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REVIEW AND SYNTHESIS

Land degradation in South Africa: Justice and climate change in tension

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Abstract

1. Land degradation is a global problem impacting biodiversity and livelihoods, with profound effects on resource-based livelihoods. As such, it impedes progress towards sustainable development goals (SDGs) and overcoming climate-related poverty. Interrelated biophysical and social factors are driving further land degradation, and, internationally, there is a range of policies and initiatives designed to address these.
2. In this paper, we argue that analysis of land degradation must encompass three key dimensions: firstly, that the causes are both physical and social; secondly, that they are shaped by historically unjust land tenure and resource allocations; and thirdly, that outcomes are the result of entwined processes at the global, national and local levels. To do this, we modify an analytical framework derived from structuration theory and populate it with illustrative material from the case of rangeland management in the Eastern Cape, South Africa. In this way, we show how understanding land degradation requires an analytical approach that is simultaneously bio-social, historically informed and multiscalar.
3. Land degradation caused by woody encroachment is a major bio-social issue for the rangelands of South Africa, exacerbated by intersecting factors including climate change, historical land tenure policies and post-apartheid reforms. However, contemporary land use policies in South Africa designed to redress historic land injustices and enhance rural livelihoods are not directly connected with those which prioritise the protection of ecosystems and biodiversity, or climate mitigation. Finally, South African policymakers face the challenge of reconciling political commitments to improve the lives of local populations whilst meeting international targets to address degradation, carbon emissions and SDGs.
4. Whilst the South African case is unique, many countries face the simultaneous challenges of trying to prevent ecological degradation whilst mitigating historical patterns of unjust access to land and natural resources. More broadly, this talks of the global challenge of reconciling goals of poverty alleviation with climate mitigation.

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KEYWORDS

land degradation, land tenure, livelihoods, rangelands, South Africa, sustainable development goals, woody plant encroachment

1 | INTRODUCTION

Land degradation is a negative trend in land conditions, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of biological productivity, ecological integrity or value to humans (IPCC, 2019). Land degradation affects 3.2 billion people globally, with loss of biodiversity and ecosystem services amounting to more than 10% of global annual gross products (Scholes et al., 2018). It also has profound effects on resource-based livelihoods and societal groups, exacerbating climate-related poverty (Olsson et al., 2014). Global estimates of degraded land are highly uncertain, ranging from just under 1 billion ha to around 6 billion ha (Gibbs & Salmon, 2015), with around 15%–63% of global degradation observed between 1977 and 2003 (Safriel, 2016). Around 25% of land area on Earth is known to be degraded or undergoing degradation (The Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils, 2015), which has adverse effects on livelihoods, affecting around 1.3–3.2 billion people affected by poverty who live in developing countries (IPCC, 2019).

The drivers of land degradation include a group of inter-related factors—biophysical, institutional and socio-economic (UNCCD, 2015). While biophysical factors such as climate and water availability determine land use, institutional factors such as land governance, and economic factors affecting demand for land, determine how the land is managed (UNCCD, 2017). The relationship between these factors can be well illustrated using the situation in South Africa, where historical inequity in access to land and natural resources has been especially pronounced.

In South Africa, land degradation is a significant issue where nearly 60% of the land is degraded (United Nations Environment Programme, 1997) and 91% prone to desertification (Hoffman & Ashwell, 2001). Before apartheid ended in 1994, nearly 3.5 million African people were resettled in South African 'homelands', now called the communal areas (Fox & Rowntree, 2001), where enforced high densities of people and livestock resulted in rangeland degradation (Hoffman & Todd, 2000; Meadows & Hoffman, 2002). Both the communal lands historically occupied by black farmers and the commercial lands owned by white farmers currently face the issue of land degradation due to woody plant encroachment. Woody plant encroachment is thought to be caused by climate change but cannot be dissociated from overgrazing and unsustainable land management practices arising from a high population to land ratio, and complicated land tenure systems stemming from the apartheid era (Bai & Dent, 2007; Fox & Rowntree, 2001; Shackleton et al., 2001). The problem, therefore, creates tensions with both contemporary land reform policies and South Africa's commitment to various international environmental treaties, making it an impediment to ecological, historical and political dimensions.

This paper proceeds as follows. We firstly provide an overview of literature on land reform and climate policies, woody plant encroachment and land degradation in South Africa. This is supplemented by some primary research on woody plant encroachment on smallholder farms and communal areas in the Eastern Cape of South Africa. We then work through the data using an analytical framework where we show the interconnection between bio-social, historical and scalar processes and phenomena. In the concluding discussion, we reflect on how the South African case can inform understanding of, and policy-making around, land degradation processes occurring in other countries and regions.

The primary research on which we draw was conducted through a short pilot study assessing the impacts of woody plant encroachment on livelihoods in the savannas of Eastern Cape during February–April 2019. Data were collected from farmers and landowners using semistructured interviews in the rural towns of Peddie, Grahamstown and Alice, some of which are presented here. Informed consent to participate in this study was obtained from the participants in accordance with the ethical guidelines of the University of Sheffield (Ethics approval reference number 024154). Most interviews were carried out in Xhosa with the help of a translator. The participants were approached by having informal introductions at first through the translator. Following this, the researcher was introduced and the work was briefed by the translator as instructed by the researcher. Furthermore, interview process was outlined, and consent to participate in the study and permission to record the interview was obtained.

