PASTORALISM AND LAND TENURE TRANSFORMATION: POLICY IMPLICATIONS AND LIVELIHOODS ADAPTATIONS IN BOTSWANA

LENYELETSE VINCENT BASUPI

SUBMITTED IN ACCORDANCE WITH THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF LEEDS

SCHOOL OF EARTH AND ENVIRONMENT

JUNE, 2018

The candidate confirms that the work submitted is his own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

Thesis Supervisors

Dr Claire H Quinn

Associate Professor: Natural Resources Management; Deputy Director of Research (Excellence) – School of Earth and Environment - University of Leeds.

Professor Andy J Dougill

Dean of Faculty of Environment & Professor of Environmental Sustainability - University of Leeds.

Academic papers

Published

1. **Basupi LV;** Quinn CH; Dougill AJ (2017) Historical perspectives on pastoralism and land tenure transformation in Ngamiland, Botswana: What are the policy and institutional lessons?, ***Pastoralism*, 7, Doi: 10.1186/s13570-017-0093-1 (CHAPTER 2).**

2. **Basupi LV;** Quinn CH; Dougill AJ (2017) Using participatory mapping and a participatory geographic information system in pastoral land use investigation: Impacts of rangeland policy in Botswana, ***Land Use Policy*, 64, pp.363-373. Doi: 10.1016/j.landusepol.2017.03.007 (CHAPTER 3).**

3. **Basupi LV;** Quinn CH; Dougill AJ (2017) Pastoralism and Land Tenure Transformation in Sub-Saharan Africa: Conflicting Policies and Priorities in Ngamiland, Botswana, ***Land*, 6, . Doi: 10.3390/land6040089 (CHAPTER 1 AND 6).**

Revised and resubmitted

4. **Basupi et al. (Revised)** Adaptation strategies to environmental and policy change in semi-arid pastoral landscapes: evidence from Ngamiland, Botswana, ***Journal of Arid Environments* (CHAPTER 4).**

Under Review

5. **Basupi et al. (Under Review)** Institutional Challenges in Pastoral Landscape Management: Towards Sustainable Land Management in Ngamiland, Botswana, ***Land Degradation and Development*** **(CHAPTER 5).**

Candidate Contribution

The candidate designed the research that led to the published journal articles or articles under review, including the methodologies, fieldwork and data analyses, and led the writing of the articles, with co-authors (supervisors) providing supervisory work, editorial input around the structure and writing style.

Rationale for thesis by alternative format

I wrote the thesis as a series of publications (Journal articles). The publication process allowed other specialists' outside my supervision team to review and critique my work, thus providing helpful feedbacks throughout the process. I found the process of developing a journal article and responding to reviewers and editors to have instilled a high level of discipline in my research process and written style.

Acknowledgements

First of all I give all praises to the almighty God for providing me with the strength and blessing to complete this thesis.

I take this opportunity to sincerely acknowledge my sponsors: The Botswana International University of Science and Technology (BUIST) and the Botswana Government – Department of Tertiary Education Financing for providing all the funds for my tuition fees and living expenses in the UK, including covering my fieldwork expenses. The fieldwork for this thesis also benefited immensely from the University of Leeds Sustainable Agriculture Bursary Fund, which enabled me to successfully host workshops in Ngamiland for which I am grateful.

Special appreciation goes to my supervisory team: Prof Andy Dougill and Dr Claire Quinn, for their supervision and constant support. Their hard work, commitment and constructive comments and suggestions throughout the thesis contributed immensely to the success of this thesis for which I am indebted.

My profound gratitude also goes to the following Botswana government ministries and departments; Department of Meteorological Services, Ministry of Agriculture, Ministry of Environment Wildlife and Tourism, Department of Environmental Affairs and Tawana Land Board for providing some of the information required for this study. I warmly thank the University of Botswana Okavango Research Institute (ORI) for providing access to their GIS lab as when needed throughout the fieldwork.

I expand my thanks to communal area pastoralists/agro-pastoralists, the chiefs, extension officers, members of different village level committees: Farmers committees, Farmers associations and Village Development Committees in the study villages: Toteng, Sehithwa, Bothatogo, Bodibeng, Kareng, Makakung and Semboyo for participating in this study with interest and enthusiasm.

My family: my fiancée (Ms Onkemetse Tabulawa), my mother, my brother and sisters, have given me their unequivocal support throughout as always for which my expression of thanks likewise does not suffice.

I am indebted to my friend Tebogo Maphondo, for his help in recruitment of research assistants, arranging fieldwork transport and fieldwork accommodation logistics. I am thankful that in the midst of all his activities, he was always there for me during the times of need. I am grateful to the support offered by Mr Ramugaupi Gaborekwe (Office of the District Commissioner Maun), particularly his help in arranging stakeholder workshops and availing some documents needed for this thesis.

Lastly but not least, I am indebted to my research fieldwork assistants team; Mr Godfrey Tamuthiba, Mr Tebogo Maphondo and Ms Tebogo Malumbila, for providing a stimulating and fun filled environment for a fieldwork and learning.

At the end I would once more want to thank all those people who made this thesis possible and an unforgettable experience for me including those that I might not have mentioned here. However, I take the entire responsibility for any errors or inadequacies that might remain in this work.

ABSTRACT

In dryland Africa, access to land and water resources are central to pastoral livelihood activities and sustainability. Policy intervention in these regions represents the outcome of concerted post-independence processes in which countries have committed to land tenure transformation as a policy objective. This was meant to create private, liberal property rights to replace communal customary tenure systems which were considered to be a constraint to development. Despite these efforts, decades of research indicate that countries are struggling to meet environmental sustainability objectives. In Ngamiland District of Botswana, communal pastoral herders find themselves in a situation where they are now surrounded by privatised ranches, veterinary fences and wildlife conservation areas. Their resilience to environmental-related threats such as drought and livestock diseases have been significantly weakened. Using iterative participatory research methods, this thesis examined the social and spatial impacts of rangeland subdivisions and privatisation policies in Ngamiland District to inform sustainable pastoralism and sustainable land management (SLM) policies in sub-Saharan Africa and pastoral drylands. Results point to continued landscape fragmentations, land use conflicts and increase in outbreaks of livestock diseases that have resulted in pastoralists' marginalisation and vulnerability. Fragmented institutional and policy frameworks, weak governance structures and a lack of political will to build capacity at the local level limit pastoralists' adaptations and SLM adoption. Protecting pastoral land rights and livelihoods requires establishing negotiated and flexible tenure frameworks that strengthen pastoralists' participation in decision-making arenas. The integration of local spatial knowledge and integrative geospatial approaches can be used to foster better articulation and understanding of pastoralists' tenures for a supportive decision-making system for SLM. As the ability to adapt has positive attributes for livelihood sustainability and resilience, there is a need for practical initiatives that improve pastoralists' adaptive capacity including access to land and markets. This thesis support and expand on the African Union Policy Framework for Pastoralism of 2010, that call for the involvement of pastoral

communities and their local level institutions in policy making and implementation for greater SLM goals.

Table of Contents

List of Tables

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

List of Figures

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

Acronyms and abbreviations

BMC	-	Botswana Meat Commission
CBPP	-	Contagious Bovine Pleuropneumonia
CHAs	-	Controlled Hunting Areas
CKGR	-	Central Kalahari Game Reserve
CSO	-	Central Statistics Office
DEA	-	Department of Environmental Affairs
DVS	-	Department of Veterinary Services
DWNP	-	Department of Wildlife and National Parks
EIA	-	Environmental Impact Assessment
FMD	-	Foot and Mouth Disease
GIS	-	Geographic Information Systems
GPS	-	Global Positioning System
MOA	-	Ministry of Agriculture
NPAD	-	National Policy on Agricultural Development
ODMP	-	Okavango Delta Management Plan
ODRS	-	Okavango Delta Ramsar Site
PRA	-	Participatory Rural Appraisal
PGIS	-	Participatory Geographic Information System
RAD	-	Remote Area Dweller
RADP	-	Remote Area Development Programme
SLM	-	Sustainable Land Management
SSA	-	sub-Saharan Africa
SLOCA	-	Services to Livestock Owners in Communal areas
TGLP	-	Tribal Grazing Land Policy
UNESCO	-	United Nations Educational, Scientific and Cultural Organisation

Definition of key terms

ADAPTIVE CAPACITY: The ability of a pastoral socio-ecological system to adjust to constraints or potential damages by taking advantage of available opportunities to self-organise and implement new strategies that can help manage the consequences of constraints and reduce livelihood vulnerability.

ADAPTIVE MANAGEMENT: An integral method of resource and ecosystem management that acknowledges that environmental conditions are always changing, requiring societies to respond by adjusting and evolving through feedback learning (Berkes et al., 2000).

CO-MANAGEMENT: A situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory and natural resources contained therein (Borrini-Feyerabend et al., 2007)

COMMUNAL LAND: Land shared by multiple users for grazing and for gathering veldt products (fuel, building poles, medicinal plants, etc.) and managed through customary laws (Chauveau, 2007).

LAND DEGRADATION: A human – induced phenomenon that decreases the capacity of the land system and threatens the long term biological and/or economic resilience and adaptive capacity of the ecosystem (UNEP, 1997).

LAND SUBDIVISIONS: In this thesis, the term shall mean, the division of communal land into pieces for the purpose of commercial ranches, veterinary fences, wildlife management areas and human settlements.

LAND TENURE: The system of rights and institutions that govern access to and the use of land (Simbizi et al., 2014).

PARTICIPATORY GIS: A spatial tool which is used to combine both official expert and local stakeholders' spatial knowledge into a mapping process for the exploration of issues (Wang et al., 2008).

PASTORALISM: In this thesis, where the term 'pastoralism' is used, it should be understood to mean 'the pastoral way of living' that includes livestock rearing, especially where livestock constitute an important part of the pastoral livelihood identity.

PRIVATISATION: A process that involves the transfer of ownership of public properties such as state land or communal land to private individuals. Where the term is used in this thesis, it should be understood to include all measures and policies aimed at commercialization of the rangelands by privatizing land for private use by individuals or syndicates.

PROPERTY RIGHTS: Variety of rights which include the right to access natural resources, management and exclusion. Research in the area of property rights seeks to understand how allocations of property rights influence the efficiency and sustainability of natural resources (Ostrom, 1990).

VULNERABILITY: Lack of resilience by pastoral communities to the occurrences of uncertain events; droughts, livestock diseases, exclusion from markets including resource scarcity in the form of marginalised access or rangeland degradation (Rass, 2006).

CHAPTER 1:

General Introduction and Rationale

1.1. INTRODUCTION

This chapter provides the background on pastoralism and land tenure discourse in sub-Saharan Africa (SSA) and sets the scene for studying pastoralists' issues in Ngamiland District, Botswana. The motivation and rationale for the study is discussed. The aim and specific objectives are highlighted. A brief introduction to the research design and data collection methods is provided. The study area is described in detail and choice justified with further information about the study area also provided in each results chapter. This chapter therefore aims to outline the academic and policy position of this study, the subject matter and the research methods. The chapter concludes by presenting the thesis structure, significance and a framework for reading the result chapters and the thesis as a whole.

1.2. OVERVIEW OF PASTORALISM AND LAND TENURE DISCOURSE IN SUB-SAHARAN AFRICA

In drylands, access to grazing and water resources are central to rural pastoral livelihoods activities. Pastoralism is based on a resource use system that is highly dynamic and uncertain (Catley et al., 2013). For rural community dwellers, communal lands and their resources are the mainstay of most economic activities and rural livelihoods; including arable farming, hunting and the day to day gathering of natural resources such as veld products (e.g. Bennett and Barrett, 2007, Chanda et al., 2003). Pastoral communities typically hold their land under customary tenure, based on

customary laws. Customary laws includes a body of extremely diverse rules and regulations (usually unwritten) founding their legitimacy in 'tradition' (Chauveau, 2007). This management regime is critical because it creates shared communal rights of access, providing an ideal framework for communities to exploit scarce resources across various agro- ecological conditions, which in turn reduces the level of vulnerability (Agrawal, 2001). However, concerns over the demise of traditional pastoral resource use systems due to rangeland and water resource degradation, impacts of climate change, impacts of land tenure policies, and expansion in commercial agricultural activities and conservation areas continue to occupy the central agenda in pastoralism literature (e.g. Lesorogol, 2008, Lebert and Rohde, 2007, Thornton et al., 2009). Many pastoral communities are faced with shifts in land tenure as their communal rights are considered by development practitioners as a constraint that hinders development and that needs to be modernised (Elhadary, 2010). Moreover, climate change, population growth and land use policies that focus on sedentarisation of pastoral communities continue to cause accelerated pressure on natural resources leading to rangeland resource degradation, wildlife declines and pastoralist vulnerability (Western et al., 2009, Meadows and Hoffman, 2003).

As drylands are characterised by low and spatio-temporally variable precipitation (Kaptue et al., 2015), sustainable land and livestock management in these environments is dependent on adaptive mobility and pastoralist flexibility to make use of highly variable rangeland resources (Turner, 2011). Historically pastoralists have been able to follow rainfall or specific pasture resources through space and time in order to meet the needs of their animals and prevent rangeland degradation caused by the concentration of animals in smaller territories (Oba, 2013, Adriansen and Nielsen, 2002). It is this flexibility that provides a measure of security in times of drought or other ecological disasters by creating reciprocal expectations of resource sharing between groups (Stringer et al., 2017, Reynolds et al., 2007).

1.2.1. Land tenure, Property Rights and Common Pool Resources

In SSA, access to land is widely considered a precondition for access to other livelihood opportunities (Ellis, 2000, Toulmin, 2009). Land tenure is the institutional arrangements that define the rules of how rights to land are distributed/allocated, how the land is used and who can use the land; for how long and under what conditions (Clover and Eriksen, 2009). Property rights are important institutional arrangements for access to land and other natural resources. The term property implies a system of relations between resource users which involves rights, duties, privileges and power, among others (Payne, 2004). Property rights define uses, which can be viewed through a bundle of characteristics: exclusivity, inheritability, transferability and rights enforcement mechanisms (Feder and Feeny, 1991). Rights to land may also have a temporal dimension, such as in pastoral regions. There are four main categories of rights concerned with land and other natural resources: open access, common property rights, private property rights, and state property rights (Vatn, 2015). In open access, rights are left unassigned and access to resources is characterised by a lack of exclusivity, which means anyone can access the land and use the resource (Feder and Feeny, 1991). An absence of property rights means resources can be subject to overexploitation and degradation. Under common property, exclusive rights are assigned to a group of individuals who determine who can access the resource and under what conditions. Groups of individuals (e.g. members of a community) who collectively use the resource determine the rules under customary management institutions. These rules include: (1) defining who the members of the common are, and (2) defining their rights to use the resource, what benefits streams can be utilised and by which members (Vatn, 2015). In state property, management of the land and its resources are assigned to the public sector. While the resource is in principle owned by all persons having state membership, state-authorised representatives or a public department make decisions concerning

resource use. In private property, an individual is assigned all or certain rights and obligations regarding the use of the land.

Providing security of tenure is often seen as a precondition for better natural resource management and sustainable rural livelihoods (Clover and Eriksen, 2009). Because land rights comprises a full set of use and transfer rights, vested in communities, groups, individuals or households, secure tenure implies being able to enforce those rights against claims of others (Mutangadura, 2007). Land rights addresses the ownership of land which provides security against threat of expulsion or exclusion (Clover and Eriksen, 2009). Rural communities generally need both secure individual rights to farm plots and secure collective rights to the common pool resources upon which they depend collectively for livestock grazing, veld products harvesting and fishing, among others.

Common Pool Resources (CPRs) are goods that are either natural or manmade, large enough that exclusion from the resource system is costly, but where consumption of the resource unit is subject to competition and rivalry (Araral, 2014). Communal pastures are described as CPRs. CPRs can be defined based on two attributes: the difficulties of excluding individuals from benefiting from a good, pertaining to provision problems, and the subtractability of the benefits consumed by one individual from those available to others, pertaining to appropriation problems (Ostrom, 1990). Excludability and competition are two features that distinguish CPR from private property. These two characteristics make CPRs susceptible to overharvesting and destruction hence the 'tragedy of the commons'. CPR are not always open access as customary institutions act to dictate rules of access and use of the resource, though they are always characterised by rivalry (Quinn et al., 2007, Vatn, 2015). In SSA, CPRs are important since the majority of the rural population rely on them to provide at least part of their livelihood (Moritz et al., 2013). Decisions made through common property regimes (institutions) can lead to collective action for the management of CPR and therefore allow communities to spread risk created

by ecological uncertainty because CPRs can cover a larger area allowing a group of users to access resources across a landscape as they become available over time.

1.2.1.1. Theoretical debates on Land Tenure, Property Rights and Common Pool Resources

1.2.1.1.1. The tragedy of the commons

Hardin's metaphorical theory 'The tragedy of the commons' has been used to symbolise the degradation of the environment to be expected whenever many individuals use a scarce CPR (Ostrom, 1990). The theory pictures an open pasture, with pasture resources open to all, hence 'the commons'. Each herder receives large benefits from selling his or her own animals while facing small costs of overgrazing. When the number of animals exceeds the carrying capacity of the pasture, each herder is still motivated to add more animals since the herder receives all of the proceeds from the sale of animals and the cost of overgrazing is shared equally among herders in the form of reduced pasture or rangeland degradation (Hardin, 1968). Once the rangeland has reached its carrying capacity, every animal added degrades the commons, leading to 'the tragedy'. Hardin presumed that resource users were trapped in a commons dilemma where they are unable to create solutions which safeguard the sustainability of the commons (Hardin, 1968). He claimed that only state-established institutional arrangements and a property rights system could sustain CPR over the long run (Dietz et al., 2003).

In SSA Africa, pastoralism has often been described as unproductive and directly responsible for land degradation, since it is carried out in rangelands open to all or common lands where access is rarely restricted (Dregne, 2002, Oba, 2013). Stocking rates were assumed to exceed the ecological carrying capacity of the land, making

production unsustainable, off-take per animal sub – optimal and rangeland degradation unavoidable. Indigenous land tenure practices were blamed for discouraging private incentives to manage pasture CPR and encouraging higher stocking rates; livestock farmers overexploit an area and move on (Rohde et al., 2006). This view portrays pastoralism as a destructive and maladaptive system, which needs to be changed before 'the tragedy' strikes. Enclosure and individualization of the commons was the logical policy prescription that emerged from this analysis, since only private individuals or the state are seen by governments as capable of managing resources sustainably where the incentives to do so under communal system is weak or absent (Rohde et al., 2006, Peters, 1994).

Hardin (1968)'s thesis had a large impact on understanding and shaping scientific research concerned with famine and environmental degradation in arid lands (e.g. Nori et al., 2008, Adams et al., 2003) Critiques of Hardin's tragedy thesis however, point to his oversimplification of CPR use which inherently missed many aspects of CPR management institutions. The simple model of a group of herders seeking to maximise private benefit from a common pasture unless constrained by state established rules is compelling but quite divergent from on-the-ground realities (Tuner, 2011). Many societies, including pastoral herders, have for many years developed self-governing institutions which are successful against threats of resource degradation and climatic variability

1.2.1.1.2. The Economic/market theory of property rights

In sub–Saharan Africa (SSA), competition over land has intensified over the last few decades due to urbanisation, agricultural intensification, conservation initiatives and privatisation of communal lands through rangeland policies that have sought to create private, liberal property rights to replace communal customary systems (Kisamba-Mugerwa et al., 2006). It has been argued that communal land tenure

arrangements, whereby pastoralists have unregulated access to communal lands, were responsible for land degradation and desertification due to overstocking and poor livestock management practices (Magole, 2009). The market-oriented theory of land tenure and property rights (Simbizi et al., 2014), was at the forefront of communal lands privatisation schemes in SSA since the 1970s (Deininger, 2003). Proponents of the theory argued that indigenous customary tenure encourages land degradation and limits entry into the market economy, hence better farmers have difficulties gaining access to productive land (Sjaastad and Cousins, 2009). The land was seen to be embedded in local backward social systems (Dorner, 1972). It was further argued that the success of economic policy will depend on the state's commitment to free markets, the privatisation of state-owned enterprises and communal land resources, and legal security of property rights (Simbizi et al., 2014).

The two opposing views in this debate are focussed on either supporting tenure reform through the registration of land to individuals and the state, or strengthening customary tenure. The proponents of tenure reform have received support since Hardin's argument that communal tenure arrangements fail to regulate irrational behaviour, leading to overexploitation of communal resources (Hardin, 1968). Hardin's thesis also provided the rationale for World Bank programs calling for privatisation of communal grazing lands so as to commercialise the livestock sector in developing countries (Fratkin, 1997). De Soto's support has been particularly singled out, with his theoretical argument stating that the conditions and terms of negotiation under which land is held under customary tenure only encourage low rates of productivity-enhancing investments (De Soto, 2000). De Soto refers to land held under customary tenure as 'dead capital' because it cannot be used as collateral in a formal banking system.

1.2.1.1.3. The legal based School

The legal system is at the core of this school of thought arguing that the basis of land tenure security is in legal statutory systems that protect someone's rights to the land. This school of thought places emphasis on formalisation of tenure and security of property rights for personal welfare and economic development through enforcement of one's rights or interest in land (Simbizi et al., 2014). The security of property rights is an outcome of policy choices and institutions that define and enforce property rights by applying the law fairly to all and ensuring that government does not engage in coercion and expropriation of common property resources (Levine, 2005). Besides formal legal based systems, this school of thought recognises that land tenure and property rights are also shaped by moral and ethical norms governing human interaction.

1.2.1.1.4. The adaptation paradigm oriented school of thought

However, both these views have been widely contested as not representing customary land rights and management systems that were in place for African rural communities (e.g. Cousins and Scoones, 2010, Leach et al., 1999). The adaptation paradigm school of land and property rights (Simbizi et al., 2014) emerged in the 1990s as a reaction to the popular views held by the economic/market oriented school of thought. Proponents of this theory argue against communal land privatisation, emphasising the adaptive nature of customary tenure systems within the context of unpredictable ecological conditions in African dryland systems. It is further argued that communal tenure systems often provide safety nets for marginalised groups such as women and the youth by providing low cost access to land (German et al., 2013). Farmers have long term and secure usufruct rights, and

in many places communal tenures are evolving to accommodate new technologies at a cost lower than state run land titling and registration systems (ILRI, 1995). Ostrom (1990), and others have argued against solutions that are imposed on users by external authorities, arguing that traditional group property regimes are able to self-organise, that local users are capable of designing and changing their own rules, implementing the agreed upon rules and most importantly can draw on inherited skills to learn strong locally crafted rules as well as evolved norms of behaviour (Ostrom, 1999, Ostrom, 1990), especially reciprocity (Bendor, 1987). Ostrom further argues that undermining local resource users through privatisation or rangeland enclosure schemes increases the vulnerability of resources to degradation and increases the vulnerability of their users (Ostrom, 1990).

1.2.1.1.5. The Ostrom school of thought

Issues concerning the management of the CPRs, including common pastures, have been rigorously debated since Hardin's 'Tragedy of the commons'. Some scholars have advocated for a 'market solution' as discussed above (e.g. De Soto, 2000). Whilst others have advocated for a state solution (Wade, 1987). Those advocating for a state solution argue that external coercion is required because CPR users, in the absence of external influence, overexploit resources giving priority to individual interest over common interest (Sarker and Itoh, 2001).

Ostrom's work, 'Governing the commons' (Ostrom, 1990) strongly advocates for institutional solutions (i.e. self-governance) as the best alternative in the management of CPRs. She argues that neither state nor market solutions as proposed are consistently successful in facilitating individuals to sustain long-term productivity of CPRs. She further argues that communities have relied on locally crafted institutions resembling neither the state nor market to govern CPRs with some degree of success over long periods of time (Forsyth and Johnson, 2014). Using a

number of empirical case studies of CPRs, Ostrom establishes that self-governance of CPRs is possible under customary property institutions that users of the commons design and implement themselves (Ostrom, 1990). Institutions are defined as shared decisions and behavioural practices that control rational but self-centred actions of individuals (Ostrom et al., 2002). Ostrom argues that Hardin's alternatives of ecological collapse, state-led solutions, or privatisation could be replaced by a more inclusive and flexible locally crafted institutions for the management of CPRs (Ostrom, 1990). Individuals are more likely to conserve the commons when they have reliable information about costs and benefits of resource decisions, including an opportunity to decide the rules of the game (Dietz et al., 2003).

Ostrom identified her design principles as being most directly about long-term institutional sustainability (Agrawal, 2014). The design principles are enabling conditions that should be present in order for successful CPR management regimes to occur (Quinn et al., 2007, Sarker and Itoh, 2001). These principles provide a theoretical framing for analysing resource management institutions.

Design principle 1: Clearly defined boundaries

Knowing the physical and ecological properties of resources is of critical importance in the management of CPRs. Ostrom argues that individuals, including households, who have access rights to a common resource must be clearly defined, as should be the physical boundaries of the CPR itself. Without clearly defined boundaries, users face the risk that the benefits of a CPR will also be enjoyed by outsiders, including those that did not invest in the management of the CPR, resulting in overexploitation and resource degradation (Ostrom, 1990). However, in SSA pasture CPR, climate variability and ecological factors such as drought means that resource availability varies both spatial and temporally (Quinn et al., 2007). This means that an extensive area of exploitation is needed to ensure pastoralists survival and also avoid rangeland

degradation. Rangeland carrying capacity is likely to increase if pastoralists have access over a large area following fluid boundaries (Vetter, 2005).

Design principle 2: Congruence between appropriation and provision rules and local conditions

This design principle attempts to address the aspect of sustainable use of CPR resources (Quinn et al., 2007). The management of CPRs usually encounters two broad types of problems; appropriation and provision problems. Appropriation problems are time independent and result from the allocation arrangement of a limited resource (Ostrom, 1990). Provision problems are time dependent and result from the allocation arrangement of responsibilities for building, repairing, or maintaining resource systems, as well as the appropriators' well-being (Ostrom, 1990). Ecological factors may prevent effective management institutions and this principle attempts to link the local social structures that make management of CPR possible with the ecological system (Vatn, 2015). In a study of Tanzanian CPR regimes, Quinn et al (2007), found a strong adherence to this rule in CPR regimes such as forest management regimes. However, adherence to the principle was found to be weak among the pasture CPR regimes.

Design principle 3: Collective – choice arrangements

This design principle maintains that individuals who use the CPR and are affected by the operational rules will create rules best suited to their local conditions and context (Ostrom, 1990). The strength of CPR regimes is determined by strong adherence to these rules. In sub-Saharan Africa, most pre-colonial CPR management was based on customary institutions with most of the executive powers vested on traditional leaders such as the chiefs (Peters, 1994). After independence, there was a lot of restructuring of CPR management. In South Africa, recent legislation placed considerable powers in the hands of the traditional chiefs (Wisborg and Rhode,

2005), while countries such as Lesotho and Botswana preferred democratically elected members from resource users or appointed local land management bodies (Peters, 1994).

Design principle 4: Monitoring

This design principle demonstrates that communities can self-organise to limit and monitor extraction of commonly held resources by establishment of clear rules and boundaries (Dietz et al., 2003). The continuous auditing of CPR conditions and behaviour of appropriators is the responsibility CPR institutions. Monitoring serves to ensure that users adhere to the operational rules so as to safeguard the resource from overexploitation and degradation (Ostrom, 1990). Based on this principle, community based conservation works since the early 1990s have focused on developing rules by local communities, creating governance structures and establishing resource boundaries for management of the commons (Ribot et al., 2010, Vatn, 2015).

Design principle 5: Graduated sanctions

This design principle maintains that where there is a robust institution for the management of CPRs, monitoring and sanctioning of abusers is taken not by external authorities but by participants/users of the CPR themselves. Violators are assessed based on the severity of their infractions and modest sanctions are imposed on first offenders (Dietz et al., 2003). The severity of sanctions will increase for repeat violators (Ostrom, 1990). CPR management regimes rely on informal strategies for achieving compliance and commitment to the rules. From a range management perspective, this principle addresses management factors affecting the magnitude of grazing pressures at range sites: the spatiotemporal distribution of livestock population and the overall size of the livestock population across the grazing common (Turner, 2011).

Design principle 6: Conflict resolution mechanisms

Differences in power and values of individuals make conflicts inherent in the management of CPRs (Dietz et al., 2003). This principle maintains that users of resources have rapid access to low cost local arenas to solve conflicts among and between themselves compared to external induced mechanisms (Ostrom, 1990). Delegating authority to a third party does not always solve conflicts satisfactorily.

Design principle 7: Minimum recognition to organise

This principle maintains that CPR users have the right to devise their own management institutions. Resource users devise their own rules and associated arrangements without the involvement of government officials (Ostrom, 1990). In SSA, though the traditional leadership was more responsible for CPR management, informal institutions for the management of CPR exist in the form of social networks of alliances and lobbying groups. Rules set by external authorities do not always work.

Design principle 8: Nested enterprises

The nested enterprise design principle describes institutional arrangements that must be available to ensure effective management of CPRs (Ostrom, 1990). Institutional arrangements must be complex and nested in many layers of collaborative management that ensures monitoring, enforcement of rules and conflict resolution (Dietz et al., 2003). Imposed strategies for management of CPR such as centralised command and control or markets solutions do no always work and can lead to catastrophic failures such as massive environmental degradation and poverty (Dietz et al, 2003).

Ostrom's work has been criticised for a lack of attention to the state and its role in structuring contemporary resource governance (Agrawal, 2014). Many of the design principles also overlook the complexities inherent in communities and the variability of the natural environment (Quinn et al., 2007). The design principles have also been found to be only specific to a certain type of CPR (e.g. Quinn et al, 2007). In SSA, the conclusion is that indigenous management regimes have been weakened in terms of their adherence to the structure as outlined in Ostrom's 8 design principles (Wily, 2011). In many cases, post-colonial governments claimed overall control and legislated on property rules which ignored customary management institutions, often undermining and thus weakening existing forms of authority over land (Lund and Boone, 2013). Communal land tenure transformation means that boundaries, protection of access rights, conflict resolution and the general protection of CPRs has been significantly affected, mostly in a negative way (Magole et al., 2010). Customary management institutions have been replaced by sectorial based institutions and fragmented systems characterised by conflicting power relations, making it difficult for local communities to negotiate their stake in the management of CPRs (Büscher, 2010). CPR management is now mostly in the hands of respective government departments, whose resource management agencies operate in various degrees through command and control instruments with minimal cooperation with local communities, and/or traditional decision making authorities (Benjamin, 2008).

However, Ostrom's work provides a more positive and focused framework for research and development on CPRs than previous discussions based on the Tragedy of the Commons thesis. Her argument that individuals who are well informed and with minimum rights of autonomy and monitoring could undertake collective action to protect communal resources without causing unnecessary degradation, or requiring state or private intervention, has contributed significantly to the CPR discourse and is critical to the conceptualisation of the common property struggles that subsequently present themselves in this thesis.

1.2.2. Privatisation of common pastures in sub-Saharan Africa

In SSA, land use policies have often ignored the multi-purpose goals of traditional group property regimes as practiced in communal lands and emphasised rangeland enclosure, privatisation of communal grazing lands and commercialisation of the livestock sector, leading to weakening and marginalisation of traditional land and pastoral management regimes (Oba, 2013, Rohde et al., 2006). Mobility and flexibility have diminished as land ownership has become more rigid and fixed, with different land uses separated by fences and other administrative barriers (Letai and Lind, 2013). In Kenya's Maasailand for example, researchers describe the impact of government enclosure policy in which rangeland development schemes have not only privatised the best land but have also led to overgrazing, violent conflicts and increased wealth inequalities (Galaty, 1992, Lesorogol, 2008).

Inspired by the tragedy of the commons and market liberalisation theory, since the 1960s many SSA countries have been revisiting their customary tenure arrangements in pastoralists' areas, reforming institutions for the administration of land rights and finding ways of liberalising tenure arrangements by embarking on individualisation, rangeland enclosures, commercialisation and privatisation of communal lands (Adams, 2013, Mwangi, 2009). While the views expressed by neo-liberal scholars that privatisation is essential in stimulating economic growth, in sub-Saharan pastoralists economies, this was not found to be the case because pastoralism and the nature of dryland environments (Vetter, 2005) and cultural institutions (Berry, 2002, Ostrom, 2015) required that communities manage resources flexibly and jointly over relatively large tracts of land (Fernandez-Gimenez and Febre, 2006).

The literature highlights land tenure security and land expropriation as key problems in pastoral land development (e.g. Fernandez-Gimenez, 2002, Lane, 2014). Expansion of competing land-uses, land tenure transformation, individualisation and enclosures have reduced the net availability of rangeland resources, often with significant

consequences for pastoral livelihoods and the environment. For example, in Kenya, the group ranch concept is now said to be in its fourth decade, but there is general consensus among scholars and researchers, including policymakers, that the policy has failed to meet its objective (of commercializing production, improving pastoral wellbeing, improving environmental management) and has also jeopardised the socio-economic welfare of the Maasai community (e.g. Letai and Lind, 2013, Mwangi and Dohrn, 2008, Mwangi, 2007b).

In Ethiopia, the practice of reserving some pastures for drought was widely practiced by *Borana, Guji* and *Gabra Oromo* communities long before the arrival of externally/donor funded land tenure and pastoral development projects (Tache, 2013). Tache argues that these reserved areas were not fenced, but word of mouth was enough to restrict access. Over the years pastoralists in Ethiopian drylands have experienced a major shrinkage in available dry season grazing, a reduction in communally managed grazing reserves and a growing individualisation of land use rights through privatisation. Similarly, in Sudan, the process of land resource individualisation has severely fragmented the Central Sudan rangelands as land is expropriated for large-scale commercial farming and wildlife conservation (Babiker, 2013).

In summary, the issues emanating from the literature show that in SSA, land tenure transformation policies have been based on western, classical rangeland ecological models (Klintenberg and Verlinden, 2008, Rohde et al., 2006), economic theories (Simbizi et al., 2014), rangeland degradation narratives and tragedy of the commons theory (Rohde et al., 2006, Hardin, 1968), rather than the socio-ecological realities of dryland rangeland dynamics. Often economic development objectives have been prioritised over environmental concerns or pastoralists wellbeing. Consequently, traditional grazing territories have been shrinking while pastoralists dependent on rangeland resources and ecosystem services have been displaced and exposed to incremental risks; poverty, livestock diseases and a breakdown of social networks and safety nets as well as a decline in rangeland productivity. This compression has

suppressed the flexibility and spatial extent necessary for pastoralism in these dryland environments.

Implementing property rights that are equitable and that enhance the sustainability of both pastoral livelihoods and resources has remained a challenge for public policy in SSA drylands (Mwangi, 2009). The performance of land tenure transformation policies has had mixed results and issues of impacts and implementation of such policies for sustainability remains debated in the research literature. Proponents of communal land privatisation do not indicate how the various attributes of communal resources involved will be measured; how impacts associated with such processes will be mitigated, who will pay for the costs of excluding communal pastoralists from access, how conflicts over rights of access will be adjudicated, or how the residual interests of the different stakeholders in the resource will be organized (Ostrom, 1990). In SSA, only a small minority of pastoral elites have been able to take advantage of government incentives that have facilitated private commercial ranching (Galaty, 2013, Magole, 2009, Sjaastad and Cousins, 2009). As such, the failure of rangeland privatization programs is almost universal (German et al., 2013, Mwangi, 2007a, Homewood, 2004). Low levels of economic development and deficiencies in markets also makes it almost impossible to achieve environmental sustainability objectives (Thomas, 2008). Further evidence from the literature suggests that the perceived benefits of tenure transformation have acted as a justification for the concentration of land in the hands of a few, especially political connected individuals, exacerbating insecurity of land tenure for the rural poor (Boone, 2014). The overall policymaking processes in these regions remain weak and insufficient as deficiencies in the data and governments priorities often lead to poor performance of different land tenure transformation policies.

