN by 2030 will be uncertain. About a third of the countries aim to target areas the equivalent size of the land's negative trends (which could be ‘no net loss’), whereas others aim for a smaller proportion of the degrading land – as small as 1.5% in Bhutan's case. With a target of 97.3%, the LDN Project Team's example does not quite meet spatial ‘no net loss’ either.

Table 4.1 Summary of LDN totals and targets provided by the LDN Project pilot country reports and the example given by the LDN Project Management Team in the Methodological Note provided to the pilot countries (Retière et al., 2015), converted to hectares. The percentage of targeted area was calculated by converting the proportion of targeted area out of area with negative trends into a percentage. The projected average cost was calculated by using the investments required of USD per hectare of the total target area, although it is recognised that within a country, some rehabilitation work will be more expensive than others.

Country	Total area with negative trends (hectares)	Total target area (hectares)	Target year(s)	Total investments required (in millions of USD)	Percentage of area with negative trends that is targeted (if less than 100, to one decimal place)	Projected average cost per hectare (in USD, to nearest dollar)
Chad	70 933 005	3 075 675	2040	21 167.18	4.3	6 882
Ethiopia	33 193 390	33 193 390	2021, 2023, 2026, 2031, 2036	33 198.59	100	1 000
Algeria	20 657 618	4 925 000	2015-2020, 2025, 2030	-	23.8	-
Namibia	13 817 080	13 817 080	2030, 2040	1 939.2	100	140
Indonesia	13 775 820	13 775 820	2040	-	100	-
Belarus	9 134 400	945 400	2020, 2030	368.622	10.3	390
Senegal	6 860 932	5 145 699	2020-2035	3 790 200	75.0	736 576
Italy	2 951 100	2 425 000	2017, 2030	313.2	82.2	129
Bhutan	417 505	6 300	2025, 2030, 2035, 2040	16	1.5	2 540
Armenia	41 980	40 750	2030, 2040, 2050	210	97.1	5 153
Grenada	1 900	1 900	2025, 2030	6.5	100	3 421
Costa Rica*	-	-	2025	-	100	-
Chile*	-	-	-	-	-	-
Turkey*	-	-	-	-	-	-
Example from the LDN Project team	10 480 100	10 193 683	2015, 2020, 2025, 2030	1 551	97.3	152
*Costa Rica: A target-setting table is not provided because of a perceived lack of credible, reliable data, although the report includes a target to achieve LDN by 2025 (with conditions regarding use of national data). *Chile: The target-setting table is included but left blank. *Turkey: A target-setting table is not provided; the report follows its own structure based on a small study area within Turkey.						

The anticipated investments required for SLM, restoration and rehabilitation measures in Table 4.1 are particularly wildly variable. Approximate averaged cost per hectare ranged from USD 129 (Italy), to USD 6882 (Chad) – and even to USD 736 576 for Senegal (although this figure appears erroneous as it would require funding larger than the country's 2015 Gross Domestic Product). The anticipated investments contrast to the UNCCD's message that SLM and restoration are cheap and affordable: "it can take as little as USD 20 to rehabilitate one hectare of farmland in Africa" (UNCCD, 2015a, p. 9). Indeed, in an analysis of the establishment and maintenance costs of WOCAT's technologies, Giger et al. (2015) found that the median costs were USD 500 per hectare, with a range from less than 20 to over 5000 per hectare (the most expensive being afforestation projects). Smith (2015) found that the reports produced figures according to what they should do rather than what they can do, and that Bhutan for example was unsure what to pitch in the targets (according to their expectations or what would be needed to attract funding resources); however, it remained clear that public funds cannot cover the proposed costs.

According to one of Smith's participant interviewees, there was the realisation that "the secretariat needed conclusions that could support the impression that the project is successful and that the approach should continue" (2015, p. 8). Indeed, according to the UNCCD (2016b, p. 12), the 'champion countries' implemented a "successful" project, which "harnesses synergies between LDN target setting and countries' efforts to mitigate and adapt to climate change". In these ways, it appears the LDN Project was most important for the UNCCD as a success story of target setting, and potential means for synergistic funding. Following the accomplishments of the pilot project, the second phase of the target-setting program is set to include 63 more countries (UNCCD, 2016c).

4.4.3 The LDN Fund

The Impact Investment Fund for Land Degradation Neutrality ("the LDN Fund") is a keystone initiative of the Global Mechanism for the UNCCD, and is set to become operational at the end of 2016. A White Paper for the LDN Fund was released in June 2015 but soon removed online, although it was replaced with a general brochure (see Global Mechanism & Mirova, 2015) and a substantially different White Paper in June 2016 (see Mirova & Global Mechanism, 2016), which were made in collaboration with the LDN Fund's partner organisation Mirova. These are accompanied by Mirova and Bonterra Partners' business case for LDN fund opportunities (see Maillard & Cheung, 2016).

Originally, the LDN Fund was primarily intended to enable investments to rehabilitate up to 12 million hectares per year (reflecting a 'no net loss' approach to the UNCCD's figure of annual global degradation), through the leasing of degraded land to restoration companies for 5-10 year tenures

(Global Mechanism, 2015) - demonstrated by a closely reproduced model by the WBCSD (Figure 4.5). There were a number of social and political issues with this structure, such as land users' displacement and the possibility for leakage problems, which can occur when people are excluded from land under restoration and consequently continue to degrade elsewhere, as has been a case for concern in the REDD+ (Reducing Emissions from Deforestation and forest Degradation) scheme (Pasgaard et al., 2016). Additionally, short-term leases predicate short bursts of productivity, not long-term sustainability plans, and Cowie et al. warn that "a focus on maximising production in the short term reduces resilience and strains ecosystem integrity" (2011, pp. 257-258). Gibbons and Lindenmayer show that "ecosystems cannot generally be shoehorned into a predetermined restoration trajectory" (2007, p. 28), raising uncertainty about the long-term viability of such actions. The initial proposal for the LDN Fund was endorsed by big business (such as in the business perspective by WBCSD, 2015a) but critiqued by civil society organisations, for example as representatives of Drynet, Burger and Oettle viewed the Fund as a means to enrich investors while the interests that are served "are clearly not those of the poor" (2015, p. 4).

Figure 4.5 has been removed due to copyright restrictions.

Available at:

WBCSD. (2015). Land Degradation Neutrality: A business perspective. World Business Council for Sustainable Development. Retrieved from
http://www.commonland.com_doc/WBCSDLandDegradationNeutralityABusinessPerspective_651616121.pdf [https://perma.cc/8WME-BP4G]

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Figure 4.5 The 2015 LDN Fund model (WBCSD, 2015b, p. 9)

The 2016 version of the LDN Fund White Paper takes a different approach. The LDN Fund is currently pitched as being a way to raise and deploy private finance for degradation avoidance (that is, sustainable land management) and rehabilitation, because public funding will not be sufficient to address the "worrying" extent and severity of the problem (Mirova & Global Mechanism, 2016). However, as a blended finance mechanism, the Fund still provides a role for public and philanthropic donors, whose "shares would take any first losses resulting from the Fund's underlying investments, effectively building a risk cushion for private impact investors, institutional investors and foundations" (Mirova & Global Mechanism, 2016, p. 4). The LDN Fund intends to work with the market to develop a top-down approach targeting industry supply chains, and a bottom-up approach improving

small and medium-scale producers' livelihoods. The LDN Fund is now suggested as potentially becoming a "patient investor" (Maillard & Cheung, 2016, p. 30), recognising longer timeframes needed than the first Fund model.

To be eligible for investment through the LDN Fund, land management projects must meet four criteria (Mirova & Global Mechanism, 2016, p. 5). Firstly, they must have a "high environmental and social contribution". Maillard and Cheung (2016) expand on this by saying that they should aid ecosystem services and at least one the UNCCD's three LDN targets (specified in section 4.3.2). They also add that the LDN Fund should focus on providing direct benefits; however, "indirect benefits can potentially be large enough to justify investment", such as wind turbine projects on farms (2016, p. 18). The second criterion is that land management projects should be a large size, or have the potential for scaling up and replicating "at a regional, national or international level to maximise their impact" (Maillard & Cheung, 2016, p. 18). Thirdly, projects must already be at a maturity stage, ready for investment. Finally, for the LDN Fund to consider a project for investment it must be financially profitable, that is, "bankable" or designed to generate a financial profit for investors" (Maillard & Cheung, 2016, p. 18).

Lessons from biodiversity offsetting and payments for ecosystem services (PES) schemes illuminate some considerations for these eligibility conditions of the Fund. Rather than a holistic approach, using limited indicators of land cover/use, productivity and/or carbon storage might neglect other issues. For example, as a market for carbon sequestration services, the REDD+ program has been to the detriment of other services, social issues and ecological values (McAfee, 2012). REDD+ projects have also suffered from an insufficiency of national reforms to land tenure insecurity (Larson et al., 2013) and have been criticised for unfair procedures (in terms of who has been recognised and included in decision-making) and unfair distributional outcomes (in terms of who bears the benefits and costs) (Corbera, 2012). In regards to direct benefits, biodiversity offset schemes have struggled to find appropriate locations – far enough away from the cause of degradation but close enough to serve the same social and/or ecological community (Gonçalves et al., 2015). Likewise, the justifiable scale of indirect benefits facilitated by the LDN Fund needs clarification.

The requirements for projects to be of a large size (or replicable) and mature enough for investment appear to prioritise certain land users over others. It does not address the capacity of emerging or innovative projects, or ecological small-scale practices, as Maillard and Cheung (2016) suggest that investor interest in such projects is low, because they are less cost-effective and potentially more risky than established, conventional practices. The LDN Fund's scope includes all countries worldwide, so more competitive countries may see more investment. Concerns about equity in PES schemes have led some to conclude that the poorest of the poor are left out (Wunder, 2008).

The necessity for projects to be profitable leads to an anticipated focus on reliable food and fibre projects (Maillard & Cheung, 2016). Although eco-tourism may be appropriate for conservation, it is often “not sufficient” for profitability, and most biodiversity, water quality or habitat restoration projects do not produce revenue, with the exception of possible offsetting incomes from governmental schemes - with Australia’s Emissions Reduction Fund offered as an example (Maillard & Cheung, 2016, p. 28). However, the Emissions Reduction Fund is systemically susceptible to favouring low-quality abatements or ‘anyway projects’, such as a commitment not to clear land when it was never an intention anyway (Burke, 2016). Similar to how PES mechanisms can be biased towards ecosystem services with a market benefit at a cost to others (Reed et al., 2015), by requiring profits for investors, it appears that more lucrative land uses will be invested in, over potentially more diverse and environmentally or socially significant ones.

If rehabilitation is financially incentivised (as is the case with the LDN Fund’s criterion for profitable projects), Walker et al. (2009) suggest that officials may be less likely to put in their best efforts to avoid and minimise environmental damages. As discussed by Bullock et al. (2011), losses of livelihoods and leakages from the displacement of local people during restoration works have been an issue in PES, and these would need to be addressed in the governance structure of the proposed fund. In regards to Australia, Mirova and Banterra Partners indicate an interest in purchasing underperforming land from landholders:

“In developed countries where there is strong rule of law and clear land title, there remains an opportunity to acquire and restore privately-owned farmland, grasslands and forests. Many private properties in countries such as the USA and Australia suffer from land degradation either due to mismanagement, neglect or abandonment. For LDN activities to deliver the intended environmental and economic returns, long-term investments in improving land conditions and infrastructure are required which ultimately add value to the property. Making permanent improvements on leased land and leaving the economic upside to the landowner would not make financial sense. A landowner may also prohibit tenants from adopting certain land management approaches, preventing them from implementing the appropriate LDN activities.” (Maillard & Cheung, 2016, p. 27)

This kind of argument continues the desertification narrative of mismanagement by local land users, and the elevated importance of global investors to rescue the land from them. However, only 15% of Australian land is privately held; the government is already in a position to establish criteria for appropriate activities on Australia's mainly leased agricultural Crown lands (Hamblin, 2009). Despite this, if struggling landowners see value in the money to be gained from selling their lease to the degraded land within the LDN Fund mechanism, this proposition could propel rather than shift the

paradigm of ‘degrade-abandon-migrate’. This potential acquisition of land for rehabilitation may lean dubiously close to land grabbing or ‘green grabbing’, the transfer of use rights and control over resources from the poor to the powerful for environmental objectives (Fairhead et al., 2012).

McMichael analyses how “the land grab is represented as a form of development, insofar as land ‘development’ is associated with productivity gains and employment” (2012, p. 694) – both of which are promoted in Global Mechanism and Mirova (2015). It is observed in political ecology that neoliberal approaches to global environmental management are known to advocate for control over others’ resources (Peet & Watts, 2002).

The LDN Fund can be seen as an example of an attempt to circumvent weak governance and overcome funding deficiencies through the creation of an emerging market mechanism as a public-private partnership. It is advocated as a potential incentive to bring multi-national mining corporations more in line with SLM progress, potentially through financing compliance and post-mining rehabilitation or through providing an avenue to invest in SLM as part of a mine’s corporate social responsibility (Quatrini et al., 2016). However, market solutions depend on the strength of governance structures to protect the least powerful (Andersson et al., 2011). In offsetting schemes, administrative issues of transparency, monitoring and compliance have frequently been ongoing problems (Burgin, 2008; Gibbons & Lindenmayer, 2007; Gonçalves et al., 2015; Walker et al., 2009).

Although discussing the now out-dated version of the LDN Fund, Drynet discuss how the Fund has ignored research which shows that small-scale farmer-led restoration has been more successful than large-scale funded interventions in the Sahel (Burger & Oettle, 2015). Similarly, Groupe Travail Desertification (2015) highlighted a number of issues about the originally proposed Fund: it does not address drivers of degradation; it could “generate commoditization and land grabbing impulses”; it leaves little room for long-term SLM when investors’ return on investment is prioritised; and it excludes civil society from decision making. The latest LDN Fund proposal does not clearly address these concerns either.

4.5 Is LDN in the future ‘we’ want?

According to Grainger (2015), the political development of LDN is a typical progression in a series of ‘hybrid lay-scientific concepts’, like desertification and sustainable development. LDN emerged as an aspirational phrase in the UN’s ‘The Future We Want’ (2012), and scientific experts worked on establishing a technical definition during the same time that it was being inserted into the global sustainable development agenda. Its political basis shows in the scientific challenges that arise when applying either a ‘no net loss’ or indicators-based approach to measuring neutrality.

LDN's discourses as outlined above display elements of the classic and neo-liberal approaches, classically in terms of the far-reaching desertification crisis, self-inflicting victims, and neo-liberally through financial solutions and the role of global actors and investors. There is little evidence for or acknowledgement of populist approaches – grassroots approaches based on the perspectives and knowledge of local people, for example – despite it being part of the UNCCD's original mandate and one of LDN's apparently vital principles (section 4.2). Instead, top-down mechanisms are pursued, through potentially biased knowledge transfer via the Soil Leadership Academy, degradation assessments and targets based on limited global data-sets via the LDN Project with pilot countries, and a focus on large-scale and profitable rehabilitation works as facilitated by the LDN Fund. In her analysis of policy documents like national adaptation programs of action for the UNFCCC and the GGWSSI, Reenberg (2012, p. 109) found that while bottom-up and interdisciplinary considerations are noted in the documents, they “seem to replicate many of the basic narratives and implicit understandings that were already presented decades ago”. A similar case appears with the UNCCD documentation about LDN, in the publicity and issue briefs as well as the programs for implementation.

Reactions to LDN proposals indicate that it is not the future that is wanted by numerous civil society organisations, while most land users remain unaware of the concept and its programs. With limited validation of information, Burger and Oettle (2015, p. 3) say that the national voluntary LDN targets “could become a meaningless exercise of manipulation of data” (and indeed, data quality problems were highlighted in the pilot countries' attempts), and criticise LDN because “even though it appears relatively harmless, it may prove the undoing of millions of people who make their living on land that others judge to be degraded.” Although generally supporting the notion of LDN, Groupe Travail Desertification (2015) nonetheless raised concerns about “the risk of creating a system that legitimizes the ‘right to degrade’ and encourages land grabbing”. The apparent contrast between the top-down approach and the needs of local land managers has been alerted to the UNCCD since LDN's onset. Jonathan Davies (Coordinator of Global Drylands Initiative, IUCN) suggested that the local context that land users work within should be better recognised, and that: “[LDN] may be a worthy global goal, but it is one that risks being extremely disconnected from the realities of farmers around the world” (in UNCCD, 2012b).

In contrast, the concept of LDN can be seen as fitting snugly into the future that corporations want. Describing land degradation's risks to business (such as reduced productivity, impacted operating environments, reduced quality and price level of products, political instability leading to disruptions and potential loss of the license to operate, and possible regulations and taxations as governments' responses to land degradation), the WBCSD (2015b) describes how contributing to LDN can

counteract these risks, while improving businesses' reputations and creating new business opportunities. These benefits through collaboration with the UN as a whole have been observed to enable business to sustain growth, operate within a more predictable market, increase geographical reach and enhance the value of a company's image (Ivanova et al., 2007). More critical interpretations of such efforts describe business' reputation management through the UN as 'bluewash', and that the insertion of business' goals into the UN's work risks 'capture' and the subversion of the UN's public purposes (Fortin & Jolly, 2015).

The rise of the neoliberal discourses and public-private partnerships is not a new phenomenon for the UN in general; such developments have been consistent since the 1980s (Utting, 2000) to the extent that "there is hardly any UN agency that does not actively promote and seek out some sort of partnership between itself and the corporate sector" (Richter, 2003, p. 9). Indeed, business interests are centrally positioned in the post-2015 sustainable development agenda (Pingeot, 2015). However, Utting critiques the UN's naive approach to such partnerships as inevitably 'win-win', and asks what compromises (such as self-censorship) are made in the pursuit of a "narrow financial agenda" (2000, p. 7). Business partnerships have come at a cost to the UN's relations with NGOs (Pingeot, 2015; Utting, 2000) and have fuelled civil society's opposition to the SDGs (for example, see Social Watch, 2013; The Peoples' Goals, 2015). Pingeot (2015, p. 189; 197) suggests that the UN's motivations were self-interested, acting for "bureaucratic survival", seeking both budget increases and the desire "to reaffirm authority and legitimacy" through alignment with the powerful corporate sector.

Although the UNCCD has historically been renowned as the convention for civil society, prioritising networks with development agencies and small non-government organisations as well as governments, more recently it has become apparent to UNCCD conference participants that "a new player has joined them... the private sector, including agribusiness" (IISD, 2013, p. 20). The LDN programs indicate that motivations for these growing partnerships might be to spread the UNCCD's goals and to reach alternative sources of funding, but their challenge is to assure that vulnerable peoples remain integral to drylands' solutions.

5 Case study research design and methodology

5.1 Research design

Although the phenomenon of land degradation has been studied for several decades, research has primarily focussed on biophysical issues and technical solutions, often based on narrow frames of perspective. This is despite the fact that the significant drivers of land degradation are social, economic and political, necessitating an integrated approach (Escadafal et al., 2015). Therefore, this case study seeks to fill a gap of qualitative data, noting that qualitative research is best suited to complex, contextual and nuanced circumstances (Mason, 2002), all of which are fundamental qualities of land degradation phenomena, as established previously (section 3.1). A substantial increase in social science research is needed to provide insights into perceptions of land degradation to assess the criteria which determine it to be a problem in a particular context and what social steps are required to enable potential solutions (Blaikie & Brookfield, 1987). Exploring a case study is accepted as an appropriate approach because it allows the researcher to take a real-world perspective of a particular complex social situation, making use of multiple sources of data and working within many contextual variables (Yin, 2014).

Specifically, a locally-bound case study comes from an understanding of the importance of the local community for appropriate natural resource management of rangelands, representing the general shift in global arguments for sustainable development (such as the UNCED in 1992) as well as the direction of governance transitions in Australian NRM towards a more active role for local communities (Waudby et al., 2012). However, Waudby et al. (2012) acknowledge that land managers are not solely responsible for the rangelands, necessitating the involvement of policy-centred stakeholders in order to meet sustainability goals. Within rural Australia, Robertson and Roshier (1999) assert that research about restoration or rehabilitation should focus on agricultural landscapes, because results need to match appropriate scales and contexts for where the studied processes may be applied. Such landscapes are perceived and valued significantly differently by farmers, management agencies and scientists, based on different experiences, knowledge and perspectives (Robertson & Roshier, 1999).

Perceptions of local stakeholders are of particular importance when their input is considered essential to the design of environmental policy (Cocklin et al., 2007), where it can be argued that “people have a right to participate in the management of their environment” (Reed et al., 2009, p. 1935).

Stakeholder input into bodies of developmental and environmental knowledge comes with normative benefits (such as democracy, equity, diversity) as well as pragmatic benefits (such as adaptation to context, quality of information and decision-making, active implementation) (Reed, 2008).

Because the socio-ecological interactions in drylands are complicated to model, involvement of stakeholders helps to discuss the viability of policy options and livelihood pathways (Whitfield & Reed, 2012). The use of local knowledge and perceptions also allows research results to be able to “flow through society” (Geeson et al., 2015, p. 124). Researching perceptions of different stakeholders helps to address adaptation to land degradation and climate change, as awareness of indicators and conflicting priorities are significant barriers to the adoption of changes (Reed & Stringer, 2015). Interpretive social science approaches can aid in understanding how prior lay knowledge has shaped perceptions and consequent actions (Connor & Higginbotham, 2013).

Numerous political ecological case study approaches over several decades have explored the undermining of local knowledge and perceptions of land degradation in comparison to the scientific and/or official institutional reports influencing land management policies (as raised in section 1.1). Often these studies have taken place in ‘developing’ countries, comparing the official reports to local stakeholders who were poor or indigenous; however, the case may be made for similar studies to be conducted in countries like Australia. In a Victorian section of the Murray-Darling Basin, Curtis et al. investigated landholder knowledge of dryland salinity in comparison to expert maps and found that landholders had “excellent awareness of the current extent of salinity on their properties” (2003, p. 406), while the official maps were deficient, missing half of the identified saline sites. Their findings refute the previous assumptions that the landholders had been either unaware or in denial about less obvious forms of land degradation. The following section describes why the far west of NSW was selected for the case study.

5.2 Background of the far west of NSW in the Australian rangelands

81% of Australia’s land area is rangelands (Bastin & the ACRIS Management Committee, 2008), depicted in Figure 5.1. Mercer et al note that “with a population of 20 million people, Australians represent less than 1% of the global population, yet have stewardship over almost 20% of the world’s landmass” (2007, p. 273). Unusually, Australia’s rangelands are mainly managed on a large-scale sedentary basis and oriented for the export market, as opposed to the predominantly nomadic, subsistence systems in the world’s drylands (Walker, 1979). While contentiously calculated (Wessels, 2009), global assessments have suggested that degradation in Australia’s drylands is more prominent than in other drylands (Bai et al., 2008).



Figure 5.1 The Australian rangelands region and population centres
(from Bastin & the ACRIS Management Committee, 2008)

The Western region (Figure 5.2) covers 314 500 km², which makes up 40% of New South Wales and the vast majority of the state's rangelands. It mostly overlaps with what was known as the Western Division. The far west area (and focus of the case study, Figure 5.3) is within the Western region, encapsulating the Broken Hill City Council, and parts of the Central Darling Shire Council and Unincorporated Area of NSW. Predominant land uses include grazing (sheep, cattle and goats), metal ore mining, tourism and nature conservation. Renewable energy firms are also taking further interest in operations in the area, and Broken Hill now has a large-scale solar farm (which, along with its sister plant in Nyngan, is the largest in Australia). Nearly all of the region is held under Western Lands Leases⁶, where pastoralism is embedded in the legislation (Hamblin, 2009). Nearly all of the region's pastoralism makes use of native vegetation, which is predominantly chenopod shrublands (saltbush and bluebush communities) and mulga (*Acacia aneura*) communities, among others (NSW OEH, 2016).

⁶ Western Lands Leases (established under the NSW *Western Lands Act 1901*) are mostly perpetual leases on Crown land granted for grazing or agriculture. Among other compulsory lease conditions, they include requirements to not overgraze, to obtain approval for changing land uses, and to upkeep boundary fences.



Figure 5.2 The Western Local Land Services region (from <http://www.lls.nsw.gov.au/>)

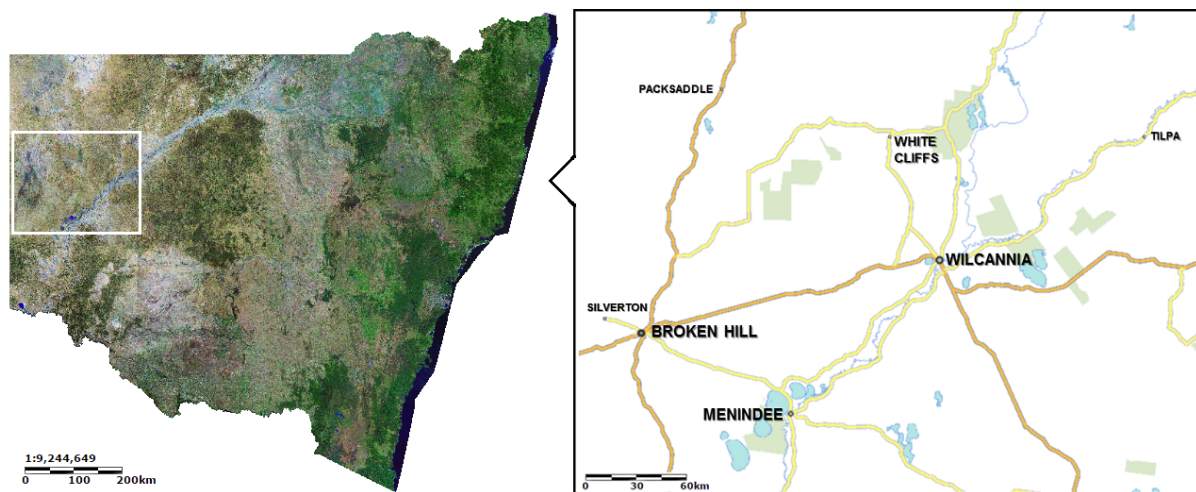


Figure 5.3 The far west case study area. National park conservation areas are depicted in green (in the second image). The maps have been modified from copyright images from (left) State of New South Wales and Office of Environment and Heritage 2011 and (right) the Department of Finance, Services & Innovation 2016.

Although covering the largest area of a NSW governmental planning region, the Western region is also the least populated (approximately 43 000 people), with almost half (18 500) living in the city of Broken Hill. Waudby et al. (2012) observe that with Australia's rangelands being so sparsely populated, theoretically there are relatively few people to engage with for the achievement of extensive outcomes; however, their sparseness also renders community engagement more logistically difficult (Measham et al., 2011). Among other characteristics, the region's climate variability, sparse population and remoteness displays a similarity to outback Australia's hypothesised 'desert syndrome' (Stafford Smith, 2008).

The population of arid and semi-arid zones of Australia are ageing overall. The number of non-indigenous people aged over 65 years is expected to increase by 81% from 2006-2021, together with a decline in all age groups under 45 (Brown et al., 2008) (Figure 5.4(b)). On the other hand, the

indigenous population is increasing in all age groups (Figure 5.4(a)), implying “a need for accelerated provision of social services and infrastructure as well as enhanced economic participation just to maintain the *status quo* in socioeconomic status” (Brown et al., 2008, p. 40). Additionally, having fewer overall people of working age is anticipated to decrease the ability of land managers to reduce the pressures of land degradation in western NSW (NSW EPA, 2012).

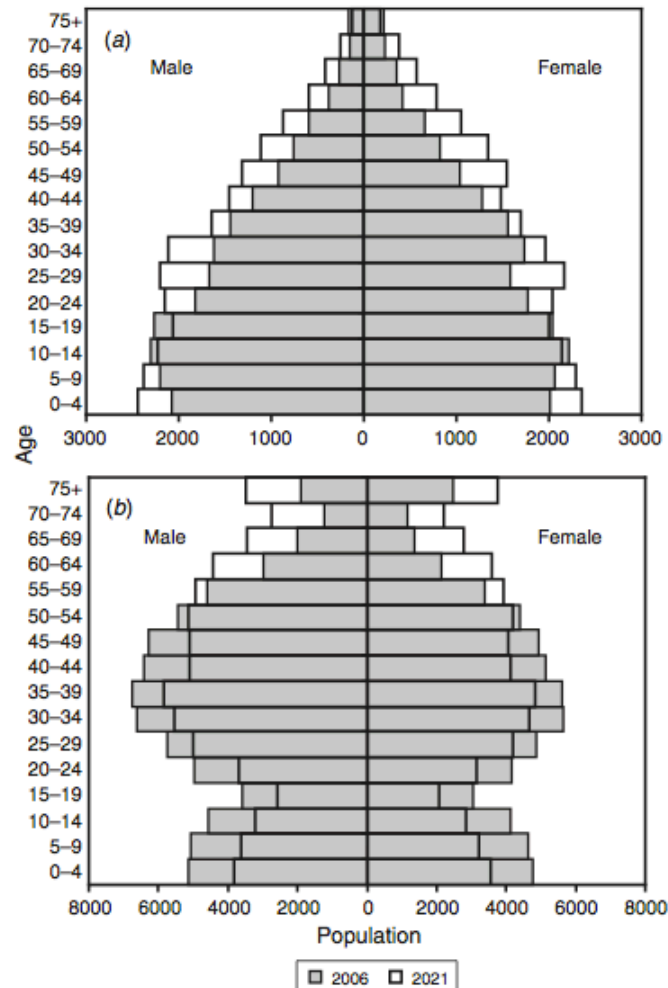


Figure 5.4 Age pyramids for the population of the Australian arid zone, 2006 and 2021: (a) indigenous, (b) non-indigenous (from Brown et al., 2008, p. 40)

With a nation identity formed in recognition of the hardships of the Outback, Australia is popularly known as “a sunburnt country... of droughts and flooding rains” (Dorothea Mackellar, *My Country*, 1908). Droughts and excessive rainfall are also scientifically anticipated features of the landscape (Mercer et al., 2007). The far west’s climate is highly variable and dry, with on average 250 mm annual rainfall in Broken Hill (see Figure 5.5).

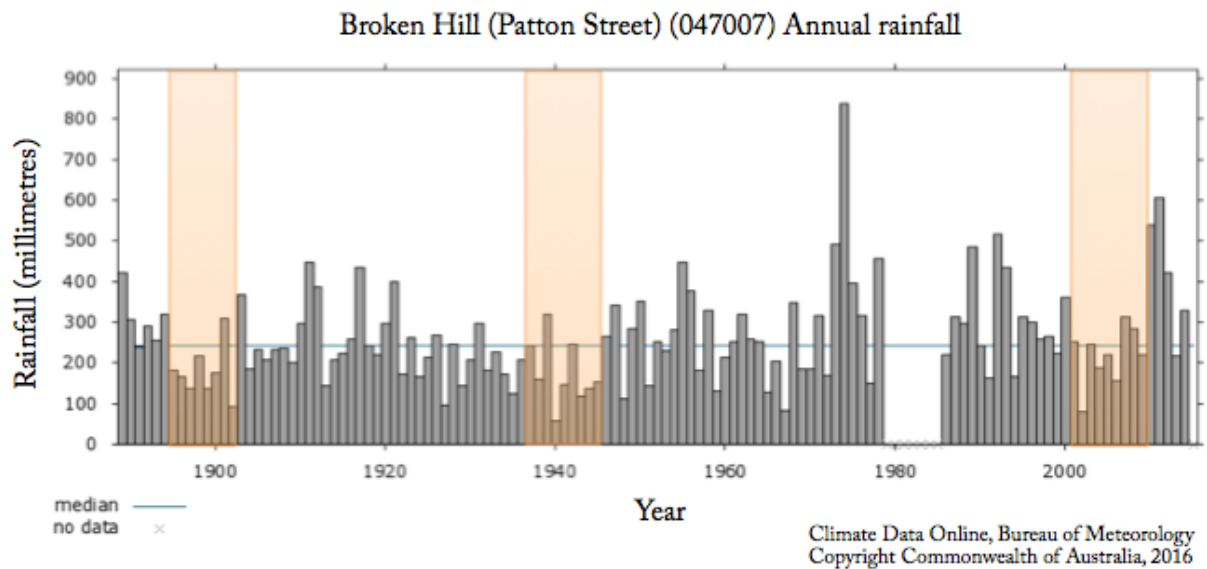


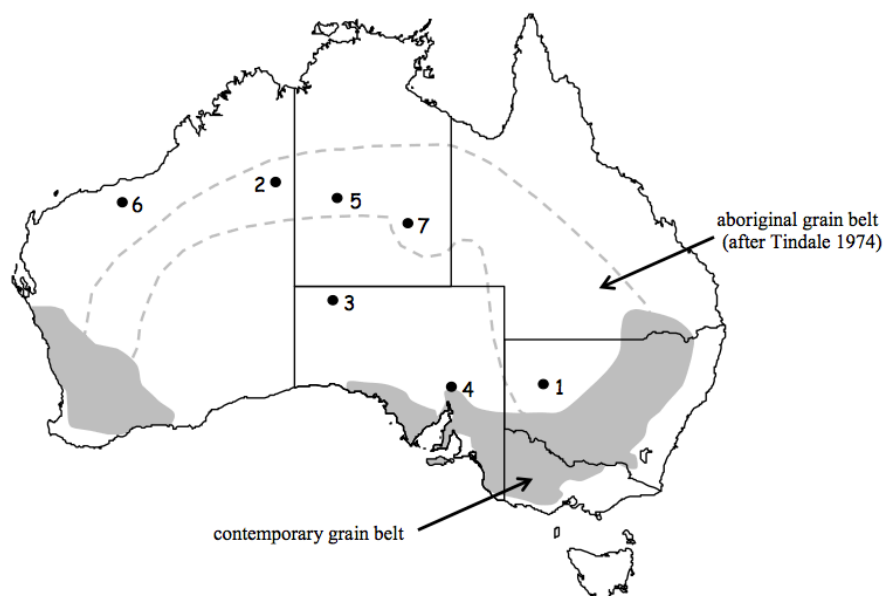
Figure 5.5 Broken Hill's annual rainfall data from 1899-2015, adapted from the Bureau of Meteorology (2016). The overlaid orange bands indicate three famous droughts: the Federation Drought (1895-1903), the World War II Drought (1937-1945), and the Millennium Drought (2001-2009). 1974 and the three consecutive years 2010, 2011 and 2012 included major flooding events across the region.

Australia's high non-annual climatic variability and reliance on volatile export market mean that risk and uncertainty are particular considerations (Greiner & Gregg, 2011). Understanding how Australian people in the rangelands respond to this uncertainty makes for a worthwhile case study in a time when the rest of the world will become increasingly unpredictable.

5.2.1 Historical context of land use and land degradation in the far west

Understanding the historical context of land use and management is essential for making sense of the present, particularly when delayed consequences from causes of degradation are taken into consideration (Blaikie & Brookfield, 1987). In the case of NSW's far west, evidence suggests that it was managed sustainably for tens of thousands of years by the indigenous owners preceding significant perturbations from the introduction of agricultural and industrial changes (Fanning, 1999; Marx et al., 2014). European exploration of the area in the 1840s introduced the rapid expansion of pastoral leases and reports of over 15 million sheep in the Western Division in the 1880s and 1890s which, coinciding with drought and rabbit plagues, preceded a swift and severe transition to a significantly degraded state, supporting just over 3 million sheep in 1902 (Fanning, 1999). Mining and domestic uses also encouraged timber harvesting and clearing surrounding the settlement of Broken Hill. Over a century later, the same land uses still dominate, although the practices are arguably better adapted to the land's conditions and capacity.

Dominant narratives of Aboriginal people prior to European settlement typically depict them as nomadic ‘hunter-gatherers’, harmonically living off what was naturally provided by the land without much of an impact on the untouched wilderness. However, there is strong evidence to suggest that throughout Australia, indigenous peoples took much more responsibility and management of the land than this discourse implies. Gammage (2011) shows how the far west grasslands were sustainably manipulated through fire management for ease of hunting. Through archaeological evidence, Aboriginal accounts and the journals of early explorers, Pascoe (2014) demonstrates clear examples of the qualities of agriculture and aquaculture in the region and across the continent, such as grain cultivation (see Figure 5.6), harvesting, grinding and storing; permanent shelters; weirs and fish traps.



1. Allen, 1974; 2. Cane, 1989; 3. Cleland and Johnston, 1936; 4. Cleland and Johnston, 1939a; 5. Cleland and Johnston 1939b; 6. Maggiore 1985; 7. O'Connell 1983.

Figure 5.6 The contemporary and Aboriginal grain belts (reproduced from Davies et al., 2005, p. 3), with the locations of specific studies cited within Davies et al. (2005).

Goodall discusses how “the invasion of Aboriginal lands did not necessarily cause dispossession” and that indigenous peoples were able to adapt their relationships to country within the new colonised context (2001, p. 101). In western NSW, many Aboriginal people died in the grassland wars and through the introduction of viral diseases, or were forced to move to safer places or missions. However, many were able to maintain connection with their land in the form of cheap labour for pastoralism, which in turn greatly aided its development. The introduction of machinery and fences in pastoralist practices has consequently restricted this access and “destroyed the potential for sustained dual economic occupation” (Goodall, 2001, p. 105). Because Western Lands Leases extinguish Aboriginal land claims (NSW DPI, 2015), regaining access and land management has proven difficult for traditional owners.

The significant land degradation of the far west at the turn of the last century is usually attributed primarily to poor pastoral land management, compounded by the drought and rabbit infestation. Green (1989, p. 110) says that the degradation is a result of the “ignorance of the potential of the country and a false impression” of the climate due to unusually favourable conditions in the 1880s. Similarly, Messer states that the “failure or inability of policy-makers, professionals, and land-users to understand the nature and complexities of the land must be considered as a primary causal variable” (1987, p. 233), but she also suggests a role of the inappropriateness of the introduced farming practices and the cultural ideological values they entail. Using radiocarbon dating of Aboriginal cooking pits, Fanning (1999) argues that European pastoralism is the principal cause of current gully erosion of valley floors in far western NSW, as it was not evident for 20 000 years ago, up until the mid-nineteenth century in the same timeframe as the introduction of domestic grazing animals. Also according to Fanning (1994), overstocking in the late 1800s may have destroyed the soil stability of millions of hectares within the region, rendering the land surface to be in a state that cannot be rehabilitated. Despite these impressions of the management of the rangelands, the Australian economy is commonly purported to have flourished by ‘riding on the sheep’s back’ - through merino exports from pastoral areas such as the far west.