Informed verbal consent was obtained from all interview participants. Since recruitment of participants in the study was opportunistic, and the participants were approached during their work time, obtaining verbal consent was the preferred choice for the participants owing to time constraints and literacy issues. While some participants expressed discomfort over written consent, verbal consent was obtained from all participants.

The recorded interviews were transcribed into English. For various reasons, it was not possible to continue to a full-scale study. The trajectory of this paper thus evolved over time into a piece focussing on the development of a framework to analyse a case study, drawing both on published literature and necessarily limited data.

2 | THE PROBLEM: LAND DEGRADATION AND THE THORNY ISSUE OF WOODY PLANT ENCROACHMENT

Several definitions of land degradation exist in the South African context (Scholes, 2009; Palmer & Bennett, 2013). However, all are united by the common theme of a decline in the ability of an ecosystem to deliver valued services. For example, Scholes (2009) defines

land degradation as 'as a persistent decrease in the capacity of an arid or semiarid ecosystem to supply a range of services, including (but not restricted to) forage, fuel, timber, crops, fresh water, wild-harvested foods, biodiversity habitat and tourism opportunities'.

Communal land degradation in South Africa has been especially characterised by woody plant encroachment. This phenomenon involves an increase in tree or shrub densities in savannas, altering ecosystem functions and services, by reducing water availability and total productivity of the vegetation, altering fire regimes, carrying capacity, biodiversity and carbon storage capacity (Buitenwerf et al., 2012; Auken, 2009). Woody plant encroachment into grasslands is often considered a catalyst for soil degradation and desertification (Schlesinger et al., 1990). The South African government policy brief on woody plant encroachment recommends that it be regarded as a form of land degradation, despite its potential to sequester carbon (Department of Environmental Affairs, 2019b). Continuing encroachment is therefore causing significant negative impacts on biodiversity, livelihoods and the overall supply and value of ecosystem services, reducing the ability of rangelands to regulate water. Woody cover increases linearly with an increase in mean annual precipitation (MAP) up to 650 mm, but rainfall is not limiting thereafter (Sankaran et al., 2005). Shrublands or savannas are found in areas with an MAP below 650 mm, with a tendency to develop into forests above the threshold. In the drier savannas of the Eastern Cape we studied in South Africa, woody plant encroachment manifests as an increasing cover of thorny *Acacia* trees, which enables woody thicket species to establish, and eventually transforms open grassy vegetation into closed woody thicket.

Steps to prevent land degradation through existing environmental agreements often provide significant scope for action to reduce land degradation. For example, South Africa has made provisions to avoid, reduce and reverse land degradation by being a signatory to several multilateral climate and environmental agreements. These include the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, the Ramsar Convention and the 2030 Agenda for Sustainable Development (IPBES, 2018).

The degradation of rangelands in South Africa has become central to debate surrounding how to meet the United Nations Sustainable Development Goals (SDGs). Several of the goals depend to some degree on addressing land degradation (IPBES, 2018) through ecosystem-based adaptation. These adaptations are particularly important for managing woody plant encroachment to satisfy the goals relating to life on land (SDG15), climate action (SDG13), no poverty (SDG1) and decent jobs (SDG8). However, as discussed in this paper, there are tensions among the SDGs, which mean that addressing one goal may undermine efforts to meet others.

3 | WOODY PLANT ENCROACHMENT: THE INTERACTING EFFECTS OF CLIMATE CHANGE AND LAND USE

This section highlights the dynamics between climate change, rangeland management and woody plant encroachment in South Africa.

It shows how land degradation through woody plant encroachment is caused by a complex interaction of factors, including global environmental change, the dynamics of local land use and historical land reforms.

The causes of woody plant encroachment in South Africa are debated. While a long-standing hypothesis argues that changes in fire regimes and grazing patterns cause woody plant encroachment at a regional scale, a more recent alternative holds the post-industrial rise in atmospheric carbon dioxide (CO₂) responsible. This hypothesis argues that rising CO₂ fertilises woody plant growth relative to grasses, accelerating tree and shrub recruitment into rangelands (Archer et al., 1995; Bond & Midgley, 2000). In support of this hypothesis, woody plant encroachment was observed across communal, commercial and conservation land-use systems between 1937 and 2000 in Kwazulu Natal (Wigley et al., 2009). A related hypothesis is that changing temperature and rainfall patterns are causing the change in woody plant cover, alongside continental changes in fire regimes and herbivory by livestock and wildlife (Venter et al., 2018). In fact, rising CO₂ may interact with rainfall, having greater effects on woody plant encroachment in wetter rather than drier savannas (Skowno et al., 2017). Despite the evidence of large-scale landscape alterations caused by rising CO₂ and climate change, important interactions with land use remain. A recent acceleration of woody plant encroachment has been most rapid on small, protected areas and commercial rangelands, and slowest under communal tenure land, and on land with megaherbivores such as elephants (O'Connor et al., 2014; Stevens et al., 2016). The evidence therefore suggests that external environmental drivers interact with local ecological processes to produce woody plant encroachment.