The relevance of the ranching system in rangeland resource management and its principal assumptions have been hotly debated in the pastoralism literature (e.g. Rohde et al., 2006, Dougill et al., 1999, Ellis and Swift, 1988). However, studies have tended to focus more on environmental and economic consequences of land tenure

transformation. Few studies have had local spatial knowledge and historical perspectives as their point of departure. Less is understood about the interlinkages between multiple historical factors and evolution of issues in shaping pastoralists' landscapes and land use patterns. Such lack of empirical analyses on the historical evolution of issues for communal rangeland areas affects the sustainability of current rangeland policies (Fernandez-Gimenez, 2006)) and is central to the need for this study.

1.3. BOTSWANA: PASTORALISM, COMMON POOL RESOURCES AND POLICY CONTEXT

Botswana is a semi-arid country whose population depends largely on livestock production. Botswana's rural people are mostly village dwellers and their pastoral activities assume the form of transhumance under a three-tier settlement system, whereby rural village dwellers commute between villages, land areas and temporary encampments, known as cattle posts, where livestock are kept (DoL, 2009). Due to unpredictable climatic conditions, production for livelihoods can be maintained by moving to exploit resources as they become available. Traditionally, communal rangelands have been managed by traditional institutions based on customary rights to resources which allowed for inter-territorial grazing between unfixed tribal boundaries so that animals can access forage and water even in times of stress, such as drought years (Makepe, 2006). Change in environmental conditions has always influenced pastoral livelihoods in Botswana (Chanda et al., 2003). However, unfavourable ecological conditions and pastoralist vulnerability have increased since the 1980s due to increased fragmentation of landscapes as a result of new rangeland policies (Abson et al., 2012, Magole, 2009).

1.3.1. Democratic decentralisation of CPRs management

Decentralisation involves a number of related policy reforms, in which central government agencies transfer rights and responsibilities of the management of CPRs to more localised institutions (Agrawal and Gupta, 2005). Where community members are elected into these management institutions and given meaningful discretional powers, such reforms are referred to as democratic decentralisation, as they are assumed to represent the entire community (Ribot et al., 2010). Efforts to promote popular participation in the management of CPRs such as communal lands, shared water resources or forests are gaining increasing prominence. Development agencies and researchers around the world are promoting greater local participation in decision making so as to improve local communities' development and efficient management of CPRs (Ribot, 2003). Recently, Community Based Natural Resource Management (CNRM) organisations have gained prominence as decentralised CPR institutions for the efficient management of natural resources in rural sub-Saharan Africa (Cassidy, 2001, Blaikie, 2006). However, a review of CBNRM shows a number of studies documenting positive benefits for the management of wildlife resources, but evidence for positive benefits for other CPRs such as pasture land are more limited (Barcus, 2018, Ichinkhorloo and Yeh, 2016, Blaikie, 2006). Emerging from this documentation is the argument that CBNRM (its production, representation in policy documents, and implementation) is not made nor delivered for the development of the community but rather primarily concerned with a conservation agenda (Twyman, 2017, Arntzen et al., 2003). Therefore, the agenda and the rules of the game are not set by local people, but by funders and central governments (Blaikie, 2006).

In Botswana, prior to independence in 1966, rights in tribal land including common pastures were vested in the Chiefs who had both the right and the obligation to allocate land to their tribesmen (Peters, 1994). People were able to graze their stock on the commons, but land overseers appointed by the Chiefs played a role in managing the grazing commons, in consultation with land users. Before the advent

of borehole technology (in the 1930s) grazing range was confined to those areas with seasonal surface water, or where the water table was high and wells could be dug (Perkins, 1996). Improvements in deep borehole technology with motorised pumps to tap into groundwater sources in the 1950s enabled livestock farmers to expand into the sandveld.

The first post – independence land reform instrument in Botswana was the Tribal Land Act of 1968. From the Tribal Land Act, new institutions were put in place to implement the post-independence approach to land, property rights and governance. The Act made provision for the creation of Land Boards to take control of communal land duties from Chiefs and all traditional leaders (Mulale et al., 2014, Magole, 2009). The Land Boards were established in 1970 and given responsibilities for land – use zoning, planning and allocation including change of use (RoB, 1968). The Tribal Land Act did not change customary law, what it changed was who was responsible for administering it. It took that power away from the Chiefs and gave it to the Land Boards, which were decentralised. Members of the Land Boards were appointed by the Minister of Lands on the recommendation of the District Commissioner (RoB, 1968). The Chief was a member, but this was most often done to minimise the Chief's opposition to having the land allocation function taken away from them. Initially, each Land Board had two District Councillors as members to make sure that there was democratic accountability. Landholders granted lands under customary law were issued with leases or customary certificates by the Land Board (DoL, 2009). Those issued with leases had exclusive individual rights to their holding with respect to residential, cultivation and ranches.

However, as time went by, the government felt the need to professionalise the management of the Land Boards in line with modern management practices. Steps were taken by the State to remove the Chiefs and District Councillor representatives from the Land Boards altogether. This was followed by a period where Land Board members were elected at District level under the supervision of the District Commissioner. This was replaced by the current system where people apply to sit on

the Land Board and are appointed to the positions of Land Board member by the Minister of Lands.

However there are strong counter arguments which question the success of Botswana's land governance decentralisation process, particularly in relation to the Land Boards. Some studies argue that the establishment of Land Boards has enabled local elites to centralise decisions about land to the benefits of a few individuals (Peters, 1994). Others argue that the Land Boards have actually replaced an already highly decentralised system characterised by locally negotiated rights and claims to land and other CPRs (Perkins, 1996, Magole, 2009). While CBNRM programmes in Botswana have been ongoing for almost two decades, studies show that CBNRM largely involves wildlife-based tourism, and has very little to do with management of common pastures (Mbaiwa, 2015).

1.3.2. The Tribal Grazing Land Policy

Botswana registered its concern for rangeland degradation and what was termed 'unsustainable livestock keeping' in 1975 through the Tribal Grazing Land Policy (TGLP) (RoB, 1975). The "Tragedy of the Commons" (Hardin, 1968) theory had been widely used to blame communal grazing for land degradation (Magole, 2009). TGLP had three objectives: (1) to stop overgrazing and degradation of the range, (2) to promote greater equality and incomes in the rural areas and (3) to allow growth and commercialisation of the livestock industry on a sustainable basis (RoB, 1975). Through this policy, the government hypothesised that economic progress could only be accelerated by encouraging private land ownership and that pressure in communal lands would be alleviated through demarcation of ranches. Large herds owners would then be allowed to transfer their cattle to these ranches, thus leaving the communal lands for communal subsistence pastoralists (White, 1993). According to the White Paper on the TGLP and feasibility reports by the Ministry of Agriculture,

development had to start with granting exclusive rights and fencing of specific areas. Land Boards and Land Use Officers in the Ministry of Agriculture were given the responsibility of surveying the Tribal areas of Botswana (making up 71% of the total area of the country at that time). These were to be zoned into three categories: (1) commercial areas where exclusive rights would be granted to individuals and groups with a minimal rental payment, (2) Communal areas, where the land tenure system would remain the same but stock limitations would be imposed and (3) reserved areas which would not be allocated to anyone but rather set aside for the future, thus ensuring 'safeguards for the future generation and poor members of the population' (APRU, 1976).

The planning stage of TGLP focussed on economic gains and administrative initiatives (Childers, 1981). In spite of complaints from local people at the consultation stage (i.e. before implementation) of the uncertainty of potential benefits (White, 1993), the policy was implemented without mapping to provide the necessary spatial baseline information on how much land would be available for the policy's different objectives. In addition, there was no plan to monitor the progress of activities in the different zones stated above. Lack of spatial information and a good monitoring plan made implementation in its original form difficult to evaluate. Bennett et al (2013), argue that successful legitimisation of SSA land tenure reforms will depend on clear descriptions of pastoral systems and environments, including the spatial dimensions, being understood and available to decision makers at both local and national level. Yet, many tenure transformation policies in SSA lacked an understanding of this critical component. The integration of pastoralists' spatial knowledge, spatial comparisons and/or participatory mapping approaches and geospatial technologies (such as GIS) to analyse pastoral management systems is lacking. Studies have emphasised the need to generate such spatial landscape knowledge regarding pastoralists' tenures and land use in order to develop the capacity of local communities and to help governments develop appropriate policies, reconcile pastoral tenure conflicts and manage resources in dryland areas (e.g. Turner et al.,

2014, Bennett et al., 2013, Lengoiboni et al., 2010). This spatial component is also central to the need for this study

1.3.3. National Policy on Agricultural Development

In spite of difficulties in implementation of the TGLP (Tsimako, 1991), Botswana continued with communal land privatisation in the subsequent National Policy on Agricultural Development (NPAD) issued in 1991 (RoB, 1991). NPAD included a wide range of objectives for the development of the agricultural sector in Botswana. As regards to fencing and privatisation of communal lands, NPAD emphasised that TGLP would be intensified and expanded into all communal areas. Under NPAD, the ranches would not have a fixed size as originally stated in the first stage of TGLP (8 km x 8 km). The size of the ranch would depend on the number of cattle the applicant for a ranch owned and the availability of land and its carrying capacity. Most importantly individuals could apply to fence areas within the vicinity or around boreholes, regardless of their location in communal areas (RoB, 1991). This policy implied a major land tenure transformation since the zones that were originally identified as communal lands in the earlier TGLP zoning process would gradually be privatised (RoB, 1991).

1.4. MOTIVATION AND JUSTIFICATION FOR THE STUDY

In drylands, although livelihoods options are affected by multiple factors such as climate conditions, insecure land tenure and limited access to land have the most profound effects on smallholder livelihoods in SSA (Peters, 2009). Loss of access to land and water resources have dramatically increased in recent years due to poor land use planning, privatisation policies, including a lack of recognition of land and

resource ownership rights of pastoralists in communal areas (Derman et al., 2007, Reid et al., 2004). The literature presents a striking situation in which private land rights have been unduly treated as superior to customary land rights so that land reform policies in SSA have sought to modernise customary rights and pastoralism (Chimhowu and Woodhouse, 2006, Rohde et al., 2006). This has in turn resulted in increased landscape fragmentations and pastoralist vulnerability (Hobbs et al., 2008, Galvin et al., 2008).

Meanwhile, many African countries support for communal land privatisation was accompanied by expansion of conservation areas and fences for diseases control purposes (McGahey, 2011, Galvin et al., 2008). The coexistence of different forms of tenure suggest the need to develop appropriate policies and analytical frameworks focusing on the relationship between land tenure, pastoralists' wellbeing and sustainable land management (SLM). The empirical evidence on the failure of rangeland policies in relation to pastoralism, poverty reduction and land tenure security is clear in Africa. Although research has focused on developing methodologies and strategies for poverty reduction (e.g. Krantz, 2001, Fraser, 2005) combating land degradation (e.g. Stringer and Reed, 2007, Dregne, 2002), and ameliorating the impacts of climate change (e.g. Gillson et al., 2013, Belay et al., 2017, Di Falco and Veronesi, 2018), most of these studies pay only a scant attention to the role of critical historical perspectives, local spatial knowledge and pastoralist adaptation strategies to policy change, particularly their small scale variations in shaping and informing SLM strategies in Africa's drylands.

Current communal lands across SSA are becoming increasingly fragmented and are under increased pressure from encroaching land uses, increases in livestock numbers and expansion in human population. This increases rural communities' vulnerability, with significant consequences for pastoral livelihoods. In Botswana these issues have so far only been considered in terms of how they impact on pastoral livelihoods (e.g. Rohde et al 2006). Research has yet to consider how pastoralists respond to these

constraints. Therefore, pastoralists' micro level adaptations to both environmental and policy change in these marginal environments remain poorly understood.

The study was carried out in Ngamiland District, North-western Botswana. The focus of the study was on communal grazing lands adjacent to the south of the Okavango Delta (a Ramsar and UNESCO world heritage inscribed site) including areas around Lake Ngami. In communal areas south of Lake Ngami, blocks of commercial ranches were demarcated and allocated under both TGLP and NPAD policies (Magole, 2009). Wildlife Management Areas (WMAs) emerged in the 1980s as a result of a national land zoning exercise following the introduction of the TGLP (DoL, 2009). In Ngamiland, pastoral herders find themselves in a situation where they are squeezed from all sides from privatized ranches, protection/buffer zones, veterinary fences and wildlife conservation areas (see Figure 1.2). In Ngamiland, veterinary disease control fences have formed an integral part of the land use system and have led to increasingly fragmented parcels of land. Such zoning methods of disease control aim to prevent and contain disease outbreaks (McGahey, 2011). These fences have since resulted in several kilometres of fences that aim to separate livestock from wildlife (particularly buffalo which are known carriers of FMD). These changes are likely to increase pastoralists' vulnerability and their adaptation mechanisms remains unknown.

While efforts have been made to address unsustainable practices, reduce rangeland degradation and improve rural livelihoods in drylands (e.g. Stringer et al., 2017, Mulale et al., 2014, Reynolds et al., 2007), the implementation of rangeland management strategies remains a challenge. Botswana's policy approach to management of land and water resources, as with other SSA countries, is through a range actors with a multiplicity of policies, regulations, and legislative instruments (Mulale et al., 2014). To date, studies of institutional frameworks and the capacities of actors to implement strategies that are geared towards the sustainable use of rangelands in drylands are limited.

This thesis is envisaged to contribute to the debate on land tenure and privatisation of communal grazing lands. It offers some useful robust empirical evidence from an area that has been less investigated. It is on this basis that it is hoped that the results will influence and/or shape policy directions towards pastoral communities adaptations and SLM in SSA and pastoral drylands more generally.

1.5. RESEARCH AIM AND OBJECTIVES

The overall research aim of this study is to examine the spatial impact of subdivisions, fragmentation and privatisation of communal grazing lands on pastoral livelihoods, traditional grazing and water resource access and pastoral management regimes in Ngamiland, South of the Okavango Delta. The thesis addresses four objectives which have been used to develop four papers each with its own specific aim and research questions or sub-objectives, as below.

1. **Critical historical perspectives**:

Objective: To provide a synthesis of historical perspectives on pastoral land use and tenure transformations in Ngamiland, south of the Okavango Delta, Botswana.

Sub-objectives: (1) Identify historical occurrences that influenced pastoralists land use patterns and determine their impact on the current form of land use;

(2) Explore pastoral communities' perspectives on current land use and rangeland access;

(3) Explore the relevance of historical perspectives to lessons regarding policy processes, institutions and strategies for SLM in pastoral landscapes.

2. Resources access and spatial Impacts:

Objective: To explore local spatial knowledge through participatory mapping and PGIS to understand and analyse pastoralists' grazing spaces and patterns of spatial mobility prior to the 1975 rangeland policy and after policy intervention in Ngamiland, Botswana.

Sub-objectives: (1) Investigate the spatial extent of communal grazing, past patterns of transhumance, and regulatory mechanisms for accessing grazing lands from before land tenure transformation to the current situation in Ngamiland District, Botswana; and

(2) Determine current land use patterns and the spatial impacts of rangeland policies on access to grazing and water resources based on respondents' spatial knowledge.

3. Pastoralists adaptations to environmental and policy change:

Objective: To investigate the ways in which pastoral communities cope and adapt to constraints due to environmental and policy changes in Ngamiland, Botswana.

Research Questions:

1. What processes constrain pastoral livelihoods in Ngamiland pastoral landscapes?
2. How do pastoral communities cope and adapt to constraints due to environmental and policy changes in Ngamiland pastoral landscapes?
3. What processes constrain or enable pastoralists' adaptive capacity in Ngamiland?

4. Institutional frameworks and/or policy appraisal:

Objective: To analyse current policy, institutional and governance challenges in relation to SLM and access to rangeland resources in Ngamiland pastoral landscapes.

Sub-objectives: (1) identify policies and legislative frameworks that have a direct or indirect impact on communal grazing lands and assess their stance on issues of SLM;

(2) Assess the district institutional frameworks and their implications for SLM in Ngamiland pastoral landscapes and

(3) Determine how current arrangements for managing pastoral landscapes can be integrated into a more effective and accountable framework for SLM adoption in drylands.

1.6. RESEARCH DESIGN AND METHODOLOGICAL CONSIDERATIONS

This section outlines the overarching research design, research strategy and broad methodological approaches, including the two main phases of fieldwork and methods used. Using inspiration from participatory research methods, the methodological framework illustrated in Figure 1.1 was designed with a pragmatist's lens to facilitate an iterative mixed methods approach. Pragmatism as a research philosophy suggests the use of mixed methods and emphasises on choosing explanations and methods that best produce desired outcomes (Morgan, 2014). Pragmatists argue that the research problem, questions and/or objectives are the most important and individual researchers have freedom of choice regarding the methods, techniques and procedures of research that best meet their need and purpose (Pansiri, 2005). It is against this background that the study adopts an iterative participatory mixed methods approach to address the study objectives. This includes; Oral histories, Participatory Mapping, Participatory GIS, Key Informant Interviews, GPS based transect walks, Focus Group Discussions, Stakeholder workshops, Policy Content Analysis and some Qualitative Semi-structured

Interviews. These methods were chosen based on their practical applications and the specific details of individual methods are provided in each of the results-based chapters (due to their stand-alone journal article basis).

Any research method has its inherent limitations and the choice of that method alone limits conclusions that can be drawn (Scandura and Williams, 2000). Therefore, obtaining evidence through methodological triangulation (combining different methods to measure the same phenomena) helped to achieve greater validity (Leech and Onwuegbuzie, 2007). The mixed method approach was tailored to allow the issue of impacts of rangeland policies to remain at the centre of the analysis, while thoroughly exploring issues of pastoralists' adaptations and other local level issues of rangeland resource access, property rights and policy stances for SLM. The integration of the qualitative methods, spatial analysis methods with policy content analysis (Figure 1.1) enabled the research process to focus on providing robust empirical evidence and a grounded analysis of the pastoral landscape.

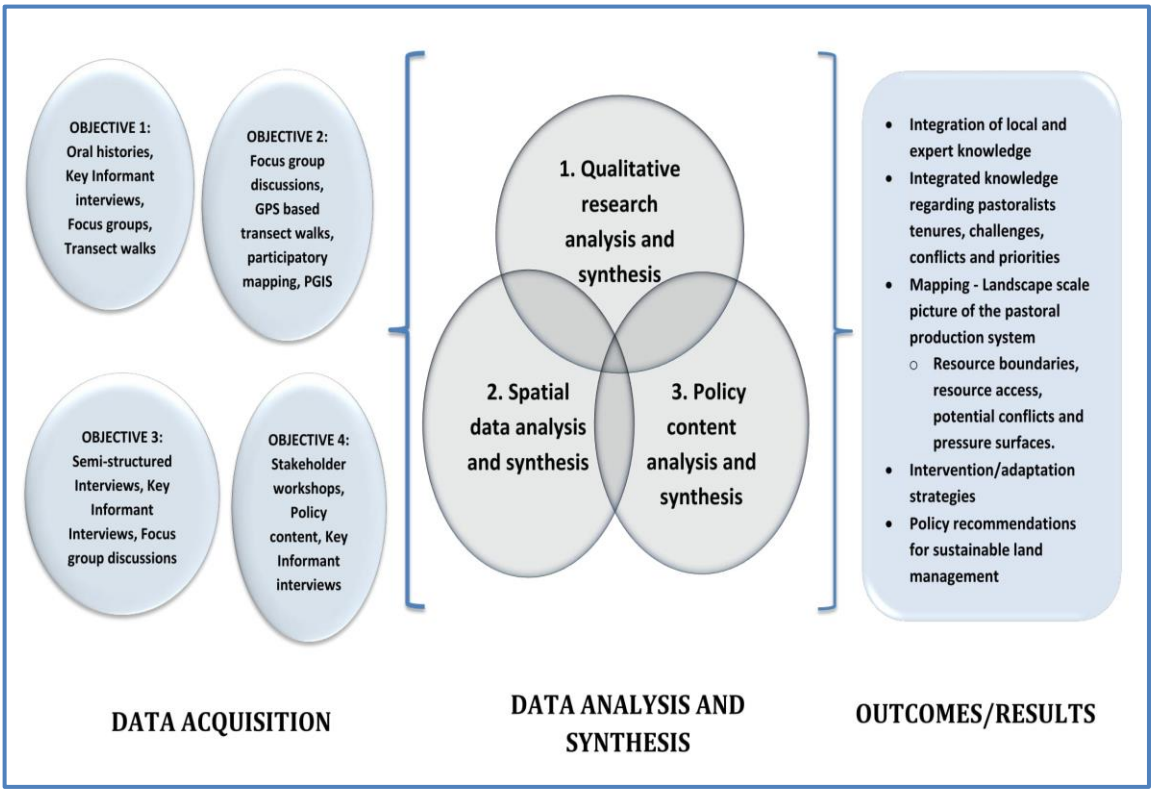

Figure 1.1: Methodological Framework.

The fieldwork was carried out in two separate phases. The first phase of fieldwork (April 2015 – August 2015) focused on analysis of the problem; historical and socio-political forces governing patterns of pastoral land use and tenures, resources access and impacts of rangeland enclosures. The second phase (April 2016 – September 2016) focused on exploring issues of adaptation and policy analysis for sustainable pastoral and land management. The fieldwork supported the interweaving use of a range of methods which helped in understanding the causal connections between policy, societies, institutions, environmental and social impacts.

1.6.1. Positionality

Positionality describes the practice of a researcher delineating his or her own position in relation to the research, with the implication that this position may influence aspects of the study such as the level of trust with participants, data collected and the ways in which it is interpreted (Merriam et al., 2001, Bourke, 2014). This research focused on pastoralism, land tenure and shifts in property rights and institutions including implications for policy and livelihood adaptation. As such the research included discussions with local people and with state policy makers and other non-governmental organisations. The local communities of Ovambaderu and Ovaherero value cattle, and issues related to land and cattle always generates interest, meaning I did not have any access problems.

I am a Motswana and prior to studying for this PhD, I worked for the government of Botswana in the Ministry of Lands and Housing, Department of Lands, as well as the Department of Town and Regional Planning. My experience working on issues of land and land use planning ultimately led to my interest in conducting this research in Ngamiland. Being a former government employee meant I had to mediate my positionality such that I achieved a shared space of engagement that was not

influenced by my previous roles. Throughout the research, I introduced myself as a research student from the University of Leeds, UK but also as a former government employee in order to be transparent. This kind of positionality was important for the respondents to separate myself and the research team from government officials. Conscious of my difference and the local dynamic inherent in the area; power hierarchies, the culture, beliefs and values, I made considerable effort to blend in as much as I could. I believe that who I am and the way I interacted and associated with local people helped in forming relationships of trust that are important and desirable in any fieldwork. The main research approaches; focus group discussions, participatory mapping, in-depth interviews and participant field observations were meant to diminish the distance between the researcher and the participants thus creating an anti-authoritative researcher-researched relationship. However, that did not mean that I became a complete insider, or that my relationship with the people was fully on an equal basis. Being from a different part of the country and of different ethnic background meant I could not communicate in the local dialect (Otjiherero) which obviously identified me as an outsider. Fortunately, Setswana is a national language which means all the locals were conversant in Setswana and the entire field work was conducted in Setswana.

Participants in stakeholder workshops were qualified professionals with expert knowledge within the research area. In this case I held a privileged position in terms of being a former government employee so that we shared some body of knowledge by virtue of having a similar background. This in itself created some level of trust. In this case, I knew who to contact; that is knowledgeable people in the field and most were willing to participate.

In line with ethical best practice, respondents were constantly assured that their involvement in the study was voluntary and that their identities would be kept anonymous throughout the research. At the end, local communities, the chiefs and some members of village level committees, participated in this research with interest and enthusiasm.

Ethical approval was granted by the University of Leeds Ethics Review Committee (Reference number Area 14-091). The research was conducted with the permission of The Ministry of Environment, Wildlife and Tourism in Botswana (Now Ministry of Environment, Natural Resources Conservation and Tourism) (Government research permit number EWT 8/36/4 XXX (73)).

1.7. DESCRIPTION OF THE STUDY AREA

1.7.1. Location and Physiography

Field data collection was conducted within the semi-arid area of Ngamiland South of the Okavango Delta, around Lake Ngami and areas south of the Setata veterinary cordon fence (Figure 1.2). The study villages included Semboyo and Makakung to the northern part; Kareng to the south – western part of the Okavango Delta; Bothatogo and Bodibeng on the southern shore of lake Ngami; Sehithwa on the northern shore of Lake Ngami and Toteng to the south east at the confluence of Nhabe and Kunyere which are the main channels feeding into the lake from the Okavango Delta (Figure 1.2). The criteria for selecting these sites were based on the highest concentration of livestock numbers and distance from privatised ranches and veterinary fences so as to make it more relevant to the phenomenon being studied and enable a spatial comparison. The delta is fed with water through the Okavango River that rises in the Angolan highlands, flowing through Namibia before entering Botswana (DoL, 2009). Water from the Okavango River feeds the Selinda, Nhokwa, Boro, Thaoge, Khwai, Gomoti and Santatadibe distributaries. Flow over the delta extends over a great area feeding into Thamalakane, the Nhabe and Boteti rivers. The Nhabe and Kunyere discharge into the Lake Ngami (Water Surveys, 2003). The hydrological system has a significant influence on livestock grazing particularly around Lake Ngami.

Ngamiland is generally flat with gently undulating plateau surface averaging about 1000m above sea level. Together with the delta, parts of the Kalahari basin found in the district form the dominating feature of the land surface. The parts of the Kalahari Basin that lie within the district, dip to the south, with the lowest parts being in the Mababe depression, Lake Ngami and the Makgadikgadi depression (DEA, 2008). Within Ngamiland District, there are some isolated hills of the Ghanzi ridges sticking up through the vast sands. These include the Tsodilo hills, Aha hills, Gcwihaba hills and Kgwebe hills in the area known as Hainaveld where most of the TGLP ranches are found. The connectivity between the two systems (the delta and the sandveld) is critical for pastoralists survival.

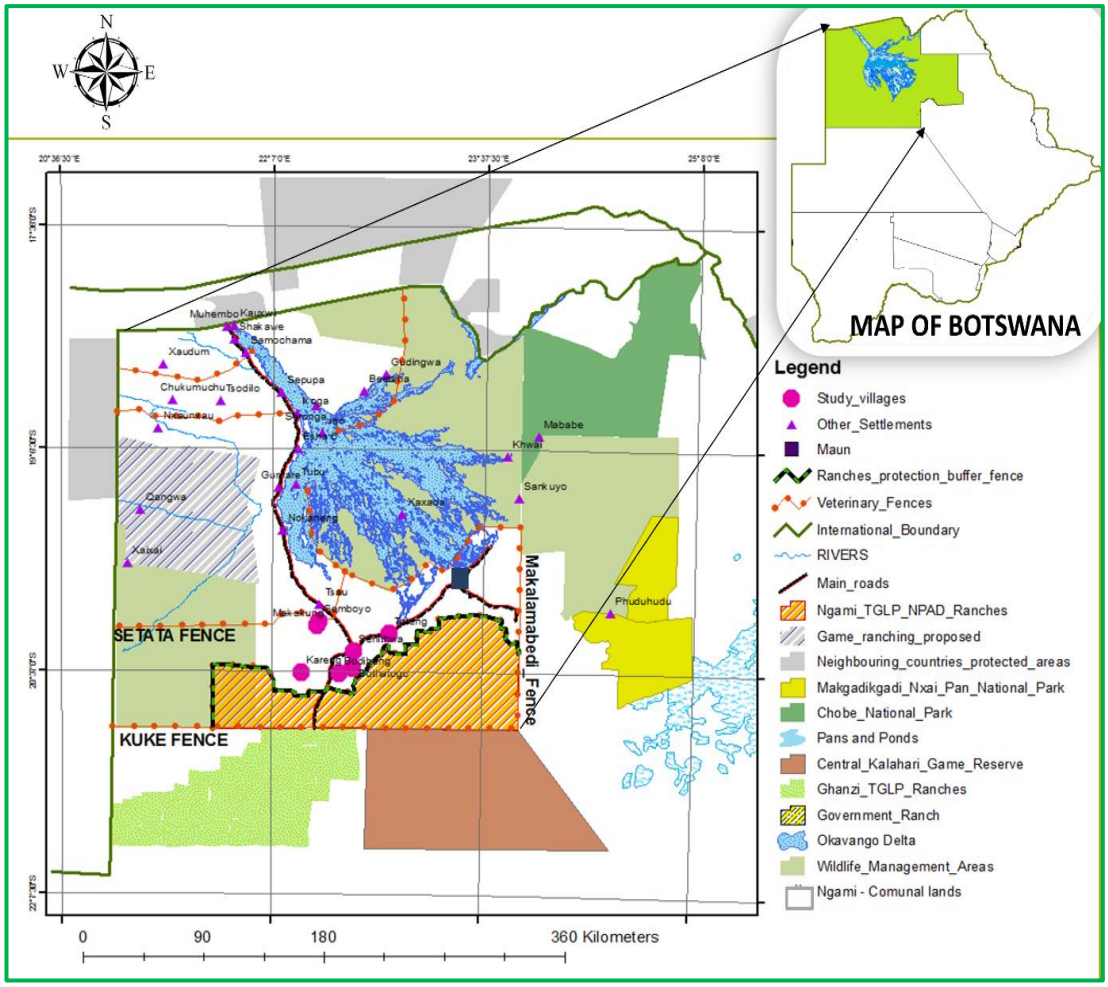

Figure 1.2: Land use zones in Ngamiland, Location of the study sites/villages.

1.7.2. Climate

The climate is sub-tropical (semi-arid), with distinct hot, wet summers, and cold dry winters. Most of the rains in Ngamiland fall between the months of November and March, with peaks recorded in January. The average annual rainfall recorded in Ngamiland District averages between 350 – 550 mm in the South and up to 650 mm in the north (Figure 1.3 and Figure 1.4) (DMS, 2013). Rainfall tends to be erratic and localised falling in spells of 2 -4 days (DMS, 2013). The temperature is characterised by large diurnal variations, with winter temperatures varying widely from as high as 26°C to as low as 7°C in July. During summer months temperatures equally vary, from a maximum of about 35°C to a minimum of about 18°C (Figure 1.3). Maximum temperatures hovering around 40°C in the summer have been recorded in the district especially in Maun (DMS, 2017). The sunshine duration is between 8 – 10 hours a day during the summer months, and 5 – 8 hours a day during the winter months (DMS, 2013). Drought is endemic due to the interior's peripheral and topographically isolated location in respect to the region's northern and eastern moisture bearing air masses (Bhalotra, 1987).

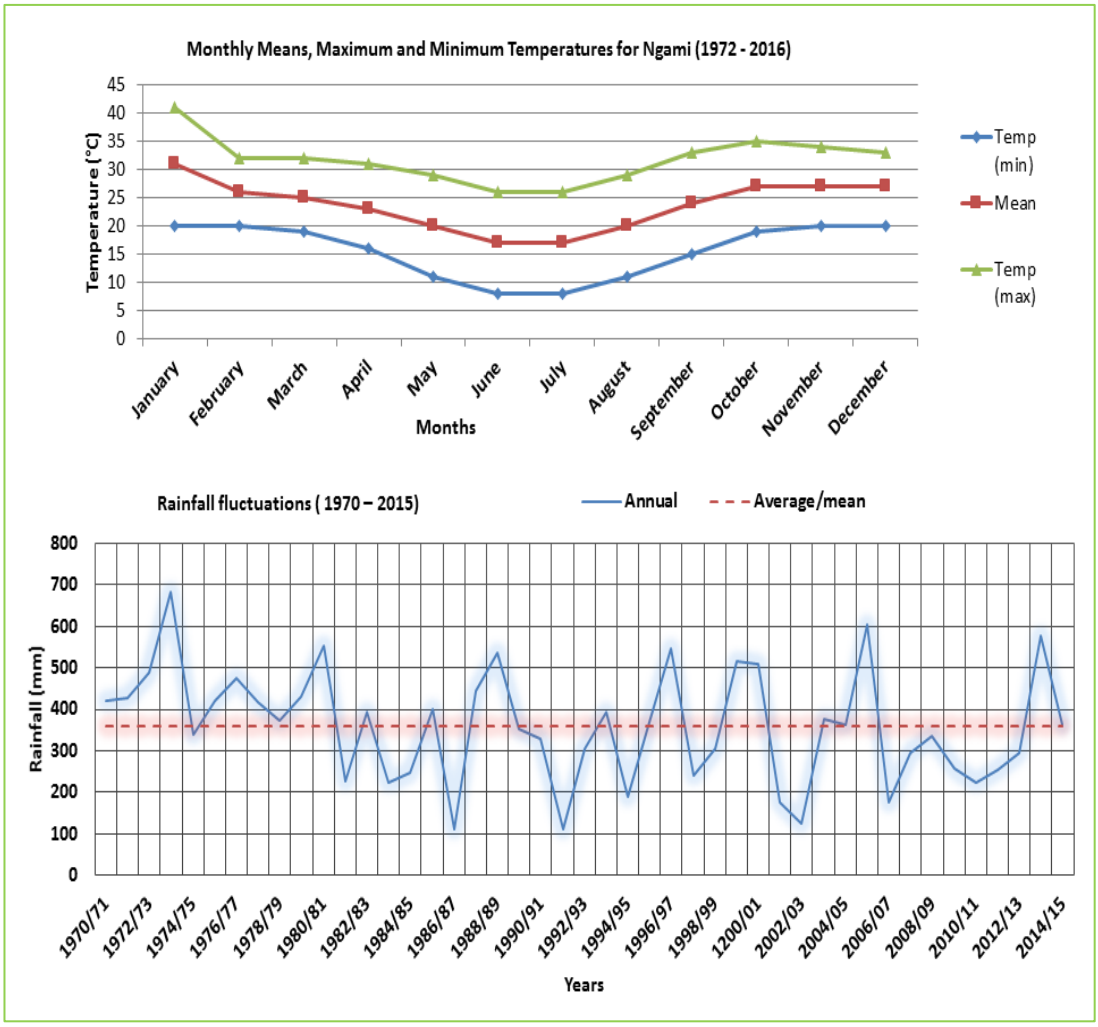

Figure 1.3: Temperature and rainfall variations in Ngami, Sehithwa village weather station, Data source: (DMS, 2017).

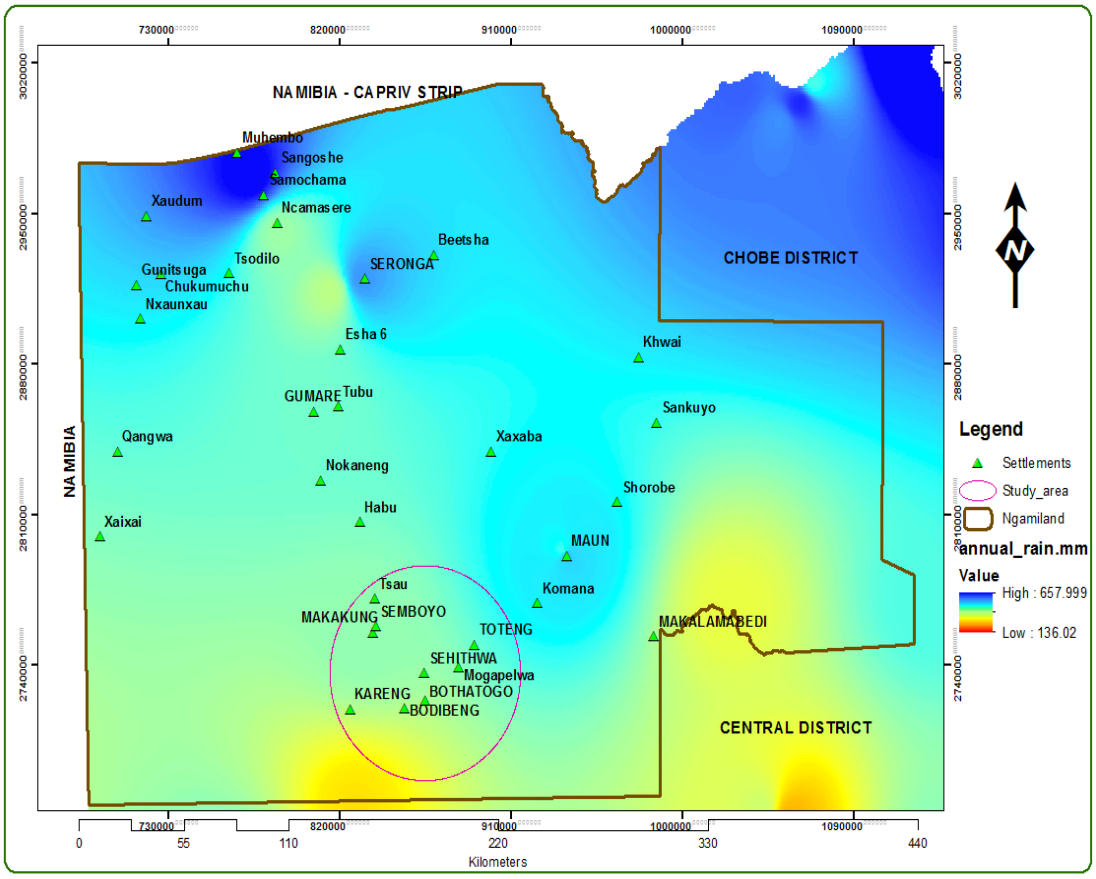

Figure 1.3: Rainfall spatial distribution in Ngamiland, Botswana (1970 – 2017) Data source: (DMS, 2017).