Alarm about the early widespread degradation spurred the 1901 Royal Commission of Enquiry into the Western Division. The testimony of pastoralists suggested that they felt that they had disrupted previously sustainable land management (LaFlamme, 2011) and caused “a gradual deterioration of the country” (James Cotton, 1901, quoted in Green, 1989, p. 110). Following the Royal Commission, land use and management through tenancy of Crown land was regulated through the *Western Lands Act 1901*. However, Walker argues that the rent from these leases continue not to represent the land’s true value and “in consequence do not return to the community the full costs of pastoralism”, while being “overcapitalised and economically precarious” (1994, p. 240), critiquing the political and financial systems which influence the region’s land management.

Reflective of arid Australia’s relegation to ‘uselessness’ (Figure 5.7), assessments of arid Australia’s land degradation were often extreme (see Pick, 1942). South-eastern Australia has been described as a dustbowl from 1895-1945, suffering from extensive wind erosion and dust storms, such as in Broken Hill which had “almost continuous dusty conditions and sand drift into the town” (Cattle, 2016, p. 16). By the 1970s, more than 80% of NSW was assessed as requiring treatment, facing the highest levels of Australia’s land degradation, while in the 1980s half of Australia’s agricultural land was considered to be degraded (Messer, 1987). In 1995, Ludwig and Tongway asserted that, of the 42% of Australia’s arid or semi-arid lands suffering from desertification (citing Christie, 1986), more than half of which was occurring due to the historic and continued “naive land use” of pastoralists (1995, p.

232). The far west suffered from the Millennium Drought for most of the 2000s (Figure 5.5), forcing major destocking and financial pressures.

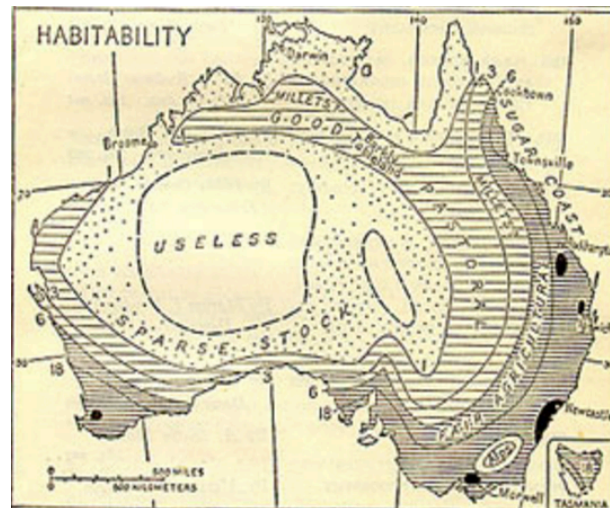


Figure 5.7 The habitability of and uses for Australia's land according to a map in 1947 (Griffith Taylor, 1947, frontispiece. Adapted from http://www.austehc.unimelb.edu.au/fam/0003_image.html).

Rangeland rehabilitation in NSW was primarily championed by the Soil Conservation Service of NSW, addressing the connected issues of erosion, woody weeds and their effects on production (Green, 1989). Numerous government-funded bodies have been responsible for monitoring and addressing land degradation, including CSIRO, agricultural departments, ACRIS, and more recently some forms of citizen data generation such as Dustwatch and Pestwatch. The NSW State of the Environment reports indicate that NSW soil is in 'fair condition' yet its degradation remains one of the greatest management problems, with very or extremely low land capability in the western region, especially with wind erosion as a significant concern (NSW EPA, 2012, 2015). This is evident in the strength of the dust storm of 23 September 2009, where strong winds, originating in South Australia's Lake Eyre region, Queensland's Channel Country and north-western NSW, combined with the dry conditions from ten years of drought, and at least some influence of land management. This caused an estimated 2.54 Mt of soil to be transported over and off the east coast, making it the largest dust storm and loss of soil in Australia since records from 1940 (Leys et al., 2011) with an estimated cost of almost \$300 million to the NSW economy (Tozer & Leys, 2013).

5.2.2 Natural resource management and governance in the far west

For the past several decades in Australia, environmental governance has been targeted at the local and regional level. Historically, Australia's environmental governance has focussed on public regulation, but the rise of the Landcare movement (see section 3.3.2) saw a new emphasis on community decision-making instead of a top-down intervention approach (Price & Leviston, 2014). This

recognised that land users need to be directly involved in the process and that their attitudes are important for the development of appropriate land management (Guerin, 2000).

Despite being well lauded domestically and internationally, questions about the extent of Landcare's demonstrable effectiveness and whether there was 'excessive optimism' (Guerin, 2000) have coincided with a change of focus of several governments since the 1990s. Natural resource management at the regional level was pursued through Catchment Management Authorities (CMAs) which have now changed to Local Land Services (LLS) bodies. This was accompanied by a recent shift towards more voluntary or market-based policies focussing on an involvement from and responsibility of the individual (Cocklin et al., 2007), which have been seen as a way for governments to maintain 'control' over the behaviour of farmers (Curtis et al., 2014). As such, funding for Landcare greatly reduced, while changes also skewed Landcare more towards biodiversity conservation than sustainable agriculture (Curtis et al., 2014).

While participatory approaches are empowering and have often achieved a strong stewardship ethic within the communities, there can be limitations in terms of resource funding, continuous voluntary input, power dynamics and reduced strategic direction. Gill (2014) suggests that this encouragement of a stewardship ethic may not be enough, because of studies finding little correlation between positive environmental attitudes and uptake of sustainable land management techniques. Wilson (2004, p. 481) argues that the proven attitudinal changes are an important first step, but need to be joined with local "policy-making empowerment". Although Landcare lives on and receives some federal funding, the predominance of neoliberal ideology in Australian NRM (Curtis et al., 2014) and emphasis on governance through the Local Land Services means that it is no longer the 'golden era' of Landcare.

The dominant frame of the Outback continues to be that of pastoralists surviving in an arid land of extremes, and pride behind sentiments of stewardship of this land (Gill, 2014). Gill (2014) discusses how, despite the historical conflict over indigenous land rights and land uses from which the pride emerges, Australia's natural resource policy has long been geared towards fostering these claims of stewardship and the idea that the land and pastoralists reciprocally sustain each other. Regardless of future land uses, rangeland managers are key regulators of land degradation, so their perceptions of the issues and possible responses are essential for developing appropriate governance.

5.3 Research methods

Rather than undermining local knowledge or discrediting land managers' 'perceptions' in the face of scientific 'facts', the approach taken in my case study is to give voice to local perspectives, compare the evidence where available and offer potential explanations for discrepancies where possible. I regard the

data as an ‘interpretation’, recognising that the intervention of a researcher and their observations play a critical role in the results, theories and conclusions gained from the data (Hall, 2008). Drawing from grounded theory, the research was designed inductively, where theories are discovered and drawn from an analysis of the generated data (Hall, 2008). The emergence of concepts and refinement of the theory through reinterpretation is central to the approach.

The main research method employed in this case study is interviewing, in the form of “conversations with a purpose” (Mason, 2002, p. 62). Interviewing allows a flexible, fluid approach in which people’s perceptions can be brought to the fore, and allowing them to be situated within context (Mason, 2002). Semi-structured in-depth interviews allow participants to be active in directing the content of the results, with questions guiding the topics but crucially, respondents being able to frame their answers in their own terms about issues relevant to them. This allows predominant discourses to rise to the fore, rather than potentially skewed and prescribed research assumptions. To augment the interview process, photo-elicitation methods can reveal greater insights, prompt collaboration and empower the interviewee due to their familiarity with the material, as landscapes can be of a personal nature for land managers (Harper, 2002; Sherren et al., 2012).

Accordingly, this approach has focussed on gaining depth and detail, instead of statistical measures of frequency or representativeness within the population. Although there is a tendency of self-reported data to be moderated so as to “appear socially acceptable” (Hall, 2008, p. 199), the interviewees remain the best authorities of their perceptions and discourses of the land they manage. To attempt to avoid becoming “too influenced by the perspectives of the informants” (Hall, 2008, p. 80) and to strengthen findings through triangulation, comparisons to similar academic studies and official documentation of the case study area where available are also made. In the tradition of grounded theory, this information was mainly sought after the interview process, to avoid overly influencing the generation of the data. While only a minimal element of the methodological approach, local media and other unobtrusive data allows for further understanding of the background behind certain responses and how they relate to the bigger picture.

5.4 Execution of research methods

The majority of interviews in far west NSW (depicted in section 5.2) took place over a two-week period in October 2015, when graziers were in preparation for an anticipated hot, dry summer. Two additional interviews were conducted (in December 2015 and February 2016) to supplement the findings; the responses were not time-dependent so the delay is assumed to have minimal effect on results, although it is acknowledged that short-term weather patterns can influence attitudes to land degradation (Waudby et al., 2012). Participants were strategically selected as people that could be

potentially affected by policy changes, and people in charge of implementing policies relevant to the topic and study area (following Guest et al., 2013). Although more difficult, eliciting multiple perspectives was intended to add richness to the data and explore potential areas of conflict or concision. A variety of potentially relevant stakeholder groups were mapped and contacted; their varying willingness to participate or rendezvous influenced the final composition of stakeholder types.

Overall there were 16 interviews, with two that involved two participants, making 18 interviewees in total. This consisted of 10 pastoralists (two of whom were retired; one retiree and his son were interviewed together, meaning that nine properties were discussed). Among the pastoralists (signified by P01 – P10), property size varied from 16 000 hectares to 75 000 hectares, while the mean size of the interviewees' properties was 43 000 hectares, thus having a powerful role on large tracts of land (385 000 hectares in total). The interviewed pastoralists often ran a different combination of stock, predominantly sheep (merino and/or dorpers) and cattle (8 pastoralists); sheep and goats (1 pastoralist) and a domesticated goat enterprise (1 pastoralist); although, harvesting unmanaged goats opportunistically is very common practice as well.

Among the interviewees, there were also four government employees (each with different levels and roles in government, and previous professional and local experiences; signified by G01 – G04), and four local residents (consisting of three opal miners and one indigenous person; signified by L01 – L04). While opal mining is a very contained and small-scale operation, the miners' views still add depth to an understanding of the land's capacity for rehabilitation post disturbance. Further, the miners' perspectives are those of locals, who have social connections with pastoralists in the region and absorb knowledge and observations over time.

The stakeholders who declined to participate included Broken Hill's large-scale mining companies, corporate agri-businesses, Aboriginal Land Councils in the region as well as other private citizens. Although land degradation applies to all land uses, the self-exclusion of the mining companies and other stakeholders has led to a focus on pastoral land use for this case study, which is the predominant land use for the area. Staff members of the far west's National Parks and Wildlife Service were consulted but not included in the results. Conservation and tourism on privately managed land were discussed in combination with other land uses.

Interviewees were gathered from numerous points of entry: randomly but geographically through internet searches, purposively targeting prominent organisations and companies, conveniently through previously established connections with other UNSW researchers, opportunistically through snowballing, and spontaneously through the availability of relevant stakeholders at a given moment. Given the short period of time to cover large distances (see section 5.2) and minimal mobile phone

reception in the area, an organised schedule was planned but additional participants were sought in townships in person. Pre-arranged interviewees were sent a letter of information outlining the research project and its aims.

Where possible, interviews were conducted in person, on the understanding that face-to-face engagement is aided by body language and rapport is more easily established, while the participants can feel more confident that their physical context is better understood. In practice, this meant that many interviews took place at the participants' properties or workplaces, and specific descriptions of sites visible from the drive in and out of the station, as well as several tours for further demonstration of their ideas. However, the convenience of the research participants was most prioritised, and some opted to participate over the phone when they had a spare moment. Interviews over the phone were generally between 30-45 minutes, whereas in-person interviews lasted between 45 minutes to several hours. Most interviews were conducted between the participant and myself, although five interviews included a research assistant, my mother (discussed in the following section 5.5).

Preparation for the interview process included the creation of an interview guide containing questions and potential probes to follow up responses. Open-ended questions allowed for unanticipated responses and imposed criteria were deliberately avoided. The design of the interview guide took into consideration the findings of Reeve and Black (1994), where 'inconsistent' attitudes about land degradation by New England farmers challenge attempts for unidimensionality (as is typically sought by Likert scale question types). Reeve and Black also state, "[g]iven there has been a lack of progress in identifying social and demographic determinants of general environmental concern, it may not be productive to embark on a similar search for the determinants of attitudes to land degradation in general" (1994, p. 188). The sparseness and widespread nature of the study population and limited time and resources for the research necessitated a restricted number of interviews, so specific demographic data was unlikely to be of a size beneficially meaningful for analysis (Mason, 2002). Because background questions can also be uncomfortable or "basically boring" for respondents (Patton, 1990, p. 295), general demographic questions were consequently minimised. Some background questions about the stakeholders' property characteristics, employment or connection to the area were asked for the sake of logical sense to the interview.

Questions were structured according to broad topics about: (1) the participant and their connection to land management; (2) their perceptions about the region's environment and its degradation, possible sustainable land management and restoration practices; (3) the role of the government for land management; and (4) their perspectives about the concept of land degradation neutrality. Some questions were asked of all participants, but those who were more engaged or had more time were asked additional questions or more tailored questions based on their previous responses or the flow of

the interview, in a kind of ‘adaptive interviewing’ approach similar to a conversation. The loosely structured nature of the interview process was intended to place fewer demands on the participants, particularly regarding topics like drought that may be distressing (Kuehne, 2014). Interviews that were more opportunistic (given their point of entry or availability) tended to be looser in structure.

During the conduct of the interviews, photo-elicitation methods were found to be of mixed success, with some photos available but many participants unable or unwilling to provide photos – or were not feasible over the phone. Other photo-elicitation studies have lent cameras to participants (for example, Kong et al., 2014) but constraints did not accommodate that approach in this circumstance. While the limited amount of discussions over photos could be considered a weakness in this research’s application of the method, participants were able to provide vivid descriptions vocally and point to various physical landscapes as many of the conversations took place in a relevantly situated context.

Informed consent was voluntarily approved in all interviews to be audio recorded, transcribed verbatim and anonymously quoted. Their confidentiality is preserved through coded transcripts and stored securely at The University of New South Wales, managed in accordance with the Australian Code for the Responsible Conduct of Research. Prior to the conduct of the data generation, ethical approval was granted by The University of New South Wales Human Research Ethics Advisory Panel.

In accordance with grounded theory, interview data was organised and sorted through coding which emerged initially from the research questions but mainly from the data itself. QSR NVivo 10 was used to create and manage these codes. The data was read literally, interpretively and reflexively during the analytical process (Mason, 2002). The process included a combination of open coding (segmenting), axial coding (linking connections and contexts) and selective coding (highlighting central codes and relating and integrating others) (Bryman, 2012), in order to organise the data into particular themes to present the storyline. Discourse analysis is also used to situate the responses within wider discourses dominant in the society and relevant organisations (Hall, 2008).

5.5 A note on positionality and reflection on the methodological approach

The role of the interviewer cannot be overlooked, with generated data ultimately reflecting an influence from both sides of the conversation. I recognise that my personal approach to the data generation undoubtedly affected what was said – the participants’ knowledge and perceptions are not just there for simple collection. Being a young environmental researcher ‘from the city’ (despite having grown up in another part of country NSW) would have influenced the type of ideas and level of detail shared during the interviews. Family businesses are common in the area so the fact that my mother was my research assistant would not have appeared too unusual, but her presence and contributions to

the interviews also would have had an influence, particularly in their conversational tone. When agreeing to be interviewed, a few people mentioned that they thought that it is important to tell outsiders (such as me) ‘what it’s really like out here’. During the interviews, I positioned myself as the learner and the stakeholders as the experts. Although the concept of land degradation neutrality was introduced initially without comment, in the interests of full disclosure, my biases were made known particularly in terms of the difficulties of calculating ‘no net loss’ (see section 4.3.1).

While keeping an open mind, my positionality also influences my overall interpretation of the data. I accept the findings of the IPCC about anthropogenic climate change and try to make sustainable lifestyle decisions. Although there are areas of common agreement, my beliefs and perceptions do not always correspond with – and sometimes come in direct opposition to – the ideas shared by the participants. However, I strived to take a non-confrontational approach and have done my best to present their views fairly.

My ability to gain access with certain stakeholder types more than others also affects the overall results. For unknown stakeholders, emails were an unreliable form of communication and phone calls were often unanswered. In person, several Aboriginal people I approached throughout the fieldwork gave me their views but told me that did not want to formally participate. They said that they had been on so many boards and so many meetings where they have told the same story and raised the same issues, but nothing had changed as a result, and they were unconvinced that this thesis would perform any better. These responses showed signs of consultation fatigue and distrust in the political dynamics of the research/engagement process, sadly by no means a new phenomenon (Goodall, 2001). I also recognise that “indigenous people also express agency through disinterest and nonparticipation” (Wohling, 2009, p. 9) and acknowledge their reasoning for not wanting to get involved.

Reed (2008) discusses how community consultation must be seen to be able to make changes in order to be perceived as worthwhile. For this research, I was unable to prove that it would be effective in improving the situation, so it is not surprising that the interest level by certain stakeholders was low. This is a lesson learned about the difficulty of social data generation, and of telling multiple sides of a story when some sides are reluctant to be told. Indeed, several of the research participants appeared to agree to participate out of altruism, rather than giving the impression that they thought the research would make a difference for them or their capacity for sustainable land management. Nonetheless, indirect benefits may be possible depending on the uptake of the research’s key findings, particularly in terms of how land degradation policies are approached in design, communication and implementation.

6 Far west NSW case study findings

6.1 What problem? Perceptions of land degradation, its drivers and pressures

6.1.1 Understanding land degradation

As within the diverse approaches within the literature (section 3.1), interviewees approached defining land degradation with several different streams of thought. Understandings differed between attributing causes, environmental effects or other consequences, or a combination of attributes.

A production-oriented perspective was evident in a government stakeholder's categorisation of land degradation as erosion, invasive native species and weeds as well as *"all those things that make it unproductive"* (G02). In contrast, a science-oriented government stakeholder discussed how: *"infiltration, soil stability and nutrient cycling [are] three big indicators of soil health, and when those processes break down, then you get land degradation"* (G04). Landholders tended to identify land degradation in terms of its pressures or manifestations, for example woody weeds and rabbits (P02), gullies and barer hills with quicker water runoff (P06), or vegetation loss leading to soil erosion (P07).

Some focussed on the human decisions and management as a necessary factor of land degradation:

"It's country that's been abused... land degradation is where land is assaulted or that heavily impacted that there's a change of species that actually grows on that land." (P10)

"... a lot of farmers overstock and then that's where you've got a problem. You get erosion too. It's how you handle your land ... not kill it by money, by greed." (L01)

While other stakeholders nominated both 'natural' and 'man-made' causes of land degradation:

"Land degradation comes in different forms. To me, if we have a severe thunderstorm event, that causes some land degradation, with the roads and creeks and that getting washed out, just from the source being the thunderstorm. But then, at the other end of the spectrum, land degradation can be caused by overstocking, which doesn't necessarily have to be your stock, like we have a lot of range goats..." (P08).

"There's just natural land degradation through droughts and floods. You have droughts that just remove everything, topsoil, wind-storms, dust-storms, sand-storms and then naturally it breaks with big rains and then you've got flooding events which causes erosion. Which I suppose the landscape's been like that forever and a day. It's just that we've only been here for a short amount of time and we're probably not used to it. And then you've got man-made degradation just from overgrazing." (P04).

Further, others raised issues of falsely attributing the label 'land degradation' to what is actually just a process of how the landscape functions:

"I notice some areas out here that the creek beds – they're [ephemeral] creeks so they only run after a thunderstorm, and they quite often, one bank will fall in on one side and then it will slowly silt up around the corner and I'm not sure whether it's land degradation or just a function of country... it depends on how you measure land degradation." (P02)

"Because the tracks of land are so vast, most people tend to view erosion as just a part of the landscape. You can't go and plant a thousand trees out here to fix a creek line that's eroding, you know? And there have been enough studies done by different people from universities over a number of years to show that you know, creeks move, creek lines move. Yes, sheep pads and cattle pads might cause erosion and things like that, but ... you can't fix it on a major scale... people manage their erosion differently." (P03)

6.1.2 The extent of land degradation

The recognition of large scales, both spatially and temporally, affected participants' perceptions of the extent and seriousness of land degradation in the region. While some looked back to the natural variability of changes over centuries, and how there was erosion regardless of settler activities, others discussed the poor land management decisions over the last 140 years, which have ongoing consequences today. For example, the settlement of Broken Hill fundamentally changed the surrounding landscapes:

"When they started mining here, they had boilers, and the boilers had to be fed. So they basically decimated the landscape by cutting down every tree that there was, and then they ... [dug] the roots up. ... So there has been a very very changed environment from what it naturally would have been, and if it had not been subjected to the mining." (G01)

"There is a travelling stock route along the foot of the hills ... nobody had anywhere to sit in the shade at one stage in the 1880s." (P09)

However, these places are now experiencing more vegetation since becoming areas of regeneration. Similarly in White Cliffs, the opal miners recognised historic degradation, not necessarily from the mining process but from the early days of over-harvesting timber:

"A hundred years ago, there was a lot of degradation from mining because people walked here, and there were thousands of them, and they needed firewood so they chopped all the trees down on the tops of the hills ... This opal field would have been covered in mulga. But since then, that's all finished,

and everyone has gas for heating, you know, we don't chop down trees, there's almost no degradation from mining now I'd say." (L03)

Old ways of managing pastoral properties were said to encourage land degradation through overgrazing:

"Western Lands Leases used to have set stocking rates, so right you've got this area and this landscape type, therefore you can run however many sheep per acre... And people stuck to that, regardless of the condition of the land." (G02)

In contrast to these historical causes of degradation, responses followed a trend observed in Waudby et al. (2012) where people mostly thought that their land was in a more preferable condition than it have been several decades ago. When asked about the prevalence of land degradation in the region, one stakeholder discussed the bias of previous studies that chose to compare the land condition to what it was during recorded extreme land degradation events. This selective choice of scale affects the overall impression of whether the land's quality is declining or improving:

"Those droughts [the Federation drought] were obviously huge and they were the result of a combination of some sort of El Nino event and the fact that landholders were running twenty times as many sheep as they could. So when we think about whether things have improved or declined, we often use that as our benchmark. I mean, most people do, and they go, 'oh yeah, things are getting pretty much better'. ... things are way improved since the '30s, but essentially, that's like an improvement in the more obvious physical manifestations of degradation... gullies, lots of erosion, fences washed away, or exposed sand dunes, but there's this more subtle, more insidious form of land degradation which is a reduction in the productive potential of soil, which is getting worse I think." (G04)

When comparing an aerial photo (Figure 6.1) of the region in 1981 to the condition of the land today, one grazier suggested that it would be "*not very*" different (P06), whereas another said there might be a little more old man saltbush, "*but not a lot*" (P07).



Figure 6.1 P06's aerial photograph of part of the case study region, 1981

According to a researcher:

"[Landholders will say,] 'not on my place', because they don't see it. They don't see the degradation, they don't see what's happening. And probably because they're out there every day. ... I probably spent three years of my time out there, and then I went back 20 years later and I couldn't believe how bad it was, because all the salt bush is gone. But the landholders wouldn't see that because of the gradual creep." (G04)

The participants' responses highlight the difficulty in assessing land degradation due to the fact that it can be quick and obvious (such as an intensely overgrazed paddock or soil erosion following a windy storm) or a slow constant pressure (such as gradual vegetation shifts). Also, a reliance on personal experiences (which occur over a period of 70 years or so) does not easily show changes that occur over even larger timeframes.

6.1.3 Prominent forms of land degradation in far west NSW

According to the NSW State of the Environment report (2012), major issues within the case study region include wind erosion, water erosion and mass movement, shallow rocky and disturbed terrain, as well as some areas of salinisation and waterlogging (see Figure 6.2). Similarly, the most common forms of land degradation discussed by the participants were erosion by wind and by water, impacted by both natural pressures and overgrazing, in turn influenced by various pests and weeds. Soil salinity

was not seen as an issue, at least compared to Western Australia (P01) and the south of NSW's Western region (P03), although P06 described how floods raised the water table, making the soil more saline and consequently seeing more salt-tolerant vegetation on his property. Soil compaction and other issues of soil health were not raised.

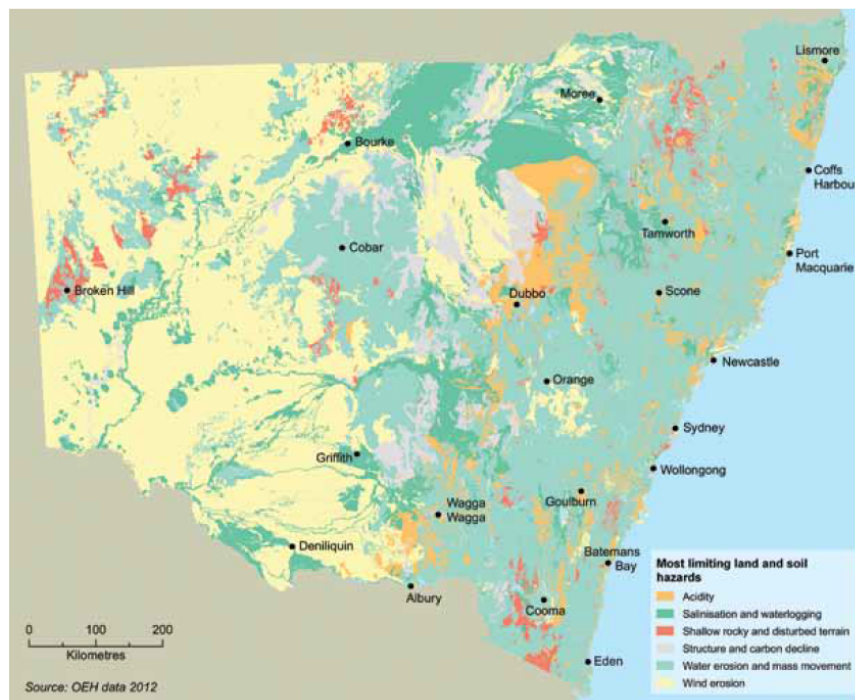


Figure 6.2 NSW's most limiting land and soil hazards (NSW EPA, 2012, p. 117). The main hazards within the case study region are wind erosion, water erosion and mass movement, and shallow rocky and disturbed terrain. Reproduced with permission from the NSW Environment Protection Authority.

6.1.3.1 Wind erosion

Wind erosion is a dominant influence on the landscape, spurred on particularly by dust storms. The SoE report (2012) stresses that in western regions of NSW, wind erosion is a significant issue of concern and that is one of the state's least sustainably managed hazards. Interview participants perceived the power and inter-regional nature of the winds:

“But we do have land degradation normally in the form of wind erosion. Because things have been stripped back and because there is marginal grass cover, apart from native grasses and trees and things like that. So when we get a decent wind coming across from the Nullabor, it can move literally hundreds of thousands of tonnes of soil, and top-dress Sydney's gardens.” (G01)

“To me, the biggest degradation factor here is wind. Because we can have a really good groundcover and if the wind's bad enough, it actually breaks all of that, breaks the stalks and everything else ... and it blows it away.” (P09)

This landholder then discussed how the soil that is blown away still provides nutrients for somewhere else: “so it does have a purpose” (P09). She continued:

“... if it doesn’t rain, it’s dry, and the soils move. It wouldn’t matter if the people were here or not, because there is still wind involved. If it was just left, and nothing virtually happened for months on end, it doesn’t matter, this process, I don’t know, I think it balances itself out in country like this because, even though we had that massive dust storm and that was dirt from somewhere else, and some of that wind was horrific, it still brought in new seed. It still brought in new dirt. So to me, it might strip but it replenishes as well. And I don’t think some people get that. I don’t think they’ve ever really thought about that.” (P09)

This sentiment was echoed by another landholder when recollecting about the massive dust storm on 23 September 2009 (section 5.2.1). While the dust storm was “a shocker”, and the roots of his blue bushes and cotton bushes became exposed off the ground or the shifting sands would bury the remaining groundcover, the recovery was dramatic:

“Everyone said it was going to take several years for it to regenerate. Because all the amount of dirt that got shifted, the topsoil, but then we had that good rain, the 2010 floods, and then it just kept raining for six months, and the amount of tucker that grew, like grasses that came back, better than ever. Better than any other flood but I suppose it had that mechanical abrasion and greater germination and bits and pieces, shifted the seed set, seed everywhere, it was awesome.” (P04)

The stripping and replenishing quality of the winds was also favourably observed by the opal mining stakeholders:

“We are in for some interesting dust storms. And that dust comes and catches across there and you can see where it gets caught. It also brings seed with it. So really we don’t need to do anything, Mother Nature works for us.” (L04)

The interview participants’ acceptance of the ebbs and flows of soil and seeds through wind movement is in contrast to the previous alarming accounts (raised in section 5.2.1). Their understanding is zoomed out to the wider interconnected picture, where their soil goes elsewhere – as far as New Zealand, but other soil comes to them too. While they strive to maintain groundcover in order to retain soil (to be discussed in section 6.2.2.1), the naturally occurring processes are seen as out of their control.

6.1.3.2 Overgrazing

One stakeholder (G03) said, “*I reckon there’s a whole lot of overgrazing.*” Others suggested that there are more isolated incidents:

“Too many goats and probably historic overgrazing... I think in general landholders are probably running fewer sheep and cattle than they did a hundred years ago. Some areas are currently obviously overgrazed.” (G04)

“We flew from Broken Hill to Dubbo a while ago, and there’s some person over near Wilcannia, and you can see from the air... where the boundary fence is because they’ve just completely denuded the place. And that’s in a good time. So they’ve taken away all that saltbush which takes years, it takes generations to get going...” (P04)

On the other hand, others were not too concerned about overgrazing, given the country’s ability to ‘bounce back’:

“...it’s very noticeable on some of the properties... you’ve only got to look and you can see on the roadside fences it’s nice and grassy and bushy, and on the paddock side it is as bare as bare. There’s not a blade of grass to be seen. So obviously there’s times when land is overgrazed at times, but it bounces back. I’ve seen some of the worst looking ground, through the mid-90s when we had the big drought through there, is some of the best looking ground now. So it got totally, totally decimated and now it looks fantastic...” (L03)

Despite at least some current overgrazing in the region, some stakeholders strongly believed that it need not occur, even when there are pressures from other uncontrolled grazing species:

“...overgrazing, because really that’s about all that could happen... other than what’s there – kangaroos, emus or whatever, but they were naturally there – but in controlling animals, whether that’s sheep or cattle or goats, we can control that. And that’s the amount you run. And that’s what any manager or owner should be able to do. Whether they do or not is a different story. But I certainly believe that we do...” (P01)

Others connected financial pressures to potential overgrazing, for example because of droughts:

“Sometimes if you’ve been through a drought for 8 years, you don’t have anything spare. There’s nothing in reserve. And I suppose under those conditions, some blocks do degrade rather badly.” (P09)

“And that’s when places get unstuck to me, they don’t get rain, they don’t get feed, but people on the land try to hold their stock numbers up... they overgraze, and then those perennials are gone, which is hard to get back again.” (P04)

Additionally, P06 discussed financial motivations to overgraze spurred by past policies, such as insecure land tenure: *“if you’ve got a short lease then you’re not going to put a lot [of infrastructure] on it. But you are going to put a lot of stock on it, before you depart”,* and death duties: *“you’ve got to be alert to make sure it doesn’t come back again because by God it moved a lot of salt bush off this Western Division country ... people were trying to run that much stock to get rid of this bloody debt that was paying interest to the banks on, you know?” (P06).*

These examples show that overgrazing was generally seen as controllable and manageable in the current context of climatic conditions and social and political systems. However, several other stakeholders discussed how overgrazing can be compounded by pests (contributing to the number of mouths on the ground), and intensified by unpalatable plants (reducing the amount of edible vegetation). Perceptions of each of these pressures will be discussed.

6.1.4 The pests conundrum

The term ‘pest’ is a loaded term, referring to unwanted animal species or contributors to grazing pressure. The word pest does not specify place of origin, so pests can be introduced species or native. An understanding of certain species as ‘pests’ has a utilitarian flavour, framing animals in terms of their impact on production outcomes, and implying that they lack instrumental value. In other contexts, the same species may be referred to as ‘threats’ to biodiversity.

One landholder said that *“the biggest concern out here at the moment is vertebrate pest management”,* listing kangaroos, wild dogs and pigs in particular (P03). The diversity of pest problems for different land managers was encapsulated by G02, saying *“some people have pig issues, some people have dog issues, some people have fox issues, some people don’t think they have any issues”.*

For areas where there is a common pest, sometimes neighbours coordinate their pest management strategies. For example, one landholder said, *“We do our fox baiting all together. So there might be five, six, seven, like a group, and we all do it at the same time to get maximum effect” (P05).* However, this contrasts to the experience of another landholder who reflected, *“pest control... people tend to do their own. Unless there’s a heap of dingoes, then they’ll group up. But that hasn’t happened since the ’90s” (P09).* Elsewhere, wild dogs are discussed as becoming a bigger issue, such as *“Wild dogs are becoming more prevalent, in the last four or five years” (P10)* and *“Wild dogs are a big problem – a much bigger problem than anyone takes credit for” (P03).* Opinions towards wild dogs may be institutionally reinforced,

where everyone is required to pay fees to the Wild Dog Destruction Board, while dingoes continue to have a contested Australian status (Trigger et al., 2008).

Pigs are also seen as a big problem, but some have found different types of instrumental value: *“People come here and chase up the pigs and shoot them, from time to time... they just do it for fun”* (P06), while P07 added: *“There is a market for them, but not here. Around Bourke and Nyngan and that, there’s a market for them, but they don’t do it here.”*

Interestingly, two of the participants also indicated that humans could at times be ‘feral’ or ‘pests’, in reference to the motorbike riders who cut the fences into Broken Hill’s regeneration areas, where *“in all honesty they wreck it. They wreck the common. They wreck the flats”* (G03) and that *“it’s so difficult to manage and police”* (G01). However, this appears to be an isolated issue mainly because of the isolated nature of the region and minimal urban populations. For most, kangaroos, rabbits and goats inspired particular discussion as ‘pest’ species.

6.1.4.1 Kangaroos

Many participants viewed kangaroos as pests, or at least undesirable on their property, for the sake of their vegetation and management plans.

“We’re not fenced to exclude kangaroos at the moment. We’d like to be. ... They have a large contribution to grazing pressure.” (P10)

“Pests [such as kangaroos and emus] bring in a big problem too, because you take everything off [remove stock], and the roos just move in and it’s so hard to move them on like you can’t muster them up; they’re wild animals. You can’t do much about it, they move from one place to the next and as soon as you give them a hammering out there, they will come back again. It’s pretty hard to manage, especially during a below-average year ... we’ve got permanent water points in these days, so they don’t have to move on anymore, and then they just hang around, they get skinnier and skinnier until they die, or you get a thunderstorm and they just keep nipping it off before the plant gets a chance to regenerate.” (P04)

Acknowledging the unique iconic role of kangaroos to Australia, the dissonance between their view of kangaroos as pests and that of the wider urban Australian and international community was described by the participants.

“People might think that they’re on our emblem and that they’re beautiful furry creatures but they compete for food...” (P03)

“People don’t realise how many kangaroos are around. This creek, during the day if you go from left to right, I go back and across checking the fence, the roos just get up and peel off over the hills, hundreds of them. People don’t realise, they say, ‘oh people shouldn’t be shooting the kangaroos’ – if you didn’t shoot them, you’d have nothing around.” (G03)

Despite this sentiment and shooting advice from the national parks and wildlife service, as a government worker, G03 does not shoot kangaroos in Broken Hill’s regeneration sanctuary (discussed further in section 6.2.3) because of concerns that if the public found out, *“hell would let loose”*. Instead, he feeds the kangaroos (maintained for tourism purposes) and controls the kangaroo population by occasionally luring certain amounts outside of the fence with feed.

One of the reasons why the kangaroo populations are seen to be expanding to pest proportions is the lack of professional kangaroo shooters due to the weak market for kangaroo meat.

“There aren’t enough kangaroo shooters, because there isn’t enough money being paid per kilo to shoot the kangaroos, because our overseas markets have slumped. So kangaroos are a massive problem.” (P03)

“We have a couple of professional roo shooters, you know for human consumption, but the markets are not very good at the moment. So we haven’t seen one for a few months. Haven’t seen a bloke. We can get ‘shoot and let lie’ tags when they get really bad, you go to the parks and they give a licence to shoot 200 roos, or 300 roos, depending on how many you’ve got.” (P04)

The underperforming kangaroo meat market was in part attributed to a case of E.coli destroying the Russian market, although there was talk of potential Chinese interest in the future (G02). The domestic market is currently stifled by consumer demand, influenced by perceptions: there are emotional deterrents to eating cute, cuddly and native animals; strong messages of animal cruelty inherent in the kangaroo industry asserted by animal rights groups; misconceptions that, as wild animals, kangaroos are full of diseases and parasites; and relatedly, a general Australian dislike for and unfamiliarity with ‘gamey’ meats (Cawthorn & Hoffman, 2016). Although scientists and government advisors advocate for the potential of the kangaroo market (Cawthorn & Hoffman, 2014), challenges include the fact that legislation prevents ownership of wildlife and there is a need for strong food safety regulations (Spiegel & Wynn, 2014).

In a Western LLS (2015a) stakeholder survey, 85% of respondents listed kangaroos as a pest problem (significantly more than the 68% of respondents in 2012). Thomsen and Davies’ study found that only one of 21 interviewed landholders in South Australian rangelands considered kangaroos as ‘pest’, although 14 suggested that they could be a nuisance or problem ‘at times’ (2007, p. 56). Instead, in

their study, kangaroos were mainly seen as a 'resource', suggesting a general shift in attitudes that is not currently apparent in western NSW. While strengthening the product prices of the kangaroo harvesting industry could encourage this shift, Chapman (2003)'s research in south-west Queensland recommends that other administrative, legal and institutional considerations would need to be addressed.