Historical and political processes matter in how land is used and shape the conditions for woody plant encroachment. For example, in the area of Bathurst in the Eastern Cape, conversion of municipal common land into commercial rangelands under the management of white farmers from 1942 to 1990 (primarily under apartheid governments) resulted in an increase in woody plant encroachment. After the reassignment of this land into municipal commons in 1994, there is little evidence that land use negatively impacted the vegetation, although woody plants did encroach into grasslands more generally (Puttick et al., 2011).

At the local scale in the Eastern Cape, an examination of land reforms, policy and encroachment found marked differences in vegetation between commercial farms and communal land in the Peddie district. After 1994, when some commercial rangelands were reclaimed from white farmers, woody plant encroachment occurred due to the removal of the farmers' livestock (Fox & Rowntree, 2001). Over the same period, a loss of woodlands in communal areas resulted from harvesting for fuelwood. Fuelwood harvesting, house building and intensive goat browsing caused similar declines in woody plant cover on municipal common land in Grahamstown (Puttick et al., 2014).

Although reductions in woody plant encroachment are observed in municipal common land after changes in land tenure and land use, rural communal and commercial rangelands continue to be at risk

of degradation. Some studies (Stevens et al., 2016) highlight the need for novel land management strategies and changes in existing management policies to combat the increase in woody cover. These include the manipulation of fire regimes or large-bodied mammals, including livestock or wild animals (reviewed Osborne et al., 2018).

This brief review clearly indicates that woody plant encroachment is a process affected by global and local phenomena, represents an interface between biophysical and social dynamics and is shaped by historical patterns of land use. To aid our exploration analysis of such layered interactions, we mobilise an analytical framework as outlined in the next section.

4 | THE FRAMEWORK: EXPLAINING MULTIFACTOR LINKAGES

We argue that analysis of land degradation through woody encroachment requires an analytical approach that is simultaneously bio-social, historically informed and multiscalar. To illustrate this, we modify a framework derived from social theory, and populate it with illustrative material from the case of rangeland management in the Eastern Cape, South Africa. In this way, we illustrate that the causes of land degradation are both physical and social; they are shaped by historically unjust land tenure and resource allocations; and the outcomes are the result of entwined processes at the global, national and local levels. We use the selected case study material to explain how these factors interrelate.

For this purpose, we adapt a framework from Franks and Cleaver (2007) (Figure 1a below). Broadly informed by Giddens' structuration theory (Giddens, 1984), the framework allows us to understand the patterning of phenomena at societal level, the scope for individual or localised collective action and the ways in which these are recursively linked. Giddens' (1984) structuration theory highlights the duality of structure, where agency interacts with structures such as power, values and creates a dynamic relationship in the society rather than being constrained by structure. He states, 'the rules and resources drawn upon in the production and reproduction of social action are at the same time the means of system reproduction'. The resources in the framework as well as the system in which they operate are based on this structuration theory. Franks and Cleaver apply structuration theory in their framework to analyse water governance arrangements. They use it to show how societal structures (patterned distributions, orders and values) shape local level arrangements for water management, producing differentiated, and sometimes unintended, outcomes for people and the environment. In applying this framework to the analysis of land degradation through woody plant encroachment in the Eastern Cape of South Africa, we make some modifications which are explained in the elaboration of the case material below. The overarching process operating in this framework is climate change which is a cause of woody plant encroachment and land degradation in South Africa.

The framework draws on several concepts and terms which we briefly explain here and in Figure 1a. In our version of the framework,

societal **resources** are the material and non-material properties of social systems from which human interaction and organisation are constructed. By deploying the concept of resources, we aim to show how contemporary land governance is formed within, and draws upon, broader societal level patterns of distribution. These may include historic governance regimes, their legislative frameworks, allocations of rights, entitlements and finances. They also include the endowment of the natural environment and physical commodities that shape and are shaped by these governance regimes.

Resources shape (but do not determine) the formation of context-specific arrangements or **mechanisms** for accessing and using the land. Mechanisms may be institutional (regulations, organisational arrangements, rules and norms), material in the form of infrastructure and technology and natural such as woody plant encroachment in this case. These mechanisms shape people's access to land, and the ways in which they use it, and produce differentiated **outcomes** for people and their livelihoods, for ecosystems and for policy goals. Outcomes are shaped by, and in turn reinforce or reshape, societal level structures and dynamics. At each interface in the framework, **actors** (individuals) are recursively implicated. Actors are shaped by, and shape, the distribution of resources, the mechanisms and the outcomes of land governance. This occurs through **processes** of deliberate management and less conscious practice, situated in particular social and biophysical milieux.

By drawing on experiences from the Eastern Cape, this framework is selectively populated and used to analyse the complex situation of land degradation in South Africa (Figure 1b). It helps us to map how various social, political and ecological factors dynamically interact, leading to land degradation that results in positive and negative outcomes both for the poor and for rangeland ecosystems.