1.7.3. Vegetation characteristics

The study area is dominated by open low shrubs and tree savannas. In spite of the different parent material (sandveld, alluvium (along the rivers) and limited hardveld), the vegetation of the region has developed in a rather uniform way according to associations on massive fossil valleys and sand dunes (Burgess, 2004, BRIMP, 2002). Associated grass species include *Anthephora pubescens, Aristicla meridionalis, Eragrostis spp*, and *Stipagrostis uniplumis* (BRIMP, 2002). Lake Ngami depends on flood water from the Okavango delta. The lake shore and the lake bed (in dry years)

consist of a *forbland of Sesbania* sp., and *Asclepias fruticosa.* The forbland merges into a zone of shrub and tree savanna on the flats, belonging to the *Terminalia sericea, Lonchocarpus nelsii / Acacia erioloba* association (DoL, 2009). Grass species include *Aristida congesta, Cenchrus ciliaris, Cynodon dactylon, and Panicum repens* (DoL, 2009, BRIMP, 2002). *Colophospermum mopane* is also found in the region and enters the region just North of Lake Ngami and runs around the Okavango Delta to the North in the direction of the village Nokaneng. From Nokaneng to Shakawe, *Colophospermum mopane* only occurs in a 5 – 15 km wide zone along the Okavango Delta and the Panhandle (DoL, 2009). Grass species such as *Anthephora pubescens, Stipagrostis uniplumis Cynodon dactylon, Panicum repens* are reported to be very good for grazing animals and as such the area around Lake Ngami attracts lots of grazing ruminants.

1.7.4. The people

Ngamiland District ranks as Botswana's most ethnically diverse district. Cultural and ethnic diversity is evident in the numerous languages spoken in the District. The following people are often cited as the natives of Ngamiland: San groups (Basarwa), BaYeyi, Bambukushu, Ovaherero and Ovambaderu, Batawana, Bakgalagadi and Basubiya (DEA, 2008). Diversity is also evident not only in the languages spoken but also in the various socio–cultural and economic activities associated with each group. The BaYeyi and Bambukushu are particularly known for their fishing skills and have intended to inhabit areas around the Okavango Delta. For their part, Ovaherero and Ovambanderu are renowned pastoral farmers who rarely engage in arable agriculture (Tlou, 1985). This was confirmed during the field work as focus groups and elders reported that the Ovambaderu and Ovaherero are still largely pastoralists practicing minimal arable agriculture with crops limited to sweet reeds, melons, pumpkins and/or maize in small scale flood recession gardens known as *Molapo*

farming. Traditional Batawana are known to engage in both pastoral and arable farming. The San communities are generally known for their hunting and gathering skills and rarely engage in arable or pastoralism activities (Tlou, 1985). According to the 2011 population census, the study villages had a total of about 6249 inhabitants (Central Statistics Office, 2012) with the dominant ethnic groups being the pastoralists; Ovambaderu and Ovaherero.

1.7.5. Land use and Land use planning

Ngamiland district covers an important ecological system characterised by both drylands and water bodies, abundant wildlife and interesting traditional cultures. In 1997, the government of Botswana ratified the Ramsar Convention on Wetlands of International Importance and listed the Okavango Delta System as a Wetland of International Importance as per Article 2 of the convention. The Convention on Wetlands, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (Matthews, 1993). In 2006, a boundary was drawn around the delta, resulting in what came to be known as the Okavango Delta Ramsar Site (ODRS) (Figure 1.5) (DEA, 2008). This boundary incorporated all the focus villages in this study. It is interesting to note that the inland delta wetland system is in what is otherwise a semi-arid region. With an average annual rainfall of 350 mm, the focus area falls into the semi-arid or dryland transition zone. It is this uniqueness, combined with annual variations in inflow and changing seasons, which has led to the delta's rich diversity in flora and fauna (DEA, 2008).

Article 3 of the Ramsar Convention reiterates the need for conservation and wise use of the Delta's resources (Matthews, 1993). It was on the basis of this that the Okavango Delta Management Plan (ODMP) was drawn up as an integrated overall

plan for the sustainable utilisation, conservation and management of the ODRS (DEA, 2008). As such, land in the district is broadly zoned into distinct uses consisting of communal areas, National Parks, Game Reserves, Conservation areas (operated as tourism concession areas), Leasehold farms and Wetlands. Within the broader land use zones listed above, there are further subdivisions as the communal areas include pastoral, arable and human settlements. Pastoral land use is further divided into cattle posts and village grazing areas (DTRP, 2003). In WMAs, the primary economic activity is natural resource use (both consumptive and non-consumptive) (DEA, 2008). The district is further divided into Controlled Hunting Areas (CHAs) for multiple uses such as photographic safaris, commercial safaris, and community-based resource management (DoL, 2009). Ngamiland has 52 CHAs, with each area zoned for land use according to the ecological and social characteristics of the environment. Twenty eight of these CHAs are classified as Wildlife Management Areas (WMAs) where the principal land use is wildlife conservation and management and most are operated as tourism concessions (DEA, 2008). While much research has been done and continues to be done on the core of the Okavango Delta, especially the wetland part, very little work has been done on the drier sandveld areas of the delta system where livestock is the principal livelihood activity.

Ngamiland rangelands contain both wildlife and livestock. Connectivity between the Okavango Delta system and the Kalahari sandveld is critical to the maintenance of key wildlife populations and ecosystem resilience. It is also a key component of land use planning for both the livestock and wildlife sectors (DoL, 2009). The ever increasing number of elephants in the district has been described as a threat to the biodiversity and livelihoods sustenance (Salerno et al., 2018). However, some studies have argued that by debarking and pushing over trees, elephants open up woodland for grass invasion, subsequently attracting a variety of grazing animals (Marchant, 2010). With a population of more than 130,000 elephants (Department of Wildlife and National Parks, 2013), Botswana has one of the highest elephant populations in Africa. More than 70% of this population is found outside of protected areas (DEA, 2008), bringing

elephants into contact with local residents and fuelling conflict over water, arable lands, fodder and space (DeMotts and Hoon, 2012). Agricultural land use activities continue to be plagued by the increasing elephant population.

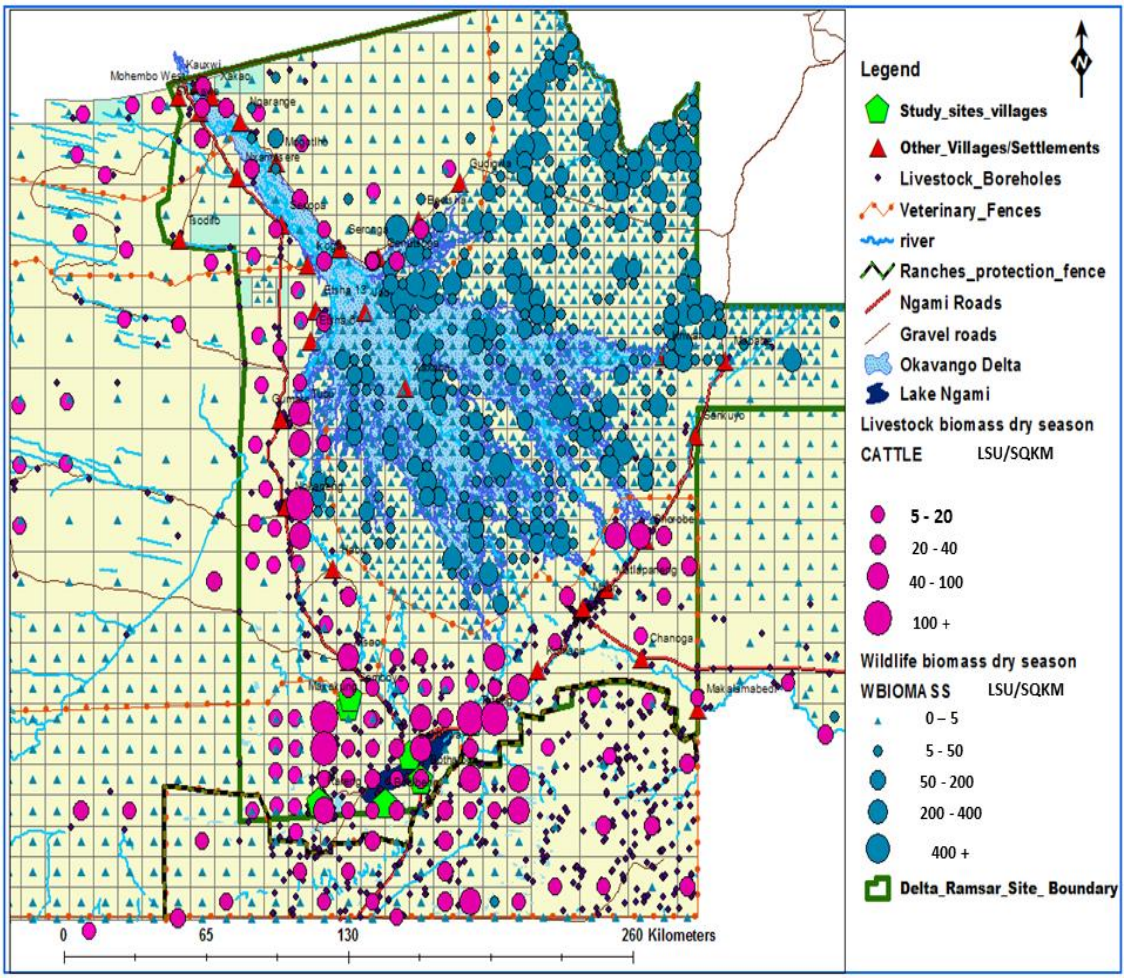

Figure 1.4: Dry season wildlife and livestock biomass in Ngamiland (analysed based on wildlife aerial survey counts by the Department of Wildlife and National Parks - 2013)—livestock distribution pattern shows a high density in communal areas especially around water resources such as Lake Ngami. The map of shows Okavango Delta Ramsar Site Boundary which incorporates all the study sites/villages selected for this study.

1.8. STRUCTURE OF THE THESIS AND SIGNIFICANCE

This thesis consists of this introductory chapter, four result chapters are organised as individual papers, and a discussion and conclusion chapter (Figure 1.6). The research was structured into four phases: Situational analysis (chapter 1), Problem analysis (chapter 2 and 3), Interventions (chapter 4 and 5) and a Discussions and concluding phase (chapter 6) (Figure 1.6). In addressing the research objectives through a participatory mixed qualitative and spatial methods, this thesis presents a range of theoretical and practical arguments and propositions which combine to provide the novelty the research seeks to make. The study portrays pastoralists' tenure issues to be embedded in a continuum of historical, spatially-determined factors that can be understood through local knowledge and genuine participatory decision making. Figure 1.6 illustrates the structure of this thesis.

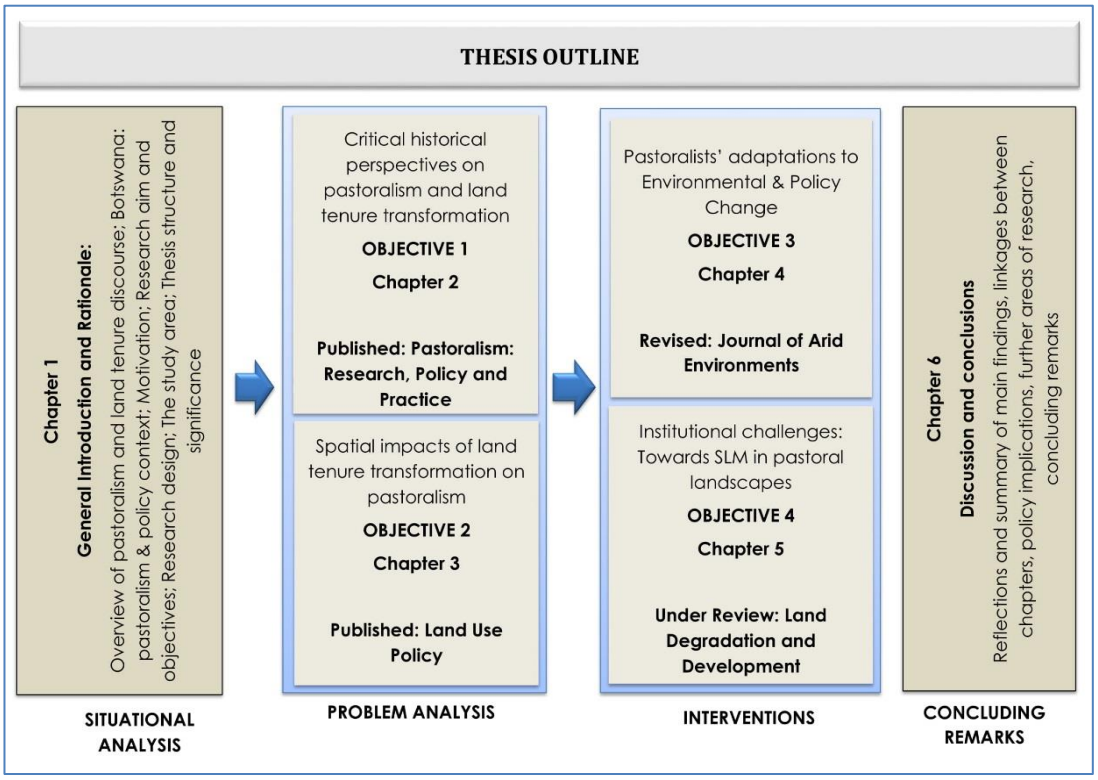

Figure 1.5: framework for reading the result chapters/papers and the thesis.

1.8.1. Significance and contribution to knowledge

CHAPTER 2: ***Historical perspectives on pastoralism and land tenure transformation in Ngamiland, Botswana: What are the policy and institutional lessons?*** This chapter demonstrates the importance of critical historical and socio-cultural contexts in land and environmental decision making. The analytical point of departure for this chapter is the local communities' 'construction of reality'. The analysis draws upon oral testimonies to investigate the implications of structural land use changes, tenure transformation and rangeland enclosure within the pastoral socio-ecological system. Current pressing pastoralism, land use and tenure issues are examined and analysed within the context of past experiences. The discussion from the analysis then draws out potential lessons of importance for rangeland policy processes. The chapter argues that historical perspectives and oral histories should be included in research and policy processes so as to understand dynamics of pastoralism, challenges brought about by policies and implications for sustainability. A neglect of pastoralists' experiences results in strategies that fail to address the root cause of the problem. On the basis of empirical understanding of the impact of land tenure transformation from pastoralists' experiences, the chapter sets analytical entry points for exploration in the subsequent chapters**.**

CHAPTER 3: ***Using Participatory Mapping and a Participatory Geographic Information System in pastoral land use investigation: Impacts of rangeland policy in Botswana.*** The empirical basis of this chapter is a case study of incremental effects of increased landscape fragmentation and subdivisions on pastoralism and landscape management. The chapter has a dual contribution; first it demonstrates the methodological potential of using participatory mapping and PGIS in exploring traditional pastoralists' information systems and local spatial knowledge in drylands. Second, and based on the previous chapter, this chapter analyses and discuss the spatial impacts of tenure transformation on traditional grazing patterns and livestock spatial mobility. Key themes emerging from this chapter are landscape

heterogeneity, spatial dynamism, dependency on indigenous spatial knowledge systems, high dependency on climate related variables and the interplay between pastoralists' interests and larger national economic and conservation goals expressed through land use planning and tenure transformation policies. While some of these characteristics are understood and discussed throughout the literature what is lacking is the use of technical spatial tools to operationalise them. As a result, the spatial relationship between local communities and the natural environment in which they make their living is often poorly understood in rangeland policies. The chapter concludes that the integration of local spatial knowledge can be used to foster better articulation and understanding of pastoralists' tenures.

CHAPTER 4: ***Adaptation strategies to environmental and policy change in semi-arid pastoral landscapes: evidence from Ngamiland, North-western Botswana.*** The adaptation discourse has influenced the way in which this chapter was conceptualised. As a departure from the common focus in the literature on adaptation to climate change, the chapter puts the spotlight on both the environment and socio-political factors constraining the livelihoods of pastoral communities and how these communities have responded through short term (coping) and long term (adaptation) strategies. The adaptation strategies of resource users are concerned with the decision making and management aimed at remedying livelihood constraints. Based on in-depth qualitative analysis of individual households in 6 pastoral communities, the chapter shows how a combination of strategies are chosen to cope with or adapt to current challenges and conditions. Moreover, the chapter discusses the small scale variations in adaptation strategies between the study villages based on their locations and/or proximity to water resources and infrastructure provisions.

CHAPTER 5: ***Institutional Challenges in Pastoral Landscape Management: Towards Sustainable Land Management in Ngamiland, Botswana.*** Tenure regimes and institutions that accommodate sustainability are critical for a pastoral way of life. In order to enhance resilience of pastoral social ecological systems policies and

management strategies must move towards tackling institutional challenges in support of more SLM practices. This chapter analyses policy, institutional and governance challenges in relation to SLM in Ngamiland pastoral landscapes. Currently, there is limited understanding of how governance structures and pastoralists interact and how policies and legal instruments affect the processes, measures, and conditions for facilitating SLM in pastoral landscapes. The analysis of the empirical data in this chapter identifies a lack of integrated planning, coordination, and cooperation between the many actors with responsibilities for the management of the same rangeland, and a fragmented policy framework which hampers prospects for SLM in drylands. The chapter concludes by setting out SLM pathways for delivery of cohesive SLM solutions in pastoral landscapes

CHAPTER 6: Discussion and conclusions: This chapter follows up on the issues raised in the introduction and the results chapters. As the chapters can be read independently, the chapter discusses issues that cut across the topics dealt with in each of the chapters and concludes by outlining the policy implications of the study.

1.9. REFERENCES

ABSON, D. J., DOUGILL, A. J. & STRINGER, L. C. 2012. Using Principal Component Analysis for information-rich socio-ecological vulnerability mapping in Southern Africa. Applied Geography, 35, 515-524

ADAMS, M. 2013. Reforming communal rangeland policy in southern Africa: challenges, dilemmas and opportunities. *African Journal of Range & Forage Science,* 30**,** 91-97.

ADAMS, W. M., BROCKINGTON, D., DYSON, J. & VIRA, B. 2003. Managing tragedies: understanding conflict over common pool resources. Science, 302, 1915-1916.

ADRIANSEN, H. K. & NIELSEN, T. T. 2002. Going where the grass is greener: On the study of pastoral mobility in Ferlo, Senegal. *Human Ecology,* 30.

AGRAWAL, A. 2001. Common property institutions and sustainable governance of resources. *World Development,* 29**,** 1649-1672.

AGRAWAL, A. 2014. Studying the commons, governing common-pool resource outcomes: Some concluding thoughts. *Environmental Science & Policy,* 36**,** 86-91

AGRAWAL, A. & GUPTA, K. 2005. Decentralization and participation: the governance of common pool resources in Nepal's Terai. *World development,* 33**,** 1101-1114

AMANOR, K. S. & MOYO, S. 2013. *Land and sustainable development in Africa*, Zed Books Ltd.

APRU 1976. An Integrated Programme of Beef Cattle and Range Research in Botswana: 1970 – 1976. *Animal Production Research Unit (APRU), Ministry of Agriculture,* Gaborone.

ARARAL, E. 2014. Ostrom, Hardin and the commons: A critical appreciation and a revisionist view. *Environmental Science & Policy,* 36**,** 11-2*3*

ARNTZEN, J. W., MOLOKOMME, D., TERRY, E., MOLEELE, N., TSHOSA, O. & MAZAMBANI, D. 2003. Main findings of the review the community-based natural resource management projects in Botswana. CBNRM Support Programme Paper, IUCN/SNV and CAR

BABIKER, M. 2013. MOBILE PASTORALISM AND LAND GRABBING IN SUDAN *Pastoralism and Development in Africa: Dynamic Change at the Margins***,** 177-185.

BARCUS, H. R. 2018. Contested Space, Contested Livelihoods: A Review of Mongolia's Pastureland Management and Land-Tenure Reform. Geographical Review, 108, 138-157.

BELAY, A., RECHA, J. W., WOLDEAMANUEL, T. & MORTON, J. F. 2017. Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. *Agriculture & Food Security,* 6**,** 24.

BENDOR, J. 1987. In good times and bad - reciprocity in an uncertain world. *American Journal of Political Science,* 31**,** 531-558.

BENJAMIN, C. E. 2008. Legal pluralism and decentralization: Natural resource management in Mali. *World Development,* 36**,** 2255-2276

BENJAMINSEN, T. A. & SJAASTAD, E. 2008. Where to draw the line: Mapping of land rights in a South African commons. *Political Geography,* 27**,** 263-279.

BENNETT, J. & BARRETT, H. 2007. Rangeland as a Common Property Resource: Contrasting Insights from Communal Areas of Central Eastern Cape Province, South Africa. *Human Ecology,* 35**,** 97-112.

BENNETT, R., ZEVENBERGEN, J. & LENGOIBONI, M. 2013. The pastoralist's parcel: towards better land tenure recognition and climate change response in

Kenya's dry lands. FIG Working Week 2013, Environment for Sustainability, Abuja, Nigeria.

BERKES, F., COLDING, J. & FOLKE, C. 2000. Rediscovery of traditional ecological knowledge as adaptive management. Ecological applications, 10, 1251-1262.

BERRY, S. 2002. Debating the land question in Africa. *Comparative Studies in Society and History,* 44**,** 638-668.

BHALOTRA, Y. P. R. 1987. Climate of Botswana – Part II: Elements of Climate. *Department of Meteorological Services, Ministry of Works and Communications, Botswana.*

BLAIKIE, P. 2006. Is small really beautiful? Community-based natural resource management in Malawi and Botswana. *World development, 34**, 1942-1957.*

BOONE, C. 2014. *Property and political order in Africa: Land rights and the structure of politics*, Cambridge University Press.

BORRINI-FEYERABEND, G., FARVAR, M. T., NGUINGUIRI, J. C. & NDANGANG, V. A. 2007. Co-management of natural resources: Organising, negotiating and learning-by-doing, GTZ and IUCN, Kasparek Verlag, Heidelberg (Germany).

BRIMP 2002. The Biomass Map of Botswana: Growing Season 2000/2001. *Botswana Range Inventory and Monitoring Project (BRIMP), Ministry of Agriculture, Gaborone.*

BURGESS, J. 2004. Country Pasture/Forage Resource Profile. *Ministry of Agriculture, Gaborone.*

BÜSCHER, B. 2010. Anti-politics as political strategy: Neoliberalism and transfrontier conservation in southern Africa. *Development and change, 41,* 29-51*.*

CATLEY, A., LIND, J. & SCOONES, I. 2013. Development at the margins: Pastoralism in the Horn of Africa. *In:* CATLEY, A., LIND, J. & SCOONES, I. (eds.) *Pastoralism and development: Dynamic change at the margins.* London: Routledge and Earthscan.

CHANDA, R., TOTOLO, O., MOLEELE, N., SETSHOGO, M. & MOSWEU, S. 2003. Prospects for subsistence livelihood and environmental sustainability along the Kalahari Transect: The case of Matsheng in Botswana's Kalahari rangelands. *Journal of Arid Environments,* 54**,** 425-445.

CHAUVEAU, J.-P. 2007. Changes in customary land tenure systems in Africa, Iied.

CASSIDY, L. 2001. *Improving Women's participation in CBNRM in Botswana*, IUCN Botswana.

CHILDERS, G. W. 1981. Western Ngwaketse Remote Area Dwellers: A Land Use and Development Plan for Remote Area Settlements in Southern District. *Government Printer, Gaborone, Botswana.*

CHIMHOWU, A. & WOODHOUSE, P. 2006. Customary vs private property rights? Dynamics and trajectories of vernacular land markets in Sub-Saharan Africa. *Journal of Agrarian Change,* 6**,** 346-371.

CLOVER, J. & ERIKSEN, S. 2009. The effects of land tenure change on sustainability: human security and environmental change in southern African savannas. *Environmental Science & Policy,* 12**,** 53-70.

COUSINS, B. & SCOONES, I. 2010. Contested paradigms of 'viability' in redistributive land reform: perspectives from southern Africa. *Journal of Peasant Studies,* 37**,** 31-66.

DE SOTO, H. 2000. The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everwhere Else. *Buntum Press, London*.

DEA 2006. Botswana National Action Programme to Combat Desertification. *Department of Environmental Affairs , Gaborone*.

DEA 2008. OKAVANGO DELTA MANAGEMENT PLAN *Department of Environmental Affairs , Gaborone, Botswana Notes and Records*.

DEININGER, K. W. 2003. *Land policies for growth and poverty reduction*, World Bank Publications.

DEMOTTS, R. & HOON, P. 2012. Whose Elephants? Conserving, Compensating, and Competing in Northern Botswana. *Society & Natural Resources,* 25**,** 837-851.

DERMAN, B., ODGAARD, R. & SJAASTAD, E. 2007. Conflicts over land & water in Africa.

DI FALCO, S. & VERONESI, M. 2018. Managing environmental risk in presence of climate change: the role of adaptation in the Nile Basin of Ethiopia. *Climate Smart Agriculture.* Springer.

DIETZ, T., OSTROM, E. & STERN, P. C. 2003. The struggle to govern the commons. *science,* 302**,** 1907-1912.

DMS 2013. Ngamiland Rainfall Statistics. *Department of Meteorological Services, Ministry of Environment Wildlife and Tourism, Gaborone, Botswana.*

DMS 2017. Weather and Climate Digest. *Department of Meteorological Services, Ministry of Environment, Natural Resources Conservation and Tourism, Gaborone, Botswana.*

DOL 2009. Department of Lands (DoL). Ngamiland Integrated Land Use Plan, Final Report, . *Ministry of Lands and Housing, Botswana.*

DORNER, P. 1972. *Land Reform and Economic Development*, Middlesex, England: Penguin Books.

DREGNE, H. E. 2002. Land degradation in the drylands. *Arid land research and management,* 16**,** 99-132.

DTRP 2003. Ngamiland District Settlement Strategy. *Department of Town and Regional Planning (DTRP), Gaborone, Botswana*.

ELHADARY, Y. A. E. 2010. Challenges facing land tenure system in relation to pastoral livelihood security in Gedarif State, Eastern Sudan. *Journal of Geography and Regional Planning,* 3**,** 208-218.

ELLIS, F. 2000. The determinants of rural livelihood diversification in developing countries. *Journal of Agricultural Economics,* 51**,** 289-302.

FEDER, G. & FEENY, D. 1991. Land tenure and property rights : theory and implications for development policy. *The World Bank economic review,* 5**,** 135-153.

FERNANDEZ-GIMENEZ, M. E. 2002. Spatial and Social Boundaries and the Paradox of Pastoral Land Tenure: A Case Study from Postsocialist Mongolia. *Human Ecology,* 30.

FERNANDEZ-GIMENEZ, M. E. & FEBRE, S. 2006. Mobility in pastoral systems: Dynamic flux or downward trend? *International Journal of Sustainable Development & World Ecology,* 13.

FORSYTH, T. & JOHNSON, C. 2014. Elinor Ostrom's Legacy: Governing the Commons and the Rational Choice Controversy. *Development and Change,* 45**,** 1093-1110.

FRASER, A. 2005. Poverty reduction strategy papers: Now who calls the shots? *Review of African Political Economy,* 32**,** 317-340.

FRATKIN, E. 1997. Pastoralism: Governance and Development Issues. *Annual Review of Anthropology,* 26**,** 235-261.

GALATY, J. G. 1992. " The land is yours": social and economic factors in the privatization, sub-division and sale of Maasai ranches. *Nomadic peoples***,** 26-40.

GALATY, J. G. 2013. Land grabbing in the Eastern African rangelands. *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 143 - 153.

GALVIN, K. A., REID, R. S., BEHNKE, R. & HOBBS, N. T. 2008. Fragmentation in semi-arid and arid landscapes. *Consequences for Human and Natural Systems. Dordrecht, The Neth.: Springer*.

GERMAN, L., SCHONEVELD, G. & MWANGI, E. 2013. Contemporary Processes of Large-Scale Land Acquisition in Sub-Saharan Africa: Legal Deficiency or Elite Capture of the Rule of Law? *World Development,* 48**,** 1-18.

GILLSON, L., DAWSON, T. P., JACK, S. & MCGEOCH, M. A. 2013. Accommodating climate change contingencies in conservation strategy. *Trends in Ecology & Evolution,* 28**,** 135-142.

HAMANDAWANA, H. & CHANDA, R. 2010. Natural and human dimensions of environmental change in the proximal reaches of Botswana's Okavango Delta. *Geographical Journal,* 176**,** 58-76.

HARDIN, G. 1968. The tragedy of the commons. *Science,* 162**,** 1243 - 8.

HOBBS, N. T., GALVIN, K. A., STOKES, C. J., LACKETT, J. M., ASH, A. J., BOONE, R. B., REID, R. S. & THORNTON, P. K. 2008. Fragmentation of rangelands: Implications for humans, animals, and landscapes. *Global Environmental Change-Human and Policy Dimensions,* 18**,** 776-785.

HOMEWOOD, K. M. 2004. Policy, environment and development in African rangelands. *Environmental Science & Policy,* 7**,** 125-143.

ICHINKHORLOO, B. & YEH, E. T. 2016. Ephemeral 'communities': spatiality and politics in rangeland interventions in Mongolia. The Journal of Peasant Studies, 43, 1010-1034.

ILRI 1995. (International Livestock Research Institute). 1995. Livestock Policy Analysis. ILRI Training Manual 2. *ILRI, Nairobi, Kenya***,** 264.

KAPTUE, A. T., HANAN, N. P., PRIHODKO, L. & RAMIREZ, J. A. 2015. Spatial and temporal characteristics of rainfall in Africa: Summary statistics for temporal downscaling. *Water Resources Research,* 51**,** 2668-2679.

KISAMBA-MUGERWA, W., PENDER, J. & KATO, E. Impacts of individualization of land tenure on livestock and rangeland management in Southwestern Uganda. 11th Biennial Conference of the International Association for the Study of Common Property, IFPR Institute, Editor, 2006.

KLINTENBERG, P. & VERLINDEN, A. 2008. Water points and their influence on grazing resources in central northern Namibia. *Land Degradation & Development,* 19**,** 1-20.

KRANTZ, L. 2001. The sustainable livelihood approach to poverty reduction. *SIDA. Division for Policy and Socio-Economic Analysis*.

LANE, C. 2014. *Custodians of the Commons: Pastoral Land Tenure in Africa*, Routledge.

LEACH, M., MEARNS, R. & SCOONES, I. 1999. Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management. *World Development,* 27**,** 225-247.

LEBERT, T. & ROHDE, R. 2007. Land reform and the new elite: Exclusion of the poor from communal land in Namaqualand, South Africa. *Journal of Arid Environments,* 70**,** 818-833.

LEECH, N. L. & ONWUEGBUZIE, A. J. 2007. An array of qualitative data analysis tools: A call for data analysis triangulation. *School psychology quarterly,* 22**,** 557.

LESOROGOL, C. K. 2008. Land privatization and pastoralist well-being in Kenya. *Development and Change,* 39**,** 309-331.

LETAI, J. & LIND, J. 2013. SQUEEZED FROM ALL SIDES Changing resource tenure and pastoralist innovation on the Laikipia Plateau, Kenya. *Pastoralism and Development in Africa: Dynamic Change at the Margins***,** 164-176.

LEVINE, R. 2005. Law, endowments and property rights. *Journal of Economic Perspectives,* 19**,** 61-88.

LUND, C. & BOONE, C. 2013. Introduction: land politics in Africa–constituting authority over territory, property and persons. *Africa,* 83**,** 1-13.

MAGOLE, L. 2009. The 'shrinking commons' in the Lake Ngami grasslands, Botswana: the impact of national rangeland policy. *Development Southern Africa,* 26**,** 611-626.

MAGOLE, L., TURNER, S. & BÜSCHER, B. 2010. Towards an effective commons governance system in Southern Africa? *International Journal of the Commons,* 4**,** 602 - 620.

MAKEPE, P. M. 2006. The Evolution of Institutions and Rules Governing Communal Grazing Lands in Botswana. *Eastern Africa Social Science Research Review,* 22**,** 39-61.

MARCHANT, R. 2010. Understanding complexity in savannas: climate, biodiversity and people. *Current Opinion in Environmental Sustainability,* 2**,** 101-108.

MATTHEWS, G. V. T. The Ramsar Convention on Wetlands: its history and development. 1993. Ramsar Convention Bureau Gland.

MBAIWA, J. E. 2015. Community-based natural resource management in Botswana. *Institutional arrangements for conservation, development and tourism in Eastern and Southern Africa.* Springer.

MCGAHEY, D. 2011. Livestock mobility and animal health policy in southern Africa: the impact of veterinary cordon fences on pastoralists. *Pastoralism,* 1**,** 1-29.

MEADOWS, M. E. & HOFFMAN, T. M. 2003. Land degradation and climate change in South Africa. *Geographical Journal,* 169**,** 168-177.

MORGAN, D. L. 2014. Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry,* 20**,** 1045-1053.

MORITZ, M., SCHOLTE, P., HAMILTON, I. M. & KARI, S. 2013. Open access, open systems: pastoral management of common-pool resources in the Chad Basin. Human Ecology, 41, 351-365.

MOTSUMI, S., MAGOLE, L. & KGATHI, D. 2012. Indigenous knowledge and land use policy: Implications for livelihoods of flood recession farming communities in

the Okavango Delta, Botswana. *Physics and Chemistry of the Earth,* 50-52**,** 185-195.

MULALE, K., CHANDA, R., PERKINS, J. S., MAGOLE, L., SEBEGO, R. J., ATLHOPHENG, J. R., MPHINYANE, W. & REED, M. S. 2014. Formal institutions and their role in promoting sustainable land management in Boteti, Botswana. Land Degradation & Development, 25, 80-91.

MUTANGADURA, G. The incidence of land tenure insecurity in Southern Africa: Policy implications for sustainable development. Natural Resources Forum, 2007. Wiley Online Library, 176-187.

MWANGI, E. 2007a. The puzzle of group ranch subdivision in Kenya's Maasailand. *Development and Change,* 38**,** 889-910.

MWANGI, E. 2007b. Subdividing the commons: Distributional conflict in the transition from collective to individual property rights in Kenya's Maasailand. *World Development,* 35**,** 815-834.

MWANGI, E. 2009. Property rights and governance of Africa's rangelands: A policy overview. *Natural Resources Forum,* 33**,** 160-170.