The commercial use of kangaroos is considered to be one of the few potentially profitable rural industries with minimal environmental consequences (Thomsen & Davies, 2005). Baumber et al. (2009) suggest a collaborative model involving kangaroo growers and harvesters for mutual benefit through the Future of Australia's Threatened Ecosystems (FATE) program. A greater emphasis on the commercial use of kangaroos could simultaneously address the expanding kangaroo population from a total grazing pressure perspective, as well as providing rural livelihoods based on resilient native species, and reduce methane emissions from sheep and cattle, which may also interact with carbon payments in the future (Baumber et al., 2009). As kangaroos also have significant cultural, subsistence and economic values for Aboriginal people, the development of the industry is in a position to address issues of social justice by including indigenous considerations throughout the process (Thomsen & Davies, 2005).

6.1.4.2 Rabbits

Although introduced as domestic reminders of Britain, pastoral opinions towards rabbits have long since shifted to regarding them as major pests and causes of land degradation (Gill, 2014). While the same degrading impacts of rabbits can be attributed to cattle, Gill (2014, p. 272) discusses how rabbits are "singled out as agents of ecological villainy" in pastoral discourses. Since pastoralists became established in the area, the expansion of plague-level rabbit populations has been attributed to several severe cases of land degradation (Cattle, 2016). In 1891, the *Brisbane Courier* described the Western Division of NSW as "one huge rabbit warren", almost bereft of native grasses and palatable scrub (Cooke, 2015, p. 7). Through general overgrazing and the restriction of regeneration, the promotion of introduced vegetation, and the reduction of biodiversity through competition with native species, Cooke argues that "there is indisputable evidence that rabbits are deleterious in arid and semiarid ecosystems in Australia" (2013, p. 284).

Rabbit populations were once commonly managed through warren ripping. The introduction of two biological control agents (Myxomatosis in 1950 and Calicivirus in 1995) has dramatically reduced rabbit numbers. A retired landholder, who stated that rabbits were one of her biggest land degradation issues, described various methods she had tried, such as Myxomatosis (initially noticeable but became less effective), Spanish rabbit fleas released down warrens, and warren ripping some

affected parts of the property, until “...by magic one day Calicivirus arrived and within a matter of a month and nearly every rabbit on our place was dead... and the increase in grasses was incredible, because the rabbits weren’t there” (P02).

Other stakeholders who had experienced the ‘before’ and ‘after’ of these rabbit controls also remarked upon the difference they made for land restoration and biodiversity:

“...since we no longer have huge numbers of rabbits, since Myxomatosis and Calici, that grazing pressure being gone out of our environment, it’s just been an absolute godsend to our ecosystems. Because there’s just so many – the biodiversity of the whole set up, by not having rabbits in our cycle, is mindboggling, the improvement.” (P10)

“Something that isn’t ... talked about – there’s two or three times more vegetation out here since the Calicivirus came through, and cleaned up the last of the rabbits... if you went out spotlighting now you’d get five or four. The vegetation on the ground has doubled or tripled since ’95. And young shrubs and young trees, leopardwoods and all that, they just got chewed off once, before ’95, not any more, they’re all growing now.” (L03)

While the rabbit population is nowhere near as bad as it used to be, some participants warned of their return:

“...they haven’t gone away, but take your eyes of them, they’d be a problem.” (L04)

“We’ve got a lot of rabbits now. We’re having problems with rabbits.” (G03)

The return of rabbits was also seen in terms of their instrumental value:

“That Calicivirus... did devastate but ... I do see more of them more frequently again now... most people harvest them, and sell them for meat. So they’re actually sometimes worth more than your sheep and cattle.” (P09)

This is another example where a land degradation pressure can hold contrasting attributes simultaneously. Indeed, three participants reflected on growing up with rabbits with a sense of nostalgia. In the mid-1950s, one interviewee used to trap rabbits for their meat and fur:

“There’s a rabbit, we got a few of those on the place. I don’t know if there’s a thousand, there might be... I used to trap rabbits. There used to be tear drop shaped little sandy islands through there, and I used to put two or three rabbit traps on each island when I was a kid. And a chiller truck used to come in and pick all the rabbits up, every day.” (P06)

In some ways and for some people, the presence of rabbits was not entirely damaging: they provided an alternative source of income and recreational value. For Aboriginal people, the abundance of rabbits provided “easier hunting” for food, at least as “an attempt to adjust to a new economy” (Cooke, 2015, p. 15). L01 described how he used to catch a hundred rabbits a day for food, and trade them for fruit, vegetables and other goods. However, their acceptance as a feature of the land and potential source of food or income does not predicate their replacement of native small mammals, and the damage they cause to the land and ecosystems should not be overlooked (Cooke, 2013, 2015).

6.1.4.3 Goats

Feral goats represent another quandary in which they are seen as both a source of income and an agricultural and environmental pest, according to different circles. Feral goats (*Capra hircus*) have an increasingly dominant presence in the arid and semi-arid regions of Australia, particularly in western NSW. While goat numbers in NSW were approximately 60 000 in 1981 (Khairo et al., 2013), by 2011, it was estimated that there were 2.95 million goats across an area of approximately 460 000 km² in NSW (predominantly the western region), with an average annual increase rate of 5-10% since aerial surveys began in 1993 (Pople & Froese, 2012). While there are specifically managed goat populations in the region, the vast majority (about 90%) are feral goats which have spread since the establishment of European settlers (Nogueira et al., 2016). These are often referred to as ‘rangeland goats’, unmanaged but available for ‘opportunistic harvesting’ when prices are attractive and significant goat numbers are observed on a property (Khairo et al., 2013).

While mainly harvested for meat, goats can also provide fibre and milk. Australia’s goat industry is still seen as ‘emerging’, but has continually grown over the last 20 years (Nogueira et al., 2016). The goat market was once considered to be constrained by the market price of goat meat, but today it is a valuable and profitable product. Australia is the world’s largest exporter of goat meat, contributing to half of the global trade in goat meat – and with NSW managing 46% of Australia’s goat flock (O’Connor, 2016). The increase in the value of goat meat is thought to have triggered an increase in harvesting but this has not resulted in a reduction of goat abundance (Pople & Froese, 2012).

Competition with native species and habitat (land) degradation by feral goats have resulted in their listing as a key threatening process in the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. They are known to compete with native fauna for palatable vegetation, water and shelter. They also have high reproductive potential, move freely through large areas to find feed, and contribute towards erosion through removal or destruction of vegetation and trampling the soil, reducing its stability (Kimball & Chuk, 2011). While studies such as Pople and Froese (2012) have attempted to gauge abundance

levels of feral goats in semi-arid NSW, this does not necessarily correlate linearly with their overall impact, which is more difficult to determine.

Responses from the interview participants reflected the multi-dimensional nature of goats. Questions regarding land management and land degradation, while not specifically targeted about goats, would often lead to various interpretations of goats as fulfilling particular roles in terms of economic income or environmental impact. Regardless of whether they were viewed positively or negatively, stakeholders agreed that they are prevalent, and increasingly so.

A government stakeholder said that he had “*never ever ever seen goats like there is now*” (G04), mentioning that he noticed their presence since he became familiar with in the area in the 1970s but now they’re “*absolutely everywhere... a huge problem*”. Two other government staff described goats as “*undesirable animals*” and “*a big problem*” (G02) and “*the biggest problem*” (G03) in the area. Likewise, a landholder in flat country said that ten years ago, she would have been lucky to get 100 goats because they prefer hilly country, but she sold 3000 of them in the last financial year, so “*they’re getting worse*” (P08). The large impression of goat numbers described by the interview participants is interesting to compare with a study by Nogueira et al. (2016), which found that producers in western NSW and central-western Queensland also determined goat stocking numbers by “eye and experience” but “tended to underestimate their stocking rates”. If the stakeholders in this study have similarly underestimated goat numbers, the question of their impact on groundcover and erosion becomes even more significant.

In regards to their negative environmental impact, a government worker described goats as “*the most destructive of all the animals*” (G01), by competing for grass and breaking tree limbs. This was reiterated by G03. A local described how “*every tree gets cropped up as high as a goat can reach*” (L03). When compared with sheep, a Barkindji man said:

“Well, sheep, he chew the top of the grass. Say there’s a little bush? He go along and he nibble that to a certain point and then he let it grow again. But goat? He rip all that out. And he’ll eat it all. So he can make erosion, and he’s pulling all the topsoil. And he climb up in the tree and he break all the limbs, on the wattle trees and smash them” (L01).

Some literature suggests that goats might have greater effect on grasses than on shrubs because they are more accessible and palatable, but that they also affect perennial plants by defoliation, debarking trunks, affecting seed production and eating young plants, with hooves that break the soil crust, leading to erosion (Kimball & Chuk, 2011). The overall impact of goats specifically, however, is unclear. Goats’ dietary requirements are not always perceived as being so clear-cut, as one pastoralist stated that “*goats are even fussier than sheep and both of them are fussy*” (P06). A goat grazer also

described how goats were not eating as much blue bush (*Chenopodium sp.*) compared to sheep, “*and it’s starting to come back, so that’s our little thing that we’re happy with. Because we can say that that’s growing, and we’re seeing hundreds and hundreds of them starting to grow in the paddocks that there’s no sheep*” (P01).

Because of their ability to browse on particular perennial shrubs, goats are perceived to survive better during droughts: “*sheep’ll die, goats’ll keep going*” (G03). Indeed, Pople and Froese (2012, p. 4) observed that the drought of the 2000s “did little to dampen” the overall increase in goat abundance. With the increase of goats came changes in land management practices (also see section 6.2.1.1 on pastoral management) and the burgeoning goat industry.

“[Goats] weren’t recognised for a long time. Even the banks when you were borrowing money, when we bought our first property, and they told us to, we had to say we were going to run sheep. Because they didn’t recognise goats. Now goat meat is worth more than mutton, so now the banks understand fully that they’re making more out of people with goats than they are out of mutton, a head of sheep. Not as much as lamb but definitely mutton.” (P01)

By all accounts the goat market is currently lucrative for the case study region, despite the fact that “*it’s still got a lot of room to go on it; it’s still quite naïve*” (G02). Gyrocopters are used for aerial mustering, often opportunistically when they are spotted in large herds on the station. The high financial value of goats appears to have enhanced their acceptability among land managers. Because his multi-species fencing allows him to exclude or enclose rangeland goats, a landholder said that “*we don’t really consider goats as pests – we consider goats as a resource*” (P10). Another landholder described how she now musters goats as a supplement for their income and she has changed her perspective about them: “*I don’t see goats as a problem any more. Probably 10–15 years ago they were, but they’re fairly much under control now. The price of goats has just skyrocketed within the last few months so people are making a more active effort*” (P03). A local government worker described goats as “*a gift*” to station owners, who have been able to build new houses from money they have made through goats (G03). Landholders described their inclusive financial value where “*they’re worth money right down to a relatively small size*” (P06).

Goats could be perceived as appropriate species for the far west of NSW. A goat farmer acknowledged “*they do get a bad name when there’s too many, but we believe that they’re better on the ground*” (P01). His reasons were that they browse on woody shrubs and cause less soil erosion from padding because, unlike sheep, they do not follow each other around water points – and consequently he found that since changing stock, “*the country’s actually getting better*”.

Goats were also seen as useful as a control measure against certain native scrubs species. P04 described a situation where at his parents’ place, they “*electric-fenced a paddock and stuck a heap of goats in there*” in

order to eat the hop bush. With the hop bush successfully cleaned out, P04 observed the return of native grasses, suggesting that goats are “*pretty handy*” and “*good if you can manage them the right way*”. This practice did not appear uncommon, with friends of another landholder tackling hop bush with goats followed by chemical control, with a caveat that “*it’s a long hard slog*” (P02). Goats as weed control has been discussed in research (Nogueira et al., 2016) and known about for some time (Noble, 1997), but there are more ideas to explore in this field.

The availability of commercial opportunities appears to be a key influence upon the stakeholders’ impressions of goats as a resource. Goat harvesting is still pursued primarily for its profitability, a motivation unrelated to environmental reasons (Kimball & Chuk, 2011). However, one landholder viewed goats as pests “*whether they’re worth money or not*”, adding that the fact that they are lucrative is “*probably a good thing*” because it means people have an incentive to get them (P08). In comparison, the stagnating kangaroo industry suffers from a lack of commercial incentivisation.

6.1.5 The weeds conundrum

Like pests, the term ‘weeds’ also refers to certain species in a pejorative sense; plants perceived to negatively affect the ‘usefulness’ of land. Weeds in western NSW can be both introduced and native, and they can be herbaceous (such as onion weed) although the main concern is about ‘woody weeds’ or ‘bush encroachment’, also known as ‘invasive native scrub’ in Australia. The transition from grasslands to areas predominated by shrubs is a worldwide phenomenon, triggered by overstocking, reduced fire regularity and compounded by droughts, and is said to result in greater runoff and soil erosion (MA, 2005). To many, bush encroachment in rangelands is considered to be the most widespread type of land degradation (Reed et al., 2015), making it difficult to use vegetation cover as an indicator of degraded areas if a transition has taken place (Vogt et al., 2011). However, much of the policies and scientific research about shrub encroachment (see Noble, 1997) have been based on certain assumptions about qualities of shrubs which may more accurately be attributed to overgrazing (Eldridge & Soliveres, 2014). The following sections explore attitudes towards native and introduced weeds in the case study region.

6.1.5.1 Invasive native scrub

Within the western region of NSW, there are 26 species listed as ‘invasive native scrub’. To be listed as invasive native scrub, species must meet three criteria: they encroach new areas or regenerate densely following disturbance; they change the vegetation community’s composition; and they are found within their natural geographic range (NSW Government, 2006). The most predominant in the far west are turpentine (*Eremophila sturtii*) and hop bush (*Dodonaea viscosa*), while mulga (*Acacia aneura*) is also listed as a potential contributor. Early settlers tried to find uses for these shrubs, such as

hop bush for making yeast and beer, but in 1997, this was disparaged in a CSIRO review: “[w]ith the wisdom of 85 years’ hindsight, it is easy to see how such optimistic perceptions of the utility of these shrubs as forage plants were fundamentally flawed” (Noble, 1997, p. 6). While finding the ‘woody weeds’ label trite, Noble (1997) acknowledges its usefulness as term in order to raise awareness of their status as a problem to land managers, governments and the general population. The frame of ‘invasive native scrub’ is now more commonly used in governmental publications, distinguishing natives which may need particular treatments and may even be tolerated in some levels, as opposed to exotic species, which should be eradicated whenever possible.

The LLS frames invasive native scrub as “a major problem facing landholders in the semi-arid rangelands across the world” (Western LLS, 2015b), recommending early and persistent action to control it. They state that in 1988, an estimated 70% of the Western Division was affected by invasive native scrub (with 10% severely infested), while many more paddocks have become unmanageably scrubby within the last 10-15 years. When asked about her perception of the most significant influence on land degradation, a Local Land Services officer said that “*out here it would be invasive native species, and that comes from a history of the land being over-utilised*” (G02).

Disapproval of the increase in scrub was also expressed by various stakeholders in terms of its decrease in the utility of the environment:

“...where you’ve got natural grasslands, that were once native grasslands, which were open country, is replaced by woody shrubs, that have no grazing, or very little grazing benefit at all. And that is said to be the largest definer of land degradation, where you’ve got land abused to a point where the land itself just changes, to a non-healthy environment.” (P10)

“There’s a little dam through there but it doesn’t fill anymore, because there’s that much shrubbery that it’s choked the channel right off... They’ve been trying to clear this [creek bank] up, they’ve been pushing all the stuff [woody scrub species] out of the way, so you can get your sheep back out to the paddock, see? ... You talk about degradation; well it’s degraded alright, only the people over here got degraded by it though. Not the plants.” (P06)

“There’s things that you keep an eye out for, like invasive scrub, if you can get rid of it, you can... it’s prickly! ... It’s more a matter of it being useless because nothing eats it, and it’s taking up room. And nothing grows under it. Same as the turpentine, you know the woody weeds? If you get too much of them then nothing grows underneath it.” (P07)

The Local Land Services actively encourages swift spot-treatments of woody shrubs to minimise their range and density (G02). Despite this, a landholder discussed wanting to do more about addressing woody weeds but feeling constrained by the government's legislation:

"...we have a woody weed problem. And in order to control the woody weed, you have to get a lot of environmental permission from the government to do it... you just can't go and fix the land degradation up..." (P08)

... as well as the government's practices on government-managed land:

"We have a stock route that borders us, and it's got ... woody weeds gone mad and because there's not the work base in any of the government agencies anymore, nothing gets done. ... Because they're not looking after their section of land, and it comes over our fence ... you're not getting rid of the source of it." (P08)

Other landholders did not discuss the issue as being completely clear-cut. On the one hand, they perceived the woody shrubs as being bad for grazing, water management and accessibility, and therefore the productivity of their land. On the other hand, they also observed that native woody shrubs helped to maintain groundcover and provide reliable food for the stock that can browse on it. According to one landholder:

"I don't consider woody weed a weed. Because it actually helps to keep the ground down. And we've only got it in clumps, as you can see it doesn't cover all our paddocks. So to me they are like a good wind break. If the clump's big enough, it'll reduce the wind over the top of the soil anyway. Plus, when it's dusty, they catch the soil as it's going through as well. So we did initially do some of the pelleting and stuff, but that wasn't very effective. Unless it rained a lot, not a little, it didn't work anyway. And there are animals that will eat it anyway." (P09)

While a retired landholder saw woody weeds as one of the biggest land degradation issues she had faced, and had done as much chemical control as she could to control it (*"Velpar, Gridball, Access, Roundup, tried them all"*), she also suggested that perhaps they had helped to withstand wind erosion:

"I know the west a bit – dust storms have decreased in the last 50 years. So there's obviously more groundcover, whether that's invasive native scrub or grasses I don't know, and native scrub's taken off a bit in a few places, so. But dust storms definitely seem to be on the wane." (P02)

This combination of sentiments was echoed by another landholder:

“This was all open through here, you could drive sheep through there no trouble at all. It’s all closed now – and that of course means a lot less dust blows around. Wind sweeps and that. Stops all that sort of stuff.” (P06)

The widespread transitions from grasslands to scrublands, often described negatively in prevailing literature and international approaches (MA, 2005; UNCCD, 2015c) was not necessarily approached in the same way by the pastoralists. A similar finding was discussed by Reed et al. (2015), where goat and sheep farmers in Botswana accepted and found uses for bush encroachment, in contrast to views in South African literature that it is a major problem for their livelihoods. The following interpretation was shared by landholders, father and son:

P07: “[Saline soil] mostly happened after 1973 or ’74, because that’s when we had record rainfalls of like 36 inches of rain, instead of our usual 8. And it raised the water table. And so along a lot of the edges of the creeks there the salt came to the surface. And that changed the vegetation as well. It used to be green grass, and now it’s more salt-tolerant salt bushes and that sort of stuff.”

P06: “Shrubs.”

P07: “It’s shrubs rather than rangeland grass.”

P06: “There weren’t many of them when we got here, and half the trees weren’t either.”

P07: “As far as that goes, it’s actually better for sheep; they live on it better. If it’s a drought and it’s a bit dry, they live a mile better on that, than they do off grass that isn’t there.”

P06: “Oh yeah. And you get the sand coming in after a couple of good winds overnight, overnight winds and you finish up with no grass anyway, you know sand moves a bit and then you’ve got nothing. This country just hangs tight.”

A rejection of the pejorative framing of native scrub species was more apparent in stakeholders who viewed shrubs in terms of their effects for ecosystems, rather than simply in narrow terms of productivity. According to this scientist for the state government:

“It’s absolute lunacy to clear them. I mean, they provide so many ecosystem benefits. ... It’s an oxymoron: invasive native scrub. When the legislation came out, I just wrote so much shit to our department, and told them it was a lot of crap, but you know. I was told that I need to get with the new paradigm: ‘You’re stuck in your old ways; you’re in the old paradigm’.” (G04)

Scientific research has found that increases in shrub density frequently referred to as ‘invasive native scrub’ encroachment may not necessarily indicate land degradation (Silcock, 2014); it is not a universally degrading phenomenon because “shrub encroachment impacts are varied and numerous, and their valuation depends upon the human culture which perceives it” (Maestre et al., 2009, p. 938). This area of research has a more nuanced approach, suggesting that management depends on what

species are there and how their effect on land degradation is skewed by what land uses are intended (Eldridge et al., 2011). Some studies from western NSW have shown positive ecosystem effects in shrub encroachment levels at the highest recorded concentration in eastern Australia (Eldridge & Soliveres, 2014), providing habitat for native fauna as well as understorey plants (Silcock, 2014). Figure 6.3 depicts changes in ecosystem services at different levels of shrub encroachment, such that all services cannot be maximised at once; mosaics of states are required (Eldridge & Soliveres, 2014). Eldridge and Soliveres (2014, p. 603) argue that “there is little evidence that in Australia, government-funded programs to remove shrubs have provided real long-term economic or environmental benefits to landholders hoping to increase plant production” in a pastoral context, finding that species-specific traits and the confounding factor of grazing need better attention.

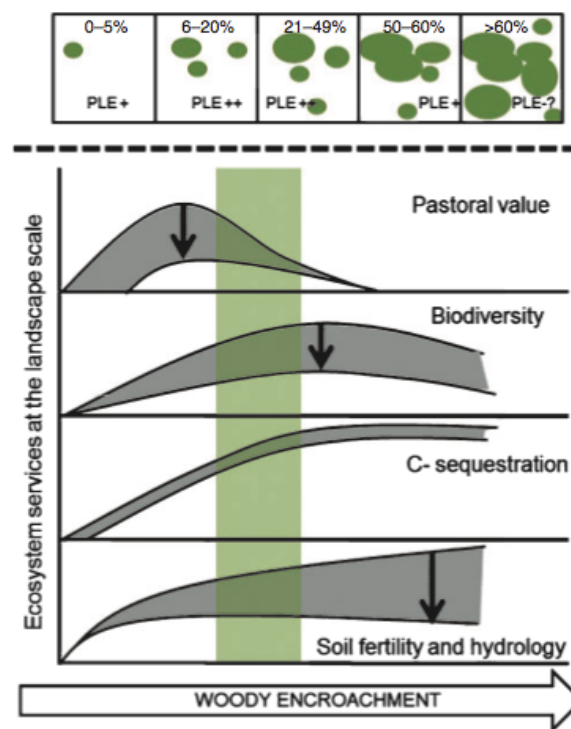


Figure 6.3 Changes in ecosystem impacts (on pastoral value, biodiversity, carbon sequestration, and soil fertility and hydrology) according to a gradient of 'patch-level effect' (PLE) of woody shrub species, at the landscape scale (Eldridge & Soliveres, 2014, p. 596). The grey band indicates the variation in service provision under different levels of grazing, and the green strip shows where the total of ecosystem services is maximised in combination.

There also appears to be a shifting perception towards shrub species and their role for pastoralism in providing some form of groundcover (for more on groundcover, see section 6.2.2.1). To some extent, the increase in native shrubs is linked with the proliferation of feral goats, because they provide browsing forage that enables them to persist further than other species.

“It doesn’t really matter what it is, as long as there’s something growing there that’ll stop the water from running. ... And we have a woody weed problem. So we have hop bush and turpentine...”

that's not so good and there's not a lot that actually eats it. But the hop bush... the goats will eat that. And they control it, they never kill it but they control it, so that lets some of the native and perennial plants and grasses come back, which is good, we like that. We can control one, not the other, but we can control one.” (P01)

The shift in perceptions about woody shrubs may be encouraged by the fact that people have found other ways to make use of them; they have adapted to the changing environment. Goat production has a more viable role to play (see section 6.1.4.3) and there are new initiatives that recognise the value of woody scrub for carbon sequestration. ‘Invasive native scrub’ species such as turpentine and hop bush are not listed as ‘known weed species’ in the carbon emissions reduction fund, and thereby not excluded from carbon farming schemes⁷. Their inclusion in carbon farming initiatives can help to shift perceptions:

“There was a long time there when they wouldn't include invasive native scrub or woody weed in the carbon offsets, now they are. Now... people are getting paid for their mulga and woody weed and stuff like that...” (P03)

However, there are challenges still to face:

“They're obviously starting to get the message because some landholders are now being paid carbon credits not to clear woody plants. The irony is some of those landholders are being paid not clear in one area and are using the money to go and clear somewhere else.” (G04)

In this way, landholders have a source of revenue outside the productive capacity of the composition of their groundcover, but care needs to be taken to avoid leakages. Challenges in such carbon sequestration schemes indicates challenges for their inclusion in land degradation initiatives and metrics, especially given different perspectives on how woody shrubs variously contribute to land degradation or environmental and economic benefits.

6.1.5.2 Introduced weeds

Certain introduced weeds – such as African box thorn (*Lycium ferocissimum*), noogoora burr (*Xanthium occidentale*) and mesquite (*Prosopis spp.*) – were afforded little sympathy from stakeholders in the case study region. The LLS stakeholder highlighted challenges in managing for particular plants:

⁷ Information about the Department of the Environment's Carbon Farming Initiative and its 'negative list' is available from <https://www.environment.gov.au/climate-change/emissions-reduction-fund/cfi/negative-list>

"We've got a weed out here called mesquite, which is a really really problematic weed, it's very difficult to control, very hardy, loves the environment out here. And it's a C4 species as well. ... weed control is very, very, very expensive out here... it's too big. We don't have money and we don't have access to funds to do that, and that can be quite frustrating, because ... they can't change what's going on there and it's becoming an increasing problem." (G02)

One landholder was applying for riparian funding to control noogoora burr:

"It's a shocker. And then it grows so thick, nothing else grows. And then it dies off and it's just dead stalks and no other plants there; that's a bit of a problem." (P04)

While another landholder described noogoora burr as being *"one of the worst. That's why we've got cattle, because you can't run sheep in it"* (P07). This determination of stocking regimes in response to undesired plants could be seen as a type of adaptive management.

Yet, despite the resounding disapproval of introduced weeds, some participants still held attitudes that expressed the capacity for certain weeds to have instrumental value.

"You know we look after the land, make sure everything's nice and watered. And look to make sure we don't get erosion, y'know from creeks and things. You notice it, I don't ever cut out the weeds from the creeks because that helps to stop the erosion of the land." (G03)⁸

Discussing innovative land management practices, one landholder referred to people she knew who deliberately used introduced weeds in order to prevent soil erosion, such as:

"...buffel grass, which was illegal. It's been declared a pest in New South Wales, because of the way that it's grown in Queensland. But, for some of this country, it was great groundcover, it slowed down water, there was less soil degradation, a whole range of things. Some people I know put kikuyu into their creeks, and sorghum into their creeks, to help slow [water] – because when these creeks fill, the water comes out of nowhere, and it washes away so much topsoil..." (P03)

These responses suggest that land managers are more concerned about the attributes or services of species than they are about whether they belong in the environment. While clearly skewed towards productivist values, they are willing to adapt their opinions and actions towards plants and animals according to perceived benefits. Therefore, if the right discourses are promoted according to private gains, there could be significant public benefits too. Muir et al. discuss how a western region

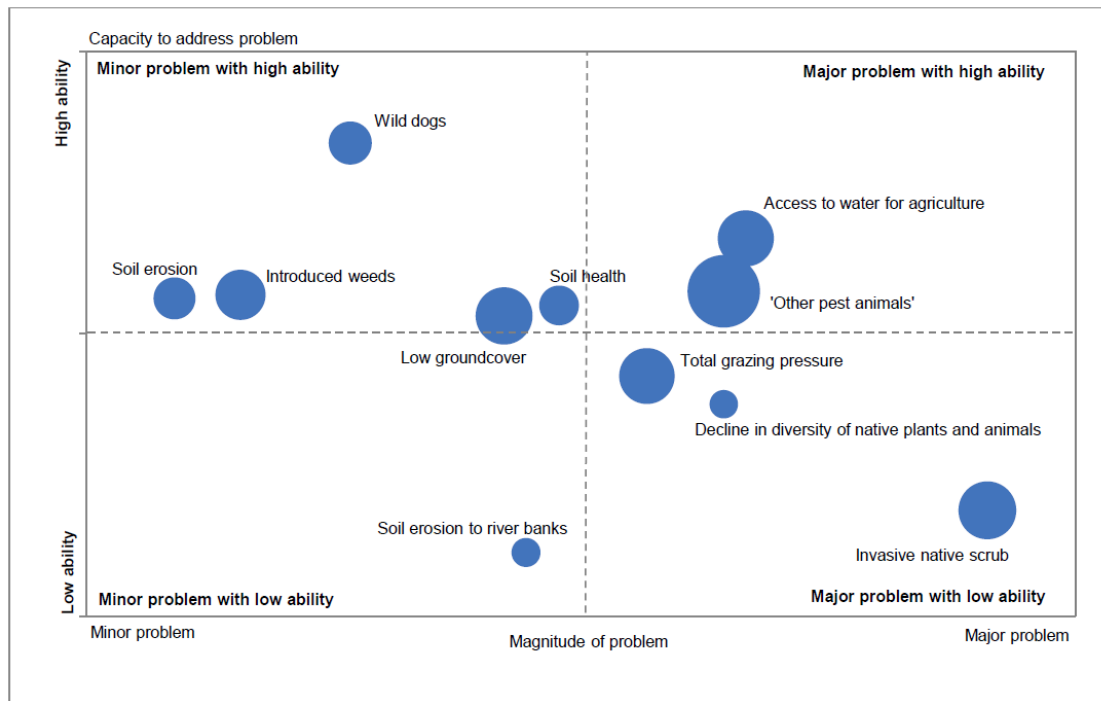
⁸ The participant did not specify whether he was referring to native or introduced weeds and in hindsight I should have asked for clarification. However, all sorts of weed species can spread through creeks and he indicated that he does not remove *any* of the weeds from the creeks, which may well include introduced species.

stakeholder saw the presence of weeds on previously scalded areas not as a bad thing, but instead acceptable because “it is country telling him that it still has potential for life” (2010, p. 264). While there are positive and negative traits ascribed to weeds without species specificity, the responses suggest that greater clarification is important.

6.1.6 Section summary

Delving deeper into the issues that cause or influence land degradation shows the complex, sometimes contradictory nature of the problem. Diversity within the academic range of understandings of the term ‘land degradation’ was likewise apparent within the localised stakeholders from this research; some emphasising the importance of managerial decisions, others including natural causes, while others deliberately excluding natural causes. Their interpretation of wide temporal and spatial scales strongly influenced their perceptions of the extent and severity of degradation throughout the region, although the majority suggested that the major degradation events from overgrazing and mismanagement had occurred in the past, particularly during the European settlement of the region. Wind was seen as a key influencing factor on erosion, but not necessarily negative – wind takes, but it also gives. For most responses, land degradation was not perceived to be a crisis. This is similar to the findings of a 2012 state-wide survey of environmental concern, in which only 1% of respondents listed land degradation (soil erosion and salinity) as one of the two most important environmental issues (NSW OEH, 2013).

Overgrazing, while still occurring at least in isolated cases, was largely seen as preventable through management, particularly requiring attention to be paid to pests and weeds. The responses towards manifestations of land degradation and potential pressures is interesting to compare with the concerns raised by landholders in a survey conducted by the Western Local Land Services (2015a) (see Figure 6.4). While soil erosion is viewed as a relatively minor problem, the most important natural resource management issue indicated by their findings is that of invasive native scrub.



Source: EBC (2015).

Figure 6.4 Landholders' perceptions of landholder ability to address degradation problems (low – high), magnitude of problems (minor – major), and prevalence of natural resource management issues (indicated by the size of the circles). 'Other pest animals' refers to all 'pest' species (most significantly kangaroos, foxes, pigs and rabbits) excluding wild dogs and unmanaged goats (adapted from Western LLS, 2015a, p. 138).

However, it is not so simple or illuminating to generally discuss 'pests and weeds' once the differences and interrelationships between species is acknowledged. There are contrasting attitudes towards many species (such as kangaroos, goats and rabbits) as a 'pests' or 'resources' to varying degrees, adding complication to the debate, with their management depending on stakeholders' perspectives and commercial opportunities. Kangaroos were mainly seen as extensive pests with little value as a resource in the current market, while the increase in rabbits was seen as a previously large influence on land degradation but with market value encouraged by the decline in other species. Rangeland goats inspired particularly strong attitudes towards their dual environmentally destructive but lucrative qualities, aided by their current dominating presence in the region as well as the profitable international goat meat market.

While to some the greatest problem regarding land degradation in the region is the spread of 'invasive native scrub', there appears to be a subtle shift in perceptions where its value for ecosystems and soil is increasingly noticed. Some stakeholders did not see the issue of 'weeds' as being clearly negative, with native scrub providing groundcover, wind breaks and carbon sequestration for example. Walker (1994) suggests that the growing use of ecologically important native species through 'benign'

techniques (notably for meat but also an increase in explorations into uses for plant species) can have environmentally positive effects regardless of farmers' motivations.

The 'nativeness' of a species did not appear to factor into whether they were considered to be a pest or weed problem by most participants. Native kangaroos and emus could be seen as pests, while introduced goats could be seen as resources. Native scrub could be seen as a weed, while introduced kikuyu and buffel grass could be seen as offering instrumental value. Possible benefits and limitations (utilitarian factors) were of more concern, thereby avoiding ethical quandaries of how nativeness should be determined particularly for restoration purposes (Callicott, 2011; Trigger et al., 2008). Cooke (2013) gives an example of rehabilitation by Parks Victoria which was less concerned with species' origin and more focussed on what is best for vegetation recovery, pragmatically doing the best they can and upgrading when possible. Flexible attitudes towards what species 'belong' can lead to better adaptive management and less paralysis.

6.2 Perceptions of sustainable land management and restoration

As discussed previously (section 4.3), central to the UNCCD's approach to land degradation neutrality is the promotion of both sustainable land management and restorative works to counterbalance continued degradation. The following section explores how these discourses apply to the far west of NSW and what action is being done in these areas.

6.2.1 Whose angle? Land management by different land managers

While pastoral rangelands management was the predominant land use investigated in this case study, it co-exists with a number of land uses and land users. Differing perspectives and some underlying tensions between these forms of land management were revealed, feeding into the notion that the question of 'whose perspective' is important for identifying the problem and sustainable solutions.

6.2.1.1 Pastoral land management

"It's how you handle your land. I'm not saying not have goats, I'm not saying not have sheep, what I'm saying is you need to manage it properly." (L01)

Sustainable land management (SLM) is a generic sounding term, and was not necessarily seen as a set of scalable solutions (see section 3.2) but instead a cue for discussions on land management carried out in a sustainable way – *"it's all about people looking after their land in terms of their grazing management"* (P04). Despite focussing on grazing land uses, land managers were quick to point out the diversity of options:

“If you go to any, like if you could go to 6 or 8 different places, just neighbours here, everyone does things a different way. Because you have to do what you have to do that suits the land type. It’s just not practical to do some things, and it’s impossible to do some things.” (P07)

Certain soil and land types would prompt certain stocking regimes (P04, P05), including the identification of areas that are unsuitable for grazing (P04, P06, P07), such as sensitive gullies and steep hills. The choice of animal breeds and their suitability for the environment, as well as the choice of alternative land uses, were important contributions to the responses.

In the region, it is common for pastoralists to run multiple livestock enterprises. The Local Land Service’s landholder survey found that most enterprises had livestock combinations (and that the most common was of sheep, cattle and goats, see Table 6.1).

Table 6.1 Different livestock enterprise combinations (sheep, cattle and/or goats)
adapted from the Western LLS’ survey (2015a, p. 48).

Sheep	Cattle	Goats	Count	Percentage
Yes	Yes	Yes	121	27.9
Yes	-	Yes	74	17.1
Yes	Yes	-	45	10.4
Yes	-	-	29	6.7
-	Yes	Yes	24	5.5
-	Yes	-	23	5.3
-	-	Yes	20	4.6
Total livestock enterprises			336	100

Decisions about which livestock enterprises were most suitable were often made for practical reasons, such as the awareness that cattle need to have fresher water than sheep (P06), an important consideration when water availability is a significant constraint in the region. Predominantly, the sheep breed throughout the region was and is merino. While many still run merinos for wool and meat, one stakeholder described how it is not particularly suited to the climate:

“...it does best in a higher rainfall softer country... it likes nice soft flat paddocks... it’s a bit precious the good old merino, if you want it to perform to its maximum potential.” (G02)

In comparison, alternative sheep breeds (predominantly dorpers as well as some damaras) are becoming more common in the region, which are different from merinos in their diet, production value, costs and resilience:

“They still like the grasses but they want a wider variety in their diet as well. And so they managed much better, and ... they are meat, so they’re only focussing on one area. ... The beauty of those animals was that they were a shedding sheep, so ... the overhead of shearing was removed, and crutching was removed... there were a lot of costs that were removed.” (G02)

The Climate Council suggests that dorpers will perform better in increasingly harsh climatic conditions because they are more heat-tolerant (Hughes et al., 2016). However, for the very same reasons that they are lauded by some stakeholders, others see this as a maladaptive cause for environmental concern:

“...as things become more tenuous, climate-wise, landholders have probably got to switch to different animals, they’re going to eat different feed, they’re going to survive better in a drought, and they’re going to have a bigger effect, like a cumulative effect... you may as well just slash and burn, if you overgraze them, which they tend to. I mean I’m not saying all people do, that have got dorpers and damaras, but the thing about merinos was, when you got into a big drought, you had to get rid of your sheep, because the merinos just couldn’t cope, which was a good thing because the country got a bit of a rest. But with the dorpers, they just keep pushing, pushing, pushing, pushing, pushing.”
(G04)

There also exists a tension between graziers with different sheep breeds, which may be difficult to reconcile:

“...people are diversifying... [but] there’s still a group of people that are merino people. And because of the hair element in these other sheep, if they get in their paddock or in their woolshed they can contaminate their wool. Wool is now at the price it was in the late 80s, when the floor-price went. So the income hasn’t changed for it in 30-odd years, but the expenses have, so they really don’t want anything that can contaminate it and drop the value of their wool. So there’s that factional fighting.”
(G02)

The promotion of certain breeds and livestock enterprises, and consequent effects on vegetation, soil and income, appears to be influenced by the stakeholders’ beliefs about the graziers’ ability to sustainably manage the land. Contrasting statements of concerns or praise about dorpers and damaras in terms of their resilience or ability to persist and the potential impact on land degradation were similar to discussions on the phenomenon of rangeland goats, where land managers are finding themselves as part of the industry, whether they intended to be or not (*“Every one of them’s a goat farmer, at the moment”* (L04), and see section 6.1.4.3).