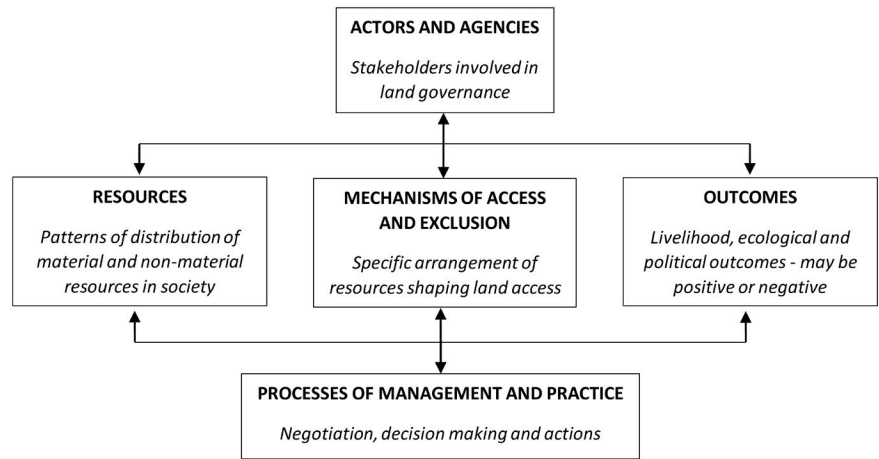
5 | RESOURCES OF GOVERNANCE: FROM APARTHEID TO POST-APARTHEID ALLOCATIONS

The governance of land in South Africa is shaped by patterned distributions of societal resources. For the purposes of this paper, we have highlighted the apartheid and post-apartheid governance regimes, international policy frameworks and savanna rangelands and thorny thickets as managed ecosystems.

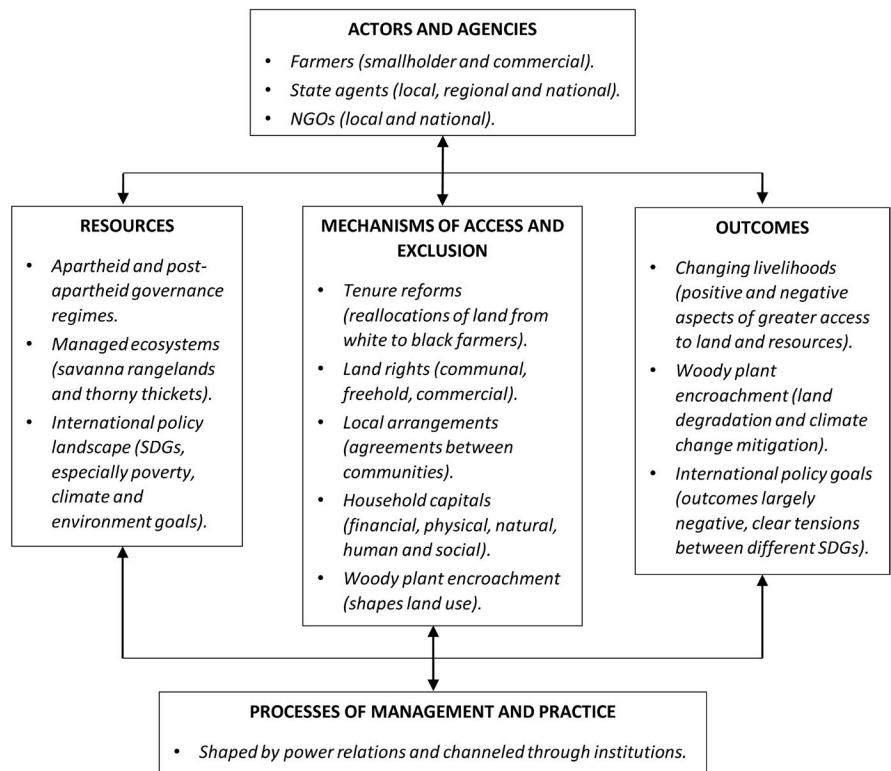
While racial segregation in South Africa has a long history starting in the British Colonial period around 1652, it was the apartheid period (1945–1994) that saw wholesale organisation of society along racial lines. This involved the systemic separation of black and white people through legislation, physical resettlement and regulation of residence, employment and social life, the unequal distribution of resources to white and black residents (e.g. for education, agricultural subsidies) and a whole array of discourses authorising and legitimising 'separate development'. During the early 20th century, a series of land acts had restricted the tenure rights of black farmers, prevented black Africans from owning land outside native reserves and forcibly removed them from areas designated for ownership by white farmers. From 1959 onwards, a 'separate development' policy allocated

FIGURE 1 Interconnected dimensions of land degradation in the Eastern Cape, South Africa: Panel (a) presents the general framework for analysing land governance (Franks & Cleaver, 2007); while (b) shows the case of land governance in the Eastern Cape of South Africa (adapted framework from Franks & Cleaver, 2007)

(a) Framework for analysing land governance



(b) Land governance in the Eastern Cape of South Africa



black South Africans to rural 'homelands' or 'Bantustans', notionally self-governing territories which further removed black people from participating in national political institutions.

The result was that most of the land in the country was reserved for the white minority. Whilst white commercial farmers had greater access to material resources such as rangelands, and were heavily supported by government subsidies, black farmers were constrained by overcrowding in the Bantustans, inadequate access to rangelands and to agricultural inputs and markets.

The end of the apartheid in 1994, the democratically elected ANC government attempted at restructuring the society to meet

the needs of all South Africans. The framework for this wide-ranging repatterning of society was with the reconstruction and development plan which set goals for the restructuring of infrastructure and housing, healthcare and social services, rural development, land reform and resettlement. These land reform measures gave black farmers greater access to rangelands.