MWANGI, E. & DOHRN, S. 2008. Securing access to drylands resources for multiple users in Africa: A review of recent research. *Land Use Policy,* 25**,** 240-248.

NORI, M., TAYLOR, M. & SENSI, A. 2008. Browsing on fences: pastoral land rights, livelihoods and adaptation to climate change, IIED.

OBA, G. 2013. The sustainability of pastoral production in Africa. *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 29-36.

OSTROM, E. 1990. Governing the commons: the evolution of Institutions for Collective Action. *Cambridge University Press, New York*.

OSTROM, E. 1999. Coping with tragedies of the commons. *Annual Review of Political Science,* 2**,** 493-535.

OSTROM, E. 2015. *Governing the commons*, Cambridge university press.

OSTROM, E. E., DIETZ, T. E., DOLŠAK, N. E., STERN, P. C., STONICH, S. E. & WEBER, E. U. 2002. *The drama of the commons*, National Academy Press.

PANSIRI, J. 2005. Pragmatism: A methodological approach to researching strategic alliances in tourism. *Tourism and Hospitality Planning & Development,* 2**,** 191-206.

PAYNE, G. 2004. Land tenure and property rights: an introduction. *Habitat International,* 28**,** 167-179.

PERKINS, J. S. 1996. Botswana: Fencing out the equity issue. Cattleposts and cattle ranching in the Kalahari Desert. *Journal of Arid Environments,* 33**,** 503-517.

PETERS, P. E. 1994. *Dividing the commons: politics, policy, and culture in Botswana,* Charlottesville, University Press of Virginia.

PETERS, P. E. 2009. Challenges in Land Tenure and Land Reform in Africa: Anthropological Contributions. *World Development,* 37**,** 1317-1325.

QUINN, C. H., HUBY, M., KIWASILA, H. & LOVETT, J. C. 2007. Design principles and common pool resource management: An institutional approach to evaluating community management in semi-arid Tanzania. *Journal of environmental management,* 84**,** 100-113.

REID, R. S., THORNTON, P. K. & KRUSKA, R. L. 2004. Loss and fragmentation of habitat for pastoral people and wildlife in east Africa: concepts and issues. *African Journal of Range & Forage Science,* 21**,** 171-181.

REYNOLDS, J. F., SMITH, D. M. S., LAMBIN, E. F., TURNER, B., MORTIMORE, M., BATTERBURY, S. P., DOWNING, T. E., DOWLATABADI, H., FERNÁNDEZ, R. J. & HERRICK, J. E. 2007. Global desertification: building a science for dryland development. science, 316, 847-851.

RIBOT, J. C. 2003. Democratic decentralisation of natural resources: institutional choice and discretionary power transfers in Sub-Saharan Africa. *Public administration and development,* 23**,** 53-65.

RIBOT, J. C., LUND, J. F. & TREUE, T. 2010. Democratic decentralization in sub-Saharan Africa: its contribution to forest management, livelihoods, and enfranchisement. *Environmental Conservation,* 37**,** 35-44.

ROB 1968. Republic of Botswana, Tribal Land Act, Chapter 32:02. *Government Printer, Gaborone*.

ROB 1975. Republic of Botswana, National Policy on Tribal Grazing Land: Government Paper No. 2 of 1975. *Government Printers, Gaborone, Botswana*.

ROB 1991. Republic of Botswana, National Policy on Agricultural Development (NPAD). *Government Printers, Gaborone, Botswana*.

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. *Environmental Science & Policy,* 9**,** 302-316.

SALERNO, J., CASSIDY, L., DRAKE, M. & HARTTER, J. 2018. Living in an Elephant Landscape. *American Scientist,* 106**,** 34-41.

SARKER, A. & ITOH, T. 2001. Design principles in long-enduring institutions of Japanese irrigation common-pool resources. *Agricultural Water Management,* 48**,** 89-102.

SCANDURA, T. A. & WILLIAMS, E. A. 2000. Research Methodology in Management: Current Practices, Trends, and Implications for Future Research. *The Academy of Management Journal,* 43**,** 1248-1264.

SCOONES, I. & GRAHAM, O. 1994. New directions for pastoral development in Africa. *Development in Practice,* 4**,** 188-198.

SIMBIZI, M. C. D., BENNETT, R. M. & ZEVENBERGEN, J. 2014. Land tenure security: Revisiting and refining the concept for Sub-Saharan Africa's rural poor. *Land Use Policy,* 36**,** 231-238.

SJAASTAD, E. & COUSINS, B. 2009. Formalisation of land rights in the South: An overview. *Land Use Policy,* 26**,** 1-9.

STRINGER, L. C. & REED, M. S. 2007. Land degradation assessment in southern Africa: integrating local and scientific knowledge bases. *Land Degradation & Development,* 18**,** 99-116.

STRINGER, L. C., REED, M. S., FLESKENS, L., THOMAS, R. J., LE, Q. B. & LALA-PRITCHARD, T. 2017. A New Dryland Development Paradigm Grounded in Empirical Analysis of Dryland Systems Science. Land Degradation & Development, 28, 1952-1961.

TACHE, B. 2013. Rangeland enclosures in Southern Oromia, Ethiopia: an innovative response or the erosion of common property resources? *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 37 - 46.

THOMAS, D. S. G., SPORTON, D. & PERKINS, J. 2000. The environmental impact of livestock ranches in the Kalahari, Botswana: natural resource use, ecological change and human response in a dynamic dryland system. *Land Degradation & Development,* 11**,** 327-341.

THOMAS, R. J. 2008. Opportunities to reduce the vulnerability of dryland farmers in Central and West Asia and North Africa to climate change. *Agriculture, Ecosystems & Environment,* 126**,** 36-45.

THORNTON, P. K., VAN DE STEEG, J., NOTENBAERT, A. & HERRERO, M. 2009. The impacts of climate change on livestock and livestock systems in developing countries: A review of what we know and what we need to know. *Agricultural Systems,* 101**,** 113-127.

TLOU, T. 1985. *A history of Ngamiland: the formation of an African State,* Gaborone, Botswana, Macmillan Publishers.

TOULMIN, C. 2009. Securing land and property rights in sub-Saharan Africa: The role of local institutions. *Land Use Policy,* 26**,** 10-19.

TSIMAKO, B. 1991. The Tribal Grazing Land Policy (TGLP) ranches: performance to date. *Ministry of Agriculture, Gaborone.*

TURNER, M. D. 2011. The New Pastoral Development Paradigm: Engaging the Realities of Property Institutions and Livestock Mobility in Dryland Africa. *Society & Natural Resources,* 24**,** 469-484.

TWYMAN, C. 2017. Community-Based Natural Resource Management. *The International Encyclopedia of Geography*.

UNEP 1997. (United Nations Environment Programme). In World Atlas of Desertification (2nd edn). Middleton N, Thomas DSG (eds). Edward Arnold: London.

VATN, A. 2015. Environmental governance: institutions, policies and actions, Edward Elgar Publishing, Cheltenham, UK.

VETTER, S. 2005. Rangelands at equilibrium and non-equilibrium: Recent developments in the debate. *Journal of Arid Environments,* 62.

WADE, R. 1987. THE MANAGEMENT OF COMMON PROPERTY RESOURCES: Finding a Cooperative Solution. The World Bank Research Observer, 2, 219-234.

WANG, X., YU, Z., CINDERBY, S. & FORRESTER, J. 2008. Enhancing participation: experiences of participatory geographic information systems in Shanxi province, China. Applied Geography, 28, 96-109.

WESTERN, D., GROOM, R. & WORDEN, J. 2009. The impact of subdivision and sedentarization of pastoral lands on wildlife in an African savanna ecosystem. *Biological Conservation,* 142**,** 2538-2546.

WHITE, R. 1993. Livestock development and pastoral production on communal rangeland in Botswana. *The Botswana Society, Gaborone*.

WILY, L. A. 2011. 'The Law is to Blame': The Vulnerable Status of Common Property Rights in Sub-Saharan Africa. Development and Change, 42, 733-757.

WISBORG, P. & ROHDE, R. 2005. Contested land tenure reform in South Africa: experiences from Namaqualand. *Development Southern Africa,* 22**,** 409-428.

CHAPTER 2:

Historical Perspectives on Pastoralism and Land Tenure Transformation in Ngamiland, Botswana: What are the Policy and Institutional Lessons?[1]

[1] **Published as:**

BASUPI, L. V., QUINN, C. H. & DOUGILL, A. J. 2017. Historical perspectives on pastoralism and land tenure transformation in Ngamiland, Botswana: What are the policy and institutional lessons? *Pastoralism,* 7**, 24**. https://doi.org/10.1186/s13570-017-0093-1

ABSTRACT

Pastoral societies in dryland Africa continue to face changes to their pastoral systems. These systems are influenced by a range of historical factors but little use is made of this information to design policies that suit pastoralists' landscapes. This article provides a synthesis of historical perspectives on pastoral land use and tenure transformations in Ngamiland, south of the Okavango Delta, Botswana. Little documentation of herders' historical perspectives exists and less is known about how past experiences can be applied to sustainable pastoralism policies. In this article, current land use pressing issues are examined and analysed within the context of past experiences. We use a series of oral histories with key informants, focus group discussions, expert interviews and rangelands field observations. Ngamiland historical perspectives depict a pastoral landscape that has been shaped by a variety of factors; livestock diseases, Human-wildlife-conflicts, droughts, land tenure transformations associated with rangeland policies and the pastoral identity of the Ovaherero/Ovambanderu ethnic groups. Pastoralists have followed unique trajectories, specific to their rangeland conditions and socio-cultural context. Resilience to climate shocks and diseases has been weakened by inequitable patterns of control over rangeland resources. We recommend institutional diversity such that from experiences of the past, lessons can be drawn of the sort of processes and institutions required for pastoralism policies including targeted pastoralists' adaptations. Using pastoralists to provide information, especially in the area of indigenous knowledge, strategies can be developed to link conservation of wildlife and rangelands with pastoral production by developing ecologically-sensitive low-volume tourism that pastoral communities can tap to diversify their livelihoods.

Keywords: Environmental histories, Livestock mobility, Institutions, Rangeland policy, Vulnerability, Okavango Delta

2.1. INTRODUCTION

Policy debates on pastoralism have given increasing attention to issues of communal area development and management (Rohde et al., 2006, Behnke, 1987). Many policies have been attempted in African countries to increase livestock production in communal areas while at the same time maintaining the forage quality of the range (Mwangi, 2009, Rass, 2006, Fratkin, 1997). In this effort, traditional pastoralism has been commonly viewed as unproductive and directly responsible for rangeland degradation (Oba, 2013).

Pastoral societies and their use of rangelands have been shaped by a range of historical factors, but little use is made of this information to make policies that suit pastoralists' landscapes and local knowledge bases (Fernandez-Gimenez, 2006). Research on pastoralism has given increasing recognition and support to traditional pastoralism, livestock spatial mobility (Kitchell et al., 2014, Scoones, 1995) and to rights of pastoral people to control and manage their grazing territories (Adriansen and Nielsen, 2002, Swift, 1991). It is argued that flexible livestock mobility reduces pastoralists' vulnerability to climate change and the likelihood of livestock-induced rangeland degradation (Brottem et al., 2014). However, in most SSA countries such recognition has not yet translated into the protection and maintenance of traditional pastoralism of flexible mobility-based systems (Basupi et al., 2017, Kitchell et al., 2014).

The history of land tenure transformation in Africa shows a prevailing trend whereby the erosion of collectively – held communal grazing lands and natural resources under customary tenure is being hastened by policies that support privatisation of formally communal grazing lands (Rohde et al., 2006). Intensified means of livestock production through privatisation are often incompatible with a mobility strategy, especially when privatised land tenures prompt pasture fragmentation and underpins ecosystem service diversity losses. The livelihood prospects of pastoralists remaining in communal grazing areas is hence potentially challenged by higher

vulnerability to livestock diseases incidences, climate variability and land degradation. Livestock mobility in resource-scarce environments is critical for reducing the concentration of livestock in smaller territories thus contributing to Sustainable Land Management (SLM) (Moritz et al., 2013). Many governments, still face the challenge of developing the right institutional frameworks and strategies that address pastoral development while ensuring SLM (Notenbaert et al., 2012). Historical perspectives can help increase our understanding of pastoral areas, thus providing a reference point for assessing current pressing issues (Swetnam et al., 1999).

Botswana represents a case study country that has focused agricultural development policy on communal land privatisation (Rohde et al., 2006, White, 1992) and fencing linked to animal health policies (McGahey, 2011). The ranching system was formally introduced in 1975 through the Tribal Grazing Land Policy (TGLP) as an option to promote the conservation and sustainability of dryland ecosystems (Magole, 2009, RoB, 1975). It was argued under TGLP that land could be used to greater advantage, if farmers had an incentive to gain control over grazing areas, exclude others by fencing their land and be able to obtain direct benefits through investments and production of quality beef. TGLP targeted land that was believed to be unused. This was later extended by the National Policy on Agricultural Development (NPAD) of 1991 through intensification and expansion of TGLP objectives into all communal areas. Through NPAD, ranches would not be limited to certain 'unused' areas, instead, demarcation of ranches would depend on the number of cattle, the availability of land and its carrying capacity, and individuals could apply to fence areas within the vicinity of their boreholes (RoB, 1991). The relevance of the ranching system in rangeland resource management and its principal assumptions has been hotly debated in the pastoralism literature (Rohde et al., 2006, Dougill et al., 1999, Ellis and Swift, 1988). What is limited in the academic debate is a detailed understanding of the historical evolution of pastoral landscapes and land use patterns, and how historical perspectives are embedded within the policy processes.

Less is understood about the interlinkages between multiple historical factors and evolution of issues in shaping pastoralists' landscapes and land use patterns. Such lack of empirical analyses on the historical evolution of issues for communal rangeland areas affects the sustainability of current rangeland policies. To understand current pastoral land use patterns and policies, a historical perspective is useful since it can help uncover the evolution of social and environmental challenges in rangelands (Fernandez-Gimenez, 2006). Our findings rest on enhancing understanding of pastoral social-ecological system from a historical analysis point of view so as to inform policy strategies to improve pastoral livelihoods and manage pastoral landscapes.

The paper aims to provide a synthesis of historical perspectives on pastoral land use and tenure transformations in Ngamiland, south of the Okavango Delta, Botswana. The study's objectives are to; (1) identify historical occurrences that influenced pastoralists land use patterns and determine their impact on the current form of land use; (2) explore pastoral communities' perspectives on current land use and rangeland access; (3) explore the relevance of historical perspectives to lessons regarding policy processes, institutions and strategies for SLM in pastoral landscapes.

2.2. MATERIALS AND METHODS

2.2.1. Study area

Ngamiland District is situated in north-western Botswana (Figure 2.1). It is home to one of the world's largest inland deltas; the Okavango. Land is broadly zoned into different uses: communal areas, National Parks, Game Reserves, ranches, wetlands, controlled hunting areas and wildlife conservation areas (operated as tourism concessions) (DoL, 2009). Flow over the delta extends over a great area feeding into the Thamalakane, Kunyere, Nhabe and Boteti rivers. The hydrological system of the district has a significant influence on livestock grazing, particularly around Lake

Ngami. The climate is sub-tropical (semi-arid), with distinct hot, wet summers, and cold dry winters. The study area is dominated by open low shrubs and tree savannas. Livestock rearing is concentrated along the permanent open water sources at the fringes of the Okavango Delta and around Lake Ngami.

A mixed- method approach; oral histories, focus group discussions and expert Interviews was used in seven study villages; Sehithwa, Toteng, Bodibeng, Bothatogo, Kareng, Semboyo and Makakung (Figure 2.1). The villages were selected on the basis that the majority of residents practice agro-pastoralism and rely heavily on livestock, particularly cattle, as the largest investment in agricultural assets and livelihoods. Table 2.1 shows human and livestock numbers in the study villages.

Table 2.1: Human and livestock numbers in the study villages

Village	Human population	Cattle population	Goats population	Sheep population	Donkeys and Horses
Sehithwa	**2748**	**16635**	**1712**	**471**	**953**
Toteng	**909**	**24828**	**3743**	**1015**	**1444**
Bodibeng/Bothatogo	**1333**	**26842**	**4070**	**1313**	**1816**
Kareng	**1259**	**37722**	**4760**	**707**	**1850**
Semboyo/Makakung	**691**	**19986**	**3484**	**632**	**1299**
Total	**6249**	**126013**	**17769**	**4138**	**7362**

Data Source: Central Statistics Office, 2011 Department of Veterinary Services, 2016

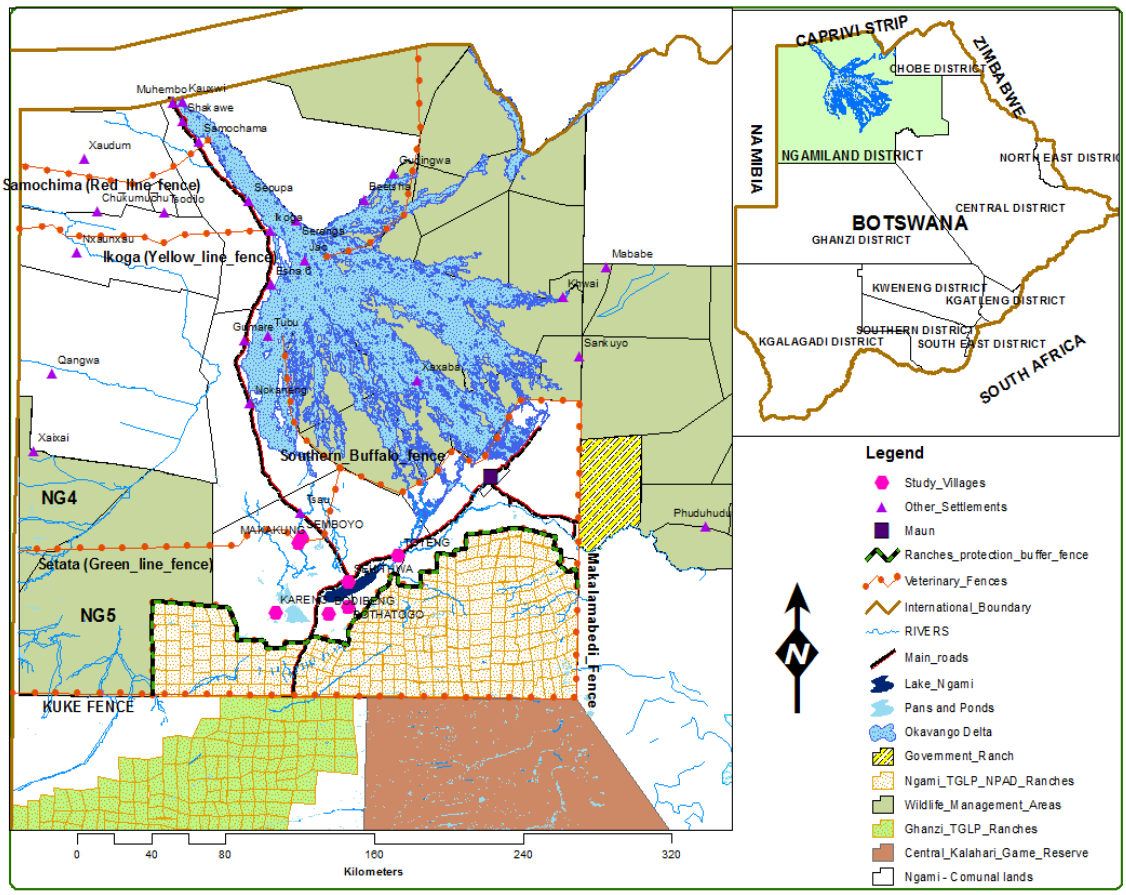

Figure 2.1: Ngamiland study area Source: Authors Data sources: Tawana Land Board, Ministry of Agriculture

2.2.2. Oral histories

An enquiry into the pastoral history of the area was conducted through oral histories to collect information from a wide range of people with experience of pastoral systems, especially around issues of land tenure transformation and historical occurrences that influenced pastoral land use patterns. Through historical accounts, we reconstruct how pastoralism, land use and tenure has changed over time as well as establishing past land management practices and historical timelines of major events influencing land use. The selection of participants was based on purposive sampling based on their extensive knowledge and experience. In order to find

participants, we established rapport with members of the pastoral community through visits and interactions. We visited cattle posts and examined watering points. We also helped some pastoralists in transporting fodder to calves and participated in Foot and Mouth Disease (FMD) *(Aphthae epizooticae)* vaccinations. Through such visits, we gained insights about the pastoral systems and explained our research to potential respondents. Potential respondents were identified and appointments for detailed in-depth interviews made. We also visited and held talks with members of farmers' committees and farmers' associations who suggested further potential respondents. Most informants were older men and women, mostly of the Ovambanderu and Ovaherero tribes who were young during the 1940s – 1960s and had witnessed most of the transformations in communal land in Ngamiland since the era of the Tsetse fly epidemic (1960s). Some of the histories narrated were passed down through generations. A total of 26 informants were sampled from across the study villages.

2.2.3. Focus group discussions and Expert Interviews

In order to gain insights into the current land use issues, nine focus group discussions (8-14 participants per focus group) were held as follows; Semboyo (n = 9 attendees), Makakung (n = 12), Bothatogo (n = 10), Bodibeng (n = 8), Toteng (n = 9), Sehithwa (n = 8), Kareng (n = 6). Data from focus groups was used to corroborate information from professional informants and Oral Histories. Focus groups targeted different stakeholders and groups in the community, especially pastoralists with experience in communal areas, members of the communal farmers' associations and farmers committees. One of the focus groups targeted only women (n = 14 participants; agro-pastoralists, members of farmers committees drawn from across the lake villages; Sehithwa, Bodibeng, Toteng, and Bothatogo) in order to incorporate divergent views and also to avoid a situation whereby influential male members of a group dictate

the discussions. Another focus group targeted young farmers (n = 14 young participants who are engaged in pastoral farming and those that were active in community projects, drawn from across the study villages). This was meant to solicit views and perceptions of youth groups concerning issues of pastoral land use and rangeland access. Interviews were also held with government officials in the Ministry of Agriculture, Department of Veterinary Services (n = 4); Tawana Land Board, Division of Land Use (n = 2); District Land Use Planning Unit (n = 2); Department of Environmental affairs (n = 2), National Development Bank (NDB) (n = 1), Department of Wildlife and National Parks (n = 4) and Department of Forestry and Range Resources (n = 2). The purpose of these interviews was to get an in-depth understanding of pastoralists' issues, perspectives on current land use, pastoralism and policy issues from professional experts.

2.2.4. Data Analysis

Oral history data were analysed based on the Miller–Rosser et al. (2009) analysis approach. This involved: (i) Testimonies' of each respondent were transcribed using Microsoft Word and interpreted to derive meaning from each historic account using a coding framework (Table 2); (ii) searching for commonalities: extrapolation of common themes from each narrative, each individual testimony was cross-validated and inconsistencies identified; (iii) writing the narrative, the interpretation of all participants testimonies was constructed into one story per theme emanating from the discussion (Miller - Rosser et al., 2009). Historical literature was used to validate and contextualize participants' accounts. Findings from oral histories were directly compared to historical literature at University of Botswana library - Botswana Collection and Botswana National Archives. The following were used; History of Ngamiland (Tlou, 1985), Herero/Mbanderu history (Gewald, 2002, Almagor, 1980)

and History of the Basarwa (Dziewiecka, 2008). Relevant quotations were used to explain and clarify data (Patton, 1990)).

Other qualitative data from focus groups were transcribed and analysed using content analysis to identify the main themes or issues emerging from the discussions (Adam et al., 2015). The development of themes involving the orderly and continuous search for patterns was used to produce full descriptions that shed light on the issues under investigation (Gale et al., 2013).

2.3. RESULTS

This section presents the study's results based on the objectives. First, we give an account of major historical occurrences affecting pastoralism and pastoral land use patterns in Ngamiland since the 1920s through to the present. Secondly, drawing from data gathered from focus group and expert interviews, we discuss local pastoralists' perspectives on current land use and how rangeland privatisation has affected pastoral land use and land tenure. Finally, the study offers insights on how historical perspectives can be used to inform policy on sustainable pastoralism. Table 2.2 is a summary of results of oral histories and focus group discussions and the four global themes have been used to organise the findings section.

Table 2.2: Results of oral histories and focus groups

Codes from data	Basic themes (ideas within organising themes)	Organising themes (clusters of similar issues)	Global themes (claims, arguments or assertions)
Critical historical factors	In-migrations Settlement patterns Okavango delta seasonal variations Opportunistic movement strategies	Biophysical factors; Socio-economic and/or -political factors	**HISTORICAL LAND USE PRACTICES** Ethnic pastoral groups, geopolitical and socio-cultural context Traditional livestock management practices and strategic livestock mobility Tsetse fly and eradication campaign
Tenure Transformation and Climate variability	Drought episodes; Government policies; Services to Livestock Owners in Communal Areas (SLOCA) and TGLP including animal health policies	Water reticulation through borehole drilling; expansion of usable grazing area	**DROUGHT AND LAND TENURE TRANSFORMATION** Severe drought cycles Communal land privatisation
Livestock diseases; FMD and Access to markets; Human – Wildlife Conflicts	Increased fencing; FMD, implementation of FMD vaccination campaign Impacts of elephants on fences, opportunistic farming – dual grazing; Farmers associations, Stray animals; mostly not vaccinated and likely responsible for some of the spread of FMD; Strained; Working relationship between farmers and veterinary officials	Diseases; Containment and control Exclusion from markets Consultations and cooperation	**THE ERA OF LIVESTOCK DISEASE OUTBREAKS** FMD is the most damaging to pastoralism and the frequent outbreaks have systematically terminated beef exports in Ngamiland, a factor which significantly contributes to the continuous increase in livestock numbers in the communal areas as there is no offtake
Rangelands access; Rangelands/ranches allocations and consultations; Perspectives on veterinary cordon fences/ animal health policies	Ranch allocation procedures; Lack of voice in decisions about land use and allocation of land resources Traditional water ponds inaccessible; Congestion between the fences and the lake; Overgrazing and bush encroachment; Wildlife migratory corridors between the lake and the sandveld blocked	Allocations and inequitable patterns of rangeland access and use Enclosure at the wildlife/livestock Interface	**PERSPECTIVES ON CURRENT LAND USE AND TENURE** Rangeland Access and Control Complex allocation processes that exclude poor communal area pastoralists Human-Wildlife Conflicts Foot and Mouth Disease Pastoralists vulnerability Lack of resilience to the occurrences of uncertain events; droughts, livestock diseases, exclusion from markets

2.3.1. HISTORICAL LAND USE PRACTICES

2.3.1.1. Ethnic pastoral groups

In Ngamiland South of the Okavango Delta, the Ovaherero and Ovambanderu ethnic groups, are the dominant community. Pastoralism is their main livelihood activity and their transhumant system has developed under variable geopolitical, social and climatic conditions (Tlou, 1985). Oral histories detail that Ovaherero and Ovambanderu pastoral communities in Ngamiland have their origin in Namibia. Historically, people who speak dialects of the Bantu language *Otjiherero* belong to the three broad divisions within the *Otjiherero* – speaking society in Namibia; the Ovaherero, the Ovambanderu, and the Ovahimba. These people share a number of cultural elements that relate to social organisation, preferred economy, epistemology, and spatio–political organisation. The Ovambanderu and Ovaherero speak the same language, both live a pastoral way of life and practice the same pattern of land and livestock management (Almagor, 1980). In spite of these similarities, they have maintained two separate identities, divided by an ethnic boundary. Many of these people fled to Ngamiland during the German – Herero colonial war of 1904 – 1914 (Tlou, 1985). During that period, *Kgosi* Sekgoma Letsholathebe (*Kgosi* translates as Chief or King in Setswana) ruled the Tawana Kingdom in Ngamiland (Gewald, 2002, Tlou, 1985). In order to establish a strong base for the Tawana Kingdom, Sekgoma allowed the Ovambanderu and Ovaherero groups to become full members of the Tawana Kingdom yet retain their own identity; speaking their own language and continuing their pastoral way of life (Tlou, 1985). Through the practice of *mafisa*[2], and through the royal cattle loans provided by Kgosi

[2] Mafisa is a traditional practice which is similar across most Tswana tribes, entitling the loan of cattle to a borrower, who in exchange for herding is entitled to the

Sekgoma, the Otjiherero refugees were able to re-establish themselves as wealthy cattle owners within a generation (Gewald, 2002).

2.3.1.2. Ovambanderu/Ovaherero settlements patterns

Oral history testimonies of pastoralists interviewed in Sehithwa, Bothatogo, Bodibeng and Toteng suggest that Ovambanderu pastoralists have been expanding their territories around Lake Ngami, especially along the western margin of the Delta, since the early 1930s. The number of settlements in the dry Kalahari Sandveld remained low until the 1950/60s outbreak of the tsetse fly epidemic after which settlements in the sandveld increased. Most cited stock losses due to diseases alongside the Okavango swamps as reasons for moving inland.

Information gathered from key informants and focus groups suggest that the area stretching from the southern and eastern shores of Lake Ngami to Kuke cordon fence (Figure 2.1) was a Basarwa[3] territory. The settlements around the Khwebe hills were a well-known area for the Basarwa, who had relatives in the adjacent, Central Kalahari Game Reserve (CKGR). The inhabitants of the Khwebe hills, otherwise known as the *Kwe* people (*Kwe* meaning place of people), were nomadic hunter-gatherers (Dziewiecka, 2008). Ngamiland was seen as being rich in grasslands, woods and water, especially during the wet season, and Okavango floods attracted a lot of game

---

milk, to use the cattle as draft power, as well as keeping some of the offspring of the herded cattle (Parsons, 1974).

3 Basarwa, also known as the San people or Bushmen, are indigenous former nomadic people occupying the Kalahari Desert and adjacent areas in Botswana. Basarwa are known to live in some of the most inhospitable terrains surviving by hunting wild game, gathering roots, tubers and wild fruits. Today the land that Basarwa used to hunt on is increasingly being taken up for grazing, commercial ranching, game reserves and national parks. They predominate among the Remote Area Dweller (RAD) groups.

making it a favourable place for the *Kwe*, *'…the Kwe were generally carefree people…, they knew the land…faced with the worst drought in the 1960s, we moved further south until we reached the Khwebe hills (Figure 2.1), we found the Kwe, …they showed us spring water in the hill…the land was good, some of our animals survived the harsh drought…'* (Oral histories data, 82-year-Old Ovambanderu pastoralist, Bodibeng, 2015). Respondents reported that, following the arrival of the Ovambanderu pastoralists, the *Kwe's* mobility started to decrease and temporary encampments were gradually replaced with semi–permanent settlements on cattle posts. Some were employed by the encroaching Ovambanderu pastoralists and were paid a calf or two a year for their service, enabling them to accrue some cattle of their own. The area of Khwebe hills was demarcated as ranches under the TGLP and is now inaccessible by the Basarwa of *Kwe* or Ovambanderu pastoralists. The remnants of the *Kwe* people can now be found in Somelo, a Remote Area Dweller (RAD)[4] settlement 70 kilometres south-east of Maun.

2.3.1.3. Traditional pastoral management practices and strategic mobility

Oral history narratives suggest that before the land tenure transformation, Ovaherero and Ovambanderu of Lake Ngami viewed their grazing landscapes as an interconnected ecological zone, divided into neighbouring localities and grazing

4 Remote Area Dweller (RAD) settlements are settlements established under the government of Botswana's Remote Area Development Programme (RADP). The programme targets socially and economically marginalised populations living outside main villages. People living in RAD settlements are out of reach in terms of distance from generally available services such as education, health and have no real access to land or adequate water rights. They are normally assisted with food, clothing, children's transportation to school and some income generating activities to address rural poverty.

grounds for different seasons. Herding practices involved following seasonal transhumant patterns between areas around the delta in the dry season and sandveld grasslands in the wet season. It was important that grazing areas had sufficient resting time from the previous grazing cycle. The grazing system was enforced by the chief (Traditional leader or *'Omuhona'*). Clans controlled different grazing areas and cattle posts *('ofarama' or 'kombanda'*) areas established around large pans *('macha' or 'ovikango'*). If pastoralists did not follow the grazing patterns, fines were imposed by the chief and a council of elders in the clan known as land overseers. These transhumant pastoralists adopted an approach involving controlled but flexible movements away from the delta to the sandveld grasslands during the wet seasons, including reciprocal access agreements with neighbouring clans in order to respond to environmental variability. Table 2.3 summarises factors that influenced the Ovambanderu/Ovaherero temporary migrations, while Figure 2.2 shows pastoralists' conceptualisation of settlements around Lake Ngami and their adjacent rainy season pastures before fences and land sub-divisions. The pans were normally associated with the rainy season because of the water that is collected. Once the rainy season started, small groups from individual compounds left their settlements and moved away from the lake in search of better pastures. They spent the entire rainy season within a single pasture area, around a specific pan, returning only when water sources had dried up. Each settlement had their own pans which they controlled and regulated through reciprocal access agreements and social relations.

Table 2.3: Factors that influenced pastoralists temporary migrations before the land tenure transformation (Focus group discussions data, 2015)

Factor influencing strategic mobility	**Justification**
Fluctuations in forage and water availability	Take advantage of resources found in different places in different seasons such as water in the sandveld pans and surrounding grasslands Allow grass to recover around Lake Ngami and Okavango riparian woodlands which were typically dry season grazing areas
The number of livestock herds owned	In order to take advantage of a diversity of ecosystems those with larger herds utilized herd splitting and grouping as a strategy to cope with drought or climatic variations; lactating, pregnant cows and calves were kept separate and closer to settlements, the males and non-producing females could travel long distances without water and were kept at distant encampments moving from one pan/*ovikango* to another in search of better grazing and water
The seasonality of the natural regimes; rainfall, Okavango delta seasonal flooding	Reduce the probability of crop damage and resultant fines because floodplains were used by agro-pastoralists for flood recession agriculture known as *'Molapo'* farming or *'Ondondu'* farming (Molapo means river in *Setswana* and *Ondondu* means river in *Otjiherero*). Avoid the moist conditions of the delta which is often a breeding ground for insects and disease outbreaks. Such movement strategies were used to combat the spread of FMD or the Nagana disease associated with the tsetse fly. During rainy season buffaloes move from the core of the delta to the peripheral areas of the delta hence increasing the possibility of mixing with cattle. By moving away to the sand veld such mixing was avoided hence pastoralists argue that outbreaks of FMD were low and manageable
Skill level of the herder and labour availability	Knowledge of the herder was paramount in exploiting the different characteristics of the range, determining niche specialization of herds and herd splitting for herds' survival during prolonged dry season and drought periods.