Goats’ influence on land management decisions was a divisive topic, with some discussing their interference with stocking decisions while others seeing the benefits of co-grazing with sheep. According to one grazier, *“when it starts to look a bit dry we tend to sell off, but if you’ve still got those goats coming in, and if you’re not on top of them, then they’re just extra mouths to feed”* regardless of how much they’re worth (P08). While not a problem for him, another landholder mentioned that they had become *“a big issue”* for others, where *“they might only be able to run 4000 sheep and those goats are*

drinking all their water and competing for feed” (P04). G02 described a practice that has been happening for over 25 years where land managers designate a fenced “*sacrifice area*” to store goats in, and sell them off when there’s enough for a truck. While this process effectively degrades the goat paddock to a ‘moonscape’, it is intended to reduce the grazing pressure from small mobs of goats wandering over entire properties.

In contrast, a local resident described how goats can be deliberately paired with sheep, and that their differing dietary requirements enable a greater overall stocking rate (L04). Some research has shown that goats can be beneficial to pasture when grazed with sheep and cattle (Nogueira et al., 2016), suggesting that the situation is more complex than simply supporting one type of stock over another.

6.2.1.2 Indigenous land management

Recognising Aboriginal peoples’ rights to land, their continued occupation, environmental interests, and role in land management demands that their perspectives be carefully considered in the rangelands (Goodall, 2001). Despite a significant proportion of the region’s demographic identified as indigenous (Brown et al., 2008), this research is limited in that there is only one Aboriginal interviewee, a Barkindji man from Wilcannia not directly managing land, but a stakeholder nonetheless (limitations discussed in section 5.5). A Barkindji man who wished not to be recorded still wanted to have his message heard, saying that “*the environment is sick*”, “*nature is doing to us what we are doing to her*” and “*it’s true what [scientists] say about climate change*” (pers. comm.).

For the Barkindji –known as ‘river people’ – the poor environmental state of the Darling River is a cause for extreme levels of concern (Forsyth, 2016); further discussed in section 6.3.1. In regards to decision-making for the Darling River, a Barkindji woman has said that “*we don’t have a voice, as far as I’m concerned*” (Buckingham, 2014).

Differing attitudes about Aboriginal peoples’ involvement with land management in the Western region was apparent from the interviews. As an Aboriginal man, this interviewee expressed a lot of concern about the state and management of the land:

“...it’s not being looked after properly. A lot of stuff happening out on the land and we sort of haven’t got any sort of say in it, on how it should be done. I think our voices are not heard. And it’s not about stopping things happening, it’s about doing it the right way in the first place. Mining, the river system, the farmer, it’s just getting out of control. It’s pretty frustrating.” (L01)

This compares dramatically to other stakeholders:

"I don't think the Aboriginal people actually really have much care out here... except for obviously where you get the national parks, where they seem to have a bit of a stronger pull somehow, like more power. You just don't see them out here." (L02)

"...we've actually found that there's quite a number of people that are in Aboriginal organisations that won't actually participate in Landcare because they don't feel like it's their thing. Or because they don't get sitting fees and stuff like that to do it, because it's volunteer, and a lot of Aboriginal people are used to getting paid to do what other people just have to do." (P03)

The significant under-involvement of Aboriginal membership in Landcare has also been related to its tendency to focus on 'white settler agriculture' issues (Wilson, 2004) and indigenous knowledge generally being undervalued in scientific NRM institutions (Curtis et al., 2014).

While reflecting that *"a lot of this country had blackfella fireplaces on it"*, and there is a closed-off traditional carvings area on the property, this landholder stated that:

"One of the things we had to fight of course was native title. And we eventually had a win on that... it was declared that if it involved a blanketing over your business or your home, you were right. Now this looks a bit like a home and the station looks remarkably like a business..." (P06)

The tension between the stakeholders about indigenous issues and land management would be worthwhile for further study.

6.2.1.3 Government-managed land

In addition to the government services, there is a network of national parks in the western region, specifically Mutawintji National Park and Paroo Darling National Park within the case study region, as well as the travelling stock routes managed by the Local Land Services. The effectiveness or legitimacy of national parks was sometimes questioned by the interviewees.

"...the landholders will say that national parks put everybody else at risk. Because the national parks, they don't maintain their fences, they don't burn when they should burn, they don't control all the feral animals, there's continuous battles I think ... the worst neighbour you can have is a national park." (L02)

"I was fairly disillusioned with parks, and still am, as a landholder and land manager ... they have their own act, their own piece of legislation, and I just think it's typical government bureaucracy... there's not enough money, to manage the national parks the way they should be managed, because I

think national parks should be managed the same way that Joe Blow landholder manages their land ... [for] things like erosion control, weed management, pest management, and all those sorts of things.” (P03)

“... we have a stock route that borders us, and it's got cactus on it for instance. And woody weeds gone mad and ... because there's not the work base in any of the government agencies anymore, nothing gets done... I suppose it's the same with national parks...” (P08)

But in contrast, a government-funded stakeholder rebutted:

“... there's a lot of misinformation. [At] farmer meetings, they always complain about national parks... But most of it's unfounded. Because national parks spend as much or more money per hectare on feral animal, feral weed, fire mitigation than most landholders.” (G04)

Although land management of national parks is out of the scope of this case study, these responses indicate that they have a significant role as stakeholders and land managers in the region, with the capacity to help or hinder SLM.

6.2.1.4 Mining land management

Mining continues to represent a dominant form of income and employment for the region's administrative centre, Broken Hill, and mining companies have to be engaged with sustainable land management practices particularly to reduce costs and risks (Barkemeyer et al., 2015). However, the small-scale opal miners do not reflect the same values and perspectives of the large-scale corporates, and they were keen to point this out, speaking of coal mining and fracking - *“they're dirty words even to us” (L04)*. Opal mining for the interviewed miners was seen as a personal choice, appreciating the thrill of the chase for valuable opals and the rural lifestyle. One of the opal miners said that *“I'm just here in town, know everyone within a 100 km radius, and I've visited nearly every property in that” (L04)*. Land degradation was not deemed to be very relevant for their small-scale land use and minimal impacts.

6.2.1.5 Corporate or 'absentee' landholders

The Western LLS' landholder survey indicated that 97% of landholders were family businesses rather than corporately owned (2015a). However, corporate owners typically have very large tracts of land, with land managers responsible for several of these properties. Several stakeholders mentioned the social and environmental consequences of this phenomenon.

“...one owns 12 properties but he’s only got 3 or 4 people working on those 12, whereas 20 years ago there would have been 12 families living on those properties. So that’s had a flow-on effect to the town as well.” (P02)

“The guy who owns it ... I think he’s got half a million acres in this area, and he has several managers on each... So it’s actually dislocated several families off places, so that’s a bit of a down-side in the area.” (L02)

“We’ve had people just come and buy up tracks of land in the Western region, like they can get it for \$10 an acre or \$15 an acre, as a tax offset ... the people that are profitable, are the corporates that have got massive amounts of land. They put managers on every third or fourth block, and pretty much just do whatever they like, because the dollar is the bottom line. ... They’re not thinking long-term, they think profit... In the ’60s and ’70s, families weren’t allowed to own more than two or three blocks of land. You actually had to go and put your case forward to the Western Lands Commissioner. Now you’ve got companies that own 20 properties. They’ve got a couple of million acres, at least. So, you can’t tell me that they’re doing the same thing on their place that small family units are trying to do. Because they’re not. ... I think big company-owned areas tend to breed more vertebrate pests.” (P03)

The changing type of ownership of the far west – facilitated by changes in the legislative context – could have consequences for its sustainability, considering environmental, social and economic factors.

6.2.1.6 Tourism (in pastoral properties)

Tourism is another land use that landholders are exploring, with consequent changes to their land management regimes. By diversifying their income, one landholder described greater financial security as well as environmental benefits:

“[With tourism,] even when it’s dry, you can still earn an income, you can’t with sheep that can’t eat that die, or you’ve got to sell them or whatever. ... So we also run less sheep than our neighbours, because we are in tourism... and I think that shows in our paddocks.” (P09)

Another grazier discussed how she had recently started tapping into the tourism industry, and the challenges of running the businesses simultaneously, having to close up the accommodation during hot weather and stock work:

“It’s not a huge earner, because we’re only in our third year and I don’t actually want to increase anything infrastructure-wise... it does give us an extra income stream, which just pays for little bits and pieces, like it’s paid for itself, in three years, which is really, really good. ... At this time of year

we're doing stock work and it's so dry, and ... you've got thousands of sheep sort of coming through a very small area, that it just turns to a dust bowl. And the shearers' quarters [tourist accommodation and facilities] are too hard to keep clean.” (P03)

For P09, tourism was another way to encourage sustainability, having “*advanced eco-accreditation and climate change business accreditation for our tourism*” (P09). Sustainability was a significant motivation for land management decisions among the interviewed landholders.

6.2.2 Sustainability in land management

“...if [we] can keep people here and producing meat, because really, agriculture is very important to the whole sustainability of the world, isn't it?” (P05)

The stakeholders in this case study were well aware of the importance of sustainability, not just for the environment but also for their livelihoods. There was a general consensus that an increasing number of pastoralists in the region are aiming for sustainable management, because it is “*pragmatism*” (P07) and “*common sense*” (L03), and more people are aware that environmental health and farming livelihoods are necessarily connected (P10, G01). Further examples include:

“At the end of the day, we are the caretakers, and it would be foolish to wreck what we've got because we can't make a living. You know, I think many people out on stations and that are very adaptable, resourceful and resilient... because you have many years where it's very, very trying and you have very low income.” (P09)

“There's some things that are going to happen, regardless, like bushfires, floods, droughts, and there's a percentage of mismanagement that will always happen in any business, but generally speaking we've got an increasing group of people who are getting switched on.” (G02)

Land managers also commonly cited concern for future generations (mainly directed towards their own children) as a significant influence for wanting to manage the land properly.

“...you've probably got about 95% or more of landholders out here that want to do the right thing because they want to have something that, if their children can have the option, to keep it going, if they can. But they've got to have something there for their kids...” (P03)

“...if you don't look after the land, the next generation to come along won't have anything to have.” (P08)

“You've got to work for the day that one of them are able to come home, I think. Otherwise there's not much point trying to fix things up, trying to make things better... You want to look after the place so

the next generation can come along and have a better run at it, or try and find it in a little bit better state than before. If each generation does that, then you're working towards that common cause."

(P04)

However, there were some expressions of concern about potential negative consequences of particular land management changes in the name of sustainability, such as a large 'sustainable' tomato farm in South Australia taking away the business of smaller tomato growers (P08), and the government-supported 'land appropriation' for a renewable energy wind farm near Broken Hill (P04, P09). In both of these examples, the stakeholders were opposed to large corporations suppressing the livelihoods of smaller family businesses, a concern familiar to political ecological studies of land degradation.

Sustainability in land management for the participants in this case study was not a complex or challenging concept. For the land managers, the most important sign of good land management was the maintenance of groundcover, through the management of total grazing pressure. There was little support for the applicability for rotational grazing (despite it being a prominent technique in SLM literature), and neither was the idea of tree-planting well regarded, although setting aside areas of land for natural regeneration may be accepted in certain circumstances, as well as other rehabilitation techniques, such as water ponding and contour furrowing. Attitudes towards each of these land management options will be discussed in turn.

6.2.2.1 Maintaining groundcover and total grazing pressure

For grazing purposes, the main indicator that land managers often use to assess sustainable land management is the maintenance of groundcover, through the management of total grazing pressure (TGP) including livestock as well as feral and native grazers. The interviewees often brought up the complementary ideas of groundcover management and total grazing pressure, and they were seen as very important facets of land management, for environmental but also significantly productive objectives. For example:

"...our pasture is native and we need to conserve it to manage grazing pressure, to maximise production, to make it all happen." (P10)

"So the more groundcover you got, the less [degradation] you'll have... and that comes from total grazing pressure... There's a little saying, 'you make more out of running less'. So that means the animal you grow is a better animal because it's got more feed to eat." (P01)

"You've got to take every opportunity you can to remain viable... keeping a certain level of groundcover and maintaining the feed you have got, knowing when to take stock off and put stock on... that's the big thing in this area." (P05)

The connection between groundcover management and water management was also highlighted:

“...if you increase groundcover... water gets filtered before it hits the river system, so that works with decreasing silt levels, and erosion levels, and increasing water quality...” (G02)

“If we’ve got good groundcover, when it rains heavy, the water can’t go anywhere. That means it’ll soak into the ground. And that’s what we’re looking for... it doesn’t really matter what it is, as long as there’s something growing there that’ll stop the water from running.” (P01)

The participants also discussed how groundcover management is not just about improving vegetation; it is also about “excluding most species” (P10) or “getting rid of the undesirable animals” (G02), that is, “getting rid of all those animals that eat the grass, and disturb the soil” (G04). A feature of TGP management is viewing pest management within the daily operations of the production. Discussing TGP, Kimball and Chuk (2011) remind that all herbivores (domestic stock, native grazers and pests) need to be considered as factors for groundcover management.

Along with TGP or multi-species fencing (G02, P10), which aids “matching livestock to available feed” (G02), tactical decisions about infrastructure also were discussed as being important for good groundcover. This includes “where water points are placed in a paddock” (P03) and generally:

“Moving waters, making more water points, making paddocks small, spreading the stock out so there’s little bits all over the place... now we’ve split them up and it has helped, for sure.” (P04)

Responsibility for total grazing pressure management was seen as squarely within the ability of land managers – a sentiment held by both land managers and government stakeholders.

“So the lesson is and these landholders have proved it, not government people – landholders: fewer animals, better quality animals, watch your drought – use technology to monitor your drought, move your animals around, get rid of them early, buy in early because then you get more money.” (G04)

“...you hear that a lot with the LLS... they’re pretty big on TGP... you as a manager should be able to work that out. But some people can and some people can’t. And I believe that it’s not hard to look at the ground and know whether you should be buying or if you should be selling. And now, it’s a good time to be selling.” (P01)

A LLS participant discussed a similar situation, instead suggesting that their role is more advisory and helping people to make their own observations and adapt accordingly.

“A lot of what we’re doing is getting people to acknowledge that that is, with our variability – variability is normal, you need to be looking and seeing when there’s a lot drying off and you need to

start lightening off. And a classic example of that is I was out, two weeks ago, on one of the forward-thinking innovator properties, and ... he was responding to what he was seeing automatically, whereas you'll be with other people that won't see it, at all." (G02)

In general, the region's groundcover was deemed to be strong, and better than previous years.

"...now we're probably be getting up to as good as it's ever been, groundcover-wise. It's the best year we've had... not for everyone, but for us." (P01)

"...even though it's dry and we really need some rain, we've still got really good groundcover." (G02)

Two financial reasons were provided for this positive assessment of groundcover. The 2009 dust storm provided an impetus for more groundcover funding: *"...because the cost to the nation, to clean up... was phenomenal... if there had been better ground coverage, this would not have happened"* (G02). The drought had also significantly reduced stock numbers, but people were unable to afford to greatly enhance their amount of stock during the following three wet years, which provided a natural environmental benefit:

"...But the stock numbers were that low, and they were competing against butchers, and the meat market, which meant that the majority of people could not afford to buy replacement stock... So they didn't, and couldn't. And that then meant that the land had time to have a couple of growth spurts and seed sets while they were naturally building their [stock] numbers up." (G02)

This shows that socio-economic contextual factors also have a role to play in the management of groundcover, and indeed, can be seen as a linked controlling variable important for assessing resilience (O'Connell et al., 2015).

6.2.2.2 Rotational grazing and other grazing regimes

Rotational grazing (and similar grazing methods such as 'holistic resource management' or 'cell grazing') is a technique involving the movement of livestock through a series of paddocks, allowing pasture to recover in the absence of livestock before the rotation starts over again, and is one of the most frequently advocated SLM techniques for rangelands. For instance, it is highlighted favourably in 'Sustainable Land Management in Practice' for Sub-Saharan Africa (Liniger et al., 2011) as an improved management technique for pastures, biodiversity, soil fertility and food security (among other reasons); in 'Sustainable Land Management Practices for Graziers' in the Southern and Central Tablelands and Southern Highlands of NSW (Stein et al., 2009) for improved groundcover, production and livestock performance; as well as multiple stories showcasing its success - such as in

the south of the NSW Western region (Walsh, 2009). Often, it is simply mentioned favourably as a solution to overgrazing, compared to continuous grazing (such as Nkonya et al., 2011a).

Although it has persisted since 1950 particularly due to Allan Savory in South Africa and US institutional restoration initiatives, the academic advocacy for rotational grazing is much less clear-cut (Briske et al., 2011). Synthesising experimental evidence on rotational grazing, Briske et al. (2008) found that it is a viable strategy for grazing, but not superior to continuous grazing across the majority of rangelands, and that weather variation and stocking rates contribute more strongly to plant and animal production than grazing regime.

In the far west, there was no particular support for rotational grazing by the pastoralist and government stakeholders over other grazing management methods. Indeed, the grazier stakeholders were sceptical at best towards rotational grazing, and provided compelling, contextual reasons for their criticism. One of the key reasons for their disapproval was that following a prescribed schedule does not take into account the unpredictability and sparseness of critical factors like rainfall, and it reduces their ability to adaptively manage according to the observable conditions.

"...it's okay if you're getting a steady rainfall that you can predict... but if it doesn't rain, it doesn't matter does it, because it's not going to regenerate." (P08)

"I don't know how that would go out in this country because it's actually too dry most of the time. You can't rely on rainfall." (P09)

Others thought that the rotational grazing technique was not applicable to the region because the pasture or water supply is not able to provide for intensive paddocks of stock; ecological limits do not allow for a concentrated grazing distribution. One grazier (P06) explained that the maximum capacity of his bores would not provide enough water to support an economically viable number of sheep in a rotational grazing regime. According to another grazier (P09): *"if you put a heap of stock in one paddock, then you'd make a dustbowl. So it's not only them eating it, it's them treading over it all as well."* Also, if vegetation is overgrazed through higher stock concentrations, then there would need to be much more time and effort for its recovery.

"I'm not actually that keen on [rotational grazing]... if you were to say put all your sheep in this paddock for three weeks and then all of them in this paddock- well, you'd be eating it all. And that sort of perennial shrubs don't grow that easily so you've got to be a bit careful of them. That you don't overgraze and kill them, because they just won't grow again. So for here, rotational grazing doesn't work. Better off having just the right number of sheep in each paddock, so they don't overgraze it." (P07)

As well as the land's limited carrying capacity, other pastoralists described how the temporarily destocked land as part of a rotational grazing regime would not necessarily be properly resting from grazing pressure, because of the presence of other grazers: *"you're still allowing all the kangaroos and the emus and everything else to go in"* (P08), and *"as soon as you take your stock out, it just gets flooded with roos... and emus, they're a bit of a problem"* (P04).

Even if some the principles of rotational grazing are considered, if pastoralists have *"got the understanding and inclination"* (G02), there are still significant implementation constraints – *"you could quite easily argue that they are just too expensive"* (G02). Because of the large scale of the properties, the technique was commonly seen as *"very intense and... very costly"* (P03) and logistically challenging (P06). For example:

"We've done a rotational grazing course. We have sort of implemented some of it. But up here, I don't know if it's that successful as it can be down south because we've just got such big areas... it'd cost you thousands in fencing to do it... and getting someone to do it, getting the time to do it." (P05)

Additionally, the lack of resounding support for rotational grazing may have been compounded by the unconvincing ways that it has been presented to graziers, described by Sherren et al. (2012) as 'almost evangelical'. P06 described rotational graziers as *"fervent... adamant about it"* while G02 discussed how, when training programs have discussed rotational grazing coming from the basis of regular rainfall, *"we don't have that here, so... people stop listening"*. Research with landholders in Victoria, while strongly supporting training and education, also found that inappropriate training content and methods, and trainers who were 'unable to relate to farmers', were a hindrance for achieving sustainable land management (Cocklin et al., 2007, p. 990), suggesting that this is not an isolated issue.

Instead of prescribed regimes like rotational grazing, the pastoralists practice grazing management that suits them and the environment, adjusting according to the amount of pasture available or keeping low stocking rates. For some this means continuous grazing (*"My old dad you see, he had the idea and we're still doing it, is that the ewes live in their paddock all their lives"* (P06)), while others rest their properties on a grander scale:

"... one of the things landholders are doing is, in good seasons, putting stock in the Western Division. And when things dry off, they truck them off and fatten them up in the Central Division or in the Eastern Division, where there's more pasture. And that's kind of like a transhumance, like it's like what traditional societies practiced. Except they're using a truck, to move all their sheep. And a lot of landholders are doing that." (G04)

Stocking rates can be more flexible with the ability to drive stock away, because previously degradation could be caused when stock became too weak to walk long distances (Green, 1989). While agistment (paying to graze on others' properties) is a common practice during drought, further future research could explore the economic and legal mechanisms which enable pastoralists to strategically move stock for greater outcomes.

Overall, it appears that managerial decisions and adaptations to variability are more influential than the choice of grazing regime (a finding also asserted by Briske et al., 2008). The high infrastructure and labour demands of rotational grazing requires more managerial input than other techniques, and may not achieve the desired goals if handled unskilfully. A better use of awareness and training might be to focus on the land managers and their values, rather than purported SLM techniques specifically. For Briske et al. (2011), the dissonance of opinions about rotational grazing is symptomatic of a greater underlying problem of recommending a narrow, technical approach as a blanket solution for rangelands management, rather than an understanding of rangelands as complex socio-ecological systems.

6.2.3 Restoration and rehabilitation

As previously discussed, the far west region of NSW was subject to severe degradation after the settlement of early pastoralists and miners, particularly from overstocking, rabbits and the denuding of landscapes for fuel. In the 1930s, however, the degraded area surrounding Broken Hill also became the site of one of the first ecological restoration projects in Australia and indeed the world (Jordan & Lubick, 2011). By this time, dust storms from the eroded land were greatly affecting daily life and operations within the town (Cattle, 2016). With the support of a local mining corporation, field naturalist Albert Morris used the local native vegetation as a reference for some selective planting and believed that the environment had the ability to heal itself, if appropriate conditions were secured. Jordan and Lubick argue that while the mining corporation's involvement was likely to be simply for dust abatement, Morris' efforts were ecocentric, "with a 'practical' objective in order to justify it in utilitarian terms" (2011, p. 75). The beneficial effects of this relatively long-running restoration project are now highly valued and the Regeneration Areas are listed by the National Trust. Two participants based in Broken Hill mentioned the success of the city's restoration areas (G01, G03).

In the 2400 hectares of the Broken Hill City Council's managed land, there is 9-hectare section that is specifically managed as a native flora site. 2500 native trees were planted in 1992, and it has continued to get thicker, while maintained by a drip line (see 'before and after' Figures 6.4 and 6.5). The restoration site is mainly "*for show... that's what it would have been like*" (G03). When asked whether it would be feasible for others to do such restoration activities, G03 said "*you have to have*

funding for it and water for it", suggesting that the regeneration area has a special treatment that is not practical on pastoral leases.

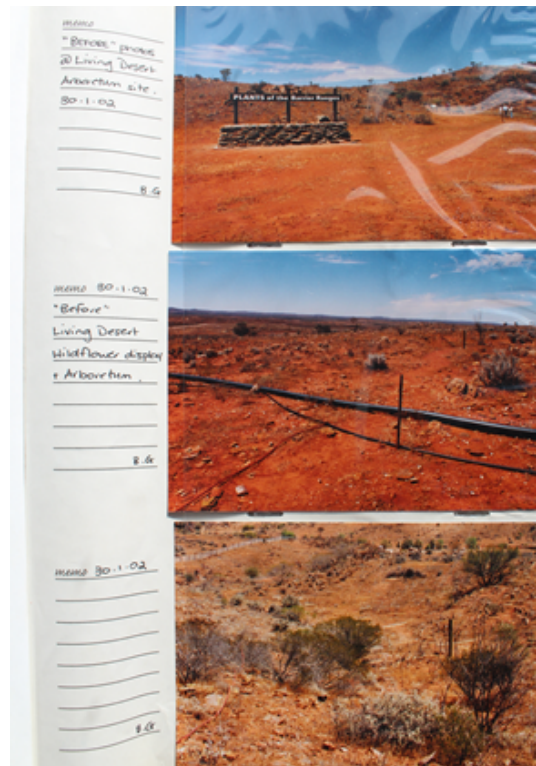


Figure 6.5 "Before" photos at the Living Desert Arboretum site, 30 January 2022 (shared by G03)



Figure 6.6 Current native flora site and surrounding land, 16 October 2015 (photo: E. Berry)

6.2.3.1 Passive restoration

In terms of repairing the grazed land from degradation, the interviewees commonly held the opinion that it was best to let it happen naturally, 'by itself'. While they were aware that this could take a long time, there was the perception that the environment could and would eventually repair itself in appropriate conditions.

"[It] all sorts itself out after a while, you turn this nutriment-free stuff up on the bank and the next thing you get a seed and dust blows against it, and it tends to balance itself." (P06)

"We let it do it by itself." (P07)

"...once the ground is denuded, it takes a hell of a long time again for it to pick up... I think it's more by resting than reforestation and replanting..." (G01)

"Just let it sit and let it regenerate back through." (G03)

An example of such restoration was observed by a pastoralist neighbouring a travelling stock route, which has been greatly relieved of livestock grazing pressure because of the now preferred method of transporting livestock via trucks.

"I've been here 30-something years, and there are far more trees around, there's acacia trees, and people don't push their stock down the stock routes anymore, so that makes a big difference." (P09)

Indeed, conservation groups are now seeing the potential of travelling stock routes for large stretches of wildlife corridors for biodiversity (Smiles et al., 2011).

Belief in the ability of land to self-restore was coupled with an opposition to the idea of manually planting trees, based on awareness of water constraints and variability:

"[There is restoration but] not in the Landcare 'plant trees and revegetate' sense. That's useless out here. ...you can't hand water, it's too big an area, and the rainfall is so uncertain." (G02)

This landholder had tried replanting with little success:

"...you lose the trees when the dam goes dry. Sometimes they can't last if the drought's too bad. I have tried to do things like that and if you introduce seedlings and things like that and if it goes dry, they tend to die, even if they're acclimatised. I've even put out salt bush, thousands of plants of salt bush in our holding paddock, and because I didn't support them with a trickle line and stuff, they died." (P09)

Whereas another landholder went as far to hold the point of view that it is counter-productive to have more trees:

"There's plenty [of trees] out there. Too many. ... Every now and again we have to go out with a bulldozer and clear a track through it so we can find [the cattle]." (P07)

The interviewed opal miners shared the graziers' sentiments about the futility of tree planting for rehabilitation. For example,

“We were asked to plant trees where an open cut had been done. We should plant trees. Now, we were in the middle of a drought. We didn’t have any water anyway. Trees would not have grown. But once the weather changed, [it would] just grow from there like there’s nowhere else around [because] it was ready to go. So, you can’t fight nature. You can’t fight nature, it’s the boss.” (L04)

NSW’s *Mining Act 1992* requires the mines to be backfilled upon completion. Since the backfilled holes rehabilitate naturally, the miners said that *“we don’t really harm the environmental at all... there’s more diversity within the [opal] field – and more [vegetation] – than in the surrounding country” (L03)*. The participant shared photos of rehabilitated mine sites (see Figures 6.7, 6.8 and 6.9) showing the thriving vegetation on old mine sites, with L04 commenting that Figure 6.9 shows *“good rehabilitation”*. As discussed by another miner,

“I’ve just seen from my own experience where I’ve mined, where the family has mined, open-cut mined ... where we’ve done open cuts in the past, in backfilling the areas, whilst then there’s a raised mound of dirt from the overburden, it has then caught seed and is now the big bushy patch on the flat, basically, where nothing else grows.” (L02)



Figure 6.7 Edge of old mining area with the surrounding plains behind (photo and caption by L03)



Figure 6.8 Rehabilitated open cut from year 2008 with prospecting drillholes in foreground, all were backfilled to normal practice and nature has done the rest (photo and caption by L03)



Figure 6.9 Rehabilitated open cut mine from year 2000 (photo and caption by L03)

The decision of letting land ‘rest’ and repair itself was often referred to as “locking it up”, away from livestock or other uses, for the benefit of the vegetation and possibly for the potential of future grazing.

“We closed off 800 acres. We had a small corner in one paddock that had three vulnerable species in it... so we fenced that off and destocked it, in an attempt to give that vegetation the best go it could have.” (P02)

“You’ve got to be able to fence those areas to keep all the grazing pressure from them. So if you can lock them up for 12 months to 18 months before you even graze them at all, you can get the native perennials established. And then once you get them established, and that’s the hard bit, it just explodes. The results have been bloody brilliant.” (P10)

While natural regeneration is preferred, several stakeholders hastened to add that ‘locked up’ land still requires management and/or grazing animals, indicative of ‘facilitated resilience’.

“If everyone walked off of the rangelands now, it’d probably go to shit, because they’d be overrun by pests and weeds... and it’s the landholders being here that keeps them under control. So you can’t just walk away and do nothing.” (P03)

“We were part of many many projects in our time on the land including the rangeland assessment project that went for 20 years, and should still be going because there was areas, small areas, I think they were about 30 foot by 30 foot, totally fenced off... after about 15 years, the vegetation inside the enclosure was less, in worse condition than what was outside.” (P02)

“...just by locking country up, doesn’t mean the country’s going to get any better. I can show you country that’s been locked up and I can show country we have that’s been stocked, and the country we have that’s been stocked is actually better than the country that’s had nothing on it for ten years or more.” (P01)

In return for the public benefits of locking up land as a restoration or conservation activity, some of the landholders held the view that they should receive some form of economic payment.

“...if restoring your landscape means that you cannot run stock on it, people need to be compensated for it. ... It is a voluntary lack of income. I mean here, we could lock up 5 or 10 thousand acres, it’d be great to see what happens with that, but there’s, you know, we could run a thousand breeding ewes on that.” (P03)

Landholders spoke favourably about a conservation program⁹ run by the Western Catchment Management Authority (precursor to the Western LLS) in which ‘high conservation value’ land was protected and landholders were paid to set it aside from grazing uses:

“...it worked really well and it actually shows that it can work, it can work financially and for conservation value it can work too.” (P03)

Another pastoralist indicated he would welcome the return of such a program:

“...instead of shutting places off you’re better off leaving it to the previous owner, or the owner actually in residence, to manage it, as a conservation area. It’s far cheaper, and generally speaking they’re onsite and they know what they’re doing.” (P06)

⁹ The ‘high conservation value’ incentive program provided all of the funding required to establish and maintain infrastructure over a 15 year period in order to protect threatened ecological communities and other land of high conservation value on private lands (Compton, 2010).

As a form of ‘enterprise based conservation’, this sort of program can encourage resilience: ecologically, through greater conservation of ecologically significant areas and ecosystems outside of national parks; socially, through an accepted form of support for rangelands families and by facilitating links within the rural community; and economically, as a supplementary form of income to landholders, encouraging diversification from only rain-dependent products (Compton et al., 2010).

One of the interviewed landholders discussed their conservation area supported by the CMA’s program. Already, it had not been in use for about 30 years because the hills were “*just too rough*”, and then with the program, “*they were paying us not to use it*” (P07). This suggests a potential need to assess for additionalities, despite willingness for conservation because of the included compensation. These landholders’ sentiments differed from research about perceptions of carbon farming in Western Australia, which found that farming co-benefits (such as improved soil quality and decreased soil erosion) were seen to be stronger motivations for carbon sequestration than the opportunity to gain compensation or carbon credits (Dumbrell et al., 2016).

Although known as ‘passive restoration’, such techniques require active management of pressures and come at costs to landholders unless otherwise compensated. This kind of restoration was seen as the most valid method; however, some land managers have actively pursued rehabilitation of eroded areas particularly in the forms of contour furrowing and waterponding.

6.2.3.2 Active rehabilitation works

Most popular in the 1960s-90s, the practice of ‘contour furrowing’ was developed in the Cobar district (adjacent to the eastern side of the far west) and also commonly practiced in the Broken Hill district. It is a rangeland rehabilitation technique where (often degraded) sloping land surfaces are mechanically furrowed (ploughed or ripped) along a steady elevation, allowing increased water harvesting in an effort to enhance productivity. While contour furrowing is generally viewed as a viable rehabilitation technique (such as Green, 1989), a review of the case study region’s contour furrows determined that there are examples of site-specific success, but that there are more complex effects than initially thought (Wakelin-King, 2011). A study of contour furrowing at Fowlers Gap concluded that the technique further dispersed the soils, changing the hydrological processes and actually enhancing erosion as well as promoting the growth of unpalatable species (Macdonald & Melville, 1999); however, Wakelin-King’s (2011) revisitation of the site attributed these issues to flaws in the treatment’s design. Her findings suggested that landholders were generally satisfied with the technique in certain geomorphic contexts (excluding claypans and floodplains); a perspective affirmed by the following pastoralists:

“...we haven’t had to do any rehabilitation at all... Some people in the hillier country, they can do contour furrowing to control the bare earths on slopes, they can slow the water down... the blue bush [has] started growing along the contours, just to try to stop erosion.” (P04)

“We did the furrowing... which was really good and you can tell where it’s been done, and how much it’s benefitted that country. But I think you have to know your country too... what happens when it rains is the water runs straight off the claypans and into the Mitchell grass and that’s how the system works... You’ve got to have the little bit of hard dry country... otherwise the grass doesn’t get a good soaking... you can’t furrow up everything because you think, ‘oh, that’ll make it all grow’, because it doesn’t work like that.” (P08)

Likewise, a waterponding technique was developed in western NSW and is accepted as a beneficial practice to retain water in order to repair scalded soils (also see ‘water spreading’). This involves creating horseshoe-shaped banks retaining ten centimetres of water after rain, encouraging leaching of soluble salts, improving infiltration and creating niches for the recovery of native shrubs and pastures (Thompson, 2008). Several participants discussed waterponding in a positive light (P05, P10, G02), often as if it were commonplace: *“A lot of people are doing things like waterponding and a lot of rangeland rehab... People are just doing what they can with what they have” (P03)*. Again, such practices require time and careful maintenance:

“We’ve done some waterponding and water spreading... there’s things that were done here 40 years ago that you can definitely see the benefit. But you’ve got to do it properly. You’ve got to be able to fence those areas to keep all the grazing pressure from them.” (P10)

However, another stakeholder was more restrained in his enthusiasm for waterponding and other such rangeland rehabilitation works, from an economic point of view:

“[Rehabilitation is] really useful but the land’s got to be worth the money. In my opinion, there’s no point doing waterponding in areas where the value of the land is low... in Broken Hill, the variability of the rainfall is very high, the rainfall is very low, you won’t get the returns if the dollar value of the land is really low... so we are not limited by technology. We have five or six technologies that are really appropriate to repairing degraded lands in the Western Division in western NSW – it comes down to economics.” (G04)

Addressing degraded land in western NSW appears not to need further technological solutions but rather the appropriate climatic and socio-economic conditions to implement them. Unlike the historical degradation caused by “ignorance” and “a false impression” of the land’s productive capacity (Green, 1989, p. 110), land managers exhibited extensive knowledge of their country and of

appropriate management practices according to environmental constraints, which needs to be fully appreciated by policy makers (as found by Waudby et al., 2012). The notion of sustainable land management may not benefit from being closely associated with particular practices and technologies but instead appealing to land managers' sense of stewardship, a moral stance of 'looking after the land' (Gill, 2014).

6.2.4 Section summary

Different types of land managers had different perspectives of legitimate land uses; however, the results are influenced by the representation of land users in the research. All participants said that the idea of sustainable land management as 'land management done in a sustainable way' was an obviously good concept, neither challenging nor counter-intuitive. This reinforces the social, economic and ecological aspects of TerrAfrica's SLM definition. Choice of livestock was discussed as an important land management decision, with sheep breeds being a hot topic. The generally better adapted qualities of dorpers and damaras compared to merinos to the Australian rangelands was seen as either a positive or negative trait, as a matter of perspective: being able to persist further through drought could lead to greater income security, but it could also create further pressure on land degradation through overgrazing, harking back to similar concerns about goats. Sustainability was seen as pragmatic, resourceful and mainstream, with intergenerational concerns – at least within pastoralists' own families – being a strong motivator for sustainable land management.

For the pastoral land managers, the most important sign of good land management was the maintenance of groundcover, through the management of total grazing pressure, involving both domestic and unmanaged grazers as well as infrastructural changes. Good land managers are seen as capable of responding to the landscape to maintain groundcover, which is generally seen to be in good condition at the moment.

While rotational grazing is often recommended in SLM literature, stakeholders from this case study region were critical of its applicability to their context, given unpredictable rainfall patterns, too dispersed vegetation and water supplies, and logistical infrastructure challenges and costs associated with the large scale of their properties. These qualities of the environment also lead to criticisms about restorative replanting. However, there was widespread belief in the ability of the vegetation to 'bounce back' and regrow naturally, despite the potentially lengthy amount of time needed for this process. In this sense, the best rehabilitation technique was often seen to be to let the land 'rest', while this would still involve management in keeping certain fauna and flora species out of the restoration area. Compensation would also be sought from land managers "locking up land" for environmental reasons.

Some more intensive rehabilitation techniques were also regarded positively (contour furrowing and waterponding), but only in site-specific conditions and to a limited extent. In general, there was the overriding perspective that there was not much that could be done by land managers to restore degraded land, other than provide to the conditions that allow natural processes to thrive. Reaffirming the perceptions of the local land managers, academic research based in this area has also recommended passive restoration which is achieved in its own sporadic timeframe, facilitated by the control of domestic and other grazers: “The land and its vegetation cannot be beaten into shape as in the agricultural [cropping] lands. It must be coaxed into the desired form, with a major eye on avoiding deleterious changes and just a glimmer of ‘input’ to ‘improve’ the natural landscape” (Wilson, 1994 in Noble, 1997, p. 77). Similarly, studying arid western NSW, Fanning (1999) advocates for conservative stocking regimes (or even stock removal) and consequently native plant growth as key to restoration of the ecosystems. While restoration techniques are known to be highly expensive without complete effectiveness, the maintenance of plant cover for infiltration enables ‘natural’ recovery (Fanning, 1999). While active rehabilitation techniques may be quite beneficial for particular soils in dire condition, current research and land managers shared the view that the most effective way to remediate land in this ecosystem is to release it from use and to allow it to heal itself.