The policy framework for land and rural development in South Africa is not a purely national concern but is shaped by and interacts with the landscape of international policy imperatives. There is a considerable international consensus around the need for sustainable development goals, protecting the environment and addressing

climate change, and a complex policy architecture set up to promote these goals. The existence of these goals and the associated policy architecture (political and financial) provide additional drivers which interact with national imperatives and priorities to shape the allocation of societal resources.

Whilst these very different governance regimes clearly shape society and the framework for land governance through legislative frameworks, allocations of rights, entitlements and finances, they exist in relation to particular endowments and processes in the natural environment. A consequence of increasing carbon dioxide, woody plant encroachment in conjunction with historical land management has significantly shaped resource availability and land use.

Land degradation has been underpinned by poverty and apartheid political planning, as in the case of woody plant encroachment being greatest in areas with a high incidence of poverty (Hoffman & Todd, 2000). The most severely degraded lands, including some of the former homelands, are susceptible to climate change (Meadows & Hoffman, 2003), thereby further threatening livelihoods.

6 | MECHANISMS: THE UNEQUAL PATTERNS OF LIVELIHOODS, LAND ACCESS AND EXCLUSION

Within these broader frameworks of societal resource distributions, it is through specific (sometimes place-specific) mechanisms by which people access land.

As we have seen above, the policies in the post-apartheid democratic government are focussed on the correction of apartheid inequalities through land redistribution, land restitution and land reforms. These progressive goals were to be furthered through specific mechanisms in the form of land acts and targeted policies and programmes. For example, the Restitution of Land Rights Act, 1994, reinforced land rights on freehold, communal and commercial land to those living in the Bantustans. The Municipal Commonage Programme started by the Department of Land Affairs in 1996 aimed at providing greater access to land owned by the state to South Africans that had been disadvantaged by policies before 1994. After integration of the Bantustans with the Republic of South Africa, the Department of Land Affairs paved the way for the transfer of communal land ownership from the State to its occupants. The White Paper (Department of Land Affairs, 1997) on South African Land Policy aimed to distribute land equally and improve livelihoods through three initiatives—land restitution for those deprived of land on racial grounds, redistribution to prevent land grabbing and land tenure reform, especially for communal lands (Fox & Rowntree, 2001).

In our framework, we also understand 'mechanisms' as relating to arrangements formal and informal made between people at local level for accessing land and for pursuing activities which support livelihoods. For example, in this research, we find evidence of different landowners and communities making agreements for reciprocal access to land for firewood collection and for grazing.

There is no simple relationship between the existence of mechanisms and access to land (a point we will return to in 'outcomes' below). There is a constant interplay between different mechanisms (shaped by societal resources), which reshapes the ways in which they channel access to and use of land. For example, a piece of legislation may award tenure rights to a particular farmer, but without access to credit, without sufficient labour and without appropriate knowledge, that farmer is unlikely to translate this into a viable livelihood. In our version of the framework, we borrow from sustainable livelihoods thinking and refer to the 'household capitals' (Scoones, 1998) which are necessary to ensure that farmers can operationalise their officially allocated rights and entitlements. We illustrate this through the following example.

In 2000, the South African government reviewed the land redistribution and tenure process with the aims of accelerating redistribution, providing more support to those settled and increasing commercialisation (Cliffe, 2000). The passing of the Communal Land Rights Act 2004 directed the transfer of land titles from the state to communities and issuance of land rights to individuals within communities (Mutangadura, 2007). However, the success of such a redistributive mechanism is limited by the configuration of circumstances in the locations to which it applies. As a farmer in the Eastern Cape suggests, merely having the legal right to secure land access is insufficient. With the end of the apartheid, the Department of Land Affairs was given an aim to restore land to the original owners, the black farmers. However, the white farmers had left the land along with the tools required for rangeland maintenance and this made it difficult for the black farmers to put the land to use without infrastructure. Access to land increased their capacity to own more cattle. However, since then, one farmer reports that drought and theft of cattle have played a role in making things difficult for them (Interviewee 8, personal communication, March 2019).

The interplay between mechanisms (shaped by societal resources) may help to explain why attempts to develop smallholder commercial farming have faced considerable difficulty in South Africa (Cousins & Scoones, 2010; Illius & O'Connor, 1999). The intersection of structural factors (our 'Resources' category) such as the scarcity of good quality land and an agricultural sector dominated by meat production and fruit for export (Lahiff, 2007) may constrain the operation of particular mechanisms of land reform.

Communal land degradation in South Africa can be analysed by implicitly drawing on different assumptions about the relationships between societal resources and mechanisms of access. The ecological perspective attributes degradation in the communal land systems to overgrazing, poor cultivation practices and unsustainable use of natural resources (Fox & Rowntree, 2001). From a socio-economic perspective, the root cause is poverty and population pressure (Hoffman & Todd, 2000). Two schools of thought about land dynamics can be seen to influence these debates.