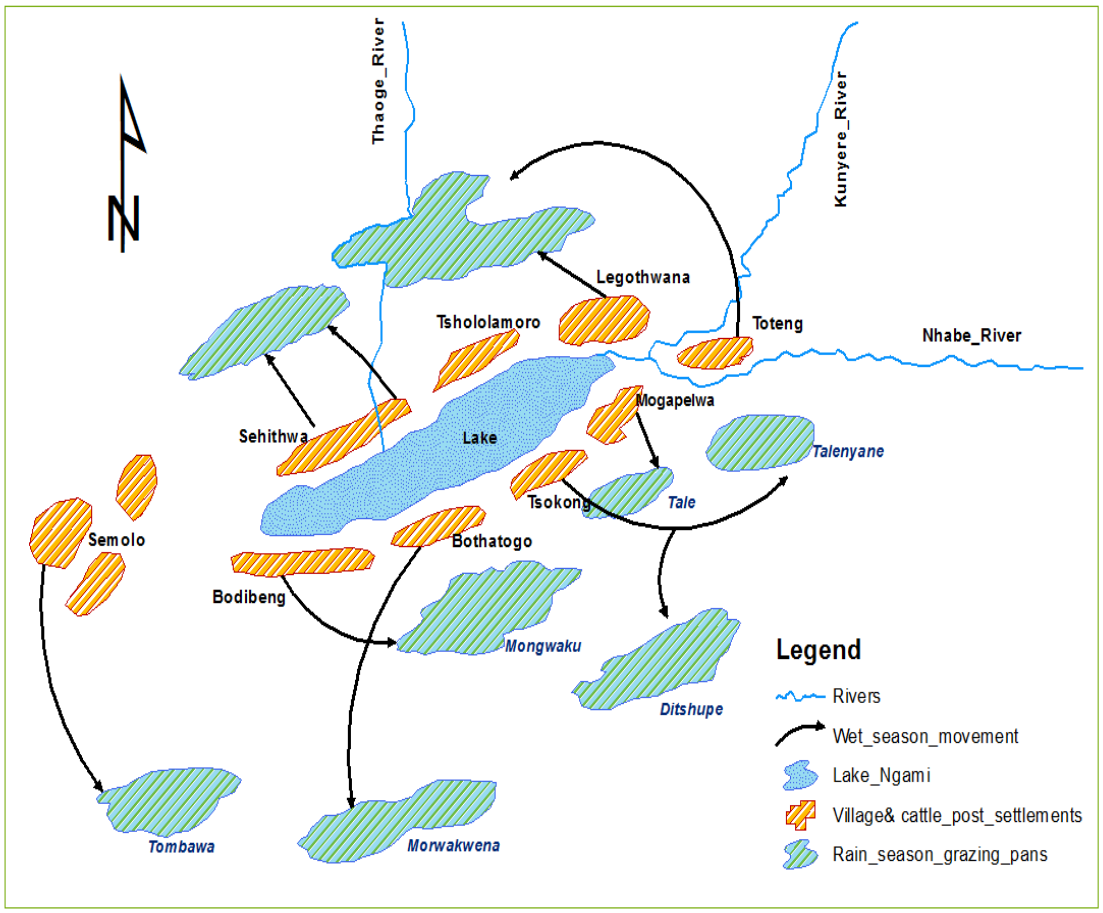

Figure 2.2: A sketch map (digitised), drawn by pastoralists during a focus group discussion at Toteng.

The sketch map depicts pastoralists' conceptualisation of settlements around Lake Ngami and their adjacent rainy season pastures before fences and land sub-divisions.

2.3.1.4. 1920s – 1960s – The Tsetse fly Epidemic and eradication campaign

Respondents reported that from the mid-1920s – late 1960s, they were confronted with frequent outbreaks of sleeping sickness and nagana disease caused by the tsetse fly. The Tsetse epidemic played a critical role in settlements and migration patterns of different ethnic groups around the Okavango Delta. To flee the ravages of the tsetse fly, people moved out into the sandveld with their livestock. Riverine lifestyles

were disrupted and new settlements emerged. According to local informants in Sehithwa and Toteng, neither the colonial government nor the Tawana authorities were able to handle the problem. The only alternative for pastoralists was to move to unaffected areas in the sandveld. It was only in the mid-1960s under Sir Seretse Khama (Botswana's first president from 1966 – 1980) that the tsetse was effectively controlled. According to Tlou (1985), the tsetse fly had the most devastating effects on the spatial distribution of the Ngamiland population because unlike mosquito-borne malaria, the tsetse fly-borne diseases, sleeping sickness (trypanosomiasis) and nagana, afflicted both humans and cattle alike. Settlements such as Semboyo and Makakung emerged during this period as the Ovaherero migrated further into the sandveld.

2.3.2. DROUGHT AND LAND TENURE TRANSFORMATION

2.3.2.1. 1960s – 1980s Severe drought cycles

This period was characterised by recurrent droughts owing to successive seasons of poor rainfall. Respondents reported that the impact of the 1965/66 drought was so significant that by the middle of the drought period grazing fodder was almost non–existent and many cattle died. Weaker and severely emaciated cows were kept near homesteads and fed on branch leaves pruned from trees around the Okavango Delta. Some calves were slaughtered so as to reduce stress on their mothers. There was a massive movement of animals to areas with water, *'…every drought in Ngamiland brought other pastoralists from different parts of the district to Lake Ngami, which even up to now has the highest concentration of cattle in Ngamiland'* (Oral histories data, 69-year-old Mbanderu pastoralist, Sehithwa, 2015). However, respondents reported that little water collected in the pans (*macha*) and lagoons dried up. Some pastoralists moved as far as the Khwebe hills in the current Hainaveld ranches area. It was also during this period (1975) that the government introduced the TGLP to

curb the problems of overgrazing that were reported to be commonplace in the communal grazing lands, particularly in the eastern hardveld of Botswana. So, this marked the start of an era of tenure transformations.

Another severe drought hit the country in 1982. Participants in both focus groups and oral histories recalled that in the midst of this drought, the government introduced the programme: Services to Livestock Owners in Communal Areas (SLOCA); a grant scheme designed to help small-scale pastoralists in the communal areas with water reticulation through borehole drilling and construction of drift fences. Some pastoralists were able to drill boreholes through this scheme and as a result, new lands in the dry Kalahari sandveld were opened up for grazing. However, some Ovambanderu and Ovaherero pastoralists reported that they were reluctant to invest in borehole drilling because they still had hopes of going back to Namibia; *'…some pastoralists thought then, it will be futile to do so, drilling a borehole is expensive and again you cannot carry a borehole to Namibia'* (Oral histories data, 74-year-old Ovaherero pastoralist, Semboyo, 2015). Many Tswana-speaking tribes invested in boreholes leaving those reliant on the water from Lake Ngami, majority Ovambanderu/Ovaherero pastoralists. During the interviews, most Tswana-speaking tribes referred to the Lake as *'lecha la ma Mbanderu'* (Meaning Lake of the Ovambanderu). Some boreholes were drilled by the government for communal use. Pastoralists also reported that they were provided with free diesel and engine maintenance parts. The development of water resources signified the expansion of usable grazing area in Ngamiland as pastoralists stretched further into the sandveld. However, most of the SLOCA boreholes are now reported to be dysfunctional, as pastoralists reported that *'…they were expensive to maintain and most of the water was saline…'* (Oral histories data, 59-year-old member of the Kareng farmers' committee, Kareng, 2015). The period also coincided with the construction of the southern buffalo fence (Figure 2.1) a veterinary cordon fence designed to separate cattle from buffaloes for the purpose of controlling the transmission of FMD, so access to the Okavango swamp grazing areas was lost at this time.

2.3.3. THE ERA OF LIVESTOCK DISEASE OUTBREAKS

2.3.3.1. 1995: The CBPP Epidemic

In February 1995, an outbreak of Contagious Bovine Pleuropneumonia (CBPP) known as cattle lung disease occurred in western Ngamiland, with first cases reported along the Xaudum valley (Figure 2.1). Respondents reported that this period was the most disturbing period of their lives as pastoralists; *'…many families were impoverished and had to rely on government temporary relief programmes...'* (Oral history data, 69-year old Mbanderu pastoralists, Sehithwa, 2015). CBPP is an acute or chronic disease of cattle and water buffaloes. According to officials at Department of Veterinary Services (DVS), during the early stages, the disease was confined to the western part of the district. Despite control measures, the disease spread rapidly to the east, prompting the government to resort to total eradication by clearing the entire district of cattle. In total, 320,000 cattle were killed of which 114,000 cattle were eradicated from ranches and 206,000 were eradicated from communal lands (DVS, 2000). According to respondents, the CBPP caused enormous disruption to the spatial configuration of the pastoral landscape. Following the outbreak, more veterinary fences were introduced. Three major fences were constructed as emergency control measures in 1995 to contain the spread of CBPP; Samochima (Red line fence), Ikoga (Yellow line fence) and Setata (Green line fence) (Raborokgwe, 1997) (Figure 2.1). Pastoralists in the villages of Semboyo and Makakung indicated that the Setata fence changed their land use patterns completely. Livestock movements were curtailed and grazing lands bisected, with some water resources becoming inaccessible. Restocking started in 1997 and by the end of the year, about 70,000 cattle had been reintroduced (DVS, 2000). The period also coincided with the implementation of the NPAD fencing component.

Following the declaration of the country as CBPP free, conservation groups, notably the Kalahari Conservation Society (KCS) and local communal pastoralists convinced the government to demolish the Setata fence. While conservation groups cited

environmental concerns, such as blockage of ungulate migratory routes, pastoralists argued that they had been separated from their critical grazing land and water resources. As a result, the Setata fence was decommissioned while the remaining two, Samochima and Ikoga fences, were declared permanent and incorporated into the Department of Veterinary Service (DVS) Master Plan.

2.3.3.2. 2007: Habu FMD outbreak

In April 2007, an outbreak of FMD was reported at Habu along the Okavango Delta southern buffalo fence. Pastoralists reported that government responded to the outbreak by reconstructing the Setata Fence. Cattle in the entire district could not be slaughtered at the Botswana Meat Commission (BMC) abattoirs, which respondents indicated, resulted in serious financial constraints as they couldn't pay school fees or have enough to eat. In the process, cattle numbers continued to accumulate in the district. The government set up a relief fund under the National Development Bank (NDB). In this fund, cattle were used as sureties for loans. A farmer could register up to 30 cattle with the Bank at BWP 1,500 per animal on the basis that pastoralists would repay the loans once they started selling to the BMC abattoir. During interviews, some pastoralists claimed that they were being driven into poverty and did not have the means to repay the loans. An interview with NDB staff in Maun revealed that 721 pastoralists used the fund before it was stopped but so far only 55 had managed to clear their loans. '*…we are owed around BWP 103 million ($10.3 million) by Ngamiland pastoralists, there is no market due to the recurrent FMD in the area…*' (Expert Interview data NDB officer in Maun, 2015).

2.3.3.3. 2012: The ranches protection buffer fence

The ranches protection buffer fence (Figure 2.1) was constructed in 2012 as an emergency measure to prevent FMD from spreading into commercial ranches and Ghanzi district. However, communal pastoralists argued that they never agreed to the creation of the fence on the grounds that it exclusively protects ranchers while cutting communal pastoralists off from their traditional grazing land and water resources. Pastoralists argued that the money used to construct the fence could have been used to maintain the southern buffalo fence which would have solved the problem for all pastoralists. Pastoralists reported that lots of cattle from the communal areas die because they become stranded along the fence while seeking to access traditionally good grazing on the ranches side[5]. Interviews with government officials revealed that the fence was not preceded by any impact assessment or feasibility study since it was assumed that it would follow the ranches boundary.

2.3.3.4. 2014: Kareng FMD outbreak

In April 2014, an outbreak of FMD occurred in Kareng communal lands, an area that has been free from the disease for a long time. It is rare to experience an FMD disease outbreak in the sandveld. According to a veterinary officer, the 2014 outbreak started in Tubu, an area within the swamp, *'…that cattle crush and the surrounding cattle posts were surrounded with water following the floods and were inaccessible…so they missed the routine vaccination…'* (Expert Interview data, Veterinary officer, Maun, 2015). However, pastoralists blamed the outbreak on elephants which destroy veterinary fences allowing cattle to cross to the buffalo area or vice versa. Following the outbreak, the Department of Veterinary Services

[5] Most ranches are unfenced, before the ranches protection buffer fence was constructed, cattle could roam freely and thus utilised numerous pans for grazing and watering on the ranches' side.

imposed stringent livestock movement protocols on herders. Livestock herding was not allowed except with a permit from the veterinary extension officer, even within the same vaccination area. Pastoralists reported that this resulted in an increase in stray animals, poor herding practices and increased livestock predation as they were not able to conduct routine herding and night kraaling of their animals.

2.3.4. PERSPECTIVES ON CURRENT LAND USE

2.3.4.1. Rangeland access and control

Respondents reported that they objected to the enclosure by TGLP ranches, mainly on the grounds of reduced resource access and restricted mobility. They feared that changes in the structure of the landscape would jeopardise their way of life as a self-sufficient pastoral community. Some informants still recall that they were told during the consultations, a period which they referred to as *'during Seretse Khama'*, that the ranches would not affect any communal area pastoralists as they would be demarcated in unused land close to the CKGR. However, many respondents argued during focus groups that the land referred to as unused was never there, that in actual fact these were rangelands that were important to pastoralists for managing periods of excessive drought and disease outbreaks near the delta system and some portions were occupied by the Basarwa communities. Respondents reported that over the years ranches have been pushing closer, and have encroached further onto communal grazing lands, especially during the implementation of the NPAD ranches; *'…the pastoral character of our comm*unity *has long been lost, so are the ethnic boundaries which distinguished us from the other tribes…*' (Interview data, 68-year-old Ovambanderu pastoralist, Bothatogo, 2015). Respondents argued that they wanted to preserve their pastoral identity, maintain the traditional arrangement in which they had regulated access to grazing resources by pastoral communities and also maintain their territorial integrity.

During focus groups, respondents were critical about government consultation processes, especially the NPAD ranches allocation process. Many argued that the ranches, which were allocated around cattle posts, did not consider many poor pastoralists who did not have boreholes but depended on the communal areas and the numerous sandveld natural water pans for survival. As respondents stressed; *'…government officials came to the Kgotla (traditional gathering place) and told the community that those with boreholes will be allocated ranches, the community agreed because they didn't know what that meant…some people had just borehole points and those were treated as boreholes and were allocated ranches…'* (Focus group discussion data, Toteng, 2015)

A few respondents reported that they tried applying for ranches, but the allocation process and requirements were beyond their comprehension so the majority of those ranches were given to outsiders or those with financial resources; *'…also, business proposals and management plans are demanded from us, overriding the practical experience we have as pastoralists …'* (Focus group discussion data, Toteng, 2015), *'I tried to apply for an NPAD ranch and I think my ranch management plan was comprehensive enough…but still, the land board turned down my application...'* (Youth focus group discussion data, Sehithwa, 2015).

The allocation process for the ranches is a complex process for communal area pastoralists, especially those without boreholes. First, the Land Board requires an applicant to show proof of financial resources in excess of BWP250 000 (US$25 000) to develop the ranch if allocated (TLB, 2015). *'The applicant is also expected to demonstrate through a business or ranch management plan a thorough knowledge of the ranching management processes; paddocking, rotational grazing, fire management, water development and disease management …'* (Expert Interview data, Maun, 2015). Such requirements exclude poor communal area farmers from competing with those with financial resources. Moreover, most of the business plans and management plans submitted for ranch applications are prepared by consultants (Ntingana, 2007). This means that the understanding of the commercial ranch

management strategies demonstrated in the management plan is a theoretical understanding by the consultant and not the applicant. The majority of the communal area pastoralists do not have financial resources to hire a consultant to write management plans for them. The allocation system is such that it gives those who previously had only *de facto* rights to grazing around their boreholes exclusive rights to previously communal grazing lands (RoB, 1991). The large costs of drilling and equipping a borehole ensures that owning a borehole remains a privilege of the wealthier.

2.3.4.2. Wildlife conservation vs traditional livelihoods

One of the pertinent issues in the area is human-wildlife conflict, especially with elephants, which respondents argued is the major contributing factor to the rampant FMD. Most of the respondents complained about the ever-increasing elephant and buffalo populations; *'It is not fair that as Ngamiland farmers we continue being impoverished by these increasing buffalo and elephant population…if the government cannot help us, they should allow these animals to move to other parts of the country…'* (Focus group discussion data, a member of Ngamiland Integrated Farmers' Association, Sehithwa, 2015). Buffaloes are considered to be the carrier of FMD. Elephants' extend their range into cattle post areas and arable lands, damaging livestock water resources and veterinary fences that separate cattle from buffaloes.

Respondents appeared to be critical about the way government departments are handling the FMD epidemic. The Department of Wildlife and National Parks is criticised for failing to control the movement of elephants which continue to destroy veterinary cordon fences on a daily basis; *'…the attitude of authorities when dealing with the control and containment of FMD is worrisome…there is no maintenance of the buffalo fence. We have long called for the electrification of that fence but up to now nothing is happening*…' (Focus group discussion data, a member of the farmer's

committee, Kareng, 2015). Government officials acknowledged that efforts to mitigate the conflict at the interface between elephants and shrinking rangelands have met with limited success. However, others still blamed pastoralists for their reluctance to help the government to contain the problem; *'….frequent damage of the buffalo fence by elephants presents our greatest challenge in confronting the FMD scourge. We continue trying…but at the same time ask for maximum cooperation from pastoralists…others are reluctant, we urge them to do their part by stopping their cattle from moving closer to the buffalo fence …'* (Interview data, Veterinary officer, Maun, 2015).

2.3.4.3. Increased vulnerability and poverty due to loss of resource access

Vulnerability denotes pastoralists' lack of resilience to the occurrences of uncertain events; droughts, livestock diseases, exclusion from markets, resource scarcity in the form of marginalised access or rangeland degradation (Rass, 2006). Historical narratives suggest that people living on the fringes of the Okavango Delta have experienced difficulties over a long period of time. Risks range from diminishing communal grazing lands, drought, livestock diseases, predation, conflicting land uses, floods and destruction of crops by animals. The FMD epidemic and the enclosure of the formerly wet season grazing pastures and water resources continues to undermine the livelihood of the Ovambanderu and Ovaherero, with communities reporting that many impoverished young men and women are being forced into seeking employment in town or the government labour intensive public works (*Ipelegeng*) programme; *'…We now depend on government hand-outs for survival because the land is not enough for sustainable pastoral farming and there are no markets for livestock products…'* (Focus group discussion data, Toteng, 2015).

Some respondents reported that they used to diversify their income sources by working off–farm, selling fuelwood, logs, thatching grass and wild berries. This is no longer the case as all these are now enclosed by the ranches protection buffer fence; *'I used to cut logs, droppers, thatching grass and gather wild berries in there and sell, now my business has collapsed because all these resources are now on private land…we can't even go near that fence because we are afraid of the soldiers...'* (Oral histories data, 68-year-old pastoralist, Bothatogo, 2015).

The persistently high stocking pressures in communal areas especially around Lake Ngami are driven not only by large numbers of animals, but also by the effects of a shrinking land base. As pressure on land increases, the pastoralists' mode of subsistence is left in a situation of worsening vulnerability. Discussions in focus groups and subsequent expert interviews both stressed that the effect of overgrazing between the ranches protection fence and Lake Ngami has significantly reduced both the grass cover density and biodiversity of the area. Bare soils and a significant presence of invasive species such as of *Acacia mellifera* were observed and some areas were choked with bushes. Congestion in communal areas has also made it difficult to control the spread of FMD.

Expert interviews and focus groups revealed that the exclusion from livestock markets has resulted in part-time and town dwelling livestock owners. This has resulted in neglected livestock near major settlements, roads, rivers and the Lake, including lots of stray animals. Some respondents argue that this is also a major contributing factor in the spread of livestock diseases since these stray animals are never vaccinated. Citing the destruction of their cattle–led lifestyle, and land use policies which pastoralists argued favours mainly two types of land use (wildlife and commercial ranching), some Ovaherero pastoralists expressed their desire to abandon Ngamiland and repatriate to their native Namibia; *'….I haven't been able to sell since 2007, the land has seriously diminished since the erection of that fence* (the ranches protection buffer fence)*…BMC buys only from the ranches, we poor*

pastoralists are in the dark. I think it's meaningful to go back to Namibia…' (Oral histories data, 65-year-old Ovaherero pastoralist, Makakung, 2015).

2.4. DISCUSSION

2.4.1. Flexible mobility and land tenure transformation

Understanding how pastoral landscapes have changed over time in response to a range of influences is essential for planning and policy development and can promote a clearer understanding of likely future changes in pastoral landscapes (Cousins et al., 2007). Adaptation and response strategies must be grounded in pastoralists historical experience and knowledge (Ericksen et al., 2013). Pastoralists have a deep knowledge and understanding of their environment and have developed grazing practices and adaptation strategies which are consistent with their environment and socio-cultural context (Basupi et al., 2017). Ngami pastoralists, have customarily used risk-spreading tactics over the years that include strategic movement of livestock away from disease prone environs such as the Okavango Delta Swamps, and to access pasture resources and water in sandveld pans after rains including herds splitting to take advantage of the varied and uncertain environmental conditions.

Dryland pastoralists rely on the demonstrated coping strategy of mobility in order to respond to environmental variability and occurrence of uncertain events such as droughts (Fernandez-Gimenez and Le Febre, 2006, Ellis, 1995). Mobility allows strategic access to scarce and scattered rangelands resources; water and pasture (Vetter, 2005, Kaye-Zwiebel and King, 2014). In Ngamiland, the *de facto* privatisation of communal rangelands did not take into consideration this effective strategy of extracting value out of these marginal lands. Botswana's rangelands policy was developed because of the perceived overstocking, degradation and the negative stigma associated with opportunistic pastoralism especially in the eastern hardveld

communal rangelands (Rohde et al., 2006, White, 1992). The severe droughts in the 1960s/80s seems to have strengthened the communal rangeland crisis narrative resulting in the conclusion by government that rangelands are in crises and in need of an intervention. This gave impetus to rangeland enclosure and privatisation through TGLP. The process of rangeland tenure transformation is changing the patterns of resource tenure and access, reinforcing the dominant patterns of winners and losers in the communal areas (Tache, 2013, Cullies and Watson, 2005). The use of boreholes as a mechanism in ranch allocation effectively meant that grazing land is allocated *de facto* to an elite of cattle owners who have acquired exclusive use of the land by making the necessary investment in borehole drilling and water reticulation (Perkins, 1996, White, 1992). In Ngamiland, resource-poor pastoralists who could not afford to invest in borehole drilling subsequently lost the opportunity to capture private land. The ensuing scenario is one in which pastoralists are squeezed between fences (Basupi et al., 2017), their resilience to climatic shocks and diseases have been significantly weakened, and problems of congestion and land use conflicts could lead to the very problems of rangeland degradation that these policies and strategies had purported to prevent.

2.4.2. Policy and institutional lessons

Historical perspectives recounted by local pastoralists provide important insights into key events and changes in an area. In Ngamiland livestock disease outbreak emerges as a key theme. FMD outbreaks have occurred with increasing frequency in recent years. Livestock owners appear to be less observant of animal health issues than was previously the case. A strategy which emphasises getting the general conditions right for livestock owners to make the necessary commitment and investment in the fight against the disease, in a manner suitable to the local condition and context is suggested. In Ngamiland, pastoralists' seasonal movements served as a means of

controlling grazing lands, preventing out of season grazing, managing livestock diseases and human-wildlife conflicts. Although the allocation of rangeland resources existed especially between villages and clans around important historical natural water pans, customary enforcement of movement patterns by village chiefs were an effective means of managing rangelands and livestock and also provided pastoralists with secure access rights to key grazing resources, especially in periods of scarcity such as during dry or drought periods. These traditional livestock management institutions have been significantly altered by rangelands transformations. The centralisation of land resources management has meant that a complex network of sectoral institutions is used to manage communal lands, excluding the pastoralists and their leaders thus rendering them losers in the process (Cullies and Watson, 2005, Peters, 1994). Pastoralists' resilience to climate shocks and uncertainties has been weakened as a result. The new pastoral environment means that pastoralists' vulnerability is increasing even to slight variations and intensity of rainfall (Letai and Lind, 2013). Technocratic approaches to policy making neglects local communities experiences in formulating rangeland policies (Rennie, 1998) resulting in strategies that fails to address the root cause of the problem.

2.5. CONCLUSION

This study proposes a strong consideration of historical perspectives in informing policy debates on sustainable pastoralism. Understanding the management of rangelands through pastoralism has substantial policy relevance and can help structure possible entry points for sustainable land management initiatives. Findings show that in Ngamiland pastoral social-ecological systems, the trajectories of change can be outlined within four themes: Ovambanderu/Ovaherero historical land use practices, disease outbreaks, climate variability and land tenure transformation facilitated through expansion in borehole technology and rangeland policies. The effect of communal land tenure transformation on SLM and pastoralists adaptive

capacity requires understanding complex social-ecological systems and developing more appropriate and locally relevant strategies. From experiences of the past, lessons can be drawn of the sort of practices, processes and institutions required for pastoralism policies and/or planned pastoralists' adaptations. In Ngamiland, historical narratives suggest a high level of human-wildlife conflict that even a double fence will do little to stop. Pastoralists' attitudes towards wildlife are negative as they feel that wild animals are responsible for their distresses such as livestock diseases. Working with pastoralists could act to protect their lifestyles as pastoralists while ensuring wildlife conservation. There is need for institutional diversity in order to maintain any part of the systems. Using pastoralists to provide services, particularly in the area of indigenous knowledge, interlocking strategies can be developed to link conservation of wildlife and rangelands with pastoral production by developing ecologically-sensitive low-volume tourism that pastoral communities can tap to diversify their livelihoods. For example, community managed game farming around the periphery of the Delta along the southern Buffalo fence would form a protective buffer against FMD while generating income opportunities for pastoral communities.

Throughout the study villages, the relationship between pastoralists and government officials when it comes to either containment of FMD, elephants – related conflicts or control and access to rangeland resources came close to institutionalised mistrust. Dealing with a complex social ecological system requires that government do more than pay lip-service to the concept of consultation and participation. While governments have access to information on climate or disease, pastoralists can provide a compact account of local conditions based on years of practical experience thus enabling a more appropriate and locally relevant policy environment. In this process, historical perspectives can form a point of reference by which institutions perceive issues, assess scientific findings and justify decisions. In Botswana, relatively little effort has been made to integrate historical perspectives into land use planning. Past attempts to support pastoral development have failed to successfully balance the needs of critical ecological pastoral areas through appropriate policy and

technical approaches. Progress from here will depends not so much on the pastoralists, but on the willingness of government agencies responsible for policy to talk to people through genuine participation.

2.6. ACKNOWLEDGEMENTS

This research fieldwork was supported by funding from the Government of Botswana, the Botswana International University of Science and Technology and the University of Leeds Sustainable Agriculture Fund Bursary. Funds for publication of this paper was provided by the Centre for Climate Change Economics and Policy, University of Leeds. The study was carried out under the Government of Botswana research permit number EWT 8/36/4 XXX (73). We thank the Ngamiland pastoral communities for sharing their opinions and for their active participation in the research. Many thanks to the anonymous reviewers for their insightful comments and suggestions. Thanks to Dr. Susannah Sallu for the insightful feedback on earlier draft of this manuscript.

2.7. REFERENCES

ADAM, Y. O., PRETZSCH, J. & DARR, D. 2015. Land use conflicts in central Sudan: Perception and local coping mechanisms. *Land Use Policy,* 42**,** 1-6.

ADRIANSEN, H. K. & NIELSEN, T. T. 2002. Going where the grass is greener: On the study of pastoral mobility in Ferlo, Senegal. *Human Ecology,* 30**,** 215-226.

ALMAGOR, U. 1980. Pastoral Identity and Reluctance to Change: the Mbanderu of Ngamiland. *Journal of African Law,* 24**,** 35-61.

BASUPI, L. V., QUINN, C. H. & DOUGILL, A. J. 2017. Using participatory mapping and a participatory geographic information system in pastoral land use investigation: Impacts of rangeland policy in Botswana. *Land Use Policy,* 64**,** 363-373.

BEHNKE, R. H. 1987. CATTLE ACCUMULATION AND THE COMMERCIALIZATION OF THE TRADITIONAL LIVESTOCK INDUSTRY IN BOTSWANA. *Agricultural Systems,* 24**,** 1-29.

BROTTEM, L., TURNER, M. D., BUTT, B. & SINGH, A. 2014. Biophysical Variability and Pastoral Rights to Resources: West African Transhumance Revisited. *Human Ecology,* 42**,** 351-365.

COUSINS, B., HOFFMAN, M. T., ALLSOPP, N. & ROHDE, R. F. 2007. A synthesis of sociological and biological perspectives on sustainable land use in Namaqualand. *Journal of Arid Environments,* 70**,** 834-846.

CULLIES, A. & WATSON, T. 2005. Winners and Losers: Privatising the commons in Botswana. *Willprint, Colchester*.

DOL 2009. Department of Lands (DoL). Ngamiland Integrated Land Use Plan, Final Report, . *Ministry of Lands and Housing, Botswana.*

DOUGILL, A. J., THOMAS, D. S. G. & HEATHWAITE, A. L. 1999. Environmental change in the Kalahari: Integrated land degradation studies for nonequilibrium dryland environments. *Annals of the Association of American Geographers,* 89**,** 420-442.

DVS 2000. Livestock Report: CBPP, destocking and restocking. *Department of Veterinary Services, Maun, Botswana.*

DZIEWIECKA, M. 2008. Place of People: The Khwebe Hills in the History of Ngamiland. *Botswana Notes and Records,* 40**,** 11 - 20.

ELLIS, J. E. 1995. Climate variability and complex system dynamics: implications for pastoral development. *In: Scoones, I. (ed.), Living with Uncertainty: New directions in pastoral development in Africa, Intermediate Technology Publications, Exeter***,** 37 - 46.

ELLIS, J. E. & SWIFT, D. M. 1988. Stability of African pastoral ecosystems: Alternate paradigms and implications for development. *Journal of Range Management,* 41.

ERICKSEN, P., LEEUW, J. D., THORNTON, P., SAID, M., HERRERO, M. & NOTENBAERT, A. 2013. Climate Change in sub-Saharan Africa: What consequences for pastoralism. *In Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege,***,** 71-81.

FERNANDEZ-GIMENEZ, M. E. 2006. Land Use and Land Tenure in Mongolia: A Brief History and Current Issues. *USDA Forest Service Proceedings,* RMRS-P-39**,** 30-36.

FERNANDEZ-GIMENEZ, M. E. & LE FEBRE, S. 2006. Mobility in pastoral systems: Dynamic flux or downward trend? *International Journal of Sustainable Development & World Ecology,* 13**,** 341-362.

FRATKIN, E. 1997. Pastoralism: Governance and Development Issues. *Annual Review of Anthropology,* 26**,** 235-261.

GALE, N. K., HEATH, G., CAMERON, E., RASHID, S. & REDWOOD, S. 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology,* 13**,** 117-117.

GEWALD, J. 2002. 'I was afraid of Samuel, therefore i came to Sekgoma': Herero refugees and patronage politics in Ngamiland, Bechuanaland protectorate, 1890 - 1994. *Journal of African History,* 43**,** 211 - 234.

KAYE-ZWIEBEL, E. & KING, E. 2014. Kenyan pastoralist societies in transition: varying perceptions of the value of ecosystem services. *Ecology and Society,* 19.

KITCHELL, E., TURNER, M. D. & MCPEAK, J. G. 2014. Mapping of pastoral corridors: practices and politics in eastern Senegal. *Pastoralism,* 4**,** 1-14.

LETAI, J. & LIND, J. 2013. SQUEEZED FROM ALL SIDES Changing resource tenure and pastoralist innovation on the Laikipia Plateau, Kenya. *Pastoralism and Development in Africa: Dynamic Change at the Margins***,** 164-176.

MAGOLE, L. 2009. The 'shrinking commons' in the Lake Ngami grasslands, Botswana: the impact of national rangeland policy. *Development Southern Africa,* 26**,** 611-626.

MCGAHEY, D. 2011. Livestock mobility and animal health policy in southern Africa: the impact of veterinary cordon fences on pastoralists. *Pastoralism,* 1**,** 1-29.

MILLER - ROSSER, K., CHAPMAN, Y. & FRANCIS, K. 2009. Analysing oral history: A new approach when linking method to methodology. *International Journal of Nursing,* 15**,** 475 - 480.

MORITZ, M., LARISA CATHERINE, B., DRENT, A., KARI, S., MOUHAMAN, A. & SCHOLTE, P. 2013. Rangeland governance in an open system: Protecting transhumance corridors in the Far North Province of Cameroon. *Pastoralism,* 3**,** 1-10.

MWANGI, E. 2009. Property rights and governance of Africa's rangelands: A policy overview. *Natural Resources Forum,* 33**,** 160-170.

NOTENBAERT, A., DAVIES, J., DE LEEUW, J., SAID, M., HERRERO, M., MANZANO, P., WAITHAKA, M., ABOUD, A. & OMONDI, S. 2012. Policies in support of pastoralism and biodiversity in the heterogeneous drylands of East Africa. *Pastoralism,* 2**,** 1-17.

NTINGANA, T. 2007. Consultant fault? Boreholes and the fencing policy in Ngamiland: A discussion paper. Sustainable Land Management Workshop. *Tawana Land Board, Maun. Botswana.*

OBA, G. 2013. The sustainability of pastoral production in Africa. *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 29-36.

PATTON, M. Q. 1990. *Qualitative Evaluation and Research Methods.*, Sage Publications, Inc, Newbury.

PERKINS, J. S. 1996. Botswana: Fencing out the equity issue. Cattleposts and cattle ranching in the Kalahari Desert. *Journal of Arid Environments,* 33**,** 503-517.

PETERS, P. E. 1994. *Dividing the commons: politics, policy, and culture in Botswana,* Charlottesville, University Press of Virginia.

RABOROKGWE, M. V. 1997. Cordon Fences and wildlife issues. *In: Proceedsings of a National Confrence on conservation and management of wildlife in Botswana: Strategies for the twenty first century, 13th - 17th October 1997***,** 114 - 120.

RASS, N. 2006. Policies and strategies to address the vulnerabilty of pastoralits in sub-Saharan Africa. *FAO Pro-poor Livestock Policy Initiative***,** Working paper No 37.

RENNIE, R. 1998. History and Policy - making. *The social science sphere, Blackwell Publishers, Oxford, UK,* ISSJ 156.

ROB 1975. Republic of Botswana, National Policy on Tribal Grazing Land: Government Paper No. 2 of 1975. *Government Printers, Gaborone, Botswana*.

ROB 1991. Republic of Botswana, National Policy on Agricultural Development (NPAD). *Government Printers, Gaborone, Botswana*.

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. *Environmental Science & Policy,* 9**,** 302-316.

SCOONES, I. 1995. *Living with uncertainty. New directions in pastoral development in Africa,* London, Intermediate Technology Publications Ltd.

SWETNAM, T. W., ALLEN, C. D. & BETANCOURT, J. L. 1999. Applied historical ecology: Using the past to manage for the future. *Ecological Applications,* 9**,** 1189-1206.

SWIFT, J. 1991. LOCAL CUSTOMARY INSTITUTIONS AS THE BASIS FOR NATURAL-RESOURCE MANAGEMENT AMONG BORAN PASTORALISTS IN NORTHERN KENYA. *Ids Bulletin-Institute of Development Studies,* 22**,** 34-37.

TACHE, B. 2013. Rangeland enclosures in Southern Oromia, Ethiopia: an innovative response or the erosion of common property resources? *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 37 - 46.

TLB 2015. Tawana Land Board, Allocation guidelines for ranches and other commercial plots. *Maun, Botswana*.

TLOU, T. 1985. *A history of Ngamiland: the formation of an African State,* Gaborone, Botswana, Macmillan Publishers.

VETTER, S. 2005. Rangelands at equilibrium and non-equilibrium: recent developments in the debate. *Journal of Arid Environments,* 62**,** 321-341.

WHITE, R. 1992. *Livestock Development and Pastoral Production on Communal Rangeland in Botswana: Case study for Workshop: New directions in African Range Management Policy, Matopos, Bulawayo, Zimbabwe,* London, UK, Commonwealth Secretariat.

CHAPTER 3:

Using Participatory Mapping and a Participatory Geographic Information System in Pastoral Land Use Investigation: Impacts of Rangeland Policy in Botswana[6]

[6] **Published as:**

Basupi LV; Quinn CH; Dougill AJ. 2017. Using Participatory Mapping and a Participatory Geographic Information System in Pastoral Land Use Investigation: Impacts of Rangeland Policy in Botswana, *Land Use Policy*, 64, pp.363-373. doi: 10.1016/j.landusepol.2017.03.007

ABSTRACT

Since the 1980s, the spatial extent of communal grazing lands in Botswana has been diminishing due to rangeland privatisation and fencing associated with animal health policies. Spatial comparisons of pastoral land use transformations are particularly important where accessibility to grazing and water resources remains at the core of sustainable pastoralism policies. Achieving success in pastoral development research requires a sound understanding of traditional pastoralists' information systems, including the nature of local spatial knowledge. This study explores local spatial knowledge through participatory mapping and a Participatory Geographic Information System to understand and analyse pastoralists' grazing patterns, spatial mobility and the impacts of subdivisions and privatisation policies in Botswana's Ngamiland rangelands. The study uses focus group discussions, historical analysis through key informant interviews, and participatory mapping exercises along with community guided transect walks. The resulting maps provide insights into the traditional tenure patterns of land use and the impacts of rangeland policy on traditional livestock spatial mobility and access to grazing lands. Privatisation and rangeland enclosures have resulted in the restricted movement of livestock and overstocking of floodplains and riparian rangelands, with some natural water pans becoming inaccessible to local communities. We conclude that the integration of local spatial knowledge can be used to foster better articulation and understanding of pastoralists' tenures, which are often lacking in communal land administration systems. Such integrated analysis can contribute to sustainable pastoral land management policy toolkits in semi-arid rangeland environments and enable better land tenure and management decision making for sustainable land management.