6.3 Connected environmental issues: regional water management and climate change

While not the focus of this case study, there are many important environmental issues that both affect and are affected by land degradation. Two of these of particular note are regional water management (specifically, the management of the Darling River and Menindee Lakes) and climate change. Given that ‘land’ can be interpreted to include soil, vegetation and water, the issue of water degradation is very pertinent, and “arguably the world’s major environmental problem” (Conacher, 2009, p. 93). Climate change can be seen to be both a cause and consequence of land degradation, and indeed management of water stress in drylands is key for climate change adaptation (Cowie et al., 2011).

6.3.1 The Darling River and Menindee Lakes

The Darling is one of Australia’s longest rivers, flowing from Queensland, through New South Wales and joining the Murray to the mouth of the basin in South Australia. As a vast network of tributaries, lagoons, lakes and billabongs, the Darling River holds immense importance for the region ecologically, socially and economically (Muir et al., 2010). Its annual flow is extremely variable; while often low, there are sometimes surging floods. Following recognition of the river’s poor health and allocation disagreements between the involved states, major water reform has led to the Commonwealth’s Murray Darling Basin Authority (MDBA) as managers of the river. Their current

plan involves the reframing of water as a tradeable commodity within a water market, critically neglecting territorial interests (Alston et al., 2016). While environmental concerns remain as the claimed priority, Alston et al. (2016) discuss how increasingly economic outcomes (and the protection of powerful irrigation and agricultural interests) have pervaded governance of the Murray-Darling Basin, amplifying uncertainty and spurring regional communities' distrust.

Menindee Lakes are a large inland lake system on the Darling (see Figure 5.3), largely controlled through manmade structures, and a significant water supply for Broken Hill. This water regulation greatly interrupts the 'boom and bust' water cycle of dryland river systems and is "the most serious threat" (Kingsford, 2000, p. 4) – according to Kingsford and colleagues (2002, in Jenkins et al., 2005), 99% of the Menindee Lakes and floodplains are degraded either from too much or not enough flooding, with severe ecological consequences. At the time of the field research (October 2015), the municipality was nearing the end of its fresh surface water use with the Menindee Lakes at 5% storage capacity (Murray Darling Basin Authority, 2015), practically eliminating recreational use (see Figure 6.10). Future water supply for Broken Hill was in contention at the time of the fieldwork, but the government have recently announced that a 270 kilometre pipeline will be built to transport water from the Murray River (NSW DPI, 2016).



Figure 6.10. Sunset Strip boat ramp to the dry lakebed of Lake Menindee, 19 October 2015 (photo: E. Berry)

Although this research is focussed on terrestrial land degradation, the participants drew clear connections between the management and quality of the water and the land – it was obvious that *“land is attached to the water”* (P06). For a Wilcannia resident:

“...if we just let the water run to a level that keeps pushing all that salt and stuff along to where it's supposed to be going, well then we wouldn't have a lot of issues on the land. But we're going to have a lot of problems out here.” (L01)

There is a strong mobilised community action group striving for action to improve the situation of the Darling River and Menindee Lakes, with 15 000+ membership in the group “Broken Hill, Menindee Lakes: WE WANT ACTION”¹⁰, because the current water levels and availability are “*a very real concern for the future of the town*” (G01). For the interviewees, there are many directions to point the blame. The cotton irrigators upstream, especially the particularly large Cubbie Station in south western Queensland, are a cause of anger (and see Power, 2015).

“...Up at Cubbie [Station]. They want hanging. They’ve got that much water up there, three times what Sydney Harbour holds.¹¹ ... Cotton shouldn’t be grown in Australia... Those rivers, they’re killing them.” (G03)

Such expansive, water-intensive industrial uses can be likened to the potential water impacts of land grabbing by “monopolistic infrastructural developments that alter and deprive access to water by smallholders” (McMichael, 2012, p. 685). However, there were some more sympathetic viewpoints towards the cotton irrigators, indicating that financial pressures force them to use too much water in drier years (P06) and that they have “*fairly strict governance in the water licences*” (G01). The government, however, was also seen as highly culpable for the dire state of the water situation.

“...the government for the local region... has got a responsibility for the provision of a potable water supply. And we’re heading back to where we were in 1900, 1890, et cetera, where there was no water at all... they say as you go beyond the range, beyond the divide, nothing happens out here. So it’s only lip-service when they say ‘we’ll have a look at the water supply...’” (G01)

Stakeholders were outraged at the MDBA’s decision to release water from Menindee Lakes to the mouth of the Murray River in South Australia.

“Government let it go... some idiot reckoned they wanted water down there... That’s alright to save one little green frog, but now they’re going to kill all the yabbies... And all that did was they let the water go and it washed the mouth out of the Murray... [Sussan Ley, MP] said, ‘oh, you would have lost it in evaporation’. And like you can imagine what come back out of that. Like Menindee Lakes, the most evaporative water in the world, to evaporate so quickly. Oh, she was called everything, so was all the other ministers. But it’s just a joke and it should never have been like it. They’re killing the river.” (G03)

¹⁰ The Facebook group of “Broken Hill, Menindee Lakes: WE WANT ACTION” is accessible at <https://www.facebook.com/groups/764921983546189/>.

¹¹ According to their website (<http://www.cubbie.com.au/index.php?id=water-licensing>), Cubbie Station’s capacity is 537 000 megalitres and the total cotton irrigators’ capacity in the Lower Balonne region (including Cubbie) is approximately 1 200 000 megalitres. Respectively, these are roughly equal to and 2.4 times larger than Sydney Harbour (500 000 megalitres).

The water situation was well acknowledged as a widespread issue. This pastoralist held the view that water users all along the river are in some ways responsible:

“I’ve been telling various people, including some government people who need to know, why it doesn’t run any more. And one of the very good reasons is, you don’t get any pressures down the river like you used to because there’s that many little farm dams, there’s seven on every little creek, and until all those are full and the last one trickles over, nothing gets in the river. 110 000 were put in in 10 years...” (P06)

Because the little creeks are prevented from running into the river and making the water muddy, P06 described how this results in more algae (facilitated by greater light penetration). Blue-green algae is another serious issue that the region is facing. A Broken Hill resident (G03) also identified added substances (that is, fertilisers and herbicides from the cotton fields) from land uses as recent contributors to poor water quality. Although the information centre at Menindee presents a booklet on “What algae is that?”, local residents at Wilcannia felt left in the dark. In reference to the algae pictured in Figure 6.11:

“We don’t even know what that [red algae] is. Nobody advises us on, ‘ok you’ve got some of this stuff coming down here, don’t let the kids near, it could be poison’. Y’know, the fish are eating it, and the fish could be poison. Noone’s consulting us on what’s coming down. And I think they should be, if they monitor water and they’re saying it’s all good well then come and tell us.” (L01)



Figure 6.11. Unidentified algae on the Darling River at Wilcannia, 8 October 2015 (photos: E. Berry)

Concern from the directly affected townspeople is visceral (for example, G03: “*it’s a disgrace to see it the way it is*”), but due to the large spatial distances covered in the area and independent water supplies, several out-of-town participants reported that they were not feeling directly personally affected or responsible for the state of the river’s water, despite holding very strong concern about the issue for the sake of the far west regional community in general and the environment.

The poor state of the water conditions in the Murray-Darling Basin are often attributed to considerable over-allocation, particularly in the ‘economically significant’ irrigation areas (Mercer et al., 2007). Certainly, deleterious environmental impacts of cotton irrigation in the upper tributaries of the Darling River (including soil degradation, algal blooms and chemical pollution) have been studied for decades, but through a wider perspective can be attributed in part to the decades of disturbances through rural land uses (Arthington, 1996). However, attempts of water ‘buybacks’ for environmental flows have been met with strong resistance and concern about the social consequences for irrigation communities that rely on the over-allocated water (Alston et al., 2016).

Participants discussed the historic overuse of water (P06, P07) and that there is “*a fight on between whether that water gets used for production or whether it gets used for ecology*” (L04). In contrast to the perspective of non-indigenous people who tend to view water as a divisible resource (Muir et al., 2010), an indigenous response was:

“...we don’t even own the river now – and when I say ‘own it’ I’m talking about everyone, us and the little farmers and communities, we should still be drinking our pure water. ... There shouldn’t be a border, like Victoria / New South Wales water and all that, it should be just ‘water’.” (L01)

Muir et al. (2010) discuss how, from an indigenous perspective, the environmental issues with the Darling riverine system is not only caused by management practices, but also due to poor social relationships. The ‘engineering resilience’ approach to river management has produced tensions between users, inequalities, mental health problems, and a lack of inclusiveness in decision-making (Muir et al., 2010).

Actions to improve the state of the river system have stagnated in stalemates between stakeholders. It is an extremely complex interstate, inter-regional, intergenerational and interdisciplinary challenge with no solution that will placate everyone. Farmers and local stakeholders are very frustrated with the government’s “erroneous and evasive” response to the ongoing issue – such as the NSW Department of Primary Industries’ position that the water levels are dire because of three consecutive low summer rainfalls, “the first time that’s happened in history” – rather than attributing the problem to mismanagement and over-allocation (reported in Brown, 2016).

Instead of the government’s non-interventional and neoliberal approach, Mercer et al. (2007) assert that the system needs to be radically changed through stronger governance. Conserving the boom and bust variability necessary for ecological health of the river and wetlands system is in stark contrast to the regulated water supply preferred for current uses, leading Jenkins et al. (2005) to conclude that the greatest barrier to changing management is not limited ecological knowledge but instead social and institutional acceptance. Using resilience thinking, Abel et al. (2016) suggest developing multiple

adaptation pathways, generated and evaluated through regional participatory and multi-stakeholder action, which recognises that there will be social costs for certain stakeholders (and associated political challenges) with the sustainable transformation of the resource use system, but that such social costs can be justified with intergenerational benefits.

6.3.2 Climate change

The climate change phenomenon is of paramount significance on a global scale, with consequences well into the future. Changes to the world's climate – regardless of the causes – have already had observable impacts in recent decades on all continents and all oceans, and these impacts are expected to increase in severity (IPCC, 2014). Climate change and land degradation have a complex relationship as both causes and consequences of the other (Cowie et al., 2011), representing a negative feedback loop with multiple impacts for livelihoods and wellbeing. This is particularly the case in terms of greenhouse gas emissions and the loss of soil and vegetation (MA, 2005; Reed & Stringer, 2015). Despite the recognition of their inter-relationships, climate change and land degradation are often studied separately, and without social and governance contexts (Reed & Stringer, 2015, p. 110).

In Australia, climate change's impacts (such as increased droughts, floods and associated financial debts) "disproportionally affect" rural communities (Hughes et al., 2016, p. 43). Climate change is expected to impact on rural areas' experiences of water availability and supply, food production, agricultural incomes and infrastructure (IPCC, 2014). The combined impacts of climate change and land degradation are most likely to threaten agriculture through heat stress, the increase of extent and severity of droughts, and changing rates of evapotranspiration (Reed & Stringer, 2015). It is estimated that, in the far west of NSW, average and severe fire weather will increase, rainfall will decrease in spring and increase in autumn, and there will be approximately 12 more 'hot days' (days above 35°C) on average by 2030 (NSW OEH, 2014a). The predictions suggest that pastoralists should anticipate changes to animal and plant migrations, erosion patterns, algal blooms, heat stress in livestock (affecting fertility and productivity) and an increase in range, size and density of woody shrubs (Gepp, 2012).

Farmers often have an intimate knowledge of their local climate, lending them strong views towards the 'existence' of anthropogenic climate change (Donnelly et al., 2009). There is also a stereotype that conservatives (like farmers in general) do not subscribe to the need for 'climate action'. This analysis does not attempt to categorise stakeholders into 'believers', 'sceptics' or 'deniers', understanding that such categories are often too simplistic to incorporate the range of views and concerns held by farmers or their preparedness to take action (Kuehne, 2014).

6.3.2.1 Perceptions about climate change

Researching the views of rural residents in NSW's Hunter Valley, Connor and Higginbotham (2013) found remarkable similarity between different demographics of respondents in saying that the climate changes according to a natural cycle, using scientific frames of reference. Likewise, in response to questions about climate change and its current or potential future impacts in the region, several participants framed the constant fluctuations of the climate in a planetary timescale (L04: *"climate has always been changing, and if it didn't change, we couldn't exist"*), as a cycle (G01: *"I'm sure things are cyclic, things come and go"*), and consequently minimising the impacts made by people since the industrial revolution (L02: *"climate's been changing out here for a long time regardless"*; P03: *"we may increase it, we may speed it up a bit, but my view is 'well, climate will change'"*).

The perception of the large scale of climatic cycles places people within nature, rather than an anthropocentric perspective of wielding powerful control over it. While they perceive holding control over land management, the climate and weather is seen as 'ultimately uncontrollable' (Connor & Higginbotham, 2013). This non-anthropocentric understanding of the climate is exemplified by the following interviewee, going as far to reflect on the impermanence of the human species.

"... I remember seeing years ago, in a journal which is a rural publication... an unbelievable graph [of global temperature changes over time]... it had massive swings up and down... we were down here on this tiny little wiggle just here. And it's just inflicted up a tiny bit and they're saying 'climate change'. It's like hasn't it been climate change for however many billions of years they were talking about back here? It's just an ongoing process of the globe I suppose... or the solar systems as well. So that's my thinking of it... naturally we are having an impact putting carbon into the atmosphere and I can understand that for sure. But... if that's the sole reason, what about big old volcanoes back in the year dot, chucked out more carbon than what we could throw out in a hundred years probably, and yeah that caused the ice age once, didn't it? Wiped out a heap of species. So they evolve, and come and go, and so I suppose the human species will probably come and go too..." (P04)

Other responses to climate change highlighted the importance of observable and experiential knowledge for the stakeholders, within their familiar area and the temporal scale of their lives so far, to inform their unconcerned stance towards the effects of climate change to them: *"I've been here for 50 years and I haven't seen any evidence of it at all"* (L03). Generally, respondents noticed some weather changes but put this down to natural variations: *"The weather patterns have changed... but my father-in-law who's been around for a very, very long time tells me that it changes every 15–20 years anyway. That's just the long-term cycle of it"* (P03). Likewise, Connor and Higginbotham's research found that rural Australians in particular rely on their experiences of droughts and changing seasonal patterns to back

up their positions towards climate change, and that “in a tradition of trusting their own perceptions of weather patterns, do not detect variation beyond the normal vagaries of their climate zone” (2013, p. 1856). This is despite the fact that climate change is a statistical phenomenon that is not well suited to personal observation and evaluation (Weber, 2010).

Those who had noticed confusing or different natural processes but were unwilling to accept the IPCC’s frame of climate change, referred to the changes as ‘weird’ or ‘strange’. For example, this landholder had noticed recent changes but didn’t think they represented the climate change frame:

“I’m not a great believer in global warming as such, because it doesn’t seem to really be happening... is it more intense or does it do more damage because the population density is higher? ... [but] I have to say, the last 15 years here has been as weird as anything else. We seem to be going from a drought to a flood backwards and forwards... there’s no continuity. You get an out of season rain, like the last time water ran here was in January. But that’s wrong too, because it shouldn’t rain in January, it’s not when it rains.” (P07)

And this interviewee had noticed other ‘strange but not climate change’ natural cues:

“It’s a cycle. That’s why when they say climate change, I don’t take notice of that... I’m not a believer in all this climate change and all that, you know, but there is something... This time it seems to be going in a real slow dry die off... Different to what it usually is. Like the grasses in there, used to just go ‘bang’ and that was it, now they’re just flattening out and just going to nothing... it just seems strange the way it goes.” (G03)

Weber (2010) warns that direct personal experiences need to be shown to be causally connected to climate change, as there have been instances of more extreme flooding, for example, that have not raised concerns amongst those affected, because it was not perceived to be connected. The stakeholders’ detections of different patterns may be an ‘entry point’ into shifting notions about climate change, even if they are initially reluctant to draw the links between what they perceive and what they believe. An ABC Rural article (Barbour, 2015) discusses how a young farmer in NSW broached conversations about climate change with his father, who explained:

“He was calling it climate change, I was calling it, you know, whatever type of thing really, but when we started looking at things and discussing a lot things with regards to the cattle, the rainfall, the weather, you know, all types of things, I could start to see merit in what he was talking about.” (A NSW farmer in Barbour, 2015)

The complexity and politicisation of climate science enhances the uncertainty of the climate change message. In his research with South Australian irrigators, Kuehne (2014) found that some of his

participants were unsure of what beliefs they should hold about climate change. Similarly, the uncertainty was some cause for concern with this grazier:

“Since we’ve only been here 16 years, you sort of do worry about climate change and you know, getting more extreme weather events... we’ve gone through three really bad droughts, one especially. But then we’ve had really wet periods too, so whether that’s all part of climate change?” (P05)

This contrasts to the intrinsic self-reassurance that comes with the ‘natural cycles’ stance towards the climate. The general thinking of the case study region’s residents was that droughts and floods can be tough to endure, but they will pass. For Hunter Valley residents, Connor and Higginbotham view this kind of stance towards climate change “historically as an adaptive response to the vicissitudes and extremes of the weather in settler descendant communities” (2013, p. 1858). By viewing the weather has naturally having both good and bad years, rural food producers are able to persist with the knowledge of better times to come. With droughts and floods already belonging in the climatic context, it is difficult for land managers to attribute their aggravation to human activities.

6.3.2.2 Action to respond to climate change

Overall, there seemed to be a prevalent idea that there are other issues of more immediate impact and needing greater attention than climate change. For example,

“I think probably climate change is in the back of people’s minds but ... people have got enough to worry about, without being bombarded with stuff about climate change.” (P03)

This sentiment ties into the theory of a ‘finite pool of worry’, described by Weber (2010), which suggests that as the worry for one type of risk is increased, worry about other risks decrease. This was illustrated in less concern for climate change and environmental degradation at the time of the global financial crisis (Weber, 2010). The Climate Council also describes existing stresses as a barrier to climate change adaptation in rural communities (Hughes et al., 2016).

Despite identifying with the ‘sceptic’ frames about climate change, this grazier found a way to rationalise climate action regardless:

“I’m a bit ‘two minds’ about [climate change]. I think it’s a cycle, myself. I don’t think that having coal mines is a good idea. And I think that having renewables is an excellent idea. ... The things that they do, to try and fix what they perceive as climate change, in some ways, are good for the planet anyway so why not do it. ... So I’m probably not a ‘pure’ climate change sceptic, but yeah.” (P08)

While some participants supported action to address climate change through renewable energy and reducing pollution, others appeared unwilling to attribute a role to themselves, feeling victimised by the blame they feel unfairly targeted towards country people (Donnelly et al., 2009):

“I will concede that we are polluting [but] it’s not what we’re doing out here, it’s what they’re doing in [the city]... there’s tens of thousands of tonnes of fuel used in the hour being burnt up in the atmosphere, yet they’re going off crook because the cows are farting. ... It’s all very well to sit in their lovely homes in the city and tell the country how to run.” (L04)

“It’s not the practices out here that are making [the climate] change; it’s the corporates, it’s big business.” (P03)

“There’s a lot of concrete jungles radiating a lot of heat, and yes I’d say that has to change things. But we also have a lot of jet streams that are doing a lot of funny things as well.” (P09)

In general, the respondents were unwilling to make specific changes to their land management practices specifically out of concern for climate change. However, Mazur et al. (2013) found little difference between the climate mitigation actions undertaken by rural Victorians, regardless of whether they were concerned, sceptical or unsure about anthropogenic climate change. Particularly if there are other constraints (such as lack of resources, skills or social acceptance), “willingness to act is sometimes only weakly related to implementation” (Waudby et al., 2012, p. 99), indicating that concern about climate change need not be a strong motivator for appropriate action. Rather than attempting to shift people’s ideological positions towards climate change, Kuehne (2014) suggests that other environmental and economic benefits from responses to climate change may be sufficient, and that other related challenges may prompt appropriate action. One of his respondents stated:

“Well I mean you can interpret a lot of what I do as climate change adaptations but I don’t believe I’ve done them for climate change reasons. I believe I’ve done them because of the low water allocations and [they are caused by] drought.” (A South Australian irrigator in Kuehne, 2014).

In the report for the most recent UNCCD Scientific Conference, Reed and Stringer (2015) highlight that the drivers for climate change at the local level are completely decoupled from local action, so the only option for land managers is to respond to its consequences, and that our limited understanding of the interactions between climate change and land degradation mean that there is little capacity for anticipation of what will need to be done. Being prepared for short term climactic variability and preventing land degradation through sustainable land management means that land managers are “better prepared for long term climate change” (Reed & Stringer, 2015, p. 70). In terms of mitigation and adaptation actions for pastoralists in the far west region, Gepp recommends *inter alia* improving

groundcover, managing pests and weeds, selective breeding and updating animal husbandry practices – in effect, “managing existing stressors”, while noting that these practices are “within the means and abilities of landholders and supporting agencies” (2012, p. 7). Managing for existing challenges and adapting according to the variations of the climate is by no means a new concept for the land managers in the far west. One pastoralist, while sceptical about anthropogenic climate change, said:

“I’m not concerned about [the environment] at all. It’s just a matter of managing with the climatic seasons that come to us, pretty much. That’s all you can do, just work with the climate.” (P04)

This is representative of other evidence that Australian primary producers have “a strong culture of adaptation” (Donnelly et al., 2009, p. 24). The natural variability of the semi-arid zone means that the land managers respond to large fluctuations of climate all the time. Indeed to some, the idea that predictions of a few more ‘hot days’ were calculated as days above 35°C (NSW OEH, 2014a) appeared laughably minimal compared to the extremes they regularly encounter. By living in a variable SES where adaptation is normal, the stakeholders displayed many of the traits of resilience (section 2.2).

6.3.3 Section summary

Regional water management was perceived as connected to land degradation. The perceived mismanagement of the Darling River and Menindee Lakes inspired a resounding concern from many of the stakeholders. Responsibility and blame was variously placed on the Murray Darling Basin Authority, cotton irrigators upstream, demands from South Australian water users downstream, as well as all the farming properties along the water catchment. The concern for the water represents an extremely complex interstate, inter-regional, intergenerational and interdisciplinary challenge with no clear solution, despite the local communities’ desperate demands for action.

In contrast, few participants were concerned about the potential effects of climate change on the region, despite the literature’s connection between climate change and land degradation. By perceiving widespread changes over a large time frame, anthropogenic impacts are seen as minimal in comparison and of little impact to the idea of a natural climatic ‘cycle’. The land managers’ ability to work within large fluctuations of natural variability inspired confidence in their capacity to respond to the added effects – if they believed there were any – of climate change. Instead, the current rhetoric about climate change was perceived by some as a political attempt to further marginalise and blame country people, while urban people and big business practices were seen as bigger culprits. Nonetheless, there were multiple observations of confusing or unexpected current climatic patterns, although their observers were unwilling to attribute their cause to climate change.

Although the participants were unconvinced about climate change, many expressed willingness to partake in climate-based initiatives (if given private incentives) and described their management styles as adaptive to the climate, regardless of the reasons for its variations. This suggests that ‘believing in’ climate change is unnecessary for land managers in this region to respond appropriately to its threats.

6.4 Institutional contextual factors: Landcare and governance of natural resource management

The institutional and governance context (see section 5.2.2) is important to consider for the implementation of a LDN approach to land degradation responses. This section covers the far west’s current perceptions of Landcare and the governance of NRM.

6.4.1 Landcare

Landcare maintained a mainly positive light from the perspective of the interviewees, who would welcome a renewed focus on its role in supporting sustainable land management. Throughout the case study region, Landcare prevalence and membership varied considerably, with some strongholds of proactivity, some areas of significant decline, and other areas that never achieved viable involvement. This diversity can be seen in the following comparison:

“We’ve got over 40 members and... there’s a couple of million hectares in our Landcare group. It’s huge. And we’re very pro-active...” (P03)

“Now unfortunately a lot of people have left the district, properties have become larger, we have a lot more absentee owners, so our Landcare group has virtually folded and a lot of the others have. There’s just not enough people on the ground to keep them going.” (P02)

“Landcare’s pretty much died in the butt, really. I don’t know why. Some groups are still going, groups that had started up before the Landcare movement...” (G04)

“...we’re too far out... there’s no Landcare groups or anything like that out here.” (P09)

One of the key reasons for the continued strength of some Landcare groups appeared to be for pest management: *“coordinated baiting programs and things like that, which is pretty good, so everyone gets in on that, once or twice a year” (P04)*. This appeared to be a central activity for the active Landcare groups: *“[we’re] doing tremendous things, for pest management like we’ve got pig traps, we’re doing dog traps, we’re doing [aerial] baiting, we have shooting regimes...” (P03)*. Members see the benefits of doing these activities at the same time across a connected area for a greater effect.

This practical, strategic group involvement contrasts with one of the (former) strengths of Landcare as a social support. Describing a lapsed group, this retired farmer discussed how it gave people an opportunity to get together, while knowing that others were facing similar struggles:

“We’d had a couple of members having very severe mental problems as a result of the droughts, and the Landcare group was the focus for the community. And one fellow – and it knocked me around a bit because I thought he was the tough one – he said that the last couple of Landcare meetings was what had held him together in the previous 12 months... It got him off the place, away from the problems...” (P02)

In their analysis of the social capital of Landcare, Compton and Beeton (2012) point out that Landcare groups exist within the broader rural community and that trends such as declining and ageing rural populations also contribute to decreased membership. Along with these trends, the decline in Landcare activities and programs in the far west can be particularly attributed to funding. Compared to the heavily funded Decade of Landcare, the current governmental funding was described as *“just a paltry amount”* (G04), although Landcare groups are seeking money through other agricultural organisations, with one key member asserting that *“we’re pretty savvy in where we get our money from and making it work”* (P03). Another member mentioned that funding for various land management works on their property is available through other authorities now merged with the LLS, so they *“[don’t] necessarily have to go through [their] Landcare group”* (P04). Tennent and Lockie (2013) discuss how declining Landcare membership is associated with the current model of regional funding, where incentives are delivered to individuals, so that community involvement is avoidable, particularly as Landcare’s funding is more limited. Discussing the policy changes’ effects on Landcare groups elsewhere in the Murray-Darling Basin, Cooke and Hemmings (2016) find that this efficiency has come at a cost to community, where landholders are now more like private clients of the system.

For some, this general shift from Landcare to LLS was also of concern for issues like land degradation:

“In my time with Landcare, ... it was quite often a small group of people who were the ones that noticed the problem long before it hit the radar of any government department. ... I fear that that momentum is being lost.” (P02)

6.4.2 Local Land Services

A Local Land Services employee stated their key roles to be *“customer services and devolving grants”*, with a focus on enabling people to improve their groundcover management and factor in variability (G02). The LLS representative added that *“we call our funding ‘incentives’, for a very good reason”*,

because it facilitates expensive projects such as fencing that people want to do but are unable to afford at once, “*which then has positive effects on our environment for that amount of area*” (G02). Indeed, some interviewees were in the process of applying for this funding at the time of the research.

Regarding the ‘customers’, there was a range of satisfaction with the services of the LLS. Positive feedback included the sentiments that the LLS is “*really helpful ... [they] will fund any training that people want to do*” (P05) and “*I think they have worked really really well with the community... [they] really demonstrate to the farmers that there’s more profitability in being sustainable*” (P10). However, there was also disinterest in involvement: “*We don’t use their service much at all*” (P06); “*Good as never. Hardly hear from them*” (P07). Another farmer preferred to be self-reliant for groundcover management, “*...instead of them trying to tell you or control you*” (P01). Further, there were some pastoralists who deliberately avoided applications for funding because of perceived restrictions or power over their decisions, or unnecessary burdens. For example,

“...we declined to apply for Local Land Services funding this round because if you want money for fencing you have to put up a ring-lock fence or a TGP fence. And I actually don’t agree with that. ... I actually believe that in 10 or 15 years’ time, people are going to get paid to take their ring-locks down. ... And that’s the problem with the Local Land Services. Because it’s a ‘one size fits all’. And one size does not fit all, it just does not.” (P03)

“...we’d have to physically go out and take a photo, for 10 years, of that area and send it in, and now they’ve put it up to 15 years. So you’d have to report every year for 15 years and if you forget, which you inevitably do, then you’re not eligible, they won’t give you any more grants. And really, I think that I can’t really be bothered... We do apply for stuff like... goat traps, which didn’t have that compliance monitoring thing on.” (P08)

The validity of these monitoring tasks, such as ‘step-pointing’, was called into question from a scientific perspective: “*that’s pretty damn hopeless... If you want to pick up changes, you have got to have more comprehensive measurements, or ways of assessing*” (G04). Despite this, the LLS prefers including the attached monitoring conditions for continued funding assistance, because it “*gives us some credibility for the spending money for the projects*” and because “*it sorts out the people that really want it and are really prepared to work hard, to the ones that are just looking for some sort of ‘free cash’, as they call it*” (G02). These responses suggest that the inclusion of monitoring requirements is more about accountability than the collection of scientifically valuable information.

Funding limitations were also perceived to hamper the ability of the LLS to perform their roles effectively. For huge issues like the spread of mesquite, the LLS said that they require more support in order to do something about it: “*we’ve tried the best we can but we’re piecemealy [sic], because we’ve got so*

many other things to do" (G02). This is consistent with the experience of regional bodies' perception of insufficient staff mentioned by Curtis et al. (2014). Short term funding offers and 3–4 year political cycles were not seen as conducive to feasible, strategic planning and government work: *"you need a 10 year plan for these sorts of thing, regardless of who's in politics"* (G02). Limitation of governmental impacts since the transition from Catchment Management Authorities to Local Land Services had not escaped land managers either, with one pastoralist perceiving that *"I don't think there are as many grants on the ground"* (P08) and *"because there's not the work base in any of the government agencies anymore, nothing gets done"* (P08).

6.4.3 The government as bureaucrats

Many participants were sceptical at best about higher levels of government for a variety of reasons. There were criticisms of their unawareness of the 'realities': such as a farmer's impression *"I'm not sure that governments have a really good handle on what land degradation actually is"* (P02), and water legislation requiring people to have fish ladders even though *"none of our streams or creeks have fish in them"* (P08). Criticisms of meaningless bureaucracy also came from the opal miners: *"It's a simple operation so the commensurate bureaucracy that goes with it should be simple also. [But the] application fee's ten thousand dollars, stuff like that. Paperwork. Bureaucracy. Mine Operation Plans. Post-MOPs. Pre-MOPs. Security plans. On and on and on. And all for nothing. It's really annoying"* (L03). A local government member echoed these thoughts as well: *"It's just government departments trying to justify their existence... The whole stuff, it's just prescriptive, it's nonsense... And of course the next political party comes in and they scrap that department"* (G01). There were also perceptions that some government activities were causing harm (for example, management of the Darling River and Menindee Lakes, section 6.3.1), or threatening their livelihoods (P09).

There were concerns about motivations affecting the current consultation processes: *"I think the frustration about governments is that they send consultants out to small communities, and the consultants don't talk with the right people... It's about the money at the end of the day"* (L01), as well as the passing of blame: *"Why do they have to make a mess and then try to clean it up all the time? Because there's money, gives someone a job. A consultant goes out, 'ok we'll go do this', then they do it the wrong way and go, 'oh well I didn't do that, that was the other company'"* (L01). Responses indicated a desire for better community consultation, with people who were genuinely concerned about the land.

Some respondents indicated an imbalance of power meaning that they did not feel listened to, or that the government could make changes more easily than they could. This included Aboriginal interests (*"if they start listening, if they want to change it, they'll change it"* (L01)), a pastoralist lobby group (*"not that anything ever gets listened to much"* (P07)), and small-scale mining (*"they don't listen to us"* (L03)).

On the other hand, a LLS government employee suggested that in terms of farming practices, the government's voice is not as effective as people from within the community itself. She explained:

"...there's an increasing group of young people. Some of them are intergenerational, some of them have come from other areas and moved into the region, and they're the people that are going to make the long-term differences, and they're the ones talking, and they're the ones at the pub or the gymkanas, that have the ability to go to old mate next door who's still working from a hundred years ago, using his great-grandfather's management style. They're the ones that are going, 'you're a dork, you're a dick, you need to wake up to reality'. And I can't do that as a government employee. Apparently it's frowned upon, it's not good customer service." (G02)

While it was a common perception that the government was not working in their interests, and that *"it's easy to blame the government"* (G04), one pastoralist offered an opinion suggesting that people are becoming more willing to cooperate:

"...there's a perception out there that, and I think it's changing, that people who work for the government and try to stimulate change are the enemy. But I think there's an awareness that to be healthy, to have healthy ecosystems, we need to work with what we've got." (P10)

For Curtis et al. (2014, p. 191), a key lesson is that governments need to support community-based NRM "in ways that strengthen local self-help by way of voluntary collective action rather than undermine it". On a local to regional level, there appear to be indications of this occurring in the far west, but less so on a larger scale. Others discussed their experiences of living and working in an environment with limited government input.

6.4.4 Living outside of governmental influence

Respondents indicated that, in contrast to governmental surveys and research throughout the last century, *"the investment in degradation and land management in the western part of the state is almost miniscule now... because there's no money in the rangelands anymore"* (G04). Compared to when Broken Hill was a significant contributor of mineral wealth, there was the impression that *"the state government doesn't really give a shit about here"* and that *"in local governments out in the far western areas, you receive very, very little cooperation from any governmental authority"* (G01). Additionally, a pastoralist in the Unincorporated Area of NSW (with no local government) felt further marginalised by a lack of democratic oversight: *"...we have a bit of a rogue group doing the wrong thing by the rest of us. It's very frustrating, because we actually don't have a government body per se where we elect people to it, so there's some kind of control"* (P09). Many of the participants felt isolated from governance, and culturally and institutionally different to more populated parts of NSW.

In comparison, while the residents of White Cliffs in the far west region also perceived that they received little help from the government, they discussed how they preferred it this way:

“White Cliffs is a little bit of an anomaly, [in] that we really just try to fly under the radar. Because the less help that we’re having from the department, then the less hassle that we’re having from them as well. We try to self-regulate, maintain ourselves, we maintain the opal field as it is, we don’t get the government departments coming out and filling holes, we do it ourselves up until now. We try to have as little to do with the government as possible because that’s the cheapest and easiest way it is for everybody.” (L02)

The self-organisation and adaptive capacity of the White Cliffs community may be representative of the resilience required for a social-ecological system.

6.4.5 Finding appropriate policy instruments

Interviewees were asked about their preferred policy instruments for encouraging sustainable land management and preventing degradation. Among pastoralists, there was a strong support for financial policy instruments. For example, a pastoralist described the Federal government’s tax incentives as a ‘win-win’ for production, the environment and the whole country, saying, *“I think the boost to sustainable farming is going to be over the top!”* (P10). Others indicated a preference for low interest loans (P05, P06, P07) such as those they had experienced through WEST 2000 and for drought and flood relief, which *“makes it a bit less painful”* while allowing them to remain *“on our own two feet”* (P06). Other suggestions included *“access to a freight subsidy, or an agistment subsidy... and maybe a basic living wage”* (P02) to help to financially support people to stay on their properties. In contrast, regulations were seen as restrictive and making it *“hard for you to carry out necessary work”*, but some basic regulations were seen as necessary, because *“all land owners aren’t like us”* (P08).

While supporting funding assistance, government stakeholders expressed disapproval of just grants, saying that they’re *“dangerous because that’s feeding people, not teaching them how to grow their own food”* (G02). Another described grants as *“meat and poison”*, with some good qualities but involving too much administration costs and not necessarily ensuring sustainability once the money is spent (G01). Instead, they indicated a preference for education as being *“more meaningful”* (G01), although the delivery of education was perceived to be very important. Education programs need to be targeted towards an experiential learning style (G02). Online training does not offer a suitable format, and it is significantly hampered by the poor Internet delivery through the region: *“It’s a pain in the butt. They won’t do it. They won’t sit down there for half an hour and wait for it to download, on and off, on and off”* (G02).

Findings echoed the results of other Australian studies of land managers' policy instrument preferences. Greiner and Gregg (2011) found that financial incentives were perceived to be most preferred; with regulations least favoured but understood as necessary minimum requirements. Cocklin et al. (2007) found that landholders' preferred mechanisms that supported their independence, with an antipathy towards regulations but an understanding of their role in setting minimum standards, a leaning towards education and training, and some uncertainty and scepticism regarding tradeable entitlements and credits systems.

While institutional, ecological, political and economic contexts are important for appropriate selection of policy instruments, the attitudes of land managers (not just farmers) are integral to the success of the instruments' implementation to result in improvements to land management (Cocklin et al., 2007). Land managers' disposition towards certain instruments may be affected by their attitudes towards the issues and government agencies, although historical and other regional experiences have been shown to impact upon graziers' impressions of certain policy mechanisms, including potential unawareness of relative benefits (Greiner & Gregg, 2011). Price and Leviston (2014) also assert that socio-psychological considerations should affect the policy design process, favouring instruments that foster feelings of control in farmers, which has had success in healthcare. Indeed, drawing links between effective NRM and farmers' identity and wellbeing, Schirmer et al. (2013) assert that counteracting land degradation can also be a form of health intervention.

6.4.6 Section summary

While the prevalence and membership of Landcare varied significantly within the case study region, a decline in activity was noticed. This was particularly associated with changes to funding, allowing individuals to receive 'incentives' from the LLS, although the Landcare groups remained strong for activities that work best when coordinated, such as pest management.

The Local Land Services is a major interface for the government to interact with land managers, helping 'customers' to improve their land through training and incentives; however, some felt that their approach was too 'one size fits all', unnecessary, restrictive and controlling, or too stretched with their resources to achieve a proper impact.

Frustrations with the bureaucratic nature of state government departments, their unawareness of the realities, power imbalances and perceived weak consultation were alongside sentiments that local community members are best positioned to influence positive changes in land management – sentiments shared by pastoralists and local/regional government staff alike. While some respondents were concerned about their relative isolation from the rest of the state and their lack of services (such as Internet connectivity issues), others (notably the White Cliffs community) discussed the benefits of

self-organisation and displayed traits of resilience. Similar to other research into rural Australia's preferred policy instruments, the respondents indicated a preference for mechanisms that supported their independence.

6.5 Perceptions about Land Degradation Neutrality

The participants' perceptions of land degradation, sustainable land management and restorative works and the role of the government all feed into the potential for greater application of the notion of 'land degradation neutrality'. While some material was provided, participants were unaware of the concept of LDN and were introduced to the idea within the interview itself. Although the exact wording occasionally varied among interviews, it was described to them as 'sustainable land management where possible to prevent degradation of productive land, but where there's unavoidable degradation, to restore an equal amount elsewhere' (echoing the two-pronged approach advocated by the UNCCD, section 4).