Subjected to various land tenure reforms, communal land has been perceived as vulnerable because of the presumed inability of land users to make collective decisions for the sustainable management of common resources—the so-called tragedy of the commons

(Hardin, 1968). The assertion behind Hardin's argument is that by holding land in common, individual herders have no incentive to limit the number of animals they graze on that land, but without any limits, there is overgrazing creating conditions for land degradation and desertification. However, in South Africa, the tragedy of commons due to overcrowding on the homelands was a politically created problem where Hardin's argument does not hold in less skewed political circumstances. Contrary to this, Elinor Ostrom (1990) proposes that commons can be successfully managed by locals without any regulation by central authorities or privatisation, drawn from examples across the world. Communities can self-organise, can craft mechanisms, in ways that punish those who free ride on the common resource, which shows that people can manage the common property.

So far, we have considered mechanisms and political and socio-economic arrangements that shape land access. But we argue here that biophysical configurations can also operate as mechanisms of access and exclusion. For example, woody plant encroachment driven by climate change can act as a 'mechanism' to constrain or enable access to land. Increase in woody biomass on rangelands has impacted land use in the Eastern Cape, further reducing grazing land availability. At a micro level, a shift in livestock patterns has been noticed in the communal lands. At Kwezana village, prevailing sheep theft coupled with increased trees has encouraged the farmers to replace sheep with goats wherein an absence of browsing by sheep paves the way for establishment of *Acacia* seedlings, further contributing to woody plant encroachment. In the case of commercial farms, increasing trees have reduced livestock owned by white farmers due to a reduction in areas for grazing. In addition to this phenomenon, climate change and land degradation have further impacted livelihoods as well as the policy commitments of South Africa at the national level.

7 | ACTORS AND AGENCIES

Societal level resource allocations shape specific mechanisms of access and use of land, which produce differentiated outcomes. The actors reshape these interactions at every interface through processes of management and practice. These include activities of negotiation, decision-making and deliberative actions, but also everyday livelihood practices. At the local level, smallholding farmers and commercial farmers play a crucial role in rangeland management through their varied practices of land management—grazing and browsing, ranching, cultivation and firewood collection. Such actors interact with each other in cooperative or conflictual relationships, and they also interface with state and development agency actors (agricultural extension officers, project and programme offers, local government representatives and political parties). In the Eastern Cape, some landowners are involved with The Working for Water programme (1995) administered by the DEA, to clear land off invasive *Acacia* species while providing employment to people in rural areas.

The interactions between actors are further shaped by power relations and societal structures. For example, white commercial farmers due to the legacy of past apartheid policies often have a

greater stock of capitals to draw on in the form of finances and more specialised knowledge, infrastructure and machinery to maintain rangelands along with fencing. The practices of actors and their relationships shape land governance, while institutions and processes shape their access to resources.

8 | OUTCOMES AND IMPACTS: COMPLEMENTARITIES AND CONTRADICTIONS

The interplay between societal resource allocations, mechanisms, actors and processes shapes outcomes for land and livelihoods in South Africa. The outcomes of these interactions are variable and may have both negative and positive consequences for livelihoods, land degradation and meeting national and international policy goals.

Land degradation has been exacerbated by inappropriate policy frameworks (Vetter, 2013) and skewed access to resources before 1994 (Beinart, 2000). A lack of capacity and effective governance structures continues to plague contemporary communal land systems (Palmer & Bennett, 2013), estimated to be 14% of the land (Meadows & Hoffman, 2002). Land degradation in the form of rangeland overgrazing and woody shrub encroachment critically affect these areas.

The consequences of woody plant encroachment for biodiversity and livelihoods are discussed in this section. While woody plant encroachment negatively affects biodiversity, *Acacia* trees provide some beneficial services such as browse for livestock (goats) and fuelwood. A black farmer from the communal lands of Kwezana village, Eastern Cape, highlights some of these contradictions—'*The tree (Acacia) has its advantages and disadvantages, when it comes to goats, we are happy about it. I'm sure you've noticed that there is drought in South Africa, but the tree is evergreen, and the goats benefit in terms of food. The cattle suffer because the tree expands excessively at the expense of grass and other plants which leaves them with nothing to eat. Now you see the disadvantages. Cattle eat grass and a tree called "umnquma", we don't have both because of Acacia*'. (Interviewee 11, personal communication, March 2019).

Currently, rangeland management in the Eastern Cape is characterised by an open access regime (Bennett et al., 2010). Since the Land Settlement Act 1912 put an end to nomadic ranching in the arid areas with assistance from the state for fencing (Milton & Dean, 1995), it paved the way for grazing pressures due to limited availability of rangeland. Overstocking and the resultant degradation from woody encroachment have immediate impacts on the livelihoods of rural people. Rural, smallholder farmers in the former homelands of South Africa have been particularly affected by land abandonment due to woody plant encroachment between 1950 and 2010 (Blair et al., 2018). Vetter (2013) recommends policies in support of livelihoods and strengthening common property management and tenure with a focus on smallholder farmers.

The outcomes of woody plant encroachment and the resulting degradation have caused tensions with the national and international policy commitments for climate and biodiversity in South Africa.

Like many upper- and middle-income countries, South Africa is also vulnerable to the impacts of climate change and the phenomenon of land degradation caused by woody plant encroachment is a classic example of this. South Africa entered the United Nations Convention on Biological Diversity (UNCBD) in 1993 focusing on the conservation of biological diversity and ratified the United Nations Convention to Combat Desertification (UNCCD) in 1997. The reduced biodiversity due to woody encroachment has caused tensions between South Africa's commitments to the UNCCD and UNCBD while satisfying its commitment to the Paris Agreement.