Keywords: Communal grazing lands; Pastoralism; Local spatial knowledge; Privatisation; Sustainable Land Management; Okavango Delta

3.1. INTRODUCTION

Policies and regulations that govern communal grazing lands have important implications for pastoral livelihoods and traditional pastoralism characterised by flexible herd mobility (Benjaminsen et al., 2009, Rohde et al., 2006, Chanda et al., 2003). In sub–Saharan Africa, the consequences are particularly significant (Galaty, 2013, Tache, 2013, Mwangi, 2007, Peters, 1994) as many countries have undergone rapid tenure transformations (Toulmin, 2009). The need to establish private and secure property rights, avert land degradation, and to modernise and commercialise agricultural production has been used to justify numerous land privatisation programmes undertaken through bilateral and multilateral aid agencies (Peters, 2009). The form and content of these rangeland management policies is a result of the modernisation process based on a model of development established in developed countries (Rohde et al., 2006). Enclosure and privatisation of the commons, including a shift from traditional institutions of land management to modern ones, was the policy recommendation to emerge from this modernisation process (Rohde et al., 2006). Pastoralism became a major target of the modernisation model and its subsequent policies (Cleaver and Donovan, 1996).

Pastoralism in arid or semi-arid lands is characterised by substantial spatial heterogeneity in land use, resource access, management regimes and the ways in which pastoralists respond to environmental constraints (Tsegaye et al., 2013). Pastoral land tenure needs secure land use rights that accommodate flexibility in resource access (Fernandez-Gimenez, 2002). The rationale for traditional pastoralism of herd mobility and flexibility has been reinforced by the recognition that drylands systems are non-equilibrial in nature and that resource sustainability is largely a function of spatial and temporal variability in rainfall and/or fire regimes (Dougill et al., 2016, Kakinuma et al., 2014, Dougill et al., 1999). The survival of herds depends on the pastoralists' ability to respond to variability or uncertainty and hence move to better areas with available fodder (Vetter, 2005). Therefore, extensive spatial scales

of exploitation become a prerequisite for a successful pastoral production system (Moritz et al., 2013, Notenbaert et al., 2012). For example, in Kenya the need for more spatially extensive rangelands has led some Maasai pastoralists to recombine some private parcels of land to improve mobility strategies (Coleman and Mwangi, 2015).

Pastoral societies are also characterised by a high dependency on local knowledge (Adriansen and Nielsen, 2002). The spatial knowledge systems held by herders help them determine what the temporal and spatial distribution of resources might be in any given year and are central to sustainable pastoral herd mobility (Oba, 2013). However, changes in statutory land tenure systems through privatisation have interrupted pastoralists' capacity to utilise customary land rights, including traditional mobility strategies, to cope with eventualities such as drought and disease incidences (Kaye-Zwiebel and King, 2014, Lengoiboni et al., 2010). Most rangeland privatisation policies have not yet yielded the intended benefits (Homewood, 2004). Where land degradation existed it has not been halted (Dougill et al., 2016) and traditional livestock management institutions have been disoriented, undermining traditional livelihoods and rangeland management systems (Peters, 1994).

In Botswana, the policy arrangement that has most significantly impacted communal rangelands is the TGLP of 1975 (Magole, 2009, White, 1992, Childers, 1981a). TGLP allowed for the fencing of communal grazing lands for commercial ranches (Adams, 2013). Claims related to the overstocking and degradation of communal grazing lands, including the tragedy of the commons theory (Hardin, 1968), were used to structure and justify policy objectives (Rohde et al., 2006, Cullies and Watson, 2005). The assumption was that the effect of unregulated communal grazing coupled with perceived increases in livestock numbers was responsible for rangeland degradation and that the consequences would become severe (RoB, 1975). Livestock needed to be regulated based on ecological carrying capacity, and the only way this was to be achieved was through privatisation since it was assumed that communal land tenure arrangements fail to regulate pastoralists' access to resources (APRU, 1976, RoB,

1975). TGLP assumed that there was ample unoccupied land available for privatisation (RoB, 1975). However, implementation was far more difficult than anticipated (Peters, 1994). Many parts of the country that had been assumed to be unoccupied contained substantial numbers of people, some of whom were not cattle herders, such as hunter gatherers (Childers, 1981a). Despite these shortcomings, TGLP implementation continued and by 2009 a total of 342 ranches, each measuring approximately 6400 hectares, had been allocated (Mathuba, 2009). The TGLP objectives were expanded and continued by the National Policy on Agricultural Development (NPAD) (RoB, 1991). NPAD targeted the land around communal grazing areas or cattle posts[7] owned by individuals or syndicates (Cullies and Watson, 2005). An additional 552 ranches, each measuring approximately 3600 hectares, were demarcated and allocated under NPAD by 2009 (Mathuba, 2009).

Local communities do not have much say in the ranch allocation process, as it is controlled by the Land Boards and Ministry of Agriculture (Adams, 2013). The allocation process gives those who previously had only *de facto* rights to grazing around their boreholes exclusive rights to previously communal grazing lands (RoB, 1991). The large costs of drilling and equipping a borehole ensures that owning a borehole remains a privilege of the wealthy, hence most beneficiaries belong to the wealthier echelons of society (Magole, 2009, Perkins, 1996). In a few instances, some poor pastoralists were incorporated into syndicate ranches and granted water and pastures as hirers who paid fees (Peters, 1994). Today, communal pastoralists find themselves surrounded by private ranches and disease control fences which bisect rangelands and separate communal pastoralists from critical grazing resources.

---

7 Cattle post is a traditional Tswana livestock management system that involves routine herding confined to kraaling of animals around a water point at dusk and their subsequent release in the morning (Perkins, 1996).

To date, few studies have proposed integration of pastoralists' spatial knowledge, spatial comparisons and/or participatory mapping approaches and a Participatory Geographic Information System (PGIS) to analyse pastoral management systems and the impacts of such transformations as described above. Studies have emphasised the overarching need to generate spatial landscape knowledge regarding pastoralists' tenures and land use in order to develop the capacity of local communities to help governments to reconcile pastoral tenure conflicts and manage resources in dryland areas (Turner et al., 2014, Bennett et al., 2013, Lengoiboni et al., 2010). This study draws on participatory research methods and geospatial technology to explore local spatial knowledge to understand traditional pastoralists' spatial mobility and the impacts of subdivisions and privatisation policies in Botswana's Ngamiland district. Local spatial knowledge is the unique knowledge held by local communities, acquired through practical experience and developed around specific geographic areas (McCall and Dunn, 2012). This study provides important spatial information based on local pastoralists' knowledge that could potentially be used to inform planning. This approach emphasises the involvement of local communities in producing distinctive spatial knowledge of their communities (Smith et al., 2012, Dunn, 2007).

The aim of this study is to explore local spatial knowledge through participatory mapping to understand and analyse pastoralists' grazing spaces and patterns of spatial mobility prior to the 1975 rangeland policy and after policy intervention. The study objectives are to (1) investigate the spatial extent of communal grazing, past patterns of transhumance, and regulatory mechanisms for accessing grazing lands from before land tenure transformation to the current situation in Ngamiland District, Botswana; and (2) determine current land use patterns and the spatial impacts of rangeland policies on access to grazing and water resources based on respondents' spatial knowledge.

3.2. MATERIALS AND METHODS

Participatory research methods were used to collect primary data in seven study villages between April and August 2015. Study sites were selected based on proximity to ranches and/or veterinary cordon fences to determine the impact along a gradient. The sites were categorised as follows depending on their locations: Toteng/Sehithwa/Bodibeng Bothatogo (located adjacent to the ranches and Lake Ngami: Lake villages), Kareng, located 42 km southwest of Lake Ngami, and Semboyo/Makakung, located 34 km northwest of Lake Ngami and adjacent to the Setata veterinary fence (Setata villages) (see Figure 3.1).

3.2.1. Study area

The study area is located on the southern fringe of the Okavango Delta (Figure 3.1). Ngamiland was chosen because the number of ranches (approximately 200) demarcated in the district (both through TGLP and NPAD) makes it relevant to the problem being investigated. In addition, the Okavango Delta and the surrounding rangelands are host to a large diversity of natural resources, including wildlife, diverse vegetation and water resources. Land fragmentation due to veterinary cordon fences and protection areas to separate wildlife and livestock is prominent. Wildlife management areas (WMAs) were established based on TGLP's recommendation in the early 1980s (DoL, 2009). The District is further divided into Controlled Hunting Areas (CHAs) for utilisation under the Community-Based Natural Resource Management (CBNRM) programme. Veterinary fences have been created across the district to separate livestock from wild animals, particularly buffaloes which are known carriers of Foot and Mouth Disease (FMD) (DoL, 2009). Field data collection was conducted around Lake Ngami and villages south of the Setata veterinary cordon fence, where the primary livelihood activity is subsistence pastoralism. The following ethnic groups inhabit the study area: San groups

(Basarwa), BaYeyi, Ovaherero, Ovambanderu, Batawana and Bakgalagadi. However, the dominant ethnic groups are the Ovambanderu and Ovaherero (DoL, 2009). The Ovaherero and Ovambanderu are pastoralists who rarely engage in arable agriculture (Tlou, 1985). The climate is semi-arid with distinct hot, wet summers, and cold dry winters. Average annual rainfall ranges between 450 and 550 mm (DMS, 2013). The distribution of rainfall over space and time is highly variable and is the determining factor in grazing distribution (DoL, 2009). Selection and use of natural resources as well as disease pandemics (both human and livestock) have influenced settlements and migration patterns (including configuration of kinship networks) of different ethnic groups around the Okavango Delta (Mbaiwa et al., 2008). Settlements have been largely confined to the margins of the permanent swamps. The sandveld area where the privatised ranches have been demarcated, known as Hainaveld, is located to the south of Lake Ngami.

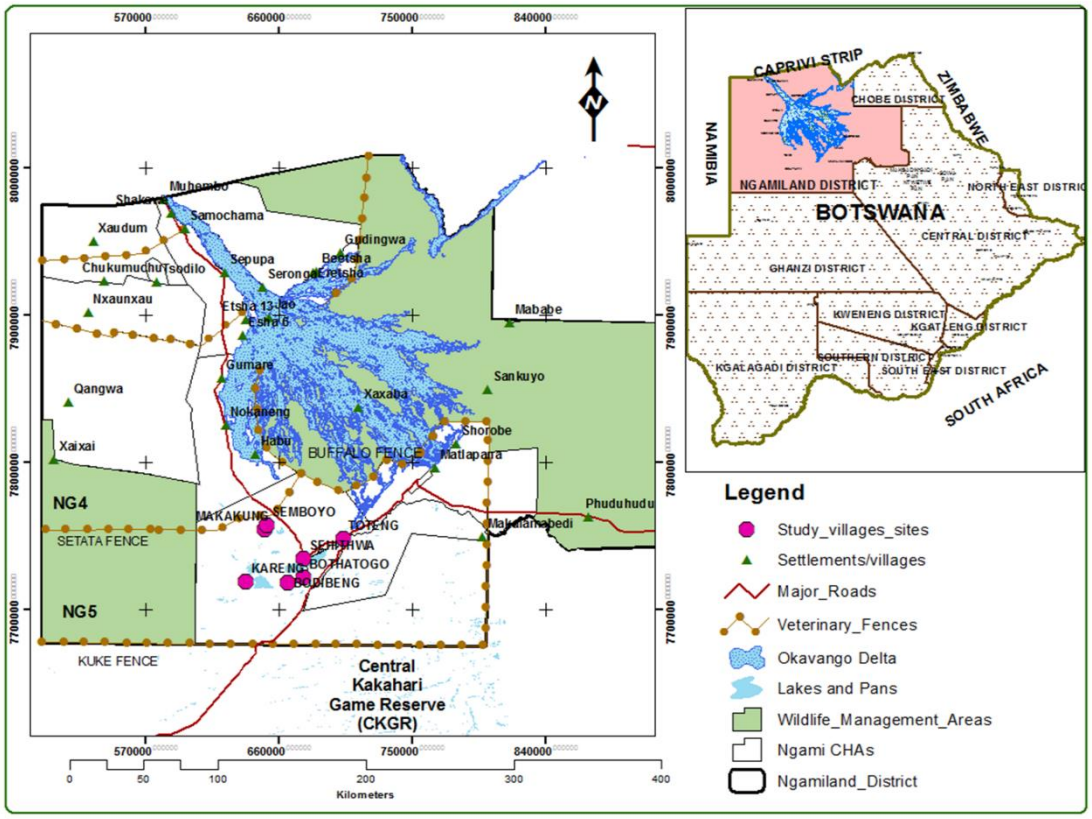

Figure 3.1: Ngamiland study area, its land uses and study sites Source: Authors

3.2.2. Focus group discussions

A total of nine focus group discussions were conducted. One focus group was held in each study village *(n = 7)*, with between 8 and 14 participants in each meeting. These discussions targeted stakeholders and groups in the community, particularly pastoralists with experience in communal areas and members of the farmers' committees[8]. Two additional focus groups targeted only women (a mix of female agro-pastoralists selected from the lake villages, *14 participants)* and youth groups (youths engaged in pastoral farming and those that were active in community projects, selected across the study villages, *14 participants)* to incorporate divergent views. This approach also helped avoid situations in which influential male members of a group dictate the mapping and discussion process. Farmers' committees, village leadership and village development committees were used to solicit names of participants for focus groups.

Discussions were structured around a set of questions on traditional mechanisms controlling access to communal lands, institutional forces governing patterns of spatial mobility, major changes in land tenure and pastoral land use arrangements since the introduction of fences in the early 1980s, problems experienced in the communal areas and perspectives on current land tenure and land use. From this, volunteers were identified who guided the transect walks and provided invaluable knowledge about the names of places and landscape features. A total of 7 transect walks were carried out and the number of volunteers were as follows: Semboyo *(n = 4)*, Makakung *(n = 6)*, Bodibeng *(n = 2)*, Bothatogo *(n = 6)* Toteng *(n = 3)*, Sehithwa *(n*

8 Farmers committees are community-level lobbying structures representing arable farmers and pastoralists or agro-pastoralists. They argue for the safeguards of pastoralists' land rights and access to water resources and markets. They are also responsible for farmer/pastoralist education and are community liaisons with government departments (DOL, 2009).

= 4), Kareng *(n = 4)*. All discussions were conducted in the *Setswana* language and tape-recorded.

3.2.3. Participatory Mapping and PGIS

Using a cognitive mapping process (Chan et al., 2014), we utilised sketch maps drawn by respondents during the focus groups to determine grazing areas and the spatial extent and patterns of seasonal livestock mobility before and after fences. Participatory mapping can form an important aspect of generating local spatial knowledge (Chapin et al., 2005, Neitschman, 1995), since it allows resource users to convey not only positions of activities but also background details concerning the locations and drivers of land use activities (Levine and Feinholz, 2015). The process involves using maps as tools to acquire indigenous knowledge and portraying this in a spatial way using GIS (Dunn, 2007, Talen, 2000). Pastoralists' maps can be incorporated into the government cadastral classification to improve awareness of pastoralists' customary tenures, thus protecting indigenous grazing land patterns and transhumance corridors.

Participants were provided with two printed land cover base maps (Figure 3.2) at a spatial scale of 1:250,000. These maps were produced using data obtained from Botswana's Department of Surveys and Mapping in the form of processed Landsat 8 imagery data for 2013 (dry season; June and August) and 2014 (wet season; December and February). The classification was achieved using ArcGIS 'cluster unsupervised classification' tool, in which pixels are grouped using reflectance properties. Accuracy was improved by combining summer and winter data rather than performing single data analyses. The map recorded the following land cover categories: savanna woodland, open low shrubland, swamp vegetation (aquatic herbaceous), natural bare ground or degraded land, natural waterbodies such as pans or ponds, hills and rivers. To validate the land cover map, ground truthing was carried out during two weeks of extensive field surveys in June 2016 (dry season).

The field surveys covered most of the accessible areas and landmark features such as natural water bodies or pans, rivers, hills, plains and gravel roads used by pastoral communities in the study area. A Global Positioning System (GPS) was used to record all the coordinates of the features visited. Local volunteers assisted in the naming of landscape features; rivers, roads, pans and plains. The aim was to produce a base map to aid the participatory mapping process.

District land use data was obtained from various government departments including the Department of Lands, Ministry of Agriculture, Department of Tourism and Tawana Land Board. Each department had a map to show its areas of interest and operation. For example, the Tawana Land Board's map showed general land uses while the Ministry of Agriculture had a more detailed map of agricultural land uses. The land cover map was geo-referenced and then overlaid with land use data. This was done to allow land use features such as roads, settlements and boreholes to appear on the land cover map, so that participants could identify and sketch their grazing spaces around these features. The principal land features on the map that respondents could identify were the Okavango delta, swamp areas, hills, Lake Ngami, roads, rivers, pans, pastoralists' settlements and fences. Borehole data obtained from the Tawana Land Board was also used to help focus group participants identify specific grazing lands and cattle posts. Borehole numbers were shown on the map and attribute data about the boreholes, such as names of owners, were printed on a separate page.

Mapping sessions were conducted with each focus group. At the beginning, participants were asked to identify their settlements and prominent landscape features and to locate their grazing areas or cattle posts. Second, participants were asked to delineate their historical pasture boundaries before the current fences, identifying them according to seasons. This was done on the land cover map provided. Based on their practical knowledge, participants were then asked to describe areas identified as grazing areas in terms of resources and access mechanisms. On a separate land cover map showing the fences and ranches,

participants were asked to identify and sketch their contemporary grazing spaces, including the general patterns of livestock movement among all pastoralists in the area (wet season/dry season alternation). The placement of a boundary or migratory movement patterns was achieved through consensus among group members. To validate features on participatory maps with features on the ground, community guided GPS transect walks were conducted with volunteers from each mapping group.

Results from the focus group discussions and participatory maps were checked for consistency through a series of key informant interviews as well as visits to cattle posts and conflict-prone zones. The selection of key informants was based on purposive/judgemental sampling (Tongco, 2007). Members of farmers' committees, village development committees and pastoralists in cattle posts were consulted to provide an initial list of potential respondents. Subsequent informants were identified using a snowballing technique (Speelman et al., 2014, Denzin and Lincoln, 2000). Participants were asked if they knew of others who met the selection criteria and could potentially participate in the interviews. A total of 26 informants were interviewed across the study area.

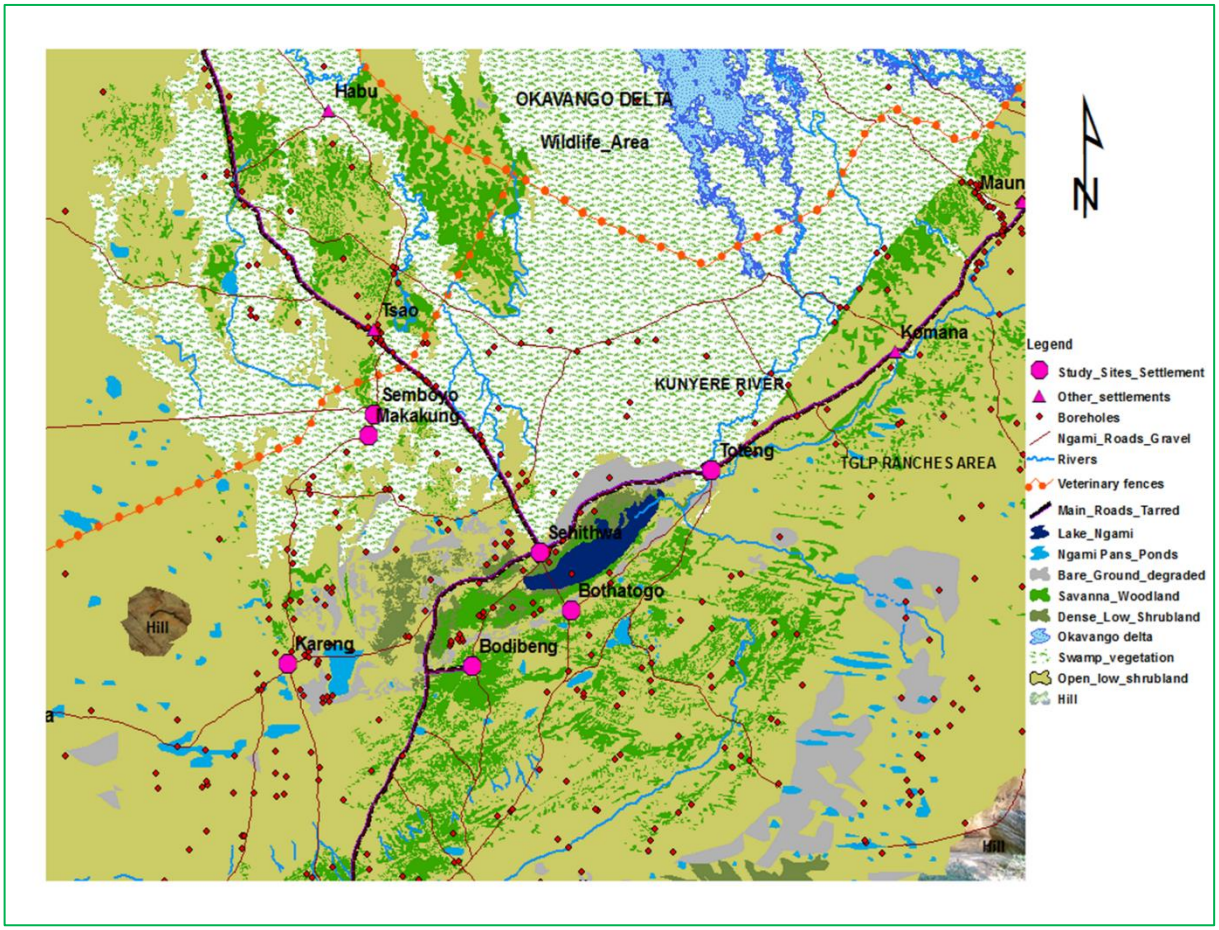

Figure 3.2: Land cover base map

Source: Authors Data Source: Landsat 8 satellite imagery, Department of Surveys and Mapping, Tawana Land Board

3.2.4. Data analysis

Maps made by local respondents were scanned and converted to digital versions using ArcGIS software. To align the coordinates, locations and other topographic features, participatory sketch maps were geo-referenced using the base maps and district land use maps. These were then digitised into layers of digital polylines or polygons delineating the full extent of boundaries identified by participants, or participants' impressions of livestock movement patterns before and after the barrier fences. Maps from different villages were overlaid to produce a consolidated

map. The aim of the mapping exercise was to provide a landscape-scale picture of the pastoral production system in terms of time and space based on the herders' spatial knowledge. These were then visualised in ArcGIS as PGIS maps. Land use pressure zones were identified using proximity and geographic distribution analysis through spatial statistics, using mean centre and standard distance tools in ArcGIS (Scott and Janikas, 2010). First, we identified the mean centre (the centre of concentration) for the land use features (cattle posts and arable lands or gardens). Standard Distance was then used to measure the degree to which these features are concentrated or dispersed around the mean centre, giving a spatial representation of the concentration of land use pressures.

Qualitative data from focus group discussions and key informant interviews were transcribed and analysed using content analysis in order to identify the main themes or issues emerging from the discussions. The content analysis involved the following steps: (i) identifying major themes emanating from the discussions (ii) assigning codes to major themes (iii) classifying responses under the identified themes (iv) writing the research narratives and discussions (Adam et al., 2015).

3.3. RESULTS

This section presents the results of the study based on the study objectives. It examines traditional pastoral systems and grazing zones before land tenure transformations, and makes spatial comparisons of past and present pastoral land use**.** From this information, the spatial impacts of land transformations were analysed.

3.3.1. Grazing zones before land use and tenure transformation

Information gathered through focus groups and in-depth interviews reveals that before the rangeland policy interventions, pastoralists' movements were prescribed and regulated through traditional institutional arrangements. Traditional village chiefs determined rules of access including regulating seasonal livestock movements. Places that contained dry season grazing resources and seasonal water sources were considered critical to the pastoral production system. Clans or kin networks controlled different pans and wells at their cattle posts and the surrounding rangelands. Each of these rangelands were delineated based on physiographic features and were defined genealogically.

Before the current land tenure and land use transformations, respondents identified three distinct grazing zones in the extensive indigenous grazing lands (Figure 3.3) according to characteristics of grazing resources, indigenous management systems and seasonal livestock movement patterns. These zones are consistent with the indigenous management system of rotating livestock between key permanent water sources and remote grazing lands in the sand veld areas (Magole, 2009). The identified grazing zones are as follows: (1) Village grazing areas which formed a radius of approximately 15 – 20 km around the main settlements. These grazing lands were reserved for milk cows, smaller calves and some small livestock. The village grazing areas were the most important communal grazing land for families with small herds of cattle. They derived from these areas not only grazing but also veld products, thatching grass, firewood and water for their livestock. (2) Dry season grazing areas, which include plains around perennial water sources, swamps, lagoons, lakes and river areas. Before the introduction of fencing and rangeland enclosures, the Lake Ngami flood plains and surrounding riverine vegetation served as dry season grazing reserves. According to information gathered from key informants and focus group discussions, each herder was expected by the village chief and/or community to take his/her livestock out of these areas immediately after the first rains when water had collected in the sand veld pans. (3) Wet season grazing areas. Central to these rangelands were the traditional natural water ponds and pans spreading along vast

sands of the dune system in the sand veld areas. These water sources are surrounded by wet season grazing areas.

During focus groups, respondents around Lake Ngami reported that immediately after the first rains, herds moved slowly away from Lake Ngami and surrounding riverine rangelands back to the south (wet season grazing areas). The first rains fall in September/October and livestock must move to the south to take advantage of renewed pastures and water in the sand veld pans. The move was an attempt to make optimal use of the rain and lessen pressure on deteriorated dry season pastures. Based on the composition and size of herds and available fodder, pastoralists pressed on towards the *Khwebe* hills in the current commercial ranch areas. Those with the largest herds made the longest moves while those with fewer cattle moved a shorter distance. In good years, the return was delayed until late winter (around July or August) because the wells and pans retained water for a longer time. In drought years, such as the 1965/1966 and 1982 droughts periods, this return would commence immediately after arable farmers had harvested (around April/May). Once back in the dry season grazing areas, the grazing pressure around settlements and water resources increased significantly, so the incentive to delay the return was a positive one. The movement was also vital for small-scale arable farmers who utilised the rivers and floodplains for flood recession arable farming. These fields were not fenced and hence the problem of cattle raiding crops was avoided. Once the harvest was complete and harvests collected, some weaker stock such as lactating cows and calves were returned to feed on crop residues. Pasturing on agricultural fields or village grazing areas was quite brief, lasting for a month. Livestock had to move with the beginning of winter.

Opportunistic movements in response to the highly spatially and temporally variable occurrence of green grass in response to rainfall and fire events were critical. Riverine and floodplain pastures were strictly conserved for use during the dry season or periods of drought. Moreover, risks imposed by environmental conditions such as livestock disease, livestock predation and sometimes flooding of the Okavango delta

demanded flexibility in pastoralists' decision-making. Permanent grazing in floodplains exposes livestock to parasites such as liver fluke and roundworms, which develop rapidly under moist conditions. Because of this risk, grazing on Okavango Delta system swamps and floodplains was limited to the dry seasons when water levels had subsided. Flexible spatial mobility ensured that pastoralists were able to mitigate risks and avert disasters. Respondents assert that when land was available before the privatisation policies, they engaged in an adaptive system of livestock herding and management which involved guiding and controlling livestock movement with techniques including herd splitting, in which livestock are divided into separate herds depending on their age, sex or type for increased niche specialisation. *'…herd splitting resulted in improved livestock watering practices and in the distribution of grazing pressure as each animal was taken to the pasture land which best suits its characteristics…*' (Interview data, pastoralist, Kareng, 2015).

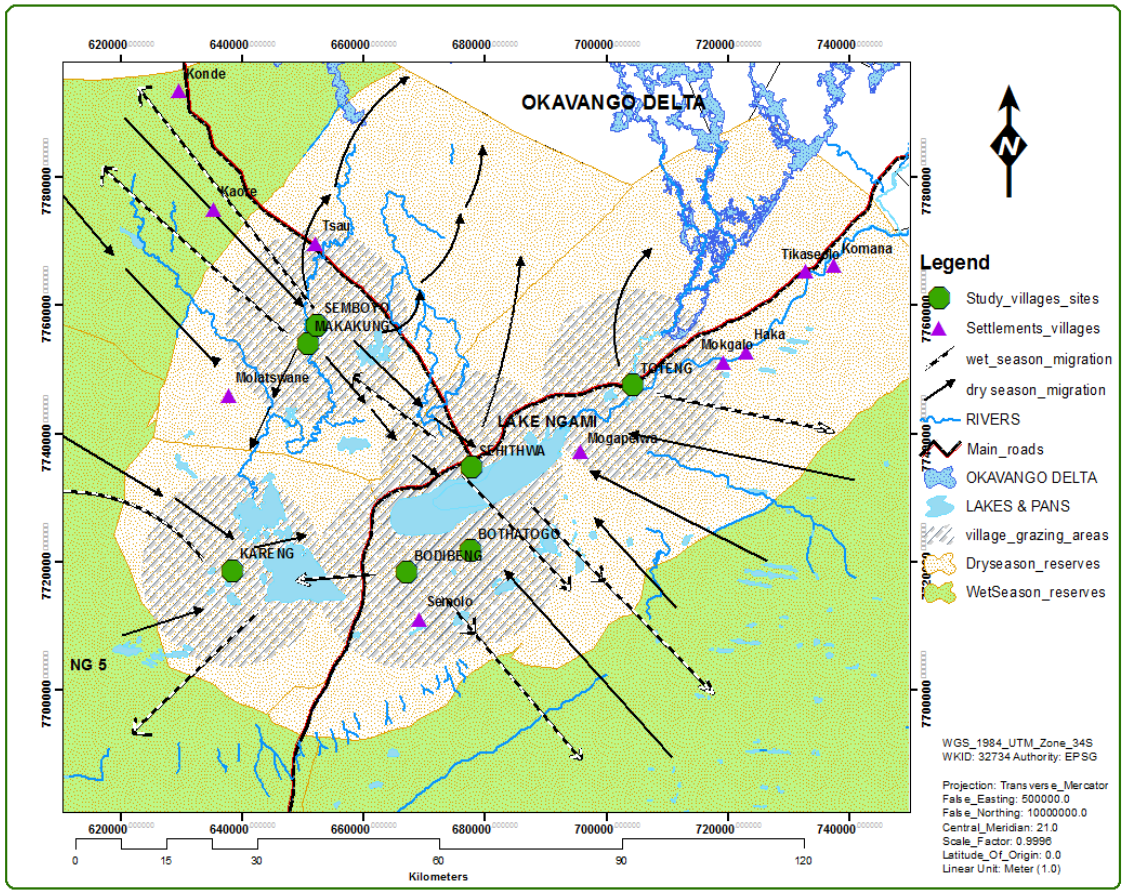

Figure 3.3: Combined respondents' participatory map

Showing grazing zones and historical migration patterns before major policy interventions.

3.3.2. Spatial comparisons and the impacts of grazing policies

Spatial comparisons of the current situation show that the functional distinction between village grazing areas, dry season grazing areas, and wet season grazing areas have been eroded by rangeland policy interventions. Figure 3.4 shows the spatial configuration of land use and the land available for communal grazing after land tenure transformation. Herds are confined around settlements, with the areas between the ranches and veterinary fences serving as all-season grazing areas. Commercial ranches have replaced wet season grazing areas to the south of Lake

Ngami. To the north, these rangelands have been bisected by veterinary fences. This has significantly reduced the area available for communal pastoralism.

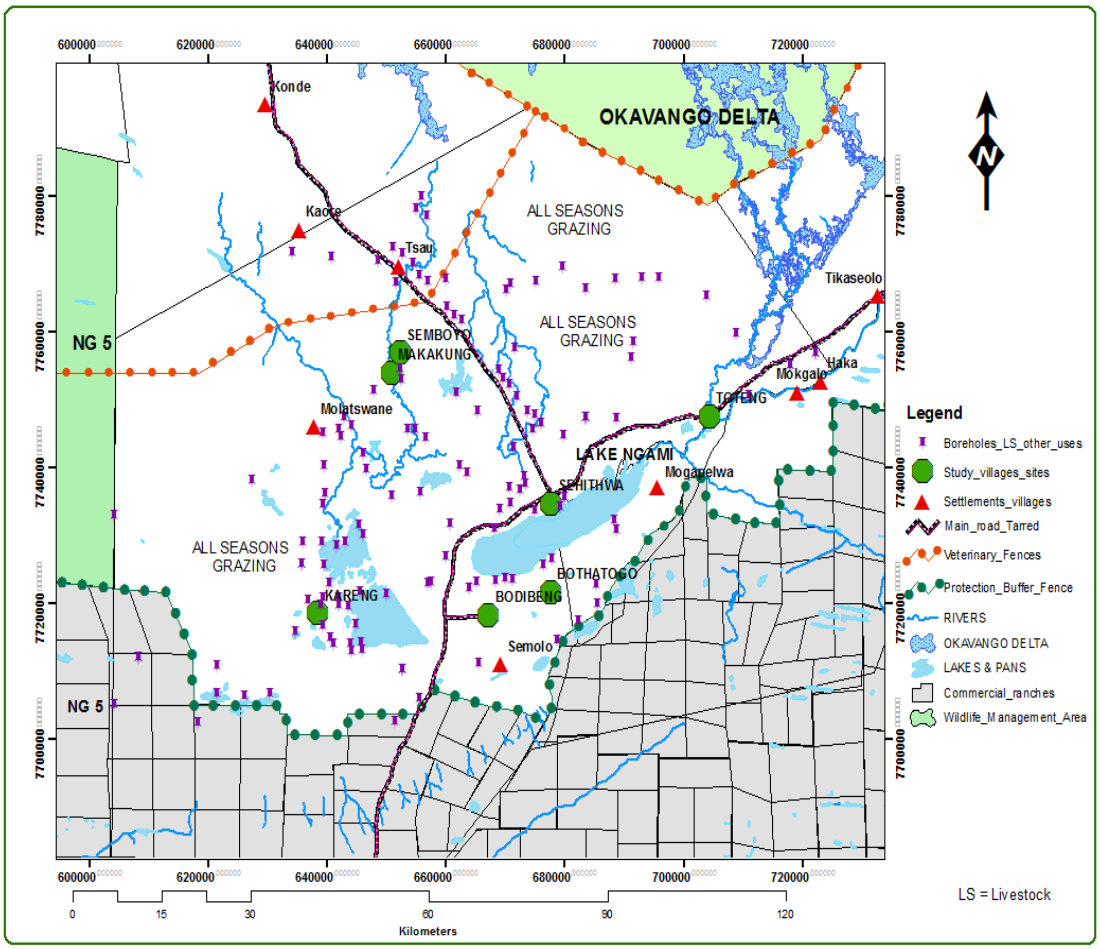

Figure 3.4: Spatial configuration after the transformation
Showing all-season grazing areas after the land tenure transformation.