A limitation of this part of the research is that the participants did not have time to deeply consider their responses to this new concept. However, their livelihoods are based on understanding land degradation and sustainable land management so they are in a reasonable position to discuss its relevance to what they think the government needs to promote in order to achieve the SDG's desired outcomes.

After hearing about the frame of a 'land degradation neutral world', several respondents were unsure about what would be considered 'unavoidable degradation'. On the one hand, some participants discussed how the landscape is always in a natural state of change (harking back to the complications of the concept of 'land degradation') and that these changes would be unable to be properly 'counterbalanced' in principle and in practice. Others indicated that they could not think of any unavoidable land practices that they do that would deliberately cause degradation and therefore require counterbalancing elsewhere. Practices that were seen as a definite cause of degradation – such as open cut mining – were discussed as being better off prevented in the first place or restored immediately afterwards, negating the need for a restoration offset.

However, there was also some support for the concept. One grazier noted its resemblance to pre-existing discourses – “one of [the Western CMA's] targets was to improve and/or maintain the quality of our country” (P10) – which he perceived to have worked well. Another saw it as an opportunity for more funding to improve their SLM, given the challenge of reversing degradation in developing countries:

“I think it's a great idea. But people aren't going to do it unless it's funded and unless they can have payments for it. ... But there's a lot of land that has been degraded, and it's still being degraded and

it's not necessarily being degraded by first world countries, it's probably being degraded in areas that are more third world, that don't have the education level or the money or the government practices, for that area not to be degraded. And if that's going to happen regardless, then an offset might not be such a bad thing?" (P03)

This kind of stance relies on perceived degradation elsewhere as being inevitable, and that funding to prevent degradation would be best allocated directly to current land managers in countries capable of restoration/rehabilitation to compensate for economic losses. However, the impacts of land degradation may considerably vary in different regions of the world. In marginal arid regions, it can result in starvation, death, or migration of 'environmental refugees'; whereas the "consequences of land degradation in the developed world pale in comparison but are nevertheless very real for those affected" (Conacher, 2009, p. 93), such as adverse effects to land managers' economic, social and psychological wellbeing.

In contrast to those open to the prospect of an LDN initiative, many participants struggled to see its applicability for their region and elsewhere. For example, the inevitability of landscape changes was seen as natural or unstoppable:

"... the landscape is constantly changing by wind movement. One day the sand hills are here, next day the sand hills are there, and that's something that I don't know that you could ever arrest."
(G01)

"I don't know, there's a lot of places in the Middle East and Africa that are very degraded. And China, where it's actually creeping further in. And they can't stop it... I don't know how they'd be able to achieve that." (P09)

In other respects, the inescapability of landscape changes specifically due to land management practices was not immediately apparent:

"Are they talking about rainforest areas? ... Just trying to think like what we could do that would cause land degradation in that way..." (P08)

Otherwise, some respondents suggested that people are already capable of finding ways to pre-empt and prevent negative changes. By spreading out many small watering points, one pastoralist described how even for typically expected places of degradation by livestock grazing and trampling, the "*bush has actually got up the dam banks*" (P06). This kind of reaction suggested that people did not want external help or intervention:

"So there is an awareness, with some groups, that some areas, if you're not careful, will be hammered

and they'll need to find another way to offset that situation.” (G02)

“... a lot of it comes to the responsibility of the custodian of the land at the time I think. More to the point, they should be concentrating on them.” (P04)

Rather than counterbalancing degradation elsewhere by agreeing to restore degraded parts of their property, this land manager thought that the LDN concept would be better suited at an individual property scale:

“... on a state-wide basis, that's partly what national parks are... But on an individual property, it's more effective probably, because you can monitor it yourself...” (P07)

Instead of an LDN approach, the respondents suggested directly dealing with the degrading practice in the first place, which was typically equated with mining. The New South Wales' biodiversity offsetting program (see NSW OEH, 2014b) may have influenced these opinions and perceptions.

“Maybe they could control less of the bad thing and there wouldn't be as much of the good thing? You know, less mining?” (P01)

“Look I think you're better off bloody fixing up the piece that you destroyed. Otherwise you're going to be in that situation where a mining company can come in and destroy an area and then it's just totally left destroyed isn't it, so I think you should be putting it back, to a degree. So no I don't agree with the whole offsetting thing myself.” (L02)

“Not knowing any better, it sounds like 'forget about what's broken, let's try and save something over here that hasn't quite broken', that's what it sounds like. Why don't they put their attention into what needs fixing over here, wherever it is degrading. That's what I'm wondering. But I'm sure that over time they'd get back to the one that was degraded and concentrate on fixing that up somehow.” (P04)

Likewise, this response indicates that the concept of LDN seems more suited to mining land uses, because degradation in their region is already self-regulated by financial costs:

“Generally out here, and this is reflective in recent Native Vegetation Act changes, because of the low cost of the land out here, anything that involves broadscale clearing – it's such a high capital cost... it regulates itself. So any clearing that people might do, is so minimal compared to the size of the land that they've got management over, that the offset isn't necessary. It's only when you're talking about industries like mining where that really sort of comes to play, and then they have to do it, it's a requirement.” (G02)

Some of the landholders thought that the idea of LDN reminded them of existing environmental trading initiatives (such as carbon trading, biodiversity offsetting, and water permit trading) which they did not endorse because of concerns about how it could be administered and financed, what would be considered land degradation, whether it would permit more questionable degradation activities and the consequences of approaching degradation from a broader-than-local scale.

"I guess that's a very fine concept to have up there as a goal. I'm not too sure how it would work. I think it would be a little bit like carbon trading, course I could never get my head around that either, and how it would actually be measured and who would measure it? And what do you call land degradation?" (P02)

"A bit like carbon trading, we can wreck it here but buy it there and I'll be fine. Clear my conscience. Okay..." (P09)

"So basically you're trading off a dodgy development with some restoration somewhere else. It's a bit like what the mining companies do, they rip out a forest and they restore an area ten times its size in another location, hopefully in the same vegetation community... these land managers would need to understand or acknowledge that some of their activities may be causing land degradation, in however you define that, and then I guess the next thing is who pays for the offset? Does the government pay for the offset? Do they pay for the offset? Why should they pay?" (G04)

"It's a bit of a funny concept though, it's like owning the water licence for the Menindee Lakes and taking it out of the Clarence River, you know? It's two different areas, I don't understand how they work that one out at all." (P07)

Similarly, other people were sceptical about what it would really mean in practice, and were reluctant to entertain the idea of a new goal to address land degradation.

"Sounds like a big concept that some bloke's come up with to keep his job safe! ... I fail to see how that could work, at this point of time. Like, they're saying, right for us to get on board, like we're not degraded out here, not by any means, I don't know what they'd expect us to do to try and make it neutral for somewhere that is degraded. We're all working for the common cause out here to try and maintain our properties and the soil, the vegetation, plant density, groundcover, all that sort of stuff, it's a hot issue at the moment. It has been for the last ten years or more, and will be for some time to come I think. It's one of the major things. And we're already doing that sort of thing. I can imagine the government coming in and saying 'this is what we're going to get you to do' and then taking the credit for all the work that's already been done. I can see that happening, for sure, bloody hell." (P04)

This kind of sentiment indicates frustration in the attempts of external bodies to influence what land managers see as their responsibility, and an inability to see what benefits an LDN approach could bring to the table, when there are currently existing and strongly held motivations to strive for sustainable land management. This shows that, when introducing initiatives, governments need to be aware of what is already being done and take care not to create additional burden. By already striving to achieve the private and environmental benefits of sustainable land management, and perceiving the unfeasibility of counterbalancing others' degradation, the land managers' first impressions of the idea of a 'land degradation neutral world' were generally not supportive.

6.5.1 Section summary

The initial responses to LDN from participants in this case study indicate that, in the absence of a particular scheme or policy, there is a general scepticism to the introduction of a new goal to combat land degradation in their area. Reasons for the scepticism included uncertainty about what degradation would need to be 'counterbalanced', belief in the ability of current land managers to keep things under control without external input or influence, and a perception that the concept did not overly suit their climatic context and land management practices. Section 7 will discuss these perceptions about LDN within a greater context.

7 Bringing it all together

7.1 Conflicting convictions and conundrums

Rather than a unified narrative of land degradation pressures and appropriate counteractive techniques, the discourses uncovered in the far west NSW case study showed a spectrum of ideas, both between and within particular ‘stakeholder types’. In some matters (such as the topic of ‘invasive native scrub’ and rangeland goats), some pastoralists aligned with scientific evidence while other pastoralists aligned with typical governmental paradigms, forming differing ‘discourse coalitions’ (Hajer, 1995). These perspectives seem to have been influenced by different experiences and land management priorities, and were often strongly held convictions.

Table 7.1 presents a summary of some of the negative ‘land degradation’ discourses and their associated ‘response’ discourses, alongside the ‘counter-discourses’ for each that were raised in the research. While the idea of local and scientific knowledge contrasting with the recommended ‘fashionable theory’ of land management is not new (for example, Addison et al., 2012; Whitfield et al., 2015), this highlights the complications of having mismatching predominant narratives and the need for contextually-tailored policies, to avoid potential conflicts and miscommunication (also see Sharp et al., 2012).

Table 7.1 Summary of ‘land degradation’ and ‘response’ discourses, and their respective counter-discourses, presented in the far west case study.

Concept	Land degradation discourses	Counter-discourses to land degradation	Responses discourses	Counter-discourses to responses
Wind erosion	Wind erosion removes topsoil; dust storms	Natural process; brings new seed/soil	Maintain groundcover through total grazing pressure; tree planting	Tree planting is useless - can't water them; trees will grow naturally when the weather conditions are right
Drought	Natural hazard; financial pressure	Natural process; Sporadic time period - the drought will always break	Sell early; transport stock to different region	Adjust stock to more adapted species that persist longer
Floods	Can cause soil salinity and change vegetation	Natural process (part of the landscape)	Adjust stock to suit the vegetation	-

Climate change	More extreme conditions and variability	Climate is always changing (planetary scale); anthropogenic changes not currently experienced (local scale)	Manage existing stressors (such as groundcover, pests and weeds, develop heat tolerance in stock)	No additional response needed
Darling River / Menindee Lakes water management	Over-allocation, pollution and algae, impacts to land quality	Water licences suitably strict; not enough water added to the river	Government action to return more water to the system; buybacks	Pipeline from the Murray River for town water supply; non-intervention
Pests	Kangaroos as pest (grazing pressure)	Kangaroos as ecologically adapted meat resource; native wild animals; tourism drawcard	Pest management; TGP; need for professional roo shooters	Develop kangaroo meat market
	Rabbits as pest (grazing pressure, biodiversity threat); plague potential	Rabbits as resource (meat and fur)	Pest management (myxomatosis, calicivirus, trapping)	Opportunistic harvesting
	Goats as problem and pest (grazing pressure, biodiversity threat); reducing soil stability	Goats as lucrative resource – better compared to sheep (not eating blue bush, less trampling of soil); control measure against other woody shrubs	Specified goat paddocks (to reduce goat pressure across property); aerial goat mustering	Specified goat paddocks become completely degraded
Weeds	Invasive native scrub as a major problem (unpalatable infestations rendering land useless, linked to goat proliferation)	Invasive native shrub can be palatable for other species; provision of ecosystem benefits, wind breaks, persistent groundcover, carbon sequestration	Spot treatments by landholders (according to government); better management of government land (according to landholders). Chemical control, goats as control.	Keep them because they are good for carbon sequestration (financial benefit in carbon farming initiatives) and other ecosystem benefits
	Introduced vegetation as weeds (useless, takes up land)	Some can reduce erosion (especially at creeks); can retain more water at creeks	Chemical control, adapt stocking decisions	Control methods are expensive; adjusting stocking decisions could permit more overgrazing

Livestock grazing	Overgrazing is a problem; the land takes a long time to recover	The land will bounce back; sporadic 'overgrazing' is fine	Adjust stocking rate; implement rotational grazing	Rotational grazing not relevant (rainfall too unreliable, intense stocking rate unfeasible and too damaging, does not factor in uncontrolled grazers, too costly and time-consuming); other grazing regimes (continuous, strategic transportation) can work
	Merino sheep are a financial threat - specific diet, less adapted to climate	Merino sheep provide multiple forms of revenue; destocking merino during drought gives land a rest	Dorpers and damara sheep have less costs involved (no shearing, mulesing, crutching), more resilient, more appropriate diet	Dorpers and damara sheep are more adapted to climate (and therefore have bigger potential environmental impact)
Degraded land	Useless and undesirable; result of historical mismanagement	Can be tolerated because the land will bounce back; it's not permanent	Tree planting, contour furrowing, waterponding	Let it regenerate itself; tree planting likely to be unsuccessful; contour furrowing and waterponding are context-specific and expensive

Land managers' land use appeared to affect what is considered to be land degradation, presenting a number of conundrums. For example, if goats are no longer 'pests' but instead 'resources' (as indicated by some pastoralists), the perspective appears to be influenced by price evolution. Likewise and although they are ecologically suitable and 'belong' in the environment, kangaroos are considered primarily as a pest and not economically valued because of a lack of market opportunities. If the kangaroo meat market was stronger, there is evidence to suggest that there would be greater acceptance of their presence in pastoralist properties as 'productive' native species. A similar sheep conundrum exists between the traditional merino stock and newer, more 'goat-like' dorper and damara breeds – while to some this means that they have a greater propensity to overgraze, to others

this enables the maintenance of income during a drought. A further example is the ‘woody weeds’ conundrum, where ‘invasive’ native shrub may be greater accepted for carbon sequestration funding even if it makes some pastoralist activities more difficult. Distinguishing beneficial natural regrowth from what others consider to be invasive native scrub requires an understanding of what benefits, constraints and trade-offs there are and values are held within the community (Lunt et al., 2010).

If land degradation is understood to be a ‘decline in the potential productivity of land’ (as conceptualised by the UNCCD), then these findings and conundrums have considerable consequences. As observed by Whitfield and Reed (2012), if diversified uses on lands previously understood to be ‘degraded’ are beneficial, such as payments for conservation or carbon sequestration, and biodiversity benefits from shrubby landscapes, then the newfound productivity of these lands may call into question whether they should be categorised as degraded.

Differing senses of temporal and spatial scales also influenced participants’ perspectives towards the conceptualisation of land degradation and its management. The fact that regeneration could take several decades was accepted; nothing else was seen as feasible. For climate change, the predominant responses were framed on a planetary and evolutionary level, serving to undermine concerns of local and seasonal changes. Vivid memories of the Darling River and Menindee Lakes, within a human lifetime scale, inspired strong perceptions that the state of the water system had degraded. Large spatial distances were perceived for the effects of wind erosion, where some losses of soil were accepted in the perspective that they would be gains for elsewhere, while dust and seeds from distant places would be brought in as well.

It is acknowledged that, in participating in this research, pastoralist interviewees were likely to defensively present themselves as ‘environmental stewards’, as is often the case due to the common and historical narrative of their role in Australia’s degradation (Saltzman et al., 2011), and this needs to be taken into consideration when interpreting the data. Indeed, despite sources of evidence to the contrary, the sentiments expressed about pastoralism by some of the landholders reflect the observations of central Australian pastoralists made by Gill, in which cattle play a role in ‘improving’ country or are “at worst, neutral in their impact on country” (Gill, 2014, p. 271). While in rural livelihoods, caring for land can be seen as a form of self-care (Schirmer et al., 2013), Gill (2014) makes the point that this meaning of ‘care’ should not necessarily be privileged without awareness of the local context and the politics in which it is encased.

7.2 Resilience and power dynamics in far west NSW

Other than the stakeholders’ own accounts, there is evidence to suggest that they have adaptive capacity. Nelson et al. (2010, p. 24) show how due to a complex set of environmental, social and

economic reasons, while the far west region is projected to be among the highest exposed to climate variability and change in terms of pasture growth, it is also less vulnerable to such changes, saying that “rural communities exposed to climate risk are often highly adapted to it.” This reflects the counter-paradigm to desertification, in which land users are inherently innovative and adaptive because of the natural challenges of their environment (Reenberg, 2012).

The prominent discourse of the climate’s ‘natural cycle’ is engrained into the land managers’ practices, but it is adapted from experiences within a limited timeframe – for pastoralism in the region, at most from lessons learned since the 1880s through inter-generational narratives. However, recent research in paleoclimate records of the region indicate that the drought and flood risks experienced since rainfall has been instrumentally measured (including the major ‘Federation’, ‘World War Two’ and ‘Millennium’ droughts over the last 150 years), are relatively stable in the wider context of an even more variable climate (Ho et al., 2015; Tozer et al., 2016). This raises the question of whether the current land managers are truly prepared for the region’s regular natural climate conditions, such as regular twenty-year droughts. While this requires further investigation, it could be that perception and response-wise the land managers are still resilient, but the infrastructure, institutions and policies are not. There may also be consequences of a waning Landcare movement and the shifting social environment (with the rise of corporate or absentee landholders), which could impact the community’s social vulnerability, demanding governance responses.

While the highly variable climate limits what sustainable land management and restoration activities are possible in the far west drylands, the land managers’ understanding of the ability of environment to ‘bounce back’ (that is, be resilient) stems from its ecological adaptation to these climatic variations, with recovery a natural process in boom and bust cycles. In resilience thinking, often there are multiple states in which a social-ecological system can operate (Nelson et al., 2007), none more necessarily desirable than another (without social goals). Because the introduction of livestock and European farming methods fundamentally changed the far west NSW drylands (irrevocably, in some perspectives), possibly the change in land management also signalled a ‘system transformation’. If so, should there be a new baseline calculated? Abel and Langston (2001) determined the western region of NSW to be resilient, due to pastoralists’ adaptability and the landscape’s ecological resilience, but they observed that there are other interests that are competing and attempting to influence the status quo. Conceptually, by not indicating preferences, resilience approaches do not engage in issues of rights and justice. Even if the SES is resilient now, the question of ‘resilience for whom?’ means that there needs to be normative considerations of whether the current system is fair and desirable.

The far west’s historical transition from entirely indigenous management to predominantly pastoral management is an example of disruptive change, with serious consequences for the original land

managers. Also, Australia has much to gain from a more culturally sensitive approach (Pascoe, 2014) and from learning across the ‘ontological divide’ – resilience through adaptive management has similarities to Aboriginal land management “but it is not founded on dynamics of love and respect” (Muir et al., 2010, p. 263). Regardless of the resilience of the current social-ecological system in far west NSW, indigenous drylands management needs to be politically recognised and empowered.

Furthermore, responses indicated that, opposed to individuals’ and community resilience of land management in the far west, the region is not resilient in terms of water. As there is a power imbalance and the issue is out of their hands, external governance and institutional structures are needed to change to bring about the necessary changes (Abel et al., 2016; Mercer et al., 2007).

More widely, imbalances in power from different levels of governance impacted the lower, more grounded, levels’ ability to support positive and sustainable changes. In regards to options for LDN strategies, if national policies are deemed irrelevant or incomprehensible, they risk turning away those who will be needed to implement improvements. Therefore people need to have ownership in the process; governance needs to be ‘translational’ in terms of language and discourses. People are not necessarily motivated by a greater global good, so policies should specify what they actually involve and what are the benefits of involvement, in ways that are meaningful to local people. Land degradation discourses need to be connected to local experiences of the phenomena. In this regard, it is illustrative to dissect the UNCCD’s global narratives about land degradation and its management, and compare the predominant LDN discourse to the local perspectives of the issues in NSW’s far west.

7.3 Comparing the far west NSW perspectives with the LDN discourse

The themes identified through the discourse analysis of the UNCCD’s version of LDN (outlined in sections 4.2.1 and 4.2.2) relate to classic and neoliberal approaches towards land degradation. To rescue self-inflicting or unaware land (mis)managers from the powerful, overarching crisis of global land degradation, a solution is for the UNCCD to facilitate the scaling up of sustainable technologies and practices over large scales and through the financial contributions of global investors, thereby achieving win-wins. Although there was some interest in perceived potential financial benefits, the idea of LDN did not initially entice most participants in the far west NSW case study. A resonating response was the thought that most land managers are already trying to achieve the best environmental outcomes for the sustainability of their production, so they did not need a new paradigm or external influence to ‘fix’ the problem or take the credit for their hard work. Nonetheless, the far west’s land management and resilience principles do correspond with the higher order goals

that LDN proponents advocate. This raises the question of whether the far west suitably addresses the six themes imbued in the UNCCD's discourse of LDN. Each will be discussed in turn.

(i) The desertification crisis

While the UNCCD and Australia do not have a strong relationship, sources that feed the desertification crisis asserted by the UNCCD have suggested that Australia's drylands are significantly degrading (such as Bai et al., 2008). This assessment has been rebutted through other more nuanced understanding of its changes and is also refuted by a variety of stakeholders in the far west of NSW. However, current impressions of a general lack of degradation could be influenced by comparisons to the land during severe episodes of degradation over the last 140 years, as opposed to what it would be in times of optimum health and productivity. In contrast, stakeholders repeatedly raised concerns of a 'water crisis' for the Darling River and Menindee Lakes, with impressions that authorities in charge downplay or fail to grasp the severity of the issue.

Most likely, Australia's contextual differences to other drylands (fixed rather than nomadic land tenure systems, orientation to the export market rather than subsistence grazing, and relatively strong socio-economic conditions) also contribute to the lack of applicability of the desertification crisis narrative in this region.

(ii) The alarming yet financially appealing amount of degraded land

In stark contrast to the UNCCD's depictions of the 'market opportunities' for the active restoring, rehabilitating or reclaiming of degraded land, the far west stakeholders were unified in their perspective that active restorative works are often too expensive. The inhibitive scale of areas, unpredictable rainfall patterns, ecological characteristics and low land value were reasons for a distinct lack of interest in widespread restoration techniques, although in particular circumstances, certain regionally-developed techniques were believed to be helpful. Tree planting was deemed 'useless out here', a finding also scientifically asserted in other semi-arid regions (such as northern China) and contrasting to positive official rhetoric about afforestation (such as in China's Great Green Wall program).

In comparison, the best restoration technique was generally believed to be enabling conditions (for example, through destocking and feral pest and weed management) in order to let the environment heal itself. While this is known as a 'passive' form of restoration, it still involves active attention of manageable degrading pressures and reducing livestock production, and therefore perceived to come at a financial cost. The only way that restoration or rehabilitation could appear financially appealing

was through revenue via other avenues, such as conservation or carbon funding incentives. Management for such purposes was deemed most appropriate by the land managers themselves.

(iii) The self-inflicting victims

Different contextual factors and land tenure nullify the applicability of the UNCCD's 'degrade-abandon-migrate' paradigm, but a common feature of the classic view of land degradation is that farmers are naive and unwittingly damaging the resources that they need to survive. At least historically, this view has been also applied to Australian rangelands, with the inappropriate transplantation of sheep and European farming measures to a wildly different landscape. Similar to evidence found by Curtis et al. (2003), this research suggests that current land managers of far west NSW are not ignorant squanderers of the resources, and nor did they appear to be in denial about their practices and motivations. These findings are limited in that this is a small and isolated case study, and it acknowledges the point raised by several participants that of course, there are a minority of land managers who are less competent and less adaptive – and perhaps more 'wilfully ignorant' – than others.

More concern could be given to subtle changes to land quality that are imperceptible to land managers, as well as more attention towards certain land users who are aware of the costs of their actions to others and the future potential of land and yet continue to pursue degrading practices, which is "undoubtedly the result of calculated human agency and not of ignorance, nor stupidity" (Blaikie & Brookfield, 1987, p. 37). Mistreatment of land can also be encouraged by perverse incentives created by governmental policies, for example, through short-term leases which encourage overgrazing or mixed messages about 'invasive native shrub' (such as carbon credits to keep them but advice and incentives to remove them).

(iv) The need to dramatically upscale SLM

The LDN discourse asserts the need for improved uptake of SLM practices to adapt to both land degradation and climate change. Table 7.2 presents a list of such recommendations, comparing them with perspectives discussed in the case study and possible consequences for the way they are generally promoted. While some SLM practices were seen as appropriate and already common practice (such as responsive alterations to stocking rates and water points), other recommended techniques (notably rotational grazing and increased provision of trees) were seen as unfeasible and undesirable, whereas others were more ambiguous, such as the perception of management of shrub encroachment being dependent on stakeholders' attitudes towards shrubs.

Table 7.2 SLM recommendations for the UNCCD Scientific Conference (from Reed & Stringer, 2015, p. 71), their applicability or inapplicability to far west NSW according to land manager perspectives, and possible implications for their continued general recommendation.

SLM recommendations for rangelands (from the 2015 UNCCD Scientific Conference)	Applicability to far west NSW (according to the interview responses)	Section reference	Implications for general SLM recommendations
Altering stocking rates to match changes in forage production in response to climate change and/or land degradation;	Already common best practice.	6.2.2.1 Maintaining groundcover and total grazing pressure	Continue as best practice.
Adjusting the management of herds and water points in response to changing seasonal and spatial patterns of forage production under climate change and inter-annual trends in forage production due to land degradation;	Already common best practice (not necessarily because of anthropogenic climate change).	6.2.2.1 Maintaining groundcover and total grazing pressure 6.3.2.2 Action to respond to climate change	Continue as best practice.
Managing diet quality (using dietary supplements, legumes, choice of introduced pasture species and pasture fertility management) to maintain herds under climate change and/or land degradation;	Contested. The strength of native pasture is relied upon, without supplements (at pastoral station and regional scales). Rather than maintaining herds on degraded land, it is common practice to sell or transport stock during tougher climatic conditions.	6.2.1.1 Pastoral land management 6.2.2.2 Rotational grazing and other grazing regimes	Reconsider whether the maintenance of herds should be prioritised over temporary reductions or changing stocking regimes/species, including the consideration of their dietary requirements and what pasture is available. Recognise that climate variations and land degradation are not linear, and management decisions may need to fluctuate accordingly.

More effective use of rotational grazing systems;	Not perceived to be best practice, due to climatic, ecological, logistical and financial constraints.	6.2.2.2 Rotational grazing and other grazing regimes	Reconsider universal recommendation of the context-specific technique over other grazing regimes.
Managing the encroachment of woody shrubs spreading on productive rangeland;	Common practice, but to some extent contested (depending on whether native woody shrubs are a weed).	6.1.5.1 Invasive native scrub	Evaluate where certain woody shrub species provide benefits (such as habitat and windbreaks) and where they are more destructive (invasive, unpalatable species), and provide appropriate incentives according to the context.
Using livestock breeds or species that are better suited to new conditions as a result of climate change and/or land degradation;	Common practice, but to some extent contested (fear that better suitability of goats and dorpers may result in more overgrazing). Although kangaroos are suited to the conditions, limited market opportunities prevent farmers from economically relying upon them.	6.2.1.1 Pastoral land management 6.1.4.1 Kangaroos	Consider the potential external and cumulative impacts of species' suitability. Facilitate appropriate policy and market contexts for appropriate stocking decisions.
Increased provision of shade from trees to reduce heat stress in livestock through the adoption of silvopastoral systems that can also reduce erosion rates and provide fodder for livestock during drought;	Trees are not integrated into the production system nor seen as feasible to actively increase their provision. However, groundcover is valued and passive regrowth may be acceptable.	6.2.2.1 Maintaining groundcover and total grazing pressure 6.2.3.1 Passive restoration	Reconsider context and method of increased tree provision, and broaden recommendation to emphasise the benefits of other types of vegetation as groundcover.

Enabling migratory pastoralist activities (though this has to be carefully managed to avoid exacerbating land use conflicts);	Feasible through agistment or management of multiple properties; otherwise current land tenure disables this practice. Short-term leases seen as environmentally undesirable and unsustainable.	6.2.2.2 Rotational grazing and other grazing regimes	Specify context and method of migratory activities, according to land tenure arrangements.
Monitoring and managing the spread of livestock and rangeland pests, weeds and diseases;	Pests and weeds management already common best practice, although the status of some 'pest' species contested as instead a 'resource'. Their spread is best managed through collaborative, targeted approaches. Diseases are not discussed in this research.	6.1.4 The pests conundrum 6.1.5 The weeds conundrum	Reconsider what determines pests and weeds, not just according to farming productivity. Recommend collaborative management across properties to maximise the effect of control methods.
Improved soil and water management.	Other than retaining groundcover, limited additional options perceived for pastoralists to adopt improved soil and water management. Water management perceived to need policy and governance improvement, at an inter-regional and inter-state level.	6.2 Perceptions of sustainable land management and restoration 6.3.1 The Darling River and Menindee Lakes	Reconsider the limited focus on SLM for local land managers; include recommendations for the wider policy and governance context.

Other techniques of sustainable land management were present in the far west but are not raised in the recommended SLM list presented in Table 7.2. This includes their collaborative style to certain degradation pressures and recognition of mutual benefits when everyone is managing their land well, which is encouraged by Landcare. Besides changing management practices, there are potential

benefits from the diversification of pastoralist livelihoods (such as alternative meat markets, tourism, conservation and other land uses).

(v) The vital role of global institutions and investors

Instead of global and external inputs, there was more interest in self-reliance and independence, and local to regional institutions. Landcare has a role to play in this approach, with social strength that adds to the local community's resilience, but it is facing issues contributing to its own weakness. Regional governance through the Local Land Services encourages the strength of the community, self-competency and empowerment, but draws away from individuals' involvement with Landcare.

According to 'the desert syndrome', people in drylands such as outback Australia will always be more removed from political powers and services provided by governments (Stafford Smith, 2008). Stafford Smith (2008, p. 12) discusses how, as this will continue to be the case, "desert dwellers need to accept this, just as they need to accept the fact that droughts and floods are out of their control; they need to think about how to manage for, and take advantage of, this reality, not fight against it". He observes that the independent history of Aboriginal peoples, as well as the predominant discourse of the Outback 'battler', are stories of people surviving with this challenge without the aid of "well meaning subsidy from the outside" – although outsiders could have a role to play in influencing appropriate policy contexts (2008, p. 11). The sentiments of several of the people in the far west – and especially members of the White Cliffs community – expressed much more interest in autonomous management instead of the need for global institutions and investors. However, foreign markets influence many of the landholders' incomes.

(vi) The synergies and win wins

Although there are potentially some land degradation synergies with biodiversity (pests to grazing also being threats to biodiversity – such as rabbits and wild pigs), as well as with climate change adaptation (similar techniques to manage extreme conditions and variability), there were also some incompatibilities identified in the case study. For example, native scrub was generally not seen as useful unless it received payments for carbon sequestration. Different land uses (conservation, mining, Aboriginal land use, and pastoralism) were often discussed as incompatible with one another – and even within pastoralism, there were perceived potential incompatibilities between merino and dorper graziers, and between family and corporate businesses. Water management along the Darling was not seen as something that could be a 'win win', with competition between users along the river about who would need to give up their water intake in order to restore its flow and health.

Overall, although the global discourses of LDN were not intended for Australia's circumstances, they appear to be ill-suited for and not reflective of this particular 'local reality', such that Adger et al. (2001)'s claim of a mismatch rings true. This is important, because the rhetoric of global discourses drives particular courses of action (Adger et al., 2001).

7.4 Implications for the international development of LDN

Drawing from various ideas raised in the conceptual frameworks of drylands, literature review, discursive investigation of LDN, and land degradation and its management in the case study, a number of concerns about the current conceptualisation and practicality of LDN arise. Here, I raise three recommendations for approaches continuing in this field.

(i) Land degradation should be approached as a qualitative phenomenon

Currently, LDN is constrained by quantification and metrics. To successfully achieve the no net loss of further land degradation, accurate calculations are required, but an understanding of the multiplicity of differing perspectives means that universally agreed numbers on land degradation cannot exist. Meeting targets based on three biophysical indicators (land use and land cover change, net primary productivity and soil organic carbon) also constrain decisions. The variety of forms of land degradation, and the extent to which land is still useful while still displaying certain characteristics of degradation, means that it is rare that land can be divided into neat parcels of 'degraded' and 'not-degraded'. Any proposed numbers will be socially constructed.

The goal for a huge amount of restoration by 2030, in fifteen years, is impatient. Holl and Aide assert that there is "a strong temporal mismatch between the temporal scale of human decision-making and that of ecosystem recovery" (2011, p. 1561). They say that many expensive – and sometimes counter-productive – active restoration programs could be more effective if more time (that is, several decades) is given to allowing natural regeneration, and that it would be better to devote restorative resources to carefully selected lands that require more intensive reconstruction. This sentiment was strongly reflected by stakeholders in the far west of NSW. Such results will not be quantifiable by 2030, and indeed, several of the UNCCD's pilot countries' targets are pitched for years beyond 2030, so it remains to be seen how LDN in SDG 15.3 could be calculable.

These problems stem from the basis that the LDN approach is primarily quantity-based, not quality-based (despite quality being a component of its IWG definition). Counterbalancing the (dubious) 12 million hectares of annually degrading land speaks nothing about restoring the quality of the land itself, its ecosystem functions and its non-standardised worth for different people. Carolan observes that the non-objective value of environmental quality is often missing from scientific debates "because

it relies precisely on those things that cannot be counted, but which for most people matter just as much as things that can be unproblematically added and subtracted” (2008, p. 735). Indeed in land degradation’s case, accurate numerical assessments of erosion are unlikely to be the most important determinant of soil and water management actions, compared to management objectives, resources and influential institutions (Jones, 1996). There is also research looking into polycentric indicators for ‘unmeasurables’ such as values and culture in environmental projects and sustainable development (for example, see Burford, 2013; Harder et al., 2014).

(ii) The concept of social-ecological systems should inform responses to land degradation

The concept of social-ecological systems recognises that the relationship between societies and the environment is uncertain, complex and dynamic. The measurement of a baseline of non-degradation through an average of recent trends in indicators does not account for drylands’ unruly ecological dynamics, where there are boom-bust cycles, unpredictable climatic factors (where ‘bad years’ may mask good management and vice versa), and some changes will be underway but take a long time to show. The need for communities to be able to manage for this variability was highlighted in the case study of far west NSW, where diversified incomes that do not rely on rainfall (for example, conservation payments and tourism) can help to maintain social resilience. The need for strong, collaborative communities for environmental benefits is also demonstrated through Landcare. In contrast, the potential investment in absentee landholders to restore Australian farmlands through the LDN Fund does not consider the significance of social communities for environmental management.

Factoring in the (common) possibility of droughts and other variability means that restoring land to an optimum state by a certain time “is not an achievable goal” (Cowie et al., 2011, p. 257).

Recognising resilience means acknowledging that changes will occur, so that “systems need to be managed for flexibility” (Nelson et al., 2007, p. 399), rather than ‘neutrality’. From a social perspective, LDN tends to strive for universality and having ‘placeless’ knowledge. Land is treated without regard to its relationship with people. This contrasts with other, locally-bound knowledge (Muir et al., 2010), and avoids important considerations of the socio-economic and political conditions in which land is managed (Blaikie & Brookfield, 1987).

(iii) Bottom-up collaborative approaches need to be better recognised and prioritised

The programs introduced to implement LDN are essentially top-down, excluding bottom-up and context-developed considerations. This appears to be the case in the approaches taken to spread SLM knowledge and practices through the Soil Leadership Academy and LDN Fund, and the methods used determine land degradation in the LDN Project with pilot countries. Remote sensing is a good method for large-scale assessments but, as demonstrated and advanced by ACRIS (Stafford Smith,

2016), it needs to be complemented with ground-truthing. Despite its international acclaim (such as in Vogt et al., 2011), ACRIS has been defunded, meaning that ‘informal’ knowledge is especially important in Australian rangelands now, and difficult to apply on a large-scale because people are unlikely to record environmental changes for themselves, and collaborative landholder monitoring is limited by poor Internet connectivity. However, remote sensing techniques can also be combined with political ecology (such as Lukas, 2014), which typically includes bottom-up considerations. While SLM should start with the land manager, collaborative approaches should recognise the influence of governance and policy contexts, and the need to address perceptions at all levels.

If it is essential that ‘whose angle’ determines the problem, and global discourses are ill-suited to local realities, then the problem according to the global/national angle on its own is unlikely to match the real circumstances. Too much reliance on international corporate responsibility and neoliberal mechanisms can restrict the sometimes important governmental policy changes and environmental governance that is needed to address degradation (Andersson et al., 2011). Working with landholders through multi-stakeholder partnerships can achieve benefits “as subtle as land users feeling heard and valued”, but can also possibly be part of the development of better SLM practices “with downstream (or global) impacts” (Fleskens & Stringer, 2014, p. 3).

7.5 What are the alternatives?

In reflection, ‘dryland degradation’ as it is currently approached is insufficient to capture the complex dynamics of change, as is measured according to standardised but ‘context-removed’ criteria. By definition, degradation is predicated on the idea that marginal land that is not productive is also not valuable. This research makes the case that, in some circumstances, land use change can offer a different form of value, not necessarily better or worse. Others, such as Silcock, have shown that “undesirable states for pastoralism do not necessarily equate to ecological degradation” (2014, p. 133). Alternatively, Pascoe (2014) reveals forms of productivity that Australian rangelands can support other than pastoralism in its current manifestation, which could widen perspectives about the inherent capacity of drylands for productivity.

Instead of assessments couched in terms of productivity, ideas of resilience offer an alternative way to approach drylands degradation, and indeed the concept of resilience is increasingly applied (with concerns that its meaning may be manipulated, Béné et al., 2012). However, on its own, resilience does not make a compelling narrative; it needs a greater purpose (Stafford Smith, 2016). Rose takes the concept of resilience to a philosophical level further than in most ecology, saying that it is about “connectivity and commitment” (2004, p. 49). By distinguishing between different types of resilience, she outlines how certain ‘resilience-oriented’ projects may not result in desirable outcomes. The

approach to restoration promoted by the UNCCD is one of ‘engineered resilience’, heavily focussed on the efficiency, market logics, and business opportunities. Alternatively, the approaches of the participants in the case study in far west NSW are more similar to ‘facilitated resilience’, managing according to cues from nature, and ‘letting it be’ – which, importantly, is not the same as being negligent. Combining a resilience approach with political ecology also allows questions of fairness and inclusivity to achieve a greater purpose.

Inherent in the land degradation discourses of declining productivity is the idea that drylands – typically less efficient lands – are negative and undesirable. This narrative persists despite many positive qualities of such places and the potential well-being of their inhabitants, not just the unique plants and animals from a conservation point of view but also the social communities and ways of life. While far from perfect, local residents in the far west of NSW told stories that expressed joy and contentment with their circumstances, revelling in experiences that are not possible in the city. A transition of general understandings and approaches to drylands will not come from scientific evidence – transformations come from discourses and politics (Whitfield et al., 2015), and this is why framing of the environment is important (Lakoff, 2010). Agronomists, ecologists and ‘participatory’ researchers need to come together to develop and use appropriate discourses (Koning & Smaling, 2005).