Woody plant encroachment may already be considered a form of climate change mitigation under the Paris Agreement due to the ability of trees to sequester carbon. Woody plant encroachment potentially represents a carbon sink if it leads to greater carbon stocks above ground without detriment to soil carbon. However, it leads to a potential conflict in commitment to the UNCCD to reduce degradation since South Africa has committed to a national Land Degradation Neutrality (LDN) as requested under SDG 15.3.

Furthermore, South Africa has committed to a National Action Programme to Combat Desertification, following which an audit of land degradation was carried out (Hoffman & Todd, 2000). The key finding of this National Review on Land Degradation is that communal tenure is the most important predictor of land degradation in South Africa, showing a significantly higher vegetation degradation index, with abiotic factors as secondary predictors (Vetter, 2009). Since a large area of land was brought under communal land tenure by the land redistribution and restitution process around this time, communal rangelands received much attention in relation to the issues of land degradation and woody plant encroachment.

The South African Government's National Climate Change Adaptation Strategy (Department of Environmental Affairs, 2019a) is developed in line with the country's commitment to the Paris Agreement on Climate Change (2016). It acts as a reference point for climate change adaptation and climate resilience, providing guidance across all levels of government, sectors and stakeholders that are affected by climate variability and change. South Africa ratified the United Nations Framework Convention on Climate Change in 1996 and Kyoto protocol 2002, and under its Nationally Determined Contribution (NDC) has firmly committed along with the other members to ensure global temperatures are kept well below 2°C above pre-industrial levels. Poverty reduction and reducing inequalities by 2030 remain key components of the NDCs. By adhering to its NDCs under the Paris Agreement, South Africa would reduce emissions from deforestation and degradation (UNFCCC, 2016).

Afforestation under the African Forest Landscape Restoration Initiative (AFR100), an offshoot of the Bonn Challenge, has opened a new set of issues for tropical savannas. Under AFR 100, South Africa has committed to the afforestation of 3.6 million hectares of grassy biomes (Bond et al., 2019), considered degraded lands. However, rather than being degraded, these biomes are largely ancient and natural savanna grasslands, in which both tree planting and woody plant encroachment reduce biodiversity and degrade several ecosystem services (Parr et al., 2014). Although clearing woody plant

encroachment has been reported as a priority intervention under AFR 100, it sits uneasily alongside parallel commitments to carry out tree planting across large areas.

The DEA is aware of this tension between afforestation policy, on the one hand, and the need to manage woody plant encroachment for the sake of ranching livelihoods and biodiversity, on the other hand.

The Department of Environmental Affairs (2019b) currently favours land management to restore ecosystem services and biodiversity, and to promote pastoral livelihoods. It recommends improved land management for protected areas, active clearing of trees coupled with better land management for private rangelands and active clearing in the grassland regions of communal rangelands as the best options to control woody plant encroachment and halt land degradation. The DEA acknowledges the non-alignment of climate mitigation, land degradation, biodiversity and ecosystem service policies in encroached areas.

By working through the 'Framework for Land Governance', we have elaborated main arguments of this paper. Land degradation and woody encroachment should be considered entwined biological and social phenomena; the contemporary condition of land is shaped by historical legacies of unequal governance arrangements at societal level; and multiple factors interact (through mechanisms, actors, processes) to produce some very contradictory outcomes for people's livelihoods and for meeting national and global policy goals. In working with the framework, we conclude that no one intervention is likely to secure sustainable land management in South Africa. In the final section of the paper, we elaborate on some of these points and reflect on the implications for South Africa and for global attempts to address land degradation.

9 | THE WAY FORWARD: EXPLORING THE POLICY SPACE

Land policies that include the recognition of customary land tenure can provide security and enable flexible responses to climate change (IPCC, 2019). Policies are recommended that promote adaptability and resilience, to reduce the vulnerability of people dependent on rangelands, even under changing conditions (Reed et al., 2015). However, the implementation of these approaches in South Africa is made challenging by unclear or overlapping land rights, high population to land ratio, the insecurity of farms and farm workers and corrupt or exploitative administrative processes (Mutangadura, 2007).

Most South African policy-based interventions since 1994 have focused on redistributing land to the landless and increasing its commercial viability for agriculture and for ranching. In doing this, rangelands dominated by grass can support livestock suboptimal for commercial production, but are resilient to heavy grazing and should not be viewed as degraded (Vetter, 2013). In many cases, degradation is not a result of communal grazing per se but due to high densities of people and maintaining heavy stocking rates (Vetter, 2009). These issues clearly demonstrate the entanglement of biophysical

and social factors in land degradation and the central role of policies designed to mitigate historical patterns of unjust access to land and natural resources.

Future policy developments in this space look set to provide greater emphasis on the intersection of biophysical and social factors, via a focus on climate change adaptation to promote sustainable livelihoods. Current land management in South Africa is governed by the Department of Environmental Affairs, Department of Agriculture, Forestry and Fisheries, Department of Land Affairs and Department of Rural Development and Land Reform, all of which function on an ecosystem-based adaptation approach (EBA). Within this governance framework, there are some promising prospects for integrative approaches both from the ecological and livelihood perspectives.