The significant reduction in the amount of communal grazing lands available was not accompanied by a reduction in cattle numbers as purported by TGLP. Under TGLP, it was assumed that large scale cattle owners would transfer their herds to ranches and leave the communal grazing land to the poor subsistence pastoralists (RoB, 1975). Respondents argued that cattle numbers continued to increase and are currently very high. Opportunistic ranchers with access to privatised land continue to keep large numbers of cattle in communal areas. This allows them access to communal

grazing lands and Lake Ngami, and to sell when opportunities for markets arise on either side of the buffer fence. Some ranchers interviewed during focus groups and key informant interviews agreed that they have cattle posts in communal lands. The persistent outbreak of FMD has systematically terminated beef exports in Ngamiland, a factor which also significantly contributes to the continuous increase in livestock numbers in the communal areas as there is no offtake. The livestock trend statistics from the Department of Veterinary Services depicted in Figure 3.5 indicate a continuing increase in cattle numbers in the communal areas. The increase has possible consequences such as overgrazing and degradation of communal lands as mobility is constrained.

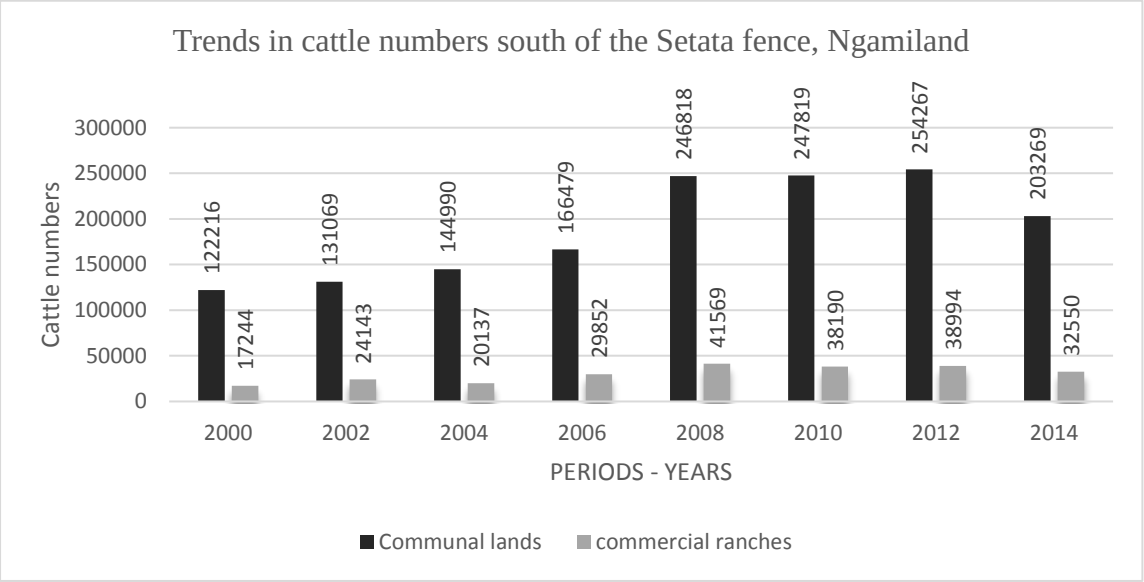

Figure 3.5: Cattle numbers, 2000 - 2014

Data source: Department of Veterinary Services (DVS)

Respondents argued that current rangelands are congested and heavily over-utilised and that conflicts are prominent. Table 3.1 provides a GIS-estimated measure of the areas used by pastoralists before land privatisation and subdivision. The current grazing area between the fences (Figure 3.4) measures 7, 371 km^2 of all-season

grazing areas shared by all villages in the study area, compared to 22,380 km^2 of wet, dry and drought season grazing before the fences. Approximately 65% of communal lands have been lost to privatisation and subdivisions since 1975. This scenario underscores the impacts of rangelands policies on livestock spatial mobility, traditional grazing patterns and access to rangeland resources.

Table 3.1: A GIS estimate of communal grazing areas before the land privatisation policies (Km^2)

Study villages	*Grazing zones*			
	Village grazing areas	*Dry season grazing areas*	*Wet season grazing areas*	*Total*
Semboyo/Makakung (Setata)	*705*	*2,009*	*2,598*	*5,312*
Kareng (Western Sandveld)	*695*	*850*	*4,586*	*6,133*
Bothatogo/Bodibeng/Toteng/Sehithwa (lake villages)	*1,863*	*2,942*	*6,131*	*10,935*
Total	*3,263*	*5,801*	*13,315*	*22,380*

Interviews with key informants focusing on their spatial knowledge revealed that after the introduction of fences and ranches, spatial mobility declined significantly and year-round use of formerly dry season riverine riparian pastures and village grazing areas increased. This has prompted uncontrolled livestock movements, livestock crop damage, stray livestock and increased human-wildlife conflicts, especially with elephants, as fences have bisected migratory corridors. *'…the construction of fences did not give due consideration to animal migratory corridors, fences have diverted animals from their traditional migratory corridors, especially elephants into our cattle posts and arable gardens...' (*Interview data, 63-year-old male pastoralist, Bothatogo, 2015).

Respondents also assert that control of livestock diseases is difficult because of congestion in communal areas. Livestock movement patterns tend to be chaotic and severely limited. Pastoralists follow individualistic strategies to access grazing and water resources with little regard for the old traditions of consensus. Most reported that it is no longer possible to migrate away from Lake Ngami or the surrounding riverine vegetation during the wet season because there is nowhere to which they can migrate.

3.3.3. Access to water resources

Competition for water is a major source of land and natural resource use pressure among pastoralists in the study area. Water rights are crucial to the sustainable management of land. Respondents argued that the government's decision to allow enclosure of natural water pans by private ranches had weakened local rangeland management systems, deprived pastoralists of valuable assets and fostered conflict over the remaining water sources, and contributed to land degradation caused by livestock congestion around Lake Ngami. Competition over access to water between and within land use systems, especially between livestock and wildlife, was also reported to be widespread as most of the natural ponds are now enclosed by private ranches. Only 30% of the 26 respondents interviewed during key informant interviews indicated that they own livestock boreholes of their own. The rest depend on natural water sources or pay a fee to those with boreholes. Respondents argued that the creation of private water points in communal areas was used as a strategy by elites to gain access to privatised communal lands, as the NPAD policy later gave preference to those with water points when allocating ranches. Moreover, respondents argued that most of the underground water is saline and some borehole owners, including ranchers, continue to use natural water sources, ponds, lagoons, rivers and the lake to water their livestock.

3.3.4. Current land use

An assessment of land use categories within the remaining area (Figure 3.4) shows a spatial configuration of cattle posts concentrated around permanent water sources, especially around Lake Ngami, settlements, and arable fields. The effects of privatisation and subdivision are reflected mostly in the changing patterns of pastoral land use, including the year-round use of critical grazing reserves that were previously used only for one season each year. Livestock is concentrated near major settlements, roads, rivers and the lake (Figure 3.6). Pastoralists are now confined to smaller areas with limited access to the broader range of ecological zones that were traditionally used for managing environmental variability.

Herding practices such as the niche specialisation of herds were dismantled as flexible movements were curtailed. *'…Hainaveld formed our grazing reserves and wet seasons retreat…these ranches and fences have displaced us from our traditional grazing land and significantly destructed our pastoral management system…the remaining piece of land is congested and overgrazed…',* (Focus group discussion data, Sehithwa, 2015). The distinction between land use systems, cattle posts, arable lands and settlements is unclear. The area between the lake and the ranches was described by respondents as a zone of competition and stocking pressure due to the ever increasing number of cattle in the area. Pastoralists displaced by the ranches have been encroaching on this zone, pushing the communal pastoralists further towards the villages.

Using land use concentrations and ArcGIS proximity and geographic distribution analysis, we utilised land use data (cattle posts and arable lands) obtained from Landsat 8 imagery and GPS-based transect walks to estimate land use pressure zones in the study area. The standard distance, 25,182.25 m from the centre of concentration (Lake Ngami), represents the highest degree of compactness of land use (severe pressure zone). Beyond this distance, the dispersion increases, and therefore land use pressure decreases (moderate pressure zone). Respondents

identified the types of land use pressures and their associated impacts (Table 3.2) during focus group discussions. Figure 3.6 identifies land use pressure zones. Land use activities are concentrated around Lake Ngami and the ranches; hence, these areas suffer the greatest land use and grazing pressure.

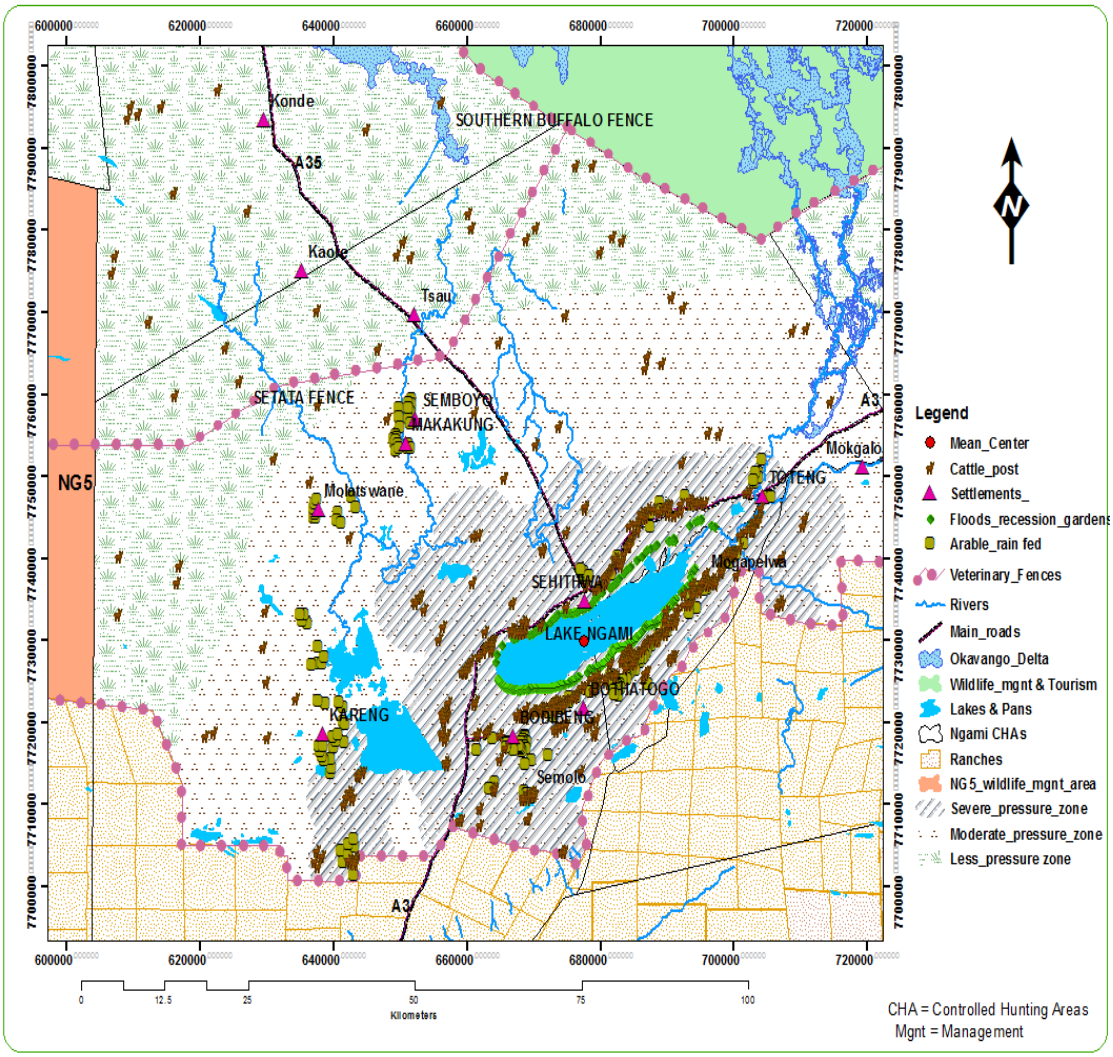

Figure 3.6: Land use pressure areas

Cattle posts concentrations and other land uses; ranches, arable fields superimposed to identify areas of competing land use using spatial statistics (mean centre and standard distance)

Table 3.2: Pressures and associated impacts due to fences and growth in livestock numbers in communal areas

Land use pressure	Associated Impacts
Fences and expansion of ranches – restricted access	Loss of grazing and water resources, blockage of livestock and wildlife migratory corridors, curtailment of seasonal migrations.
Concentration of cattle closer to permanent water sources, e.g., Lake Ngami	Overstocking of floodplains and riparian rangelands, piosphere-based rangeland degradation, destruction of ecosystems, difficulty controlling disease incidences, e.g., FMD
Land use overlaps; arable land, cattle posts and wildlife	Land use competition and conflicts; destruction of crops by livestock and wildlife, predation, human-elephant conflicts
Dual grazing – opportunistic stocking strategies	Resource use conflicts, overstocking in communal areas, land use conflicts and strained local social relations between ranchers and communal area pastoralists
Borehole-based livestock expansion in an area with poor groundwater	Borehole drilling along dry river valleys where shallow ground water exists, rapid development of sacrifice and bush encroachment zones

The research area contains four land use systems. Drawing a transect from the south to the north, land use categories and management regimes range from commercial farming on privately owned ranches (both livestock and game), to subsistence agro-pastoralists squeezed in the area between the fences where land use and grazing pressures are intense (settlements, arable and cattle posts) especially around Lake Ngami. To the southwest is the contested wildlife management area known as NG5. A network of veterinary fences is followed by a purely commercial wildlife management area and tourism facilities to the northeast, where pastoralist production systems are restricted.

3.4. DISCUSSION

3.4.1. Local spatial knowledge, rangeland privatisation and spatial mobility

To cope with environmental variability, pastoralists have developed knowledge and skills (Solomon et al., 2007), including comprehensive systems of seasonal migration and livestock mobility under controlled grazing patterns (Fernandez-Gimenez and Le Febre, 2006). The most pertinent challenge faced by pastoralists today is access to sufficient pasture resources and portable water to sustain their livestock through both good and drought years. Respondents in this study were particularly wary of problems associated with livestock spatial mobility. As elsewhere in sub–Saharan Africa, pastoralists continue to suffer extreme marginalisation due to reduced access to pastureland (Lesorogol, 2008, Bogale and Korf, 2007). Researchers have shown how policy interventions in rangelands have ignored traditional pastoral systems, leading to a widespread loss of rangeland productivity and an increase in pastoral poverty (Taylor, 2012, Bassett, 2009, Rohde et al., 2006). In Ngamiland, as common pastures and ephemeral water sources are enclosed for private use and trekking routes are blocked, communal pastoralists bear the effects of ecosystem deterioration.

The findings of this study show that pastoralists in the area used to follow a traditional transhumance pattern of pastoralism with seasonal movement to and from Lake Ngami and surrounding Okavango delta floodplains. Our findings suggest that the loss of critical wet season grazing reserves was due to a failure to recognise the spatial heterogeneity of the Ngamiland pastoral landscape, including diversity within traditional pastoralists' management strategies. This is compounded by the dual grazing rights problem, in which ranchers continue to use loopholes in policies to graze their livestock in the communal areas (Mulale et al., 2014, Magole, 2009, White, 1992). This was reported to be widespread in Ngamiland. Respondents blamed government policy interventions for the loss of traditional grazing territories,

erosion of traditional management institutions, and overall rangeland degradation in the communal areas especially around Lake Ngami.

3.4.2. Participatory mapping, PGIS and government planning

The study set out to investigate pastoral land use and livestock spatial mobility within the context of pastoralists' spatial knowledge using participatory mapping and PGIS. This process generated unique spatial knowledge representing traditional grazing systems, pasture boundaries and the impacts of rangeland policies on livestock spatial mobility. It also facilitated a spatially explicit discussion (Talen, 2000), which enabled participants to articulate their viewpoints in a spatially explicit manner. In addition to spatial data, participatory mapping processes provide non-spatial information such as histories, social relations and patterns (Levine and Feinholz, 2015). By collecting evidence from the field through participatory mapping and GPS-based transect walks, overlapping claims to pasture boundaries can be identified and mapped as spatial units. For example, conflict-prone areas or land use pressure zones can be identified. Such information can inform planning and/or strategies for resolving land use conflicts in communal areas.

Conventional land administration systems, which focus mostly on fixed tenure systems, are often not equipped to capture the dynamism inherent in traditional pastoralists' tenures (Bennett et al., 2013, Smith, 2003), particularly in sub–Saharan African rangelands. Indigenous pastoral lands have mostly been presented as empty spaces (Smith et al., 2012) by some rangeland policies. For example, Botswana's TGLP assumed that there was an abundance of empty lands which could be turned into ranches or even reserved for future use (Magole, 2009, Childers, 1981a). However, many such 'unused' lands were actually rangelands that were critically important to pastoralists for managing routine dry spells or drought cycles, as demonstrated in this paper, or used by nomadic hunter-gatherers. Smith (2003) notes that when mapmaking is done only by government officials or bureaucratic elites, they

inherently neglect features of the landscape that are important and the most relevant to local communities. We agree, and argue by extension that analysing pastoral land use using local pastoralists' spatial knowledge allows resource users to depict not only their grazing space but also the relationship between resource temporal arrangements and their spatial functionality.

Respondents reported that it was the first time they had been involved in a project in which they drew their own maps and delineated boundaries. Pasture boundaries, alienation of productive grazing lands and encroachment by ranches remain sources of disputes between pastoralists, government officials and ranchers. Respondents felt strongly that the maps produced will help them present their case to the relevant authorities or make their case for land heard. Though the study did not aim at resolving pastoralists' issues and problems, nor advocate for the dismantling of existing private rights, it did offer an alternative way of studying pastoralists' issues through participatory mapping and PGIS, and produce useful cartographic information and empirical evidence regarding problems associated with privatisation and subdivision of communal grazing lands.

The empirical evidence and experience drawn from this research shows that local pastoralists can work with researchers to transform their cognitive spatial knowledge into forms that can inform policy. The basic spatial relationship between local communities and the natural environment in which they make their living is often poorly understood by government planners and/or policy makers (Herlihy, 2003). However, instead of playing an active role in research agendas, pastoralists are often the subject of research (Vetter, 2005). Their needs, priorities, and environmental and spatial knowledge are often omitted from policies that directly affect them. Participatory mapping and PGIS becomes an alternative way of producing environmental and spatial knowledge by decentralising the process (Herlihy and Knapp, 2003) and putting it in the hands of indigenous resource users. This research has documented the spatial extent of livestock mobility and traditional grazing reserve zones, and provided a measure of traditional pastoral land use patterns

before and after rangeland policies. By creating indigenous spatial maps of pastoralism and making spatial comparisons of the impacts of rangeland policies over time, the study reveals, in a novel way, the spatial impacts of the contested land transformations that have taken place in Ngamiland since 1975.

3.5. CONCLUSIONS

This study demonstrates how participatory mapping and GIS can be used to foster better articulation and understanding of pastoralists' tenures and grazing patterns. Respondents from all focus groups lamented diminishing communal grazing lands and constriction of livestock spatial mobility as ranches have taken large tracts of land out of communal ownership. Respondents argued that animal health and rangeland policies do not recognise their traditional resource rights, grazing territories and management systems. Efforts to negotiate with authorities have been difficult mainly due to a lack of documented spatial information for their grazing territories. The local authorities observed the value of participatory mapping as a way of producing empirical evidence and detailed information that they can use to engage relevant government entities, defend their grazing space against expropriation by state or opportunistic elites, and help them manage their resources in a sustainable manner. This study reveals that local pastoralists are endowed with a wealth of spatial knowledge about their grazing territories. This knowledge is rarely documented or incorporated into conventional government planning processes. The PGIS approach produces valuable pastoral land use and spatial information vital to the sustainable management of land in dryland environments, where mobility and resource access remain at the core of pastoral sustainability. As communal lands continue to shrink and prospects for sustainable pastoralism become more uncertain, future research will need to focus on pastoralists' adaptations within this constrained environment and how pastoralist production systems can be made resilient in the face of continued environmental and policy changes.

3.6. ACKNOWLEDGEMENTS

The research was carried out under research permit number EWT 8/36/4 XXX (73) of the Government of Botswana. We are thankful for the research funding provided by the Botswana International University of Science and Technology (BIUST), Government of Botswana and University of Leeds Sustainable Agriculture Bursaries. Many thanks to the anonymous reviewers for their insightful comments and suggestions. Thanks to Professor Lindsay Stringer for feedback on earlier draft of this manuscript.

3.7. REFERENCES

ADAM, Y. O., PRETZSCH, J. & DARR, D. 2015. Land use conflicts in central Sudan: Perception and local coping mechanisms. *Land Use Policy,* 42**,** 1-6.

ADAMS, M. 2013. Reforming communal rangeland policy in southern Africa: challenges, dilemmas and opportunities. *African Journal of Range & Forage Science,* 30**,** 91-97.

ADRIANSEN, H. K. & NIELSEN, T. T. 2002. Going where the grass is greener: On the study of pastoral mobility in Ferlo, Senegal. *Human Ecology,* 30**,** 215-226.

APRU 1976. An Integrated Programme of Beef Cattle and Range Research in Botswana: 1970 – 1976. *Animal Production Research Unit (APRU), Ministry of Agriculture, Gaborone.*

BASSETT, T. J. 2009. Mobile pastoralism on the brink of land privatization in Northern Cote d'Ivoire. *Geoforum,* 40**,** 756-766.

BENJAMINSEN, T. A., HOLDEN, S., LUND, C. & SJAASTAD, E. 2009. Formalisation of land rights: Some empirical evidence from Mali, Niger and South Africa. *Land Use Policy,* 26**,** 28-35.

BENNETT, R., ZEVENBERGEN, J. & LENGOIBONI, M. 2013. The pastoralist's parcel: towards better land tenure recognition and climate change response in Kenya's dry lands. *FIG Working Week 2013, Environment for Sustainability, Abuja, Nigeria*.

BOGALE, A. & KORF, B. 2007. To share or not to share? (Non-)violence, scarcity and resource access in Somali Region, Ethiopia. *Journal of Development Studies,* 43**,** 743-765.

CHAN, D. V., HELFRICH, C. A., HURSH, N. C., ROGERS, E. S. & GOPAL, S. 2014. Measuring community integration using Geographic Information Systems (GIS) and participatory mapping for people who were once homeless. *Health & Place,* 27**,** 92-101.

CHANDA, R., TOTOLO, O., MOLEELE, N., SETSHOGO, M. & MOSWEU, S. 2003. Prospects for subsistence livelihood and environmental sustainability along the Kalahari Transect: The case of Matsheng in Botswana's Kalahari rangelands. *Journal of Arid Environments,* 54**,** 425-445.

CHAPIN, M., LAMB, Z. & THRELKELD, B. 2005. Mapping Indigenous Lands. *The Annual Review of Anthropology,* 34**,** 619 - 638.

CHILDERS, G. W. 1981. Western Ngwaketse Remote Area Dwellers: A Land Use and Development Plan for Remote Area Settlements in Southern Botswana. *Government Printers, Botswana*.

COLEMAN, E. A. & MWANGI, E. 2015. Conflict, Cooperation, and Institutional Change on the Commons. *American Journal of Political Science,* 59**,** 855-865.

CULLIES, A. & WATSON, T. 2005. Winners and Losers: Privatising the commons in Botswana. *Willprint, Colchester*.

DENZIN, N. & LINCOLN, Y. 2000. *Handbook of Quantitative Research,* London, Sage Publications.

DMS 2013. Ngamiland Rainfall Statistics. *Department of Meteorological Services, Ministry of Environment Wildlife and Tourism, Gaborone, Botswana.*

DOL 2009. Department of Lands (DoL). Ngamiland Integrated Land Use Plan, Final Report, . *Ministry of Lands and Housing, Botswana.*

DOUGILL, A. J., AKANYANG, L., PERKINS, J. S., ECKARDT, F. D., STRINGER, L. C., FAVRETTO, N., ATLHOPHENG, J. & MULALE, K. 2016. Land use, rangeland degradation and ecological changes in the southern Kalahari, Botswana. *African Journal of Ecology,* 54**,** 59-67.

DOUGILL, A. J., THOMAS, D. S. G. & HEATHWAITE, A. L. 1999. Environmental change in the Kalahari: Integrated land degradation studies for nonequilibrium dryland environments. *Annals of the Association of American Geographers,* 89**,** 420-442.

DUNN, C. E. 2007. Participatory GIS - a people's GIS? *Progress in Human Geography,* 31**,** 616 - 637.

FERNANDEZ-GIMENEZ, M. E. 2002. Spatial and Social Boundaries and the Paradox of Pastoral Land Tenure: A Case Study from Postsocialist Mongolia. *Human Ecology,* 30.

FERNANDEZ-GIMENEZ, M. E. & LE FEBRE, S. 2006. Mobility in pastoral systems: Dynamic flux or downward trend? *International Journal of Sustainable Development & World Ecology,* 13**,** 341-362.

GALATY, J. G. 2013. Land grabbing in the Eastern African rangelands. *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 143 - 153.

HARDIN, G. 1968. The tragedy of the commons. *Science,* 162**,** 1243 - 8.

HERLIHY, P. H. 2003. Participatory research mapping of indigenous lands in Darien, Panama. *Human Organization,* 62**,** 315-331.

HERLIHY, P. H. & KNAPP, G. 2003. Maps of, by, and for the peoples of Latin America. *Human Organization,* 62**,** 303-314.

KAKINUMA, K., OKAYASU, T., JAMSRAN, U., OKURO, T. & TAKEUCHI, K. 2014. Herding strategies during a drought vary at multiple scales in Mongolian rangeland. *Journal of Arid Environments,* 109**,** 88-91.

KAYE-ZWIEBEL, E. & KING, E. 2014. Kenyan pastoralist societies in transition: varying perceptions of the value of ecosystem services. *Ecology and Society,* 19.

LENGOIBONI, M., BREGT, A. K. & VAN DER MOLEN, P. 2010. Pastoralism within land administration in Kenya-The missing link. *Land Use Policy,* 27**,** 579-588.

LESOROGOL, C. K. 2008. Land privatization and pastoralist well-being in Kenya. *Development and Change,* 39**,** 309-331.

LEVINE, A. S. & FEINHOLZ, C. L. 2015. Participatory GIS to inform coral reef ecosystem management: Mapping human coastal and ocean uses in Hawaii. *Applied Geography,* 59**,** 60-69.

MAGOLE, L. 2009. The 'shrinking commons' in the Lake Ngami grasslands, Botswana: the impact of national rangeland policy. *Development Southern Africa,* 26**,** 611-626.

MATHUBA, B. 2009. Botswana Land Policy: Paper presented at an international workshop on Land Policies in Southern Africa. *Berlin, German*.

MBAIWA, J. E., NGWENYA, B. N. & SETHORA, M. 2008. Ethnicity and Utilization of Natural Resources in the Okavango Delta, Botswana: A Historical Perspective of Conflict and Collaboration. *In:* AHMED, A. (ed.) *Managing Science and Technology for a Sustainable Future: Wasd 2008 Conference Proceedings.* Brighton: World Assoc Sustainable Development-Wasd, Spru-Science & Technol Policy Res.

MCCALL, M. K. & DUNN, C. E. 2012. Geo-information tools for participatory spatial planning: Fulfilling the criteria for 'good' governance? *Geoforum,* 43**,** 81-94.

MORITZ, M., LARISA CATHERINE, B., DRENT, A., KARI, S., MOUHAMAN, A. & SCHOLTE, P. 2013. Rangeland governance in an open system: Protecting transhumance corridors in the Far North Province of Cameroon. *Pastoralism,* 3**,** 1-10.

MULALE, K., CHANDA, R., PERKINS, J. S., MAGOLE, L., SEBEGO, R. J., ATLHOPHENG, J. R., MPHINYANE, W. & REED, M. S. 2014. Formal institutions and their role in promoting sustainable land management in Boteti, Botswana. *Land Degradation & Development,* 25**,** 80-91.

MWANGI, E. 2007. Subdividing the commons: Distributional conflict in the transition from collective to individual property rights in Kenya's Maasailand. *World Development,* 35**,** 815-834.

NEITSCHMAN, B. 1995. Defending the Miskito Reefs with maps and GPS. *Cultural Survival Quarterly,* 18**,** 34 - 83.

NOTENBAERT, A., DAVIES, J., DE LEEUW, J., SAID, M., HERRERO, M., MANZANO, P., WAITHAKA, M., ABOUD, A. & OMONDI, S. 2012. Policies in support of pastoralism and biodiversity in the heterogeneous drylands of East Africa. *Pastoralism,* 2**,** 1-17.

OBA, G. 2013. The sustainability of pastoral production in Africa. *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 29-36.

PERKINS, J. S. 1996. Botswana: Fencing out the equity issue. Cattleposts and cattle ranching in the Kalahari Desert. *Journal of Arid Environments,* 33**,** 503-517.

PETERS, P. E. 1994. *Dividing the commons: politics, policy, and culture in Botswana,* Charlottesville, University Press of Virginia.

PETERS, P. E. 2009. Challenges in Land Tenure and Land Reform in Africa: Anthropological Contributions. *World Development,* 37**,** 1317-1325.

ROB 1975. Republic of Botswana, National Policy on Tribal Grazing Land: Government Paper No. 2 of 1975. *Government Printers, Gaborone, Botswana*.

ROB 1991. Republic of Botswana, National Policy on Agricultural Development (NPAD). *Government Printers, Gaborone, Botswana*.

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. *Environmental Science & Policy,* 9**,** 302-316.

SCOTT, L. M. & JANIKAS, M. V. 2010. Spatial Statiscs in ArcGIS. *In Fischer, M. M and Getis, A (Eds), Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications*.

SMITH, D. A. 2003. Participatory mapping of community lands and hunting yields among the Bugle of western Panama. *Human Organization,* 62**,** 332-343.

SMITH, D. A., HERLIHY, P. H., VIERA, A. R., KELLY, J. H., HILBURN, A. M., ROBLEDO, M. A. & DOBSON, J. E. 2012. Using Participatory Research Mapping and GIS to Explore Local Geographic Knowledge of Indigenous Landscapes in Mexico. *Focus on Geography,* 55**,** 119-124.

SOLOMON, T. B., SNYMAN, H. A. & SMIT, G. N. 2007. Cattle-rangeland management practices and perceptions of pastoralists towards rangeland degradation in the Borana zone of southern Ethiopia. *Journal of Environmental Management,* 82**,** 481-494.

SPEELMAN, E. N., GROOT, J. C. J., GARCIA-BARRIOS, L. E., KOK, K., VAN KEULEN, H. & TITTONELL, P. 2014. From coping to adaptation to economic and institutional change - Trajectories of change in land-use management and social organization in a Biosphere Reserve community, Mexico. *Land Use Policy,* 41**,** 31-44.

TACHE, B. 2013. Rangeland enclosures in Southern Oromia, Ethiopia: an innovative response or the erosion of common property resources? *In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege***,** 37 - 46.

TALEN, E. 2000. Bottom-up GIS - A new tool for individual and group expression in participatory planning. *Journal of the American Planning Association,* 66**,** 279-294.

TAYLOR, J. 2012. Constraints of grassland science, pastoral management and policy in Northern China: Anthropological perspectives on degradational narratives. *International Journal of Development Issues,* 11**,** 208-226.

TLOU, T. 1985. *A history of Ngamiland: the formation of an African State,* Gaborone, Botswana, Macmillan Publishers.

TONGCO, M. D. C. 2007. Purposive Sampling as a tool for Informant Selection: Research Methods. *Ethnobotany Research and Application: A journal of Plants, People and Applied Research.,* 5.

TOULMIN, C. 2009. Securing land and property rights in sub-Saharan Africa: The role of local institutions. *Land Use Policy,* 26**,** 10-19.

TSEGAYE, D., VEDELD, P. & MOE, S. R. 2013. Pastoralists and livelihoods: A case study from northern Afar, Ethiopia. *Journal of Arid Environments,* 91**,** 138-146.

TURNER, M. D., MCPEAK, J. & AYANTUNDE, A. A. 2014. The role of livestock mobility in the livelihood strategies of rural peoples in semi-arid West Africa. *Human Ecology,* 42.

VETTER, S. 2005. Rangelands at equilibrium and non-equilibrium: recent developments in the debate. *Journal of Arid Environments,* 62**,** 321-341.

WHITE, R. 1992. *Livestock Development and Pastoral Production on Communal Rangeland in Botswana: Case study for Workshop: New directions in African Range Management Policy, Matopos, Bulawayo, Zimbabwe,* London, UK, Commonwealth Secretariat.

CHAPTER 4:

Adaptation Strategies to Environmental and Policy Change in Semi-arid Pastoral Landscapes: Evidence from Ngamiland, Botswana[9]

[9] **Revised AND Resubmitted**

Journal of Arid Environments

ABSTRACT

Semi-arid rangeland pastoral areas have been affected by diverse pressures; livestock diseases, human-wildlife conflicts, droughts and resource scarcity as a result of fragmented landscapes that constrain pastoral livelihoods. In Botswana, pastoralists' adaptations remain insufficiently documented. Adaptation strategies are responses to livelihood constraints and if mainstreamed into development programmes can counter negative impacts arising from ecosystem deterioration. Using iterative participatory rural appraisal methods, this study examines adaptation strategies that pastoral societies in Ngamiland, Botswana have used to cope with pressures in their pastoral socio-ecological system. Findings show a move towards mixed and spatially varied livelihood strategies. Mixed agro-pastoral farming, intensification of flood recession farming, fishing and a network of self-help groups have developed over the last few decades of significant policy and environmental change. Pastoralists have become more sedentary with increases in petty trade and higher dependency on social welfare programmes. As the ability to adapt has positive attributes for livelihood sustainability and resilience, there is a need for practical initiatives that improve pastoralists' adaptive capacity, such as reforming pastoralists' institutions and expanding infrastructural development in pastoral areas so as to enable access to markets. These also include the need to share insights more widely across the district, nationally and regionally.

Keywords: Socio-ecological system; Land fragmentations; Climate variability, Vulnerability; Adaptive capacity; Coping strategies

4.1. INTRODUCTION

Dryland pastoral landscapes are characterised by unpredictable rainfall changes and frequent ecological disasters such as droughts and livestock diseases (Ellis and Swift,

1988). The International Panel on Climate Change's Fifth Assessment Report predicts that the impacts of climate change will lead to more droughts which could have a negative effect for millions of people in the poorest parts of the world, especially Africa (IPCC, 2014). Moreover, people living in dryland areas will continue to be increasingly affected by the effects of climate change because of the marginal nature of the resources to which they have access. Despite unpredictable environmental conditions, dryland areas have for many years supported pastoral livelihoods that employ strategic mobility to access water and quality grazing resources in these areas of high rainfall variability (Schnegg and Bollig, 2016). For instance, pastoralists have historically integrated their accumulated environmental knowledge of dryland systems with traditional adaptation mechanisms, which has enabled them to sustain livestock production and livelihoods even in difficult times (Niamir-Fuller, 1999, Scoones, 1995). Using locally available resources, pastoralists have always had to act to avoid the worst impacts of drought and other disasters such as livestock diseases (Ifejika Speranza, 2010). However, most pastoral socio – ecological systems have undergone dramatic changes due to landscape fragmentation, shifts in institutions and the multifaceted role of markets (Goldman and Riosmena, 2013). Increasingly, livestock mobility is dictated by rangeland policies and conservation objectives rather than herder's choice of grazing sites (Basupi et al., 2017a). This tends towards reducing pastoral mobility so potentially increasing exposure to adverse impacts of climate variability (Dougill et al., 2010).