Thankfully, we need not start from scratch to develop new drylands discourses. Thinking ahead of environmental challenges for the world, there could be many positives from learning from places where uncertainty and variability are normal. Drylands are also often the ‘last refuges’ of local and traditional knowledge (Easdale & Domptail, 2014), which offers a good starting point for ways to live with rather than control variability. Based on such knowledge, Pascoe’s proposal (2014) for an ‘Australian agricultural revolution’ is certainly worthy of contemplation. Espinosa’s account (2014) of how indigenous discourses of the Rights of Nature and Mother Earth could be promoted at the UN is inspiring.

Stafford Smith (2016) suggests that because of its unique position, perhaps the UNCCD could become more of a promoter of successful dryland wellbeing (instead of being focussed on its problems). A reformed role for the UNCCD could also reinvigorate its original focus on marginal populations through partnerships with civil society organisations, rather than inciting their disapproval through public-private partnerships with transnational corporations that have different values and distant relationships with the land they use and for which they hold responsibility. The UNCCD remains in a prominent position to shape the direction and priorities of proposed solutions, and could embrace new discourses based on local and scientific evidence.

7.6 Conclusion

In summary, the aim of this thesis has been to question the implicit discourses that make up ‘land degradation neutrality’ through the lenses of local stakeholders in Australian drylands, in order to identify the potential opportunities for new narratives to take root. This recognises that the case of the Australian drylands is different to other drylands across the world, but that a contextualised understanding of the causes of land degradation necessitates a localised approach. There exists fruitful ground for further analysis in differing settings.

The first chapter outlined existing tension in political and academic approaches to land degradation in drylands, introducing the importance of people’s perspectives as to what constitutes negative changes to land. The role of combatting land degradation in the worldwide Sustainable Development Goals adds impetus to the need to explorations into how such narratives and programs might apply to local contexts.

Chapter 2 presented the conceptual frameworks, which inevitably influenced the ways the research has been approached. Considering drylands as social-ecological systems recognises the inextricable role of people in environmental issues, and adding political ecology to such concerns means that questions of fairness and justice are also addressed when striving for resilience. This theoretical background plays into the relevance of literature reviewed in Chapter 3, where instead of finding clear and straightforward global estimations of land degradation, an awareness of alternative perceptions illustrates the lack of agreement in the academic field. While sustainable land management and land restoration (including ecological restoration, rehabilitation and reclamation) are often undoubtedly promoted as solutions, care needs to be taken to recognise that different approaches and outcomes can be implied by these terms.

With the basis of such understandings, Chapter 4 explored the first research question, using discourse analysis to uncover the narratives imbued in land degradation neutrality (LDN) as approached by the United Nations Convention to Combat Desertification (UNCCD). The UNCCD’s brochures and policy briefs describe desertification as an extensive silent crisis taking over productive areas, often because of mismanagement by land users who are degrading for survival. However, degradation is also described as being easily preventable through improved land management practices, and that it is financially rewarding to do so. The missing catalysts for change are said to be improved decision-making (notably from knowledge transfer to land users) and more investments (notably from the private sector for large-scale projects), strengthened by synergistic initiatives for climate action.

Although the term ‘neutrality’ suggests ‘no net loss’ (which comes with philosophical and practical challenges), the LDN approach taken by the UNCCD is one of target setting through three key

indicators. Demonstrated in the analysis of the LDN Project with pilot countries, these globally standardised indicators may be misleading if used on their own. Private-public partnerships are encouraged through the UNCCD's Soil Leadership Academy (in collaboration with Syngenta) and the LDN Fund (through the Global Mechanism in collaboration with Mirova). In attempting to involve potentially powerful multi-national actors in preventions of land degradation, the UNCCD programs for LDN appear to have less of a focus on marginal people in marginal lands.

Chapter 5 introduced the far west New South Wales as a place of historically severe land degradation, frequent droughts and flooding events, with a sparse market-oriented population. The interviews were conducted as purposeful conversations, with room for localised discourses to emerge spontaneously. The intention of this research design was to explore multiple perspectives of the issues, including land users and policy-oriented stakeholders, but in execution there was a paucity of the inclusion of Aboriginal perspectives and other self-excluded stakeholders. Nonetheless, for sustainable land management of the Australian rangelands, their role is recognised as an important part of the solution.

The case study findings were presented in Chapter 6. Pertinent perspectives were that mostly, the land is continuing to improve from previous states of degradation and that this is encouraged through the management of total grazing pressure and, where financially possible, letting the land restore itself. Discourses of pests and weeds are inconsistent, where much depends on perspectives and opportunities for use, rather than considerations of what natively belongs. Diversified land uses, such as tourism and dedicated conservation areas, were seen as good options for sustainable land management, not simply pastoralism. The prominent issue of water management and degradation of the Darling River and Menindee Lakes system were not seen as easily solvable 'win wins', but that instead there would need to be costly but necessary social transitions. Within a very large timeframe, climate change's impacts to the region were perceived to be relatively small, but management adaptations would take place naturally because of an already common inclination to work within the vagaries of the climate. The shifting governance and funding for Landcare and the Local Land Services appeared to have noticeable impacts for how land management is approached, revealing important policy implications. Land degradation neutrality itself was most frequently met with scepticism, reflecting its unfamiliar angle towards degradation's causes and resolutions.

Implicitly throughout this research, a question of whether it is necessary to 'think global' in order to 'act local' has persisted, to borrow a trite environmental catch-phrase. Evidence from the far west of NSW suggests that people are motivated to manage land sustainably for a variety of reasons, but not necessarily because of lofty global targets. While recommended practices for sustainable land

management are important, such recommendations should also be attentive of contextual factors and people's perceptions and values in order to facilitate resilience.

This final chapter has served to bring together the findings, particularly addressing the research objectives to examine the land degradation and management situation in far west New South Wales and reveal the complexity of perspectives, highlight the differences with the LDN narratives, and to reflect on the need for qualitative, bottom-up approaches that recognise that drylands are social-ecological systems.

The results from this thesis have found that land degradation is complex and socially informed, and the current LDN approach is inflexible for addressing such factors. There needs to be a greater conceptual understanding of global land degradation, degraded land, and the capacity of restoration and rehabilitation to contribute to LDN. However, recognising these qualities is only the first step. There is also a need to develop alternative narratives that are locally contextualised, encompassing a better story of people and their careful relationship with land. The development of such alternatives is beyond the scope of this thesis; however, the case study's participatory approach suggests that local knowledge should be an important contributor.

Several knowledge gaps and opportunities exist for further research. The case study revealed potential avenues for policy mechanisms to foster sustainable land management in far west NSW through livelihood diversification; modern transhumance-like stock movements across the state; collaborative management across properties and with multiple stakeholders, including indigenous rights for traditional land management; and landholder-centred conservation and rehabilitation. More generally, future research could explore the decision processes needed to account for differing perceptions of degradation when prescribing restoration and land management activities, recognising that these perceptions are dynamic and grounded within contexts.

Findings from this research will be shared with the research participants and appropriate stakeholders to enhance its value. Initially, results have been presented in a seminar about the future of land management in the arid zone held in Broken Hill in September 2016, and publications are intended to follow. In the global sphere, the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) intends to deliver a report about global land degradation and restoration in 2018, in coordination with the UNCCD (Ngo, 2015). Encouragingly, IPBES intends to explicitly include scientific, indigenous and local knowledge and pay particular attention to dryland degradation, so it is hoped that they take into consideration some of the insights and issues raised in this research.

In the business world, one can often hear the maxim: 'if you can't measure it, you can't manage it'. In contrast, I have strived to show how global land degradation will never be able to be measured

without question, because such calculations depend on differing perspectives and values. This does not mean measurements should be totally abandoned; they can be helpful indicators of specific areas needing attention and further investigation. However, measurements should not be solely relied on, and sustainable land management does not rest upon their accuracy. Instead, through this research I propose a renewed focus on things that are not usually measured – care for land and an interrelated care for its people, through multiple types of knowledge and responsibility. Management for such aspirations is indeterminately more complex and unable to be reduced into tidy figures of progress, but ultimately it is more invigorating and valuable.

8 References

- Abel, N., Cumming, D. H. M., & Anderies, J. M. (2006). Collapse and reorganization in social-ecological systems: Questions, some ideas, and policy implications. *Ecology and Society*, 11(1), 17 [online].
- Abel, N., & Langston, A. (2001). Evolution of a social-ecological system: Adaptation and resilience in the New South Wales rangelands 1850 to 2020. *Draft 10/01*. (pp. 33). Retrieved from http://www.cse.csiro.au/Research/aglands/nswrangelands/pubs/popular_articles/Draft_Paper.pdf [https://perma.cc/8YKV-JU9R]
- Abel, N., Wise, R. M., Colloff, M. J., Walker, B. H., Butler, J. R. A., Ryan, P., Norman, C., Langston, A., Anderies, J. M., Gorddard, R., Dunlop, M., & O'Connell, D. (2016). Building resilient pathways to transformation when "no one is in charge": Insights from Australia's Murray-Darling Basin. *Ecology and Society*, 21(2), 23 [online].
- Abensperg-Traun, M., Wrbka, T., Bieringer, G., Hobbs, R., Deininger, F., Main, B. Y., Milasowszky, N., Sauberer, N., & Zulka, K. P. (2004). Ecological restoration in the slipstream of agricultural policy in the old and new world. *Agriculture, Ecosystems & Environment*, 103(3), 601-611.
- Addison, J., Friedel, M., Brown, C., Davies, J., & Waldron, S. (2012). A critical review of degradation assumptions applied to Mongolia's Gobi Desert. *The Rangeland Journal*, 34(2), 125-137.
- Adger, W. N., Benjaminsen, T. A., Brown, K., & Svarstad, H. (2001). Advancing a Political Ecology of Global Environmental Discourses. *Development and Change*, 32, 681-715.
- Adimassu, Z., Kessler, A., Yirga, C., & Stroosnijder, L. (2013). Farmers' perceptions of land degradation and their investments in land management: A case study in the Central Rift Valley of Ethiopia. *Environmental Management*, 51(5), 989-998.
- Allen, C. R., Fontaine, J. J., Pope, K. L., & Garmestani, A. S. (2011). Adaptive management for a turbulent future. *Journal of Environmental Management*, 92(5), 1339-1345.
- Alston, M., Whittenbury, K., Western, D., & Gosling, A. (2016). Water policy, trust and governance in the Murray-Darling Basin. *Australian Geographer*, 47(1), 49-64.
- Andersson, E., Brogaard, S., & Olsson, L. (2011). The political ecology of land degradation. *Annual Review of Environment and Resources*, 36(1), 295-319.
- Aronson, J., & Alexander, S. (2013). Ecosystem restoration is now a global priority: Time to roll up our sleeves. *Restoration Ecology*, 21(3), 293-296.
- Arthington, A. H. (1996). The effects of agricultural land use and cotton production on tributaries of the Darling River, Australia. *GeoJournal*, 40(1-2), 115-125.
- Bai, Z. G., Dent, D. L., Olsson, L., & Schaepman, M. E. (2008). Proxy global assessment of land degradation. *Soil Use and Management*, 24(3), 223-234.
- Barbour, L. (2015). Farmer attitudes to climate change across generations. *ABC Rural*. Retrieved from <http://www.abc.net.au/news/2015-11-28/nrn-intergenerational-farmers-climate/6980326> [https://perma.cc/9RK9-XUKU]
- Barbut, M. (2015). 17 SDGs, but is there a priority SDG target? International Institute for Sustainable Development: Sustainable Development Policy & Practice. Retrieved from <http://sd.iisd.org/guest-articles/17-sdgs-but-is-there-a-priority-sdg-target/> [https://perma.cc/X25K-UMDX]
- Barkemeyer, R., Stringer, L. C., Hollins, J. A., & Josephi, F. (2015). Corporate reporting on solutions to wicked problems: Sustainable land management in the mining sector. *Environmental Science & Policy*, 48, 196-209.
- Bastin, G., & the ACRIS Management Committee. (2008). Rangelands 2008 – Taking the pulse (pp. 233). Canberra: National Land & Water Resources Audit.
- Baumber, A., Cooney, R., Ampt, P., & Gepp, K. (2009). Kangaroos in the rangelands: Opportunities for landholder collaboration. *The Rangeland Journal*, 31, 161-167.

- Beale, B., & Fray, P. (1990). *The vanishing continent: Australia's degraded environment*. Sydney: Hodder & Stoughton.
- Beeton, R. J. S., Buckley, K. I., Jones, G. J., Morgan, D., Reichelt, R. E., & Trewin, D. (2006). Australia: State of the environment 2006. *Independent report to the Australian Government Minister for the Environment and Heritage*. Canberra: Department of the Environment and Heritage.
- Behnke, R., & Mortimore, M. (2016). *The end of desertification? Disputing environmental change in the drylands*. Berlin, Heidelberg: Springer
- Béné, C., Godfrey Wood, R., Newsham, A., & Davies, M. (2012). Resilience: New utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. *IDS Working Paper 405*. Brighton, United Kingdom: Institute of Development Studies.
- Berkes, F., Colding, J., & Folke, C. (Eds.). (2003). *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge, United Kingdom: Cambridge University Press.
- Berry, L., Abraham, E., & Essahli, W. (2009). UNCCD recommended minimum set of impact indicators. *Consultancy Report* (pp. 95). Retrieved from http://www.unccd.int/en/programmes/Science/Monitoring-Assessment/Documents/Final-Report_UNCCD-Min-Set-of-Impact-Indicators.pdf [<https://perma.cc/8CGR-9LA7>]
- Bestelmeyer, B. T., Okin, G. S., Duniway, M. C., Archer, S. R., Sayre, N. F., Williamson, J. C., & Herrick, J. E. (2015). Desertification, land use, and the transformation of global drylands. *Frontiers in Ecology and the Environment*, 13(1), 28-36.
- Beymer-Farris, B. A., Bassett, T. J., & Bryceson, I. (2012). Promises and pitfalls of adaptive management in resilience thinking: The lens of political ecology. In T. Plieninger & C. Bieling (Eds.), *Resilience and the Cultural Landscape*. Cambridge, United Kingdom: Cambridge University Press.
- Biot, Y., Blaikie, P. M., Jackson, C., & Palmer-Jones, R. (1995). Rethinking research on land degradation in developing countries. *World Bank Discussion Papers 289*. Washington, D.C.: The World Bank.
- Bisaro, A., Kirk, M., Zdruli, P., & Zimmermann, W. (2014). Global drivers setting desertification research priorities: Insights from a stakeholder consultation forum. *Land Degradation & Development*, 25(1), 5-16.
- Blaikie, P. M., & Brookfield, H. C. (1987). *Land degradation and society*. London: Methuen & Co. Ltd.
- Bradshaw, A. D. (1996). Underlying principles of restoration. *Canadian Journal of Fisheries and Aquatic Sciences*, 53(Suppl. 1), 3-9.
- Bradstock, R. A. (2008). Effects of large fires on biodiversity in south-eastern Australia: Disaster or template for diversity? *International Journal of Wildland Fire*, 17, 809-822.
- Briske, D. D., Derner, J. D., Brown, J. R., Fuhlendorf, S. D., Teague, W. R., Havstad, K. M., Gillen, R. L., Ash, A. J., & Willms, W. D. (2008). Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. *Rangeland Ecology & Management*, 61(1), 3-17.
- Briske, D. D., Sayre, N. F., Huntsinger, L., Fernandez-Gimenez, M., Budd, B., & Derner, J. D. (2011). Origin, persistence, and resolution of the rotational grazing debate: Integrating human dimensions into rangeland research. *Rangeland Ecology & Management*, 64(4), 325-334.
- Brown, D., Taylor, J., & Bell, M. (2008). The demography of desert Australia. *The Rangeland Journal*, 30, 29-43.
- Brown, E. (2016). New South Wales Department of Primary Industries says Darling River problems a result of unprecedented low rainfall not mismanagement. *ABC Rural*. Retrieved from <http://www.abc.net.au/news/2016-04-04/vch-dpi-water/7295776> [<https://perma.cc/8K6A-VU5C>]

- Brown, J. C., & Purcell, M. (2005). There's nothing inherent about scale: Political ecology, the local trap, and the politics of development in the Brazilian Amazon. *Geoforum*, 36(5), 607-624.
- Bryman, A. (2012). *Social research methods* (4th ed.). New York: Oxford University Press.
- Buckingham, J. (2014). Barkindji woman Virgean Wilson on Darling River at Wilcannia [video file]. Retrieved from <https://youtu.be/-VhD29CO1Z8> [<https://perma.cc/T8YQ-B8MM>]
- Bullock, J. M., Aronson, J., Newton, A. C., Pywell, R. F., & Rey-Benayas, J. M. (2011). Restoration of ecosystem services and biodiversity: Conflicts and opportunities. *Trends in Ecology and Evolution*, 26(10), 541-549.
- Bureau of Meteorology. (2016). Climate statistics for Australian locations: Summary statistics for Broken Hill (Patton Street). Retrieved from http://www.bom.gov.au/climate/averages/tables/cw_047007.shtml [<https://perma.cc/4A8B-D74F>]
- Burford, G. H., E.; Velasco, I.; Janoušková, S.; Jimenez, A.; Piggot, G.; Podger, D.; Harder, M.K.;. (2013). Bringing the missing pillar into Sustainable Development Goals: Towards intersubjective values-based indicators. *Sustainability*, 5, 3035-3059.
- Burger, P., & Oettle, N. (2015). News from Drynet: A global initiative giving future to drylands. *October 2015: special issue for COP12*. Retrieved from <http://dry-net.org/wp-content/uploads/2015/10/Drynet-newsletter-COP-12.pdf> [<https://perma.cc/4VQD-N3ZL>]
- Burgin, S. (2008). BioBanking: An environmental scientist's view of the role of biodiversity banking offsets in conservation. *Biodiversity and Conservation*, 17(4), 807-816.
- Burke, P. J. (2016). Undermined by adverse selection: Australia's Direct Action abatement subsidies. *CCEP Working Paper 1605, Apr 2016* (pp. 22). The Australian National University: Crawford School of Public Policy.
- Callicott, J. B. (2011). Postmodern ecological restoration: Choosing appropriate temporal and spatial scales. *Handbook of the Philosophy of Science*, 11, 301-326.
- Cao, S., Chen, L., Shankman, D., Wang, C., Wang, X., & Zhang, H. (2011). Excessive reliance on afforestation in China's arid and semi-arid regions: Lessons in ecological restoration. *Earth-Science Reviews*, 104(4), 240-245.
- Carolan, M. S. (2008). The bright- and blind-spots of science: Why objective knowledge is not enough to resolve environmental controversies. *Critical Sociology*, 34(5), 725-740.
- Cattle, S. R. (2016). The case for a southeastern Australian Dust Bowl, 1895-1945. *Aeolian Research*, 21, 1-20.
- Cawthorn, D. M., & Hoffman, L. C. (2014). The role of traditional and non-traditional meat animals in feeding a growing and evolving world. *Animal Frontiers*, 4(4), 6-12.
- Cawthorn, D. M., & Hoffman, L. C. (2016). Controversial cuisine: A global account of the demand, supply and acceptance of "unconventional" and "exotic" meats. *Meat Science*, 120, 19-36.
- Chapman, M. (2003). Kangaroos and feral goats as economic resources for graziers: Some views from south-west Queensland. *The Rangeland Journal*, 25(1), 20-36.
- Chasek, P. (2013). Follow the money: Navigating the international aid maze for dryland development. *Journal of International Organisations Studies*, 4(1), 77-90.
- Chasek, P., Safriel, U., Shikongo, S., & Fuhrman, V. F. (2015). Operationalizing Zero Net Land Degradation: The next stage in international efforts to combat desertification? *Journal of Arid Environments*, 112, 5-13.
- Choi, Y. D. (2007). Restoration ecology to the future: A call for new paradigm. *Restoration Ecology*, 15(2), 351-353.
- Clarke, M. F. (2008). Catering for the needs of fauna in fire management: Science or just wishful thinking? *Wildlife Research*, 35(5), 385.
- Cocklin, C., Mautner, N., & Dibden, J. (2007). Public policy, private landholders: Perspectives on policy mechanisms for sustainable land management. *Journal of Environmental Management*, 85(4), 986-998.

- Compton, E. (2010). Engaging landholders in managing areas of high conservation value in the Western Catchment. In D. J. Eldridge & C. Waters (Eds.), *Proceedings of the 16th Biennial Conference of the Australian Rangeland Society* (pp. 7). Bourke: Australian Rangeland Society.
- Compton, E., & Beeton, R. J. S. (2012). An accidental outcome: Social capital and its implications for Landcare and the “status quo”. *Journal of Rural Studies*, 28(2), 149-160.
- Compton, E., Shepherd, R., & Moss, J. (2010). Ecological and social resilience in Western NSW: Insight from seven years of enterprise based conservation. In D. J. Eldridge & C. Waters (Eds.), *Proceedings of the 16th Biennial Conference of the Australian Rangeland Society* (pp. 7). Bourke: Australian Rangelands Society.
- Conacher, A. (2009). Land degradation: A global perspective. *New Zealand Geographer*, 65(2), 91-94.
- Connor, L. H., & Higginbotham, N. (2013). “Natural cycles” in lay understandings of climate change. *Global Environmental Change*, 23(6), 1852-1861.
- Cooke, B. (2013). Rabbits: Manageable environmental pests or participants in new Australian ecosystems? *Wildlife Research*, 39(4), 279.
- Cooke, B. (2015). Effects of pastoralism and rabbits on the economy and culture of the Diyari people of north-eastern South Australia. *Australian Economic History Review*, n/a-n/a.
- Cooke, P. R., & Hemmings, B. C. (2016). Policy change and its effect on Australian community-based natural resource management practices. *Journal of Education for Sustainable Development*, 10(1), 20-37.
- Corbera, E. (2012). Problematizing REDD+ as an experiment in payments for ecosystem services. *Current Opinion in Environmental Sustainability*, 4(6), 612-619.
- Cowie, A. L., Penman, T. D., Gorissen, L., Winslow, M. D., Lehmann, J., Tyrrell, T. D., Twomlow, S., Wilkes, A., Lal, R., Jones, J. W., Paulsch, A., Kellner, K., & Akhtar-Schuster, M. (2011). Towards sustainable land management in the drylands: Scientific connections in monitoring and assessing dryland degradation, climate change and biodiversity. *Land Degradation & Development*, 22(2), 248-260.
- Curtis, A., Byron, I., & McDonald, S. (2003). Integrating spatially referenced social and biophysical data to explore landholder responses to dryland salinity in Australia. *Journal of Environmental Management*, 68(4), 397-407.
- Curtis, A., Ross, H., Marshall, G. R., Baldwin, C., Cavaye, J., Freeman, C., Carr, A., & Syme, G. J. (2014). The great experiment with devolved NRM governance: Lessons from community engagement in Australia and New Zealand since the 1980s. *Australasian Journal of Environmental Management*, 21(2), 175-199.
- Davies, C. L., Waugh, D. L., & Lefroy, E. C. (2005). Perennial grain crops for high water use. *RIRDC Publication No 05/024*. Barton, ACT: Rural Industries Research and Development Corporation.
- Davis, D. K. (2005). Indigenous knowledge and the desertification debate: Problematising expert knowledge in North Africa. *Geoforum*, 36(4), 509-524.
- Davis, D. K. (2016). Deserts and drylands before the age of desertification. In R. Behnke & M. Mortimore (Eds.), *The End of Desertification? Disputing Environmental Change in the Drylands* (pp. 203-223). Berlin, Heidelberg: Springer.
- Dinham, B., & Malik, S. (2003). Pesticides and human rights. *International Journal of Occupational and Environmental Health*, 9(1), 40-52.
- Donnelly, D., Mercer, R., Dickson, J., & Wu, E. (2009). Australia’s farming future final market research report: Understanding behaviours, attitudes and preferences relating to climate change. Sydney: Instinct and Reason. Prepared for Australian Government Department of Agriculture, Fisheries and Forestry.
- Dryzek, J. S. (2013). *The politics of the Earth: Environmental discourses* (3rd ed.). Oxford, United Kingdom: Oxford University Press.
- Dumbrell, N. P., Kragt, M. E., & Gibson, F. L. (2016). What carbon farming activities are farmers likely to adopt? A best-worst scaling survey. *Land Use Policy*, 54, 29-37.

- Easdale, M. H., & Domptail, S. E. (2014). Fate can be changed! Arid rangelands in a globalizing world – A complementary co-evolutionary perspective on the current ‘desert syndrome’. *Journal of Arid Environments*, 100-101, 52-62.
- ELD Initiative. (2013). The rewards of investing in sustainable land management. *Interim Report for the Economics of Land Degradation Initiative: A global strategy for sustainable land management*. Retrieved from <http://inweh.unu.edu/wp-content/uploads/2013/10/ELD-Interim-Report-Web-Version4.pdf> [<https://perma.cc/F53F-YRKC>]
- Eldridge, D. J., Bowker, M. A., Maestre, F. T., Roger, E., Reynolds, J. F., & Whitford, W. G. (2011). Impacts of shrub encroachment on ecosystem structure and functioning: Towards a global synthesis. *Ecology Letters*, 14(7), 709-722.
- Eldridge, D. J., & Soliveres, S. (2014). Are shrubs really a sign of declining ecosystem function? Disentangling the myths and truths of woody encroachment in Australia. *Australian Journal of Botany*, 62(7), 594.
- Engel-Di Mauro, S. (2009). Seeing the local in the global: Political ecologies, world-systems, and the question of scale. *Geoforum*, 40(1), 116-125.
- Escadafal, R., Marques, M. J., Stringer, L. C., & Akhtar-Schuster, M. (2015). Opening the door to policy relevant, interdisciplinary research on land degradation and development. *Land Degradation & Development*, 26(5), 409-412.
- Espinosa, C. (2014). The advocacy of the previously inconceivable: A discourse analysis of the Universal Declaration of the Rights of Mother Earth at Rio+20. *The Journal of Environment & Development*, 23(4), 391-416.
- Fairhead, J., Leach, M., & Scoones, I. (2012). Green grabbing: A new appropriation of nature? *Journal of Peasant Studies*, 39(2), 237-261.
- Fanning, P. (1994). Long-term contemporary erosion rates in an arid rangelands environment in western New South Wales, Australia. *Journal of Arid Environments*, 28, 173-187.
- Fanning, P. (1999). Recent landscape history in arid western New South Wales: A model for regional change. *Geomorphology*, 29, 191-209.
- FAO. (2015). Global guidelines for the restoration of degraded forests and landscapes in drylands: Building resilience and benefiting livelihoods. By Berrahmouni, N., Regato, P. & Parfondry, M. *Forestry Paper No. 175*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from <http://www.fao.org/3/a-i5036e.pdf> [<https://perma.cc/8GZK-GD8A>]
- Flekens, L., & Stringer, L. C. (2014). Land management and policy responses to mitigate desertification and land degradation. *Land Degradation & Development*, 25, 1-4.
- Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change*, 16(3), 253-267.
- Forsyth, H. (2016). The Barkindji people are losing their ‘mother’, the drying Darling River. *The Conversation*. Retrieved from <http://theconversation.com/the-barkindji-people-are-losing-their-mother-the-drying-darling-river-57884> [<https://perma.cc/Z4NK-TD2R>]
- Fortin, C., & Jolly, R. (2015). The United Nations and business: Towards new modes of global governance? *Institute of Development Studies Bulletin*, 46(3), 45-58.
- Gammage, B. (2011). *The biggest estate on Earth*. Sydney: Allen & Unwin.
- Gardner, T. A., Von Hase, A., Brownlie, S., Ekstrom, J. M., Pilgrim, J. D., Savy, C. E., Stephens, R. T., Treweek, J., Ussher, G. T., Ward, G., & Ten Kate, K. (2013). Biodiversity offsets and the challenge of achieving no net loss. *Conservation Biology*, 27(6), 1254-1264.
- Geeson, N., Quaranta, G., Salvia, R., & Brandt, J. (2015). Long-term involvement of stakeholders in research projects on desertification and land degradation: How has their perception of the issues changed and what strategies have emerged for combating desertification? *Journal of Arid Environments*, 114, 124-133.
- Gepp, K. (2012). What will climate change really mean to graziers in the Western Catchment of NSW. *Proceedings of the Australian Rangeland Society Biennial Conference* (pp. 8). Australia: Australian Rangeland Society.

- GGWSSI. (undated). The Great Green Wall for the Sahara and the Sahel Initiative. Retrieved from <http://www.greatgreenwallinitiative.org/sites/default/files/publications/Great%20Green%20Wall%20Brochure.pdf> [<https://perma.cc/E52J-ESDV>]
- Gibbons, P., & Lindenmayer, D. B. (2007). Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management & Restoration*, 8(1), 26-31.
- Gibbs, H. K., & Salmon, J. M. (2015). Mapping the world's degraded lands. *Applied Geography*, 57, 12-21.
- Giger, M., Liniger, H., Sauter, C., & Schwilch, G. (2015). Economic benefits and costs of sustainable land management technologies: An analysis of WOCAT's global data. *Land Degradation & Development*, n/a-n/a.
- Gill, N. (2014). Making country good: Stewardship and environmental change in central Australian pastoral culture. *Transactions of the Institute of British Geographers*, 39(2), 265-277.
- Gisladottir, G., & Stocking, M. (2005). Land degradation control and its global environmental benefits. *Land Degradation & Development*, 16(2), 99-112.
- Global Mechanism. (2015). White paper: Land Degradation Neutrality (LDN) fund. The Global Mechanism of the United Nations Convention to Combat Desertification. (pp. 8). London: Global Landscapes Forum. Retrieved from <http://www.landscapes.org/publication/land-degradation-neutrality/> [accessed 1 September 2015]
- Global Mechanism, & Mirova. (2015). Land Degradation Neutrality fund: An innovative investment fund project. Bonn, Germany: Global Mechanism of the United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_ldn_fund_brochure_eng.pdf [<https://perma.cc/3GGX-EFZB>]
- Gnacadjia, L. (2012). Moving to zero-net rate of land degradation [Press release]. Retrieved from <http://www.unccd.int/Lists/SiteDocumentLibrary/secretariat/2012/UNCCD%20ES%20Statement%20at%20PR%20in%20NY%20on%2026%20March%202012.pdf> [<https://perma.cc/48N4-WCS5>]
- Gnacadjia, L. (2015). New challenges in science and policies to combat desertification. *Journal of Arid Environments*, 112, 1-4.
- Gonçalves, B., Marques, A., Soares, A. M. V. D. M., & Pereira, H. M. (2015). Biodiversity offsets: From current challenges to harmonized metrics. *Current Opinion in Environmental Sustainability*, 14, 61-67.
- Goodall, H. (2001). Renewing country: Aboriginal people and their lands in rangeland environments. *The Rangeland Journal*, 23(1), 99-115.
- Grainger, A. (2009). The role of science in implementing international environmental agreements: The case of desertification. *Land Degradation & Development*, 20(4), 410-430.
- Grainger, A. (2015). Is Land Degradation Neutrality feasible in dry areas? *Journal of Arid Environments*, 112, 14-24.
- Grainger, A., Stafford Smith, D. M., Squires, V. R., & Glenn, E. P. (2000). Desertification and climate change: The case for greater convergence. *Mitigation and Adaptation Strategies for Global Change*, 5, 361-377.
- Green, D. R. (1989). Rangeland restoration projects in New South Wales. *Australian Rangelands Journal*, 11(2), 110-116.
- Greiner, R., & Gregg, D. (2011). Farmers' intrinsic motivations, barriers to the adoption of conservation practices and effectiveness of policy instruments: Empirical evidence from northern Australia. *Land Use Policy*, 28(1), 257-265.
- Griffith Taylor, T. (1947). *Australia: A study of warm environments and their effect on British settlement*. London: Methuen & Co Ltd.
- Groupe Travail Desertification. (2015). A land degradation neutral world? Some insights from civil society. Retrieved from http://gtdesertification.org/IMG/pdf/Land_Degradation_Neutrality_-_GTD_ReSaD-EN-COP12.pdf [<http://perma.cc/WN8R-Q446>]

- Guerin, T. F. (2000). Overcoming the constraints to the adoption of sustainable land management practices in Australia. *Technological Forecasting and Social Change*, 65, 205-237.
- Guest, G., Namey, E. E., & Mitchell, M. L. (2013). *Collecting qualitative data: A field manual for applied research*. Thousand Oaks, California: Sage Publications.
- Hajer, M. A. (1995). *The politics of environmental discourse: Ecological modernization and the policy process*. New York: Oxford University Press.
- Hall, R. (2008). *Applied social research: Planning, designing and conducting real-world research*. South Yarra, Victoria: Palgrave Macmillan.
- Hamblin, A. (2009). Policy directions for agricultural land use in Australia and other post-industrial economies. *Land Use Policy*, 26(4), 1195-1204.
- Harder, M. K., Velasco, I., Burford, G., Podger, D., Janouskova, S., Piggot, G., & Hoover, E. (2014). Reconceptualizing 'effectiveness' in environmental projects: Can we measure values-related achievements? *Journal of Environmental Management*, 139, 120-134.
- Harding, R., Hendriks, C. M., & Faruqi, M. (2009). *Environmental decision-making: Exploring complexity and context*. Sydney: The Federation Press.
- Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies*, 17(1), 13-26.
- Herrick, J. E., Sala, O. E., & Karl, J. W. (2013). Land degradation and climate change: A sin of omission? *Frontiers in Ecology and the Environment*, 11(6), 283.
- Herrmann, S. M., & Hutchinson, C. F. (2005). The changing contexts of the desertification debate. *Journal of Arid Environments*, 63(3), 538-555.
- Herrmann, S. M., & Hutchinson, C. F. (2006). The scientific basis: Links between land degradation, drought, and desertification. In P. M. Johnson, K. Mayrand, & M. Paquin (Eds.), *Governing Global Desertification: Linking Environmental Degradation, Poverty and Participation* (pp. 11-26). Aldershot: Ashgate.
- Hillman, M., & Instone, L. (2010). Legislating nature for biodiversity offsets in New South Wales, Australia. *Social & Cultural Geography*, 11(5), 411-431.
- Ho, M., Kiem, A. S., & Verdon-Kidd, D. C. (2015). A paleoclimate rainfall reconstruction in the Murray-Darling Basin (MDB), Australia: 1. Evaluation of different paleoclimate archives, rainfall networks, and reconstruction techniques. *Water Resources Research*, 51(10), 8362-8379.
- Hobbs, R. J. (2016). Degraded or just different? Perceptions and value judgements in restoration decisions. *Restoration Ecology*, 24(2), 153-158.
- Holl, K. D., & Aide, T. M. (2011). When and where to actively restore ecosystems? *Forest Ecology and Management*, 261(10), 1558-1563.
- Hughes, L., Rickards, L., Steffen, W., Stock, P., & Rice, M. (2016). On the frontline: Climate change and rural communities (pp. 96). Climate Council of Australia Ltd.
- IISD. (2013). Summary of the eleventh session of the Conference of the Parties to the UN Convention to Combat Desertification: 16-27 September 2013. *Earth Negotiations Bulletin Vol. 4 No. 254*: International Institute for Sustainable Development. Retrieved from <http://www.iisd.ca/download/pdf/enb04254e.pdf> [<https://perma.cc/CW8E-KYEQ>]
- Ingalls, M. L., & Stedman, R. C. (2016). The power problematic: Exploring the uncertain terrains of political ecology and the resilience framework. *Ecology and Society*, 21(1), 11 [online].
- IPCC. (2014). Climate change 2014 synthesis report: Summary for policymakers (pp. 31). Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf [<https://perma.cc/EBX5-CL63>]
- IRIN. (2011). Opposition building to Great Green Wall. Nairobi. Retrieved from <http://www.irinnews.org/feature/2011/04/08/opposition-building-great-green-wall> [<https://perma.cc/T349-AZDY>]
- IUCN. (2015). Land Degradation Neutrality: Implications and opportunities for conservation. *Technical Brief 2nd Edition, November 2015* (pp. 19). Nairobi: IUCN. Retrieved from https://www.iucn.org/sites/dev/files/content/documents/tech_brief_land_degradation_neutrality_ver_2016-1.pdf [<https://perma.cc/5BRR-L8QZ>]

- Ivanova, M., Gordon, D., & Roy, J. (2007). Towards institutional symbiosis: Business and the United Nations in environmental governance. *Review of European Community & International Environmental Law*, 16(2), 123-134.
- Jenkins, K. M., Boulton, A. J., & Ryder, D. S. (2005). A common parched future? Research and management of Australian arid-zone floodplain wetlands. *Hydrobiologia*, 552(1), 57-73.
- Jiang, H. (2016). Taking down the "Great Green Wall": The science and policy discourse of desertification and its control in China. In R. Behnke & M. Mortimore (Eds.), *The End of Desertification? Disputing Environmental Change in the Drylands* (pp. 513-536). Berlin, Heidelberg: Springer.
- Jones, S. (1996). Discourses on land degradation in the Uluguru Mountains, Tanzania: Evolution and influences. *Journal of Rural Studies*, 12(2), 187-199.
- Jones, S. (2008). Political ecology and land degradation: How does the land lie 21 years after Blaikie and Brookfield's Land Degradation and Society? *Geography Compass*, 2(3), 671-694.
- Jordan, W. R. (2003). *The sunflower forest: Ecological restoration and the new communion with nature*. Berkeley: University of California Press.
- Jordan, W. R., & Lubick, G. M. (2011). *Making nature whole: A history of ecological restoration*. Washington, DC: Island Press.
- Ketabi, N. (2009). The blood of going green: Using environmental initiatives to account for the human rights violations of the green movement. *Fordham International Law Journal*, 32, 1911-1946.
- Khairo, S. A., Hacker, R. B., Atkinson, T. L., & Turnbull, G. L. (2013). Alternative strategies for management of feral goats: Implications for natural resource management policies in New South Wales rangelands. *The Rangeland Journal*, 35(2), 201.
- Kimball, N., & Chuk, M. (2011). Feral goat ecology and management in the Western NSW rangelands: A review (pp. 82): Western Catchment Management Authority.
- Kingsford, R. T. (2000). Protecting rivers in arid regions or pumping them dry? *Hydrobiologia*, 427, 1-11.
- Kolawole, O. D. (2013). Soils, science and the politics of knowledge: How African smallholder farmers are framed and situated in the global debates on integrated soil fertility management. *Land Use Policy*, 30(1), 470-484.
- Kong, T. M., Austin, D. E., Kellner, K., & Orr, B. J. (2014). The interplay of knowledge, attitude and practice of livestock farmers' land management against desertification in the South African Kalahari. *Journal of Arid Environments*, 105, 12-21.
- Koning, N., & Smaling, E. (2005). Environmental crisis or 'lie of the land'? The debate on soil degradation in Africa. *Land Use Policy*, 22(1), 3-11.
- Kotiaho, J. S., ten Brink, B., & Harris, J. (2016). A global baseline for ecosystem recovery. *Nature*, 532, 37.
- Kuehne, G. (2014). How do farmers' climate change beliefs affect adaptation to climate change? *Society & Natural Resources*, 27(5), 492-506.
- LaFlamme, M. (2011). A framework for sustainable rangeland livelihoods. *The Rangeland Journal*, 33(4), 339.
- Lakoff, G. (2010). Why it matters how we frame the environment. *Environmental Communication*, 4(1), 70-81.
- Lal, R., & Stewart, B. A. (1990). *Advances in soil science – Soil degradation* (Vol. 11). New York: Springer-Verlag.
- Lanckriet, S., Derudder, B., Naudts, J., Bauer, H., Deckers, J., Haile, M., & Nyssen, J. (2015). A political ecology perspective of land degradation in the north Ethiopian Highlands. *Land Degradation & Development*, 26(5), 521-530.
- Larson, A. M., Brockhaus, M., Sunderlin, W. D., Duchelle, A., Babon, A., Dokken, T., Pham, T. T., Resosudarmo, I. A. P., Selaya, G., Awono, A., & Huynh, T.-B. (2013). Land tenure and REDD+: The good, the bad and the ugly. *Global Environmental Change*, 23(3), 678-689.