From the ecological perspective, the South African National Terrestrial Carbon Sink Assessment (Department of Environmental Affairs, 2017) focuses on biomass energy for climate mitigation by using invasive alien species and species causing bush encroachment. Serving as a model for this proposal, the Working for Land and Working for Water Programmes aim for grassland protection by small-scale removal of encroaching species. Under these programmes, current land management strategies include the removal of invasive *Acacia* to tackle woody plant encroachment by annual cut/spray to prevent establishment of encroaching species, the rehabilitation of grassland and subtropical thickets and interventions in the land space through climate-smart agriculture. Under the Strategic Climate Policy Fund, the DEA along with UK's DFID have also commissioned a nation-wide baseline study to explore the possible use of biochar as a climate mitigation strategy (Assessment of the Potential to Produce Biochar and its Application to South African Soils as a Mitigation Measure, 2015) to address water issues and biodiversity loss. Biochar is made by burning agricultural and forestry waste, with a potential to capture and store carbon in soils when applied to agricultural land.

From the livelihoods perspective, an overarching policy framework for integrating ecological and social factors is provided by the UN's current SDGs and the associated architecture of partnerships for implementation. At a more practical level, the sustainable livelihoods approach (Scoones, 1998), promoted by development agencies for the past two decades, has considerable integrative potential to inform land reform and policy advocacy. The sustainable livelihoods approach works with an analytical framework and a participatory method to map the intersection of factors which shape people's access to resources and to identify interventions which can reduce their vulnerability. Such an orientation has partially influenced land reforms as well as policy advocacy (Cousins & Scoones, 2010). The Department of Environmental Affairs in conjunction with several other departments has now taken a more integrative natural resource management approach to satisfy livelihoods' needs whilst securing ecological restoration.

Various contemporary policies of South African government departments, therefore, have the potential to address climate change

and woody encroachment issues. Nevertheless, the fragmentation of responsibility for addressing land degradation between different departments raises questions about how meaningful efforts to tackle this issue can be strategically coordinated to clarify the legal aspects of woody plant encroachment and land degradation. Conflicts arising out of overlapping land tenures and governance can then be mediated by the various departments involved in land administration. The need to reconcile international commitments with domestic and local policies designed to promote sustainable livelihoods and access to land and resources remains a challenge and emphasises the multiscale nature of the policy landscape surrounding land degradation.

Government policies and legislation, including land tenure reform policies and approaches to wildlife, are of key importance at the national or state level because the institutional dynamics at these levels intersect with the local institutions that more directly influence rural livelihood systems (Leach et al., 1997). Although changing land tenure arrangements will not result in immediate sustainability of ecosystems, they are part of the equation to address ecological issues. Promoting land stewardship, securing livelihoods and reorienting land tenure and policies to mitigate climate change seem like the way forward for South Africa's commitment to its people and international environmental treaties.

Lessons can be learnt from successful and cautionary experiences of land reform in neighbouring countries, whilst recognising that historical, demographic and ecological factors configure differently in South Africa. Hence, a South African solution will be needed to account for its particular combination of circumstances. Whilst land reforms in South Africa were aimed at restoring land from the hands of the colonisers to the indigenous Africans, the resulting management regimes can create tensions with ecological management. This raises important questions and actions for the state and policy-makers to consider when addressing the multi-faceted issue of land distribution. What kind of land reforms might achieve the objective of equal land distribution, whilst meeting ecological goals to maintain healthy landscapes, thus improving livelihoods in a changing political landscape? How many of these reforms are translated into practice? What are the prospects for a comprehensive reform of land reform itself?

More broadly, what general lessons can be drawn from South Africa for addressing the issue of land degradation in other regions? Whilst the South African case is unique, many countries face the simultaneous challenges of trying to prevent ecological degradation in the face of climate change whilst mitigating historical patterns of unjust access to land and natural resources. The recognition that land degradation is a biophysical and social issue is crucial in this regard and requires a focus on climate change adaptations that simultaneously promote sustainable livelihoods. The multiscale nature of the problem also creates important generalities about the challenges of how to simultaneously meet global and domestic commitments and the global challenge of reconciling goals of poverty alleviation with climate mitigation.

10 | LIMITATIONS TO THE STUDY

Due to the inherent nature of this paper as a narrative, the authors are unable to provide an extensive review of literature. The authors have taken the utmost care to provide a comprehensive assessment of the literature within the scope of this study. The authors are also limited using data from pilot study, therefore not reaching data saturation, and acknowledging any limitations arising from the complexities of interpreting and translating the interviews from Xhosa. The authors have refrained from providing specialist recommendations, recognising their own positionalities in conducting this research.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS' CONTRIBUTIONS

S.M., C.P.O. and F.C. conceived the ideas for the work; S.M. collected the data and drafted the manuscript; C.P.O. and F.C. contributed critically to the drafts and revised the work for final publication.

DATA AVAILABILITY STATEMENT

Due to ethical concerns, supporting data cannot be made openly available and is held on the University of Sheffield's Research Storage and available on request. Further information about the data is available at <https://doi.org/10.15131/shef.data.15155808> (Mani, 2019).

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SUPPORTING INFORMATION

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