- Lebrecht, T., & Meienberg, F. (2014). More growth than good: A closer look at Syngenta's Good Growth Plan: The Berne Declaration. Retrieved from https://www.publiceye.ch/fileadmin/files/documents/Syngenta/2014-09-18_PF-BD-Syngenta-good-growth-plan_report-EN.pdf [<https://perma.cc/WQ2R-F7CP>]
- Leys, J. F., Heidenreich, S. K., Strong, C. L., McTainsh, G. H., & Quigley, S. (2011). PM10 concentrations and mass transport during “Red Dawn” – Sydney 23 September 2009. *Aeolian Research*, 3(3), 327-342.
- Liniger, H., & Critchley, W. (Eds.). (2007). *Where the grass is greener: Case studies and analysis of soil and water conservation initiatives worldwide*. Bern, Switzerland: World Overview of Conservation Approaches and Technologies (WOCAT).
- Liniger, H., Mekdaschi Studer, R., Hauert, C., & Gurtner, M. (2011). Sustainable land management in practice: Guidelines and best practices for Sub-Saharan Africa. TerrAfrica, World Overview of Conservation Approaches and Technologies (WOCAT) and Food and Agriculture Organization of the United Nations (FAO).
- Ludwig, J. A., & Tongway, D. G. (1995). Desertification in Australia: An eye to grass roots and landscapes. *Environmental Monitoring and Assessment*, 37(231-237).
- Lukas, M. C. (2014). Eroding battlefields: Land degradation in Java reconsidered. *Geoforum*, 56, 87-100.
- Lunt, I. D., Allan, C., Spooner, P. G., Thwaites, R., & Morgan, J. (2010). Managing regrowth in Australia's changing rural landscape: A social phenomenon. *Australasian Plant Conservation*, 19(1), 5-6.
- MA. (2005). *Ecosystems and human well-being: Current status and trends – Dryland systems*. Millennium Ecosystem Assessment. Washington, DC: Island Press.
- Macdonald, B. C. T., & Melville, M. D. (1999). The impact of contour furrowing on chenopod patterned ground at Fowlers Gap, western New South Wales. *Journal of Arid Environments*, 41, 345-357.
- Maestre, F. T., Bowker, M. A., Puche, M. D., Belen Hinojosa, M., Martinez, I., Garcia-Palacios, P., Castillo, A. P., Soliveres, S., Luzuriaga, A. L., Sanchez, A. M., Carreira, J. A., Gallardo, A., & Escudero, A. (2009). Shrub encroachment can reverse desertification in semi-arid Mediterranean grasslands. *Ecology Letters*, 12(9), 930-941.
- Maillard, S., & Cheung, R. (2016). Unlocking the market for Land Degradation Neutrality (pp. 44): Mirova Retrieved from http://www.innpact.com/dbfiles/lacentrale_files/200/280/MIROVASTUDYUnlocking-the-Market-for-LDNEN.pdf [<https://perma.cc/DUZ5-WGFZ>]
- Maron, M., Hobbs, R. J., Moilanen, A., Matthews, J. W., Christie, K., Gardner, T. A., Keith, D. A., Lindenmayer, D. B., & McAlpine, C. A. (2012). Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biological Conservation*, 155, 141-148.
- Marx, S. K., McGowan, H. A., Kamber, B. S., Knight, J. M., Denholm, J., & Zawadzki, A. (2014). Unprecedented wind erosion and perturbation of surface geochemistry marks the Anthropocene in Australia. *Journal of Geophysical Research: Earth Surface*, 119(1), 45-61.
- Mason, J. (2002). *Qualitative researching*. London: Sage Publications.
- Mazur, N., Curtis, A., & Rogers, M. (2013). Do you see what I see? Rural landholders' belief in climate change. *Society & Natural Resources*, 26(1), 75-85.
- McAfee, K. (2012). Nature in the market-world: Ecosystem services and inequality. *Development*, 55(1), 25-33.
- McMichael, P. (2012). The land grab and corporate food regime restructuring. *Journal of Peasant Studies*, 39(3-4), 681-701.
- Measham, T. G., Brake, L., Robinson, C. J., Larson, S., Richards, C., & Smith, T. F. (2011). NRM engagement between remote dryland communities and government agencies: Success factors from Australia. *Journal of Arid Environments*, 75(10), 968-973.
- Menz, M. H. M., Dixon, K. W., & Hobbs, R. (2013). Hurdles and opportunities for landscape-scale restoration. *Science*, 339(6119), 526-527.

- Mercer, D., Christesen, L., & Buxton, M. (2007). Squandering the future – Climate change, policy failure and the water crisis in Australia. *Futures*, 39(2-3), 272-287.
- Messer, J. (1987). The sociology and politics of land degradation in Australia. In P. M. Blaikie & H. C. Brookfield (Eds.), *Land Degradation and Society* (pp. 232-238). London: Methuen & Co Ltd.
- Mirova, & Global Mechanism. (2016). White paper: Land Degradation Neutrality fund project. Mirova and the Global Mechanism of the United Nations Convention to Combat Desertification. (pp. 9). London: Global Landscapes Forum. Retrieved from <http://www.landscapes.org/wp-content/uploads/docs/London-white-papers/London-2016-WhitePaper-Land-Degradation.pdf> [https://perma.cc/6XVW-Q9Y9]
- Muir, C., Rose, D., & Sullivan, P. (2010). From the other side of the knowledge frontier: Indigenous knowledge, social-ecological relationships and new perspectives. *The Rangeland Journal*, 32(3), 259.
- Murray Darling Basin Authority. (2015). River Murray weekly report for the week ending Wednesday, 21st October 2015 (pp. 6): Murray Darling Basin Authority. Retrieved from <http://www.mdba.gov.au/sites/default/files/weeklyreports/River-Murray-Operations-Weekly-Report-21-October-2015.pdf> [https://perma.cc/6S26-6CEG]
- Nalepa, R. A., & Bauer, D. M. (2012). Marginal lands: The role of remote sensing in constructing landscapes for agrofuel development. *Journal of Peasant Studies*, 39(2), 403-422.
- Namibia Press Agency. (2013). Earthlife rejects Syngenta's involvement in Soil Leadership Acad. Retrieved from <http://www.lalamobile.com/content/6382/Earthlife-rejects-Syngenta-s-involvement-in-Soil-Leadership-Acad> [https://perma.cc/UQD7-BLV3]
- Nelson, D. R., Adger, W. N., & Brown, K. (2007). Adaptation to environmental change: Contributions of a resilience framework. *Annual Review of Environment and Resources*, 32(1), 395-419.
- Nelson, R., Kokic, P., Crimp, S., Martin, P., Meinke, H., Howden, S. M., de Voil, P., & Nidumolu, U. (2010). The vulnerability of Australian rural communities to climate variability and change: Part II – Integrating impacts with adaptive capacity. *Environmental Science & Policy*, 13(1), 18-27.
- Ngo, H. (2015). IPBES land degradation and restoration assessment: Deliverable 3bi. Presentation at the 12th session of the Committee on Science and Technology: Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services. Retrieved from http://www.unccd.int/en/about-the-convention/the-bodies/The-CST/Documents/CST12-presentations/Item5a_IPBES-LDRA_PPT%20by%20Hien%20Ngo.pdf [https://perma.cc/VN5M-NN6C]
- Nkonya, E., & Anderson, W. (2015). Exploiting provisions of land economic productivity without degrading its natural capital. *Journal of Arid Environments*, 112, 33-43.
- Nkonya, E., Gerber, N., Baumgartner, P., von Braun, J., De Pinto, A., Graw, V., Kato, E., Kloos, J., & Walter, T. (2011a). The economics of desertification, land degradation, and drought: Toward an integrated global assessment. *ZEF – Discussion Papers on Development Policy No. 150* (pp. 184). Bonn, Germany: Center for Development Research.
- Nkonya, E., Winslow, M., Reed, M. S., Mortimore, M., & Mirzabaev, A. (2011b). Monitoring and assessing the influence of social, economic and policy factors on sustainable land management in drylands. *Land Degradation & Development*, 22(2), 240-247.
- Noble, J. C. (1997). *The delicate and noxious scrub: CSIRO studies on native tree and shrub proliferation in the semi-arid woodlands of eastern Australia*. Lyneham, ACT: CSIRO, Division of Wildlife and Ecology.
- Nogueira, D. M., Gardiner, C. P., Gummow, B., Cavalieri, J., Fitzpatrick, L. A., & Parker, A. J. (2016). A survey of the meat goat industry in Queensland and New South Wales. 1. General property information, goat and pasture management. *Animal Production Science*, 56, 1520-1532.

- NSW DPI. (2015). Land rights in the Western Division: New South Wales Department of Primary Industries. Retrieved from http://www.crownland.nsw.gov.au/_data/assets/pdf_file/0004/650605/Land_Rights_in_the_Western_Division.pdf [https://perma.cc/VN5M-NN6C]
- NSW DPI. (2016). Pipeline to secure Broken Hill's water (pp. 2): State of New South Wales through the Department of Industry, Skills and Regional Development. Retrieved from http://www.water.nsw.gov.au/_data/assets/pdf_file/0006/660282/pipeline-to-secure-broken-hills-water.pdf [https://perma.cc/L22Z-HCEP]
- NSW EPA. (2012). NSW state of the environment: Land. New South Wales Environment Protection Authority. Retrieved from <http://www.epa.nsw.gov.au/soe/soe2012/pdf/1284Soe2012Land.pdf> [https://perma.cc/E927-R7WP]
- NSW EPA. (2015). NSW state of the environment. New South Wales Environment Protection Authority. Retrieved from <http://www.epa.nsw.gov.au/resources/soe/20150817soe-2015.pdf> [https://perma.cc/V43X-SH4H]
- NSW Government. (2006). Identifying key invasive native scrub species. Retrieved from http://archive.ils.nsw.gov.au/_data/assets/pdf_file/0006/496716/archive-managing-invasive-native-scrub-to-rehabilitate-native-pastures-and-open-species.pdf [https://perma.cc/R542-VVMC]
- NSW OEH. (2013). Who cares about the environment in 2012? A survey of NSW people's environmental knowledge, attitudes and behaviours. Sydney: State of New South Wales and Office of Environment and Heritage.
- NSW OEH. (2014a). Far west climate change snapshot (pp. 16). State of New South Wales and Office of Environment and Heritage. Retrieved from <http://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/Far-West-Climate-Change-Downloads> [https://perma.cc/3UAP-6626]
- NSW OEH. (2014b). NSW biodiversity offsets policy for major projects (pp. 33). State of New South Wales and Office of Environment and Heritage. Retrieved from <http://www.environment.nsw.gov.au/resources/biodiversity/140672biopolicy.pdf> [https://perma.cc/K5CR-DF2J]
- NSW OEH. (2016). Broken Hill complex – Biodiversity. New South Wales Office of Environment and Heritage. Retrieved from <http://www.environment.nsw.gov.au/bioregions/BrokenHillComplex-Biodiversity.htm> [accessed 1 September 2016]
- O'Connell, D., Walker, B., Abel, N., & Grigg, N. (2015). The resilience, adaptation and transformation assessment framework: From theory to application. Australia: CSIRO.
- O'Connor, J. (2016). Australian goat industry summary 2016 (pp. 14). Sydney: Meat & Livestock Australia Pty Ltd
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325, 419-422.
- Pascoe, B. (2014). *Dark emu: Black seeds agriculture or accident?* Broome, Western Australia: Magabala Books.
- Pasgaard, M., Sun, Z., Müller, D., & Mertz, O. (2016). Challenges and opportunities for REDD+: A reality check from perspectives of effectiveness, efficiency and equity. *Environmental Science & Policy*, 63, 161-169.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, California: Sage Publications.
- Peet, R., & Watts, M. (2002). *Liberation ecologies: Environment, development and social movements*. London: Routledge.
- Pick, J. H. (1942). *Australia's dying heart: Soil erosion in the inland*. Melbourne: Melbourne University Press.

- Pingeot, L. (2015). In whose interest? The UN's strategic rapprochement with business in the sustainable development agenda. *Globalizations*, 13(2), 188-202.
- Pople, T., & Froese, J. (2012). Distribution, abundance and harvesting of feral goats in the Australian rangelands, 1984-2011. Final report to the ACRIS Management Committee. (pp. 59). Brisbane: Queensland Department of Employment, Economic Development and Innovation.
- Power, J. (2015). Broken Hill: Why is Australia's heritage city running out of water? *The Sydney Morning Herald*. Retrieved from <http://www.smh.com.au/nsw/broken-hill--why-is-australias-heritage-city-running-out-of-water-20151119-gl37m9.html> [accessed 2 February 2016]
- Price, J. C., & Leviston, Z. (2014). Predicting pro-environmental agricultural practices: The social, psychological and contextual influences on land management. *Journal of Rural Studies*, 34, 65-78.
- Prince, S. D. (2016). Where does desertification occur? Mapping dryland degradation at regional to global scales. In R. Behnke & M. Mortimore (Eds.), *The End of Desertification? Disputing Environmental Change in the Drylands* (pp. 255-264). Berlin, Heidelberg: Springer.
- Quatrini, S., Barkemeyer, R., & Stringer, L. C. (2016). Involving the mining sector in achieving Land Degradation Neutrality. *The Solutions Journal*, 7(5), 55-63.
- Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141(10), 2417-2431.
- Reed, M. S., Dougill, A. J., & Taylor, M. J. (2007). Integrating local and scientific knowledge for adaptation to land degradation: Kalahari rangeland management options. *Land Degradation & Development*, 18(3), 249-268.
- Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C. H., & Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933-1949.
- Reed, M. S., & Stringer, L. C. (2015). Climate change and desertification: Anticipating, assessing and adapting to future change in drylands. *Impulse Report for the 3rd UNCCD Scientific Conference*. Cancún, Mexico. Retrieved from http://www.unccd.int/en/programmes/Science/Conferences/Documents/3sc_unccd_impulse-report.pdf [https://perma.cc/WFM8-JJXX]
- Reed, M. S., Stringer, L. C., Dougill, A. J., Perkins, J. S., Athlopheng, J. R., Mulale, K., & Favretto, N. (2015). Reorienting land degradation towards sustainable land management: Linking sustainable livelihoods with ecosystem services in rangeland systems. *Journal of Environmental Management*, 151, 472-485.
- Reenberg, A. (2012). Insistent dryland narratives: Portraits of knowledge about human-environmental interactions in Sahelian environmental policy documents. *West African Journal of Applied Ecology*, 20(1), 97-111.
- Reeve, I. J., & Black, A. W. (1994). Understanding farmers' attitudes to land degradation: Some methodological considerations. *Land Degradation and Rehabilitation*, 5, 179-189.
- Retière, A., Sommer, S., Minelli, S., Byron-Cox, R., & Candelori, M. (2015). Land Degradation Neutrality: From concept to practice. Using the UNCCD indicator framework to set LDN national voluntary targets and monitor their achievement: Methodological note (pp. 14). Bonn, Germany: LDN Project Management Team.
- Reynolds, J. F., Grainger, A., Stafford Smith, D. M., Bastin, G., Garcia-Barrios, L., Fernández, R. J., Janssen, M. A., Jürgens, N., Scholes, R. J., Veldkamp, A., Verstraete, M. M., Von Maltitz, G., & Zdruli, P. (2011). Scientific concepts for an integrated analysis of desertification. *Land Degradation & Development*, 22(2), 166-183.
- Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P. J., Downing, T. E., Dowlatabadi, H., Fernández, R. J., Herrick, J. E., Huber-Sannwald, E., Jiang, H., Leemans, R., Lynam, T., Maestre, F. T., Ayarza, M., & Walker, B. (2007). Global desertification: Building a science for dryland development. *Science*, 316(5826), 847-851.

- Richter, J. (2003). 'We the peoples' or 'we the corporations'? Critical reflections on UN-business partnerships. Lancashire, United Kingdom: Geneva Infant Feeding Association and International Baby Food Action Network. Retrieved from <http://www.ibfan.org/art/538-3.pdf> [<https://perma.cc/UP7E-3PLD>]
- Robertson, A. I., & Roshier, D. A. (1999). Scientific and social impediments to restoration ecology as applied to rural landscapes. In A. I. Robertson & R. Watts (Eds.), *Preserving Rural Australia: Issues and Solutions*. Collingwood, Victoria: CSIRO Publishing.
- Robertson, M. M. (2000). No net loss: Wetland restoration and the incomplete capitalization of nature. *Antipode*, 32(4), 463-493.
- Rose, D. B. (2004). *Reports from a wild country: Ethics for decolonisation*. Sydney: The University of New South Wales Press.
- Safriel, U. N. (2007). The assessment of global trends in land degradation. In M. K. Sivakumar & N. Ndiang'ui (Eds.), *Climate and Land Degradation* (pp. 1-38). Berlin, Heidelberg: Springer.
- Saltzman, K., Head, L., & Stenseke, M. (2011). Do cows belong in nature? The cultural basis of agriculture in Sweden and Australia. *Journal of Rural Studies*, 27(1), 54-62.
- Salvati, L., & Carlucci, M. (2014). Zero Net Land Degradation in Italy: The role of socioeconomic and agro-forest factors. *Journal of Environmental Management*, 145, 299-306.
- Scherr, S. J. (1999). Soil degradation: A threat to developing-country food security by 2020? *Food, Agriculture, and the Environment Discussion Paper 27* (pp. 70): International Food Policy Research Institute.
- Scherr, S. J. (2000). A downward spiral? Research evidence on the relationship between poverty and natural resource degradation. *Food Policy*, 25, 479-498.
- Schirmer, J., Berry, H. L., & O'Brien, L. V. (2013). Healthier land, healthier farmers: Considering the potential of natural resource management as a place-focused farmer health intervention. *Health Place*, 24, 97-109.
- Sharp, E. A., Spooner, P. G., Millar, J., & Briggs, S. V. (2012). Can't see the grass for the trees? Community values and perceptions of tree and shrub encroachment in south-eastern Australia. *Landscape and Urban Planning*, 104(2), 260-269.
- Sherren, K., Fischer, J., & Fazey, I. (2012). Managing the grazing landscape: Insights for agricultural adaptation from a mid-drought photo-elicitation study in the Australian sheep-wheat belt. *Agricultural Systems*, 106(1), 72-83.
- Silcock, J. L. (2014). *Degraded or just dusty? 150 years of ecological change in inland eastern Australia*. (Doctor of Philosophy), The University of Queensland.
- Simm, G., & Byrnes, A. (2013). International peoples' tribunals in Asia: Political theatre, juridical farce, or meaningful intervention? *Asian Journal of International Law*, 4(01), 103-124.
- Smiles, B., Merchant, C., & Proft, K. (2011). The NSW travelling stock routes and reserves network (pp. 44): National Parks Association of NSW.
- Smith, J. (2015). Towards achieving Land Degradation Neutrality: Turning the concept into practice. Project evaluation: Final report (pp. 16). Commissioned by the UNCCD Evaluation Office: United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/Lists/SiteDocumentLibrary/secretariat/LDN%20project%20evaluation%20report.pdf> [<https://perma.cc/MD3R-A5ZT>]
- Social Watch. (2013). High level panel proposes to the UN to put mega business, not people, at the center of development. Retrieved from <https://www.globalpolicy.org/component/content/article/252-the-millennium-development-goals/52411-high-level-panel-proposes-to-the-un-to-put-mega-business-not-people-at-the-center-of-development.html> [<https://perma.cc/ADQ6-FQNR>]
- Soil Leadership Academy. (2015). Are you ready to go land degradation neutral? Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/en/Stakeholders/private_sector/Documents/Soil%20Leadership%20Academy%20Brochure.pdf [<https://perma.cc/6D5S-FTDX>]

- Spiegel, N. B., & Wynn, P. C. (2014). Promoting kangaroo as a sustainable option for meat production on the rangelands of Australia. *Animal Frontiers*, 4(4), 38-45.
- Stafford Smith, D. M. (2016). Desertification: Reflections on the mirage In R. Behnke & M. Mortimore (Eds.), *The End of Desertification? Disputing Environmental Change in the Drylands* (pp. 539-557). Berlin, Heidelberg: Springer.
- Stafford Smith, D. M., McKeon, G. M., Watson, I. W., Henry, B. K., Stone, G. S., Hall, W. B., & Howden, S. M. (2007). Learning from episodes of degradation and recovery in variable Australian rangelands. *Proceedings of the National Academy of Sciences of the United States of America*, 104(52), 20690-20695.
- Stafford Smith, M. (2008). The 'desert syndrome' – causally-linked factors that characterise outback Australia. *The Rangeland Journal*, 30, 3-14.
- Stavi, I., & Lal, R. (2015). Achieving Zero Net Land Degradation: Challenges and opportunities. *Journal of Arid Environments*, 112, 44-51.
- Stein, B., Keys, M., Langford, C., Orgill, S., & Upjohn, B. (2009). Sustainable land management practices for graziers: Best management practices for grazing in the Tablelands and Southern Highlands of NSW (pp. 74): State of New South Wales through Department of Industry and Investment (Industry & Investment NSW).
- Stringer, L. C. (2008). Reviewing the International Year of Deserts and Desertification 2006: What contribution towards combating global desertification and implementing the United Nations Convention to Combat Desertification? *Journal of Arid Environments*, 72(11), 2065-2074.
- Stringer, L. C., & Dougill, A. J. (2013). Channelling science into policy: Enabling best practices from research on land degradation and sustainable land management in dryland Africa. *Journal of Environmental Management*, 114, 328-335.
- Stringer, L. C., Dyer, J. C., Reed, M. S., Dougill, A. J., Twyman, C., & Mkwambisi, D. (2009). Adaptations to climate change, drought and desertification: Local insights to enhance policy in southern Africa. *Environmental Science & Policy*, 12(7), 748-765.
- Stringer, L. C., Reed, M. S., Dougill, A. J., Seely, M. K., & Rokitzki, M. (2007). Implementing the UNCCD: Participatory challenges. *Natural Resources Forum*, 31, 198-211.
- Suding, K., Higgs, E., Palmer, M., Callicott, J. B., Anderson, C. B., Baker, M., Gutrich, J. J., Hondula, K. L., LaFevor, M. C., Larson, B. M. H., Randall, A., Ruhl, J. B., & Schwartz, K. Z. S. (2015). Committing to ecological restoration. *Science*, 348(6235), 638-640.
- Sullivan, S., & Hannis, M. (2015). Nets and frames, losses and gains: Value struggles in engagements with biodiversity offsetting policy in England. *Ecosystem Services*, 15, 162-173.
- Syngenta. (2014). The good growth plan (pp. 16). Retrieved from <http://www4.syngenta.com/~media/Files/S/Syngenta/documents/the-good-growth-plan-16pp-brochure-eng.pdf> [https://perma.cc/W4PY-26A6]
- Tal, A. (2015). The implications of environmental trading mechanisms on a future Zero Net Land Degradation protocol. *Journal of Arid Environments*, 112, 25-32.
- Tennent, R., & Lockie, S. (2013). Vale Landcare: The rise and decline of community-based natural resource management in rural Australia. *Journal of Environmental Planning and Management*, 56(4), 572-587.
- The Peoples' Goals. (2015). Reclaim our future. Oppose the corporate "development" agenda. Retrieved from <http://peoplesgoals.org/wp-content/uploads/2015/07/Reclaim-our-future.-Oppose-the-Corporate-Development-Agenda19.pdf> [https://perma.cc/76HP-DLJP]
- Thomas, D. S. G. (1997). Science and the desertification debate. *Journal of Arid Environments*, 37, 599-608.
- Thompson, R. (2008). Waterponding: Reclamation technique for scalded duplex soils in western New South Wales rangelands. *Ecological Management & Restoration*, 9(3), 170-181.
- Thomsen, D., & Davies, J. (2005). Social and cultural dimensions of commercial kangaroo harvest in South Australia. *Australian Journal of Experimental Agriculture*, 45, 1239-1243.

- Thomsen, D., & Davies, J. (2007). People and the kangaroo harvest in the South Australian rangelands: Social and institutional considerations for kangaroo management and the kangaroo industry. Rural Industries Research and Development Corporation.
- Toulmin, C., & Brock, K. (2016). Desertification in the Sahel: Local practice meets global narrative. In R. Behnke & M. Mortimore (Eds.), *The End of Desertification? Disputing Environmental Change in the Drylands* (pp. 37-64). Berlin, Heidelberg: Springer.
- Tozer, C. R., Vance, T. R., Roberts, J. L., Kiem, A. S., Curran, M. A. J., & Moy, A. D. (2016). An ice core derived 1013-year catchment-scale annual rainfall reconstruction in subtropical eastern Australia. *Hydrology and Earth System Sciences*, 20(5), 1703-1717.
- Tozer, P., & Leys, J. (2013). Dust storms – What do they really cost? *The Rangeland Journal*, 35(2), 131.
- Trigger, D., Mulcock, J., Gaynor, A., & Toussaint, Y. (2008). Ecological restoration, cultural preferences and the negotiation of ‘nativeness’ in Australia. *Geoforum*, 39(3), 1273-1283.
- Turner, M. D. (2013). Political ecology I: An alliance with resilience? *Progress in Human Geography*, 38(4), 616-623.
- UNCCD. (1994). United Nations convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/UNCCD_Convention_EN_G.pdf [https://perma.cc/ABY9-V8W9]
- UNCCD. (2012a). Desertification: A visual synthesis. United Nations Convention to Combat Desertification & Zoi Environment Network. Retrieved from <http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/Desertification-EN.pdf> [https://perma.cc/J956-2S3D]
- UNCCD. (2012b). UNCCD stakeholders share their opinions about Rio+20 outcome on Land-Degradation Neutrality. United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/en/programmes/RioConventions/RioPlus20/Pages/Land-Degradation-Neutrality.aspx> [https://perma.cc/TT32-LPZ7]
- UNCCD. (2012c). Zero Net Land Degradation: UNCCD policy brief. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Rio+20/UNCCD_PolicyBrief_ZeroNetLandDegradation.pdf [https://perma.cc/4MN4-E2RL]
- UNCCD. (2013a). A stronger UNCCD for a land-degradation neutral world: UNCCD issue brief. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Rio+20/issue%20brief%2004_09_13%20web.pdf [https://perma.cc/LP8L-WB8B]
- UNCCD. (2013b). Advice on how best to measure progress on strategic objectives 1, 2 and 3 of The Strategy. *Decision 22/COP.11*. United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/en/programmes/Science/Monitoring-Assessment/Documents/Decision22-COP11.pdf> [https://perma.cc/K7XD-S4F7]
- UNCCD. (2013c). Business commits to UNCCD capacity building for soil leadership. United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/en/media-center/MediaNews/Pages/highlightdetail.aspx?HighlightID=240> [https://perma.cc/6UHW-VT94]
- UNCCD. (2013d). Land Degradation Neutrality: Resilience at local, national and regional levels. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/Land_Degrad_Neutrality_E_Web.pdf [https://perma.cc/58JB-VVN3]
- UNCCD. (2014). Desertification: The invisible frontline. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/Desertification_The%20invisible_frontend.pdf [https://perma.cc/8MCF-WV3J]

- UNCCD. (2015a). Land matters for climate: Reducing the gap and approaching the target. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015Nov_Land_matters_For_Climate_ENG.pdf [https://perma.cc/HHD3-WP76]
- UNCCD. (2015b). LDN Project Country Reports. Retrieved from <http://www.unccd.int/en/programmes/RioConventions/RioPlus20/Pages/LDN-Project-Country-Reports.aspx> [https://perma.cc/57SW-EXWM]
- UNCCD. (2015c). Proposal for an indicator for target 15.3. United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/Lists/SiteDocumentLibrary/Rio+20/Land%20degradation%20neutrality%202015/UNCCD%20Metadata%20Target%2015.3.pdf> [https://perma.cc/T4UB-2TMW]
- UNCCD. (2015d). Reaping the rewards: Financing Land Degradation Neutrality. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_Reaping_the_rewards_addis%20final%20low%20res_10August.pdf [https://perma.cc/32PW-UNQQ]
- UNCCD. (2015e). Soil Leadership Academy. United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/en/Stakeholders/private_sector/Pages/Soil-Leadership-Academy.aspx [https://perma.cc/S6NM-LX2A]
- UNCCD. (2016a). The Great Green Wall: Hope for the Sahara and the Sahel. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/4_2016_GGW_ENG.pdf [https://perma.cc/UP6X-THQV]
- UNCCD. (2016b). Land Degradation Neutrality: The target setting programme. Bonn, Germany: The Global Mechanism of the United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/4_2016_LDN_TS%20_EN_G.pdf [https://perma.cc/N6BK-KXLD]
- UNCCD. (2016c). Minutes of the meeting of the COP Bureau (05 April 2016). United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/Lists/SiteDocumentLibrary/COP/COP12/COP12%20Bureau%20Meeting%20Report-5%20April%202016.pdf> [https://perma.cc/2ZL9-4WRW]
- UNCCD. (2016d). A natural fix: A joined-up approach to delivering the global goals for sustainable development. Bonn, Germany: United Nations Convention to Combat Desertification. Retrieved from http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/4_2016_Land_SDGs_ENG.pdf [https://perma.cc/K6JV-L6XM]
- UNCCD Secretariat. (2015). Integration of the Sustainable Development Goals and targets into the implementation of the United Nations Convention to Combat Desertification and the report of the Intergovernmental Working Group on Land Degradation Neutrality. *ICCD/COP(12)/4*. United Nations Convention to Combat Desertification. Retrieved from <http://www.unccd.int/Lists/OfficialDocuments/cop12/4eng.pdf> [https://perma.cc/3PXV-DA69]
- UNEP. (2012). Global environment outlook GEO 5: Environment for the future we want. Nairobi, Kenya: United Nations Environment Programme.
- United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development Retrieved from <https://sustainabledevelopment.un.org/post2015/transformingourworld> [https://perma.cc/8FGQ-TZVT]
- United Nations System Task Team. (2012). Realizing the future we want for all: Report to the Secretary-General. New York: United Nations. Retrieved from http://www.un.org/en/development/desa/policy/untaskteam_undf/untt_report.pdf [https://perma.cc/3EDB-F4UM]

- Utting, P. (2000). UN-business partnerships: Whose agenda counts? *Paper presented at seminar on "Partnerships for Development or Privatization of the Multilateral System?"*, organised by the North-South Coalition. Oslo, Norway: United Nations Research Institute for Social Development.
- Verón, S. R., Paruelo, J. M., & Oesterheld, M. (2006). Assessing desertification. *Journal of Arid Environments*, 66(4), 751-763.
- Vogt, J. V., Safriel, U., Von Maltitz, G., Sokona, Y., Zougmore, R., Bastin, G., & Hill, J. (2011). Monitoring and assessment of land degradation and desertification: Towards new conceptual and integrated approaches. *Land Degradation & Development*, 22(2), 150-165.
- Wakelin-King, G. (2011). Using geomorphology to assess contour furrowing in western New South Wales, Australia. *The Rangeland Journal*, 33, 153-171.
- Walker, B. H. (1979). *Management of semi-arid ecosystems*. Amsterdam; New York: Elsevier Scientific Pub. Co.
- Walker, K. J. (1994). *The political economy of environmental policy: An Australian introduction*. Sydney: The University of New South Wales Press.
- Walker, S., Brower, A. L., Stephens, R. T. T., & Lee, W. G. (2009). Why bartering biodiversity fails. *Conservation Letters*, 2(4), 149-157.
- Walsh, D. (2009). Flexible rotational grazing: Wyndham Station, NSW. *DKCRC Working Paper 61, The Central Australian Grazing Strategies project Working Paper Series*. Alice Springs: Desert Knowledge CRC.
- Wang, X. M., Zhang, C. X., Hasi, E., & Dong, Z. B. (2010). Has the Three Norths Forest Shelterbelt Program solved the desertification and dust storm problems in arid and semiarid China? *Journal of Arid Environments*, 74(1), 13-22.
- Warren, A. (2002). Land degradation is contextual. *Land Degradation & Development*, 13(6), 449-459.
- Waudby, H. P., Petit, S., & Robinson, G. (2012). Pastoralists' perceptions of biodiversity and land management strategies in the arid Stony Plains region of South Australia: Implications for policy makers. *Journal of Environmental Management*, 112, 96-103.
- Way, S. (2006). Examining the links between poverty and land degradation: From blaming the poor toward recognising the rights of the poor. In P. M. Johnson, K. Mayrand, & M. Paquin (Eds.), *Governing Global Desertification: Linking Environmental Degradation, Poverty and Participation* (pp. 27-41). Aldershot: Ashgate.
- WBCSD. (2015a). Land Degradation Neutrality: A business perspective. World Business Council for Sustainable Development. Retrieved from http://www.commonland.com/_doc/WBCSDLandDegradationNeutralityABusinessPerspective_651616121.pdf [https://perma.cc/8WME-BP4G]
- WBCSD. (2015b). Land Degradation Neutrality: Issue brief for business. World Business Council for Sustainable Development. Retrieved from http://www.wbcsdservers.org/web/org/Land_Degradation_Neutrality_Issue_Brief.pdf [https://perma.cc/BC27-F9AR]
- Weber, E. U. (2010). What shapes perceptions of climate change? *Wiley Interdisciplinary Reviews: Climate Change*, 1(3), 332-342.
- Welton, S., Biasutti, M., & Gerrard, M. B. (2015). Legal and scientific integrity in advancing a "land degradation neutral world". *Columbia Journal of Environmental Law*, 40(1), 39-97.
- Wessels, K. J. (2009). Comments on 'Proxy global assessment of land degradation' by Bai et al. (2008). *Soil Use and Management*, 25(1), 91-92.
- Western LLS. (2015a). Catchment action plan: Landholder benchmarking (pp. 177). State of New South Wales through Western Local Land Services.
- Western LLS. (2015b). Managing invasive native scrub. Grazing management principles: Factsheet No. 5: State of New South Wales through Western Local Land Services. Retrieved from http://western.lls.nsw.gov.au/_data/assets/pdf_file/0011/568217/gmp5-manageINS.pdf [https://perma.cc/9WJU-YTLN]

- Whitfield, S., Dougill, A. J., Dyer, J. C., Kalaba, F. K., Leventon, J., & Stringer, L. C. (2015). Critical reflection on knowledge and narratives of conservation agriculture. *Geoforum*, 60, 133-142.
- Whitfield, S., & Reed, M. S. (2012). Participatory environmental assessment in drylands: Introducing a new approach. *Journal of Arid Environments*, 77, 1-10.
- Williams, D. M. (2006). *Beyond great walls: Environment, identity and development on the Chinese grasslands of Inner Mongolia*. Stanford, California: Stanford University Press.
- Willow, A. J. (2014). The new politics of environmental degradation: Un/expected landscapes of disempowerment and vulnerability. *Journal of Political Ecology*, 21, 237-257.
- Wilske, B., Lu, N., Wei, L., Chen, S., Zha, T., Liu, C., Xu, W., Noormets, A., Huang, J., Wei, Y., Chen, J., Zhang, Z., Ni, J., Sun, G., Guo, K., McNulty, S., John, R., Han, X., Lin, G., & Chen, J. (2009). Poplar plantation has the potential to alter the water balance in semiarid Inner Mongolia. *Journal of Environmental Management*, 90(8), 2762-2770.
- Wilson, G. A. (2004). The Australian Landcare movement: Towards 'post-productivist' rural governance? *Journal of Rural Studies*, 20(4), 461-484.
- Wohling, M. (2009). The problem of scale in indigenous knowledge: A perspective from northern Australia. *Ecology and Society*, 14(1), 14 [online].
- Wortley, L., Hero, J.-M., & Howes, M. (2013). Evaluating ecological restoration success: A review of the literature. *Restoration Ecology*, 21(5), 537-543.
- Wunder, S. (2008). Payments for environmental services and the poor: Concepts and preliminary evidence. *Environment and Development Economics*, 13(03).
- Xu, J. (2011). China's new forests aren't as green as they seem. *Nature*, 477, 371.
- Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). The United States of America: Sage Publications.
- Zdruli, P., Pagliai, M., Kapur, S., & Faz Cano, A. (2010). What we know about the saga of land degradation and how to deal with it? In P. Zdruli, M. Pagliai, S. Kapur, & A. Faz Cano (Eds.), *Land Degradation and Desertification: Assessment, Mitigation and Remediation*. Dordrecht: Springer.
- Zimmerer, K. S. (1993). Soil erosion and social (dis)courses in Cochabamba, Bolivia: Perceiving the nature of environmental degradation. *Economic Geography*, 69(3), 312-327.