The ability of pastoralist communities to cope with, and adapt to changes to their environment and livelihoods has been given greater attention in environmental research agendas (e.g. Agrawal, 2010, Paavola, 2008). However, this attention has tended to focus on particular types of change, notably climate change. This bias is reflected in National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPAs). This is despite significant evidence suggesting that marginalised pastoral communities are faced with a number of challenges including fragmented landscapes and livestock diseases (AU, 2010). Since the 1970s countries in sub-

Saharan Africa have caused significant disruption to pastoral socio-ecological systems through privatisation of communal grazing lands (Rohde et al., 2006), wildlife reserves, mining operations and rapid economic adjustment (Neumann, 1995). This is in addition to exposure to extreme events such as droughts and disease epidemics (Hitchcock, 2002). This situation makes pastoral adaptation necessary and disaster risk management a primary need (Bollig, 2010). Studies of pastoralism in drylands show that securing the mobility of herders and their access to relevant natural resources (pasture and water) is a key strategy for adaptation to constraints and risk management (Scoones, 1995). In pastoral areas, risk management includes activities geared towards reducing livelihood vulnerability due to system deterioration (Moritz et al., 2011). Restricting access to resources that are unevenly distributed in space leads to increased vulnerability due to limitations imposed by traditional coping and adaptation strategies.

Botswana's poor tend to be more rural and has struggled with increasingly unreliable rain-fed agriculture and significant environmental change affecting the resources they depend upon. Key environmental problems in Botswana include land degradation, water scarcity and biodiversity loss (DoL, 2009, DTRP, 2003). The main factors contributing to land degradation are the growing human population with increased livestock numbers kept on smaller areas of communal land. Some studies emphasise that large tracts of the Kalahari sandveld are degraded, with indicators of declining productivity such as soil erosion, loss of vegetation cover, and bush encroachment evident in communal areas (Stringer and Reed, 2007). Major threats to biodiversity include rangeland degradation, inappropriate harvesting methods, habitat destruction, climate change, increased elephant population (especially in northern areas) (DeMotts and Hoon, 2012), fuel wood collection and the impacts of rangeland policies.

Botswana's Tribal Grazing Lands Policy (TGLP) of 1975, was initiated to alleviate grazing pressure on the eastern hardveld, mitigate the 'Tragedy of the Commons' (Hardin, 1968) and commercialise the livestock sector through the creation of a series

of cattle ranches in 'unused' sandveld areas (White, 1993). This was then rolled out to other parts of the country; the largest TGLP block is in Ngamiland district (Basupi et al., 2017b). It was believed that large herd owners would transfer their herds into ranches and leave the dwindling communal grazing land to subsistence agro-pastoralists (White, 1993). Studies have shown that the policy has failed to achieve this and as a result has drastically changed animal husbandry practices and herder livelihoods (Magole, 2009). The idea that there were ample unused land that could be reserved for future use was misleading as most land was already occupied by smallholder pastoralists (Basupi et al., 2017a). Moreover, those allocated ranches continued to enjoy dual grazing rights by keeping their livestock in communal areas and ranches (White, 1993). This led to environmental threats through concentration of livestock in reduced areas.

The government of Botswana continued with the ranch model in the subsequent National Policy on Agricultural Development (NPAD) issued in 1991; prompting fears that the concentration of rural poor on the country's remaining communal lands may cause further social and environmental problems (Rohde et al., 2006, Peters, 1994). Through NPAD, ranches were not limited to 'unused' areas, because demarcation of ranches depended on the number of cattle, the availability of land and its carrying capacity, and individuals could apply to fence areas within the vicinity of their boreholes (Basupi et al., 2017b). Veterinary disease control fences have also been constructed alongside TGLP/NPAD ranches resulting in severe landscape fragmentation. In Ngamiland, the most recent and controversial veterinary cordon fence is the ranches protection buffer fence constructed at the request of Ngamiland ranchers in 2012 (Basupi et al., 2017a). Current communal land across the district is becoming increasingly fragmented and is under increased pressure from shrinking land area, increases in livestock numbers and competing land uses (Basupi et al., 2017b). These issues have so far only been considered in terms of how they impact on pastoral livelihoods (Rohde et al 2006). Research has yet to consider how

pastoralists respond to these constraints. Pastoralists' coping and adaptations in these marginal environments remain poorly understood.

Through a case study of pastoralist communities in Ngamiland, Botswana, we illustrate how pastoralists are coping and adapting to multiple constraints in fragmented landscapes. We study factors (termed constraints) affecting pastoralists livelihoods in communal areas. Livelihood decisions or strategies to deal with these constraints are identified as household coping or adaptation strategies. The aim of this study is to investigate the ways in which pastoral communities cope and adapt to constraints due to environmental and policy changes in Ngamiland, Botswana. The study is driven by the following questions: 1. What processes constrain pastoral livelihoods in Ngamiland pastoral landscapes? 2. How do communities respond and adapt to environment and policy changes in Ngamiland pastoral landscapes? 3. What processes constrain or enable pastoralists' adaptive capacity in Ngamiland?

4.1.1. Conceptualising coping and adaptation strategies

In dryland pastoral areas, environments and livelihoods are intrinsically connected (Herrero et al., 2009). Agro-pastoral communities depend on the services provided by the socio-ecological system for their wealth and security. However, human actions, policy impacts and environmental factors such as drought can render ecosystems unable to provide environmental services, with consequences for livelihoods (Folke et al., 2002). Robust socio-ecological systems are those that can absorb shocks without changing in fundamental ways (Anderies et al., 2004). However, when transformation is inevitable, a flexible system which can cope, adapt or reorganise (Magnani et al., 2014) without sacrificing the livelihoods dependent upon it is necessary. Such a system is said to be resilient. Resilience refers to the capacity of a socio-ecological system to tolerate disturbance without shifting into a different state (Abel et al., 2006). Management that causes continued ecosystem

fragmentation and excessive sub-division can erode resilience and reduce the capacity of the system to self-organise (Abel et al., 2006). The system is hence in a state of fragility (Figure 4.1) and livelihoods become threatened because of ecosystem deterioration. This requires adaptive responses that increase the range of pathways or alternative livelihoods so as to enable the system to cope and sustain livelihoods (Folke, 2006).

Adaptation strategies represent pathways that individuals develop to reduce vulnerability (Smit and Wandel, 2006). These strategies can be autonomous or spontaneous or a result of directed intervention by a public agency (Forsyth and Evans, 2013). For this study we adopt the definition provided by Smit and Wandel (2006, pp 282), which defines adaptation in the context of human dimensions as a ‘‘process, action or outcome in a system (household, community…) in order for the system to better cope with, manage or adjust to some changing condition, hazard, risk or opportunity…”. Adaptive capacity is the central element in this adaptation discourse (Engle, 2011, Adger and Vincent, 2005). Adaptive capacity enables a socio-ecological system, including its components, to be robust to disturbance and be capable of responding to change (Folke, 2006). In this study, we define adaptive capacity as the ability of a pastoral socio-ecological system to adjust to constraints or potential damages by taking advantage of available opportunities to self-organise and implement new strategies that can help manage the consequences of constraints and reduce livelihood vulnerability. The capacity of a household to respond to constraints depends on the enabling environment of the community and whose adaptive capacity is reflective of the available resources and institutional processes therein (Smit and Wandel, 2006). In this study, we understand short-term and temporary responses to shocks as coping strategies (Davies, 1993). While adaptation strategies are perceived as longer term adjustment to livelihood activities which also involve alternative livelihood activities and are backed by some institutional processes. Development of strong social organisation and institutions are key to improving adaptive capacity and can help transform coping responses into adaptive

strategies (Speelman et al., 2014). Figure 4.1 provides the framework used to distinguish between coping and adaptation strategies and was used to structure the results section (A = constraints to livelihoods, B = System behaviour in response to constraints or deteriorating socio-ecological system and C = Pastoral communities' response to constraints).

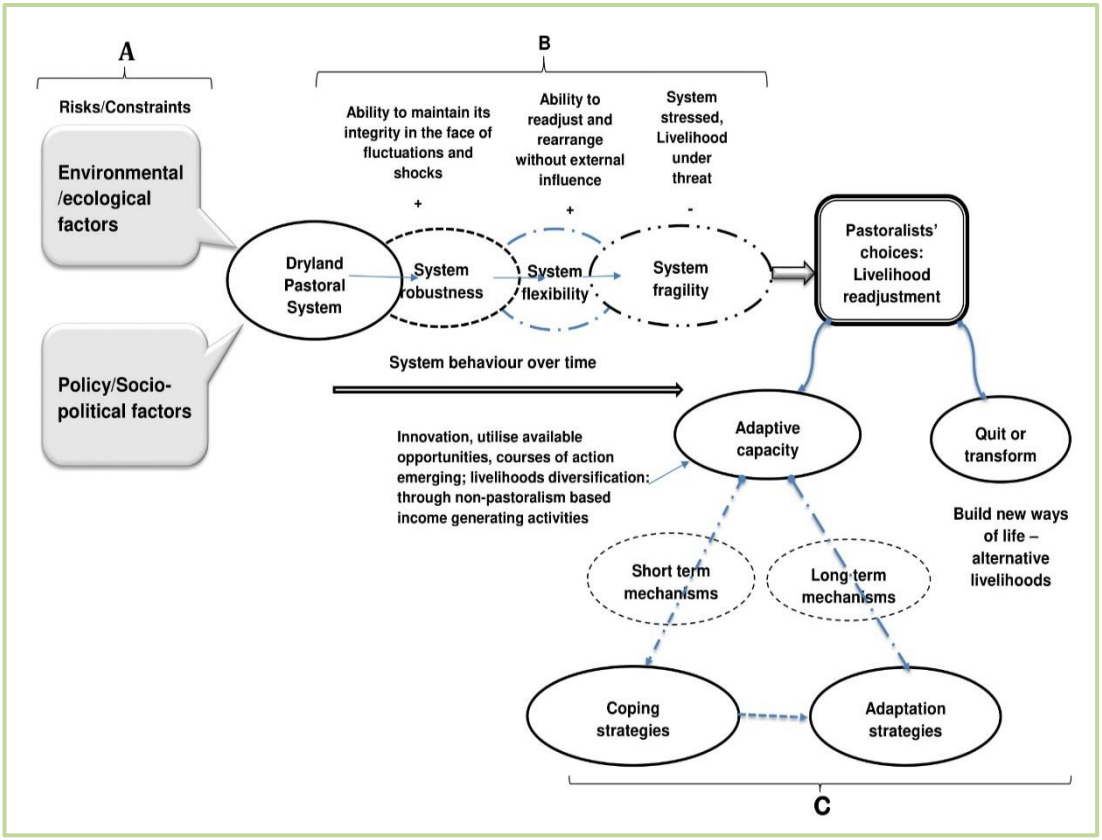

Figure 4.1: Schematic of constraints and coping/adaptation strategies in pastoral socio-ecological systems.

4.2. MATERIALS AND METHODS

4.2.1. Study area

The research area is located on the southern fringes of the Okavango Delta in Ngamiland District, North-western Botswana (Figure 4.2). This region is characterised by inherent climatic variability, particularly in rainfall, and exhibits low and highly

variable biomass productivity (DoL, 2009). The average annual rainfall is 350mm. Unpredictable precipitation changes mean that droughts are endemic and the most obvious characteristic of the local climate. Temperature is characterised by large diurnal variations, with winter temperatures as high as 26^0C to as low as 7^0C. During summer months, temperatures equally vary from a maximum of about 35^0C to a minimum of about 18^0C (DMS, 2017). In recent years, maximum temperatures around 40^0C have been recorded, especially in January. The vegetation is dominated by open low shrubs and bush savanna. Associated herbaceous species include *Anthephora pubescens, Aristicla meridionalis, Eragrostis spp, and Stipagrostis uniplumis (BRIMP, 2002)*.

A prominent feature in the region is Lake Ngami, which is a terminal portion of the Okavango Delta distributaries (Nhabe and Kunyere Rivers). The delta is fed with water through the Okavango River that rises in the Angolan highlands, flowing through Namibia before entering Botswana. The lake flood regime has been characterised by periodic fluctuations. Between 1989 and 2004 there was no water inflow and the lake dried (DoL, 2009). However, exceptional flooding in the Okavango Delta since 2008 has resulted in extensive surface water in the Kunyere, Nhabe and Boteti rivers thus filling Lake Ngami to unprecedented levels. This has resulted in an increase in livestock numbers in the region as watering has become possible on the lake.

A mosaic of tenure arrangements and natural resource management regimes, ranging across core protected areas, wildlife management areas, communal subsistence agro-pastoralism and fenced commercial ranches have existed side by side since the introduction of rangeland enclosures by the TGLP (Basupi et al., 2017b), later extended by the ranches of the NPAD (RoB, 1991). Two-thirds of the district's land area is utilised for wildlife conservation and tourism (DoL, 2009). Land use types are affected by environmental factors such as the distribution of surface water and soil quality, regulating the spatial distribution of cattle, wildlife, and dryland and floodplain cultivation. Within the study area the six study villages were: Semboyo and

Makakung 50 km north of Lake Ngami (sandveld villages) and villages' adjacent Lake Ngami: Bothatogo, Bodibeng, Sehithwa and Toteng (riparian villages) (Figure 4.2). The sites were purposively selected based on an understanding that there are mainly pastoral communities with high numbers of livestock (Table 4.1). The location factor (sandveld vs riparian) and distance from the privatised ranches also influenced selection of these sites. Pastoral and agro-pastoral communities in the area include the Ovambanderu, Ovaherero and to a lesser extent the Bakgalagadi, Batawana and BaYeyi ethnic groups (Tlou, 1985). The majority of residents follow an agro-pastoral lifestyle keeping multispecies livestock. Livestock statistics indicate that the communal areas south of the Setata veterinary cordon fence have the highest concentration of livestock in Ngamiland (DVS, 2016).

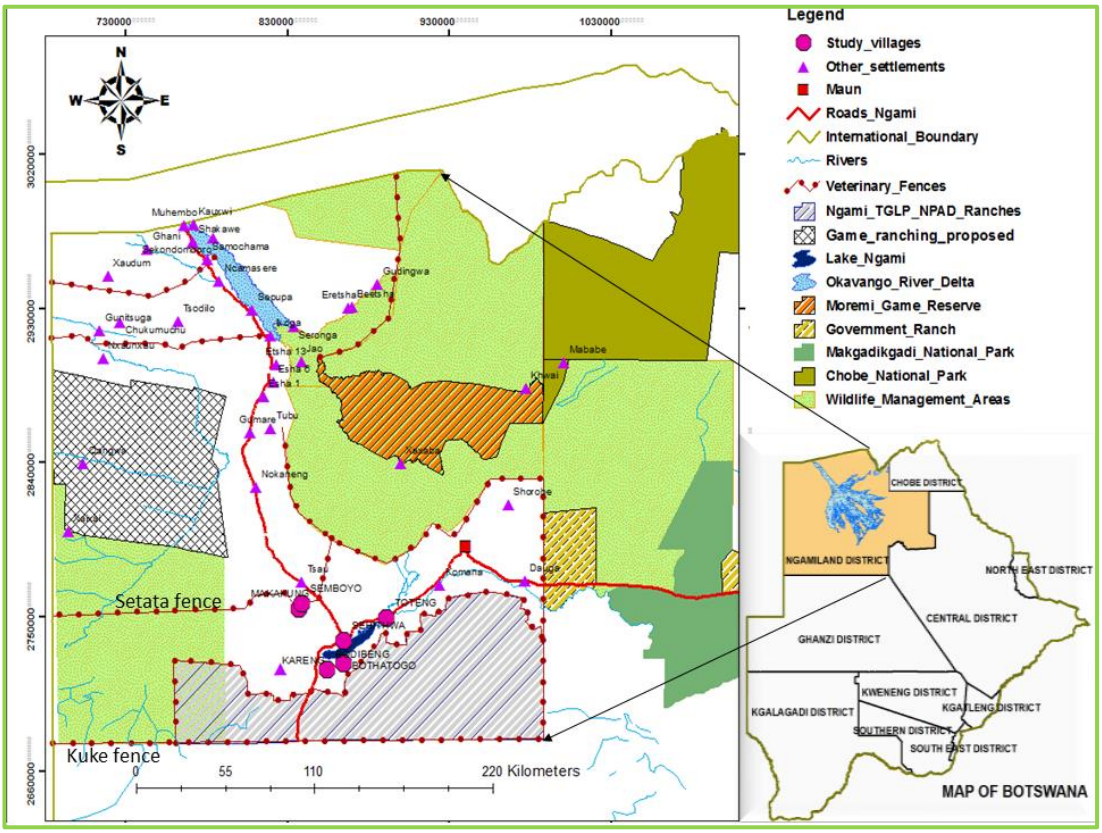

Figure 4.2: Location of the study sites and adjacent land use zones; privatised communal lands (ranches) and conservation areas.

4.2.2. Research methodology

The study uses iterative participatory rural appraisal (PRA) methods. PRA approaches seek to enable local people to share their knowledge of life and conditions (Narayanasamy, 2009). Field data collection took place from April to September 2016 using a number of PRA tools; qualitative semi-structured interviews, Focus Group Discussions (FGD), Key informant interviews and participant field observations. A total of 112 households in the 6 study villages participated in semi-structured interviews. Participants were selected from a cross-section of the pastoral community and included both genders, different age groups and different tribal groups in different localities (Table 4.1). In each study area, pastoral households were randomly selected with the aid of extension officers from the ministry of agriculture and field assistants recruited from the villages. In each household a head, or available adult member, who was either a pastoralist or agro-pastoralist was interviewed. All interviews were conducted face to face and tape recorded, with each lasting for about 30 minutes. Table 4.1 shows the population in the study villages, ethnic groups and numbers in semi-structured interviews. Further discussions were held with a total of 26 people considered to be key informants; village elders, local chiefs, chairperson of farmers associations, village extension officers and political leaders. In addition, 6 focus group discussions were held (1 focus group per village, each with 10 – 14 participants). Purposive sampling and snowballing techniques (Tongco, 2007) were used to identify key informants. Farmers' committees, village leadership and village development committees were used to solicit names of participants for key informant interviews and focus groups. Participants were selected based on their pastoral and local environmental knowledge. Respondents were asked to talk, in open-ended terms, about constraints that they have to deal with as pastoralists. Information about coping or adaptive strategies was collected by asking respondents about how they responded to constraints. This also included both changing pastoralist practices as well as livelihood diversification and other sources of income.

Respondents were further asked how long they had been using the identified strategy and how significant it was to their livelihood.

Field observations and community guided walks were used to corroborate the information from interviews and focus group discussions. Volunteers mostly comprising of community elders guided the field observations. In each study village the number of volunteers were as follows: Semboyo (n = 3), Makakung (n = 4), Bodibeng (n = 2), Bothatogo (n = 4) Toteng (n = 3), Sehithwa (n = 2).

Table 4.1: Demographics of interview participants, Population of study villages and livestock numbers per village

Variables	Study areas (semi-structured interviews n=112)			
	Sehithwa (n =28)	Toteng (n=20)	Bodibeng & Bothatogo (n=31)	Semboyo & Makakung n=33)
Gender				
(i) Male	**18 (64%)**	**12 (60%)**	**13 (42%)**	**15 (45%)**
(ii) Female	**10 (36%)**	**8 (40%)**	**18 (58%)**	**18 (55%)**
Age group				
(i) 20 to 40 years	**11 (39%)**	**8 (40%)**	**11 (35%)**	**10 (30%)**
(ii) 41 to 60 years	**9 (32%)**	**9 (45%)**	**12 (39%)**	**12(36%)**
(iii) 61 - 80 years	**8 (29%)**	**3 (15%)**	**8 (26%)**	**11 (34%)**
Ethnic groups				
Ovambaderu	**12 (43%)**	**8 (40%)**	**10 (32%)**	**9 (27%)**
Ovaherero	**7 (25%)**	**3 (15%)**	**5 (16%)**	**15(46%)**
Batawana	**3 (11%)**	**4 (20%)**	**3 (10%)**	**6 (18%)**
BaKgalagadi	**2 (7%)**	**2 (10%)**	**11 (35%)**	**2 (6%)**
Others	**4 (14%)**	**1 (5%)**	**2 (7%)**	**1 (3%)**
Village population	**2748**	**909**	**1333**	**691**
Livestock numbers per village				
(i) Cattle	**19251**	**29319**	**39916**	**28030**
(ii) Goats	**1712**	**3743**	**4070**	**3484**
(iii) Sheep	**471**	**1015**	**1313**	**632**
(iv) Donkeys/Horses	**953**	**1444**	**1816**	**1299**

Data source: Statistics Botswana, 2011; Department of Veterinary Services 2016; Author's Interview transcripts

4.2.3. Data processing and analysis

Our qualitative analysis procedure was done in accordance with principles of qualitative content analysis: (i) identifying major themes emanating from the discussions; (ii) assigning codes to major themes; (iii) classifying responses under the identified themes; (iv) writing the research narratives and discussions. Each testimony from semi-structured interview respondent was converted to text using Microsoft word. The process involved close observation of data through repeated careful listening. This was done simultaneously with the researcher's reflective field notes (memos). Transcribed interviews were imported into Nvivo 10 (QRS 2012) for coding. Themes were organised into tables, arrived at by counting the number of times (entries) each theme was mentioned. Further, data was rearranged by categorising it into coping or adaptation strategies, allowing for cross checking against the objectives so that only the most pertinent findings are included. This also facilitated comparison between villages. Relevant quotes from focus groups and key informant interviews were used to explain and clarify data (Patton, 1990).

4.3. RESULTS

4.3.1. Constraints to pastoral livelihoods in Ngamiland pastoral landscapes

Table 4.2 gives a summary of thematic analysis of livelihood constraints across the six study villages. Constraints related to environmental changes were cited as livestock diseases, drought, wildlife issues and limited water availability. Livestock diseases were closely linked to market constraints. Respondents across the study

villages frequently cited increased landscape fragmentation due to land privatisation policies, dual grazing by ranchers' and fencing related to animal health policies as major contributors to the constraint of limited grazing lands and livestock congestion in communal areas.

Table 4.2: Entries (counts) identifying livelihood constraints in the six study villages

Themes Livelihood Constraints	Study villages (n = 112)						
	Bodibeng (n=16)	Makakung (n=16)	Semboyo (n=17)	Bothatogo (n=15)	Toteng (n=20)	Sehithwa (n=28)	Total
Livestock diseases	13	15	14	14	18	25	99
Limited markets	15	14	15	13	17	23	97
Limited grazing land	11	14	12	9	15	19	80
Human-wildlife - conflicts	10	9	9	11	13	16	68
Stray animals	6	8	12	9	10	8	53
Drought/declining rains	7	6	11	8	10	9	51
Dual grazing by ranchers	8	0	0	7	11	7	33
Access to water	2	7	5	1	6	11	32
Underground water salinity	4	6	6	0	2	5	23

Data from semi-structured interviews, generated though Nvivo 10 (QRS 2012)

4.3.1.1. Livestock diseases and market access

Livestock diseases are endemic to Ngamiland and have a significant effect on livelihoods and herd management. For example in 1995, there was a severe outbreak of a cattle lung disease (contagious bovine pleuro-pneumonia - CBPP) which resulted in the culling of the entire district herd (DVS, 2000) leaving many households on the brink of destitution and dependent on government social welfare programmes. In the period from 2007 to 2017, the district experienced an outbreak of foot and

mouth disease (FMD) (Basupi et al., 2017a). Continuous outbreaks of livestock diseases have meant a dramatic collapse of a major livelihood asset as the market and value of cattle has dropped significantly and households continue to experience a serious loss of income leading to instances of 'destitute' pastoralists. Market access was not simply defined by the numbers of cows sold to Botswana's meat abattoirs or local butchers, but by a combination of other factors such as labour, time and sustainability of livelihoods dependent upon livestock herding. Many pastoral households reported that they had lost herding labour through reallocation to other more productive pursuits. The remaining herders, mostly elderly men and women, were often constrained as out-migration of young men and women led to higher workloads, *'….many young men and women are growing impatient about the lack of sale and most have migrated to towns or are pursuing other means of livelihood…'* (FGD data, Sehithwa). Substantial variation in herder behaviour was observed throughout the study area. Those with smaller herds were in a better position to perform daily herding and sometimes night kraaling of cattle. Large herd owners preferred to leave their cattle to roam around and only rounded them up for vaccination or when performing management practices such as branding. Together these factors contributed to the decline in the quality of herding, increasing environmental stress and the spread of livestock diseases through livestock congestion around water resources.

4.3.1.2. Resource scarcity and limited access to rangelands

The most persistently discussed aspect of resource scarcity in all study villages was a shortage of grazing lands because of fragmented and disconnected landscapes that restricted access to pasture and water resources. Limited grazing land placed limitations on the ability of pastoralists to carry out livestock management practices such as herding and kraaling of animals, controlled grazing, control of animal diseases and increased the likelihood of livestock loss during drought years. Conflicts between

herders over the limited key pasture resources also remained an issue. Respondents also referred to higher incidences of dual grazing by ranchers and stray animals, blamed on absentee pastoralists who have migrated to towns. These animals were considered problematic because they accumulate near major roads causing road accidents especially at night, encroach on arable fields and make vaccination against FMD difficult. Similarly, the Ministry of Agriculture's Livestock Management and Infrastructure Development Programme (LIMID) and the Ministry of Youth Development are said to have been funding livestock projects despite disease outbreaks and lack of markets. This has contributed to the increase in livestock numbers, worsening the problem of intensive grazing in communal areas as there is no offtake.

4.3.1.3. Elephant raids

In the study villages, especially around Lake Ngami, elephants were blamed for crop damage, especially on flood recession arable fields, and ecosystem deterioration, and considered a threat to human life. In the sandveld villages, the threat was attributed mostly to the destruction of veterinary fences and water resources such as boreholes, *'…For us the cost of living alongside these animals is the hectares of crops crushed, that borehole-pumping machinery routinely destroyed or the life of a farmer that is constantly under threat…' (FGD data, Bodibeng)*. Explanations given for the increasing elephant threats were mainly related to land use changes as fencing has significantly affected ecosystem integrity. Respondents argued that policies favour wildlife compared to pastoralism. Notwithstanding these challenges, the pastoral community is confronted with the reality of having to live with elephants.

4.3.1.4. Drought and associated constraints

Respondents mentioned recurrent drought and decreasing and more irregular rainfall patterns as a primary risk factor. Like in many sub-Saharan African countries, over-reliance on cattle makes rural communities more vulnerable to climate variability, especially trends in low rainfall (Herrero et al., 2009). Respondents reported that their vulnerability to climate-related environmental shocks was mainly due to their inability to adapt to changes brought about by rangeland policies that hamper livestock mobility and the capacity to access critical grazing and water resources. Rainfall in Ngamiland, as in the rest of the country, is characterised by large annual variability (Batisani and Yarnal, 2010). Some years are characterised by significantly less than average rainfall (drought). This risk was defined by the impacts on pasture regeneration, rainfed arable agriculture and the impact of societal reliance on ecosystem services. Other constraints associated with low rainfall were defined in terms of availability of potable water for livestock, with ephemeral water sources said to be especially congested during dry years, while ground water sources were said to be mostly saline and not suitable for livestock.

4.3.2. Pastoral communities' response to constraints

4.3.2.1. Coping Strategies

A thematic analysis of coping strategies across the study villages is summarised in Table 4.3. Coping strategies are more reactive and involve the short term and temporary arrangement of livelihood activities in response to constraints faced. In all the study villages, respondents emphasised the importance of government relief programmes in providing temporary safety nets in the face of a lack of alternative livelihoods and formal employment opportunities. Over-reliance on the government's Labour Intensive Public Works Program (LIPWP) and transfer payments in the form of old age pensions was mentioned in all villages. The LIPWP is a government strategy employed to address problems of rural income and poverty.

It provides temporary employment, especially to young people. In all the study villages, respondents reported that some able bodied people were employed to work for wages on LIPWP such as routine road maintenance and bush clearing, fire control in rangelands, village cleaning, sorghum stamping for the school feeding programme and the community policing programme. In almost all the interviewed households, one or more person per household worked for LIPWP. Other government social–welfare programmes included food packages for the very poor and school feeding programmes.

Table 4.3: Coping strategies mentioned per village

Coping strategies	Study villages (n = 112)						
	Bodibeng (n=16)	Makakung (n=16)	Semboyo (n=17)	Bothatogo (n=15)	Toteng (n=20)	Sehithwa (n=28)	Total
Labour intensive programmes (LIPWP)	9	10	11	12	14	16	72
Social alliances/self-help groups	10	12	8	9	11	13	63
Social welfare programmes	6	5	7	6	8	9	41
Household splitting	0	6	7	0	10	13	36
Old cows for household consumption	5	4	9	3	6	7	34

Data from semi-structured interviews, generated though Nvivo 10 (QRS 2012)

Because of the vagaries of livestock production: livestock diseases, markets conditions, and limited pastureland, income from livestock is subject to great uncertainty. One of the important mechanisms that communities, especially women, used to buffer livelihood constraints in was the ability to participate in informal institutions of self–help groups and social alliances known as *'metshelo'*. These

networks are developed in a reciprocal and participatory manner and are defined by kinship, friendship, or neighbourhood and some extend beyond village boundaries to incorporate members from other villages. They pursue active give-and-take links which include labour exchange (during ploughing season), the establishment of saving schemes and a traditional non-cash gift system that includes food and household utensil donations on a rotational basis among members. In the sandveld village of Makakung, the village network went a step further to establish a traditional choral group that was often engaged to perform in cultural events both locally and in neighbouring Namibia. Proceeds from the choir went towards the saving scheme, some of which linked into a burial society fund used to help members bury loved ones by contributing food and money. Households that were able to invest resources in such schemes were able to buffer shocks, such as enabling them to borrow money to buy school uniforms.

Respondents also reported that they compensated for labour lost through reallocation to other activities by relying on social networks or support from friends. This included cooperation over herding related tasks and practices of labour sharing such as watering of livestock on a rotational basis. Families with more labour subdivided their household spatially (household splitting) such that they had a cattle post on either side of the veterinary fences. Having two or more cattle posts strategically located was considered advantageous because it allowed such a family to sell when a market opportunity arose on either side of the fence.

4.3.2.2. Adaptation and livelihood diversification strategies

Livelihood diversification involves the creation of a portfolio of non-pastoral livelihood activities. Table 4.4 gives a summary of thematic analysis of livelihood adaptation strategies across the six study villages. Most households still keep a significant number of diversified livestock; cattle, sheep, goats, donkeys and horses.

Hence these strategies are most commonly used to complement pastoralism rather than as a substitutes.

Table 4.4: Adaptation and livelihood diversification strategies mentioned per village

Themes (Adaptation Strategies)	Study villages (n = 112)						
	Bodibeng (n=16)	Makakung (n=16)	Semboyo (n=17)	Bothatogo (n=15)	Toteng (n= 20)	Sehithwa (n=28)	Total
Fishing	11	0	0	10	12	13	46
Flood recession agriculture	10	0	0	9	13	14	46
Migration to towns for wage labour	5	9	8	6	4	5	37
Farmers association	5	4	4	5	9	9	36
Petty trade/handicrafts	7	3	1	7	7	10	35
Buy arable lands/ Fodder accumulation	3	6	5	5	7	9	35
Use of chili pepper	4	1	0	3	4	6	18
Livestock diversification	4	3	3	0	3	4	17

Data from semi-structured interviews, generated though Nvivo 10 (QRS 2012)

Issues of limited pastureland were at the forefront of adaptation strategies, especially in the riparian villages. '…Limited access to rangelands means we cannot set aside any pastures for use in late winter or dry seasons…' (Interview data, Bothatogo). Many respondents expressed interest in establishing fodder storage facilities. Some respondents reported that they had been buying and accumulating supplementary feeds. While others were negotiating with arable farmers to use their arable lands for grazing in winter. Those with financial resources were buying arable lands exclusively for livestock grazing during the dry season. Management strategies to improve forage or plant fodder were mostly insignificant.

The recurrent outbreaks of livestock diseases meant that many households were vulnerable and had to constantly search for viable alternatives. The majority of households reported livelihood diversification as a major adaptation strategy, *'…We*

have to find alternative ways of putting food on the table. It is greedy to kill cows just for meat, except of course on special occasions…' (Key Informant Interview data, Makakung). Livelihood diversification strategies included; fishing, migration to towns by some members of the household in search of wage labour, petty trade, artisan work such as basket weaving and leather tanning, and a shift to agro-pastoralism especially the intensification of flood recession agriculture. The primary source of petty commodity income was described in terms of the artisan production of crafts as marketable commodities, table traders who sell produce in the market and some illicit brews in homes.

The outbreaks of FMD since 2007 have resulted in an intensification of two livelihood activities: fishing and flood recession cultivation. The riparian villages (Sehithwa, Toteng, Bodibeng, and Bothatogo) all mentioned fishing as a livelihood diversification strategy. Some young people have obtained loans from the Youth Development Fund with the intention of investing in fishing activities. However, interviews with key informants revealed that even though proceeds from fishing are attractive, fishing in the area is not sustainable because of the nature of the lake's flood regime. The high number of people from across the district, and the country, flocking to the lake in search of an alternative livelihood also make fishing a problematic activity. This has prompted the Department of Wildlife and National Parks to frequently suspend fishing in the lake citing hygiene issues and pollution problems, as well as conflicts between fishers and other users; '*…issues of squatters, poor sanitation, untidy surroundings and criminal activities, including incidents of drowning were rife…the decision to suspend fishing activities had to be taken…' (Key informant interview, Department Wildlife and National Parks, Fisheries Division, 2016).*

Most of Ngamiland sandveld areas lack adequate rainfall for arable agriculture and soils are generally poor. Discussants in both FGD and interviews reported that flood recession agriculture, known locally as *Molapo* farming, is an important land use and livelihood diversification activity for the rural poor living on the fringes of the Okavango Delta. *Molapo* is a local term coined to refer to the seasonally flooded

plains (Motsumi et al., 2012). Villages along the rivers Kunyere, Nhabe and Lake Ngami flood plains reported that they preferred *Molapo* farming over dryland farming because soils are higher in fertility and tend to retain moisture for a long time. *Molapo* cropping is less risky as the residual flood water in the soil acts as a supply of moisture during seasons of low or poorly distributed rainfall. Respondents reported that they also accessed government transfer payments to bolster dryland rain-fed arable agriculture through the government's Integrated Support Program for Arable Agriculture Development (ISPAAD). Through ISPAAD, villagers received free seeds, fertiliser and farming implements. Farmers who did not use the ISPAAD tractors and ploughed using their own resources were given money equivalent to the amount that the government would have spent to plough for them. However, frustration towards elephants that destroy crops has caused many respondents to be sceptical about arable farming, at least on a large scale. '…*with ISPAAD you can have some of your money back, but if you are lucky and the elephants avoid you, you can have the money and the harvest*' (FGD data, Toteng).

Strategies to deal with human-elephant conflicts were limited. Traditional scare tactics mentioned by respondents included making noise by beating drums, lighting fires close to arable lands and keeping them burning overnight, or clearing vegetation around the fields and boreholes so as to see elephants from a distance. *'…these tactics are not always effective as elephants quickly get used to them and with time ignore them…'* (Key Informant Interview data, Toteng). Respondents expressed frustration that elephants have become increasingly aggressive and less fearful of humans. A few households reported that they had resorted to using chilli pepper as a deterrent; a concept that was introduced to them by the Department of Wildlife and National Parks. According to respondents, chilli is a natural irritant and its smell causes intense but short-lived pain that drives elephants away. Chilli is dried, mixed with cow dung and sun-dried into a brick, which is burnt by the edge of a field or borehole at night. Others reported that they mix the chilli powder with used engine oil or grease, which is then smeared on fences.

4.3.3. Processes that constrain or enable pastoralists' adaptive capacity

Understanding adaptation processes requires scrutiny of the combination of conditions that affect the ability to adapt, and incentives or barriers that affect adaptive capacity (Adger, 2006). In Ngamiland, focus group discussions perceived a nexus of adaptation under three categories as detailed in Figure 4.3; Physical/Natural environment, Economic resources and knowledge and Institutional structures. The three can be considered pillars of adaptive capacity due to their influence on how pastoral communities respond to constraints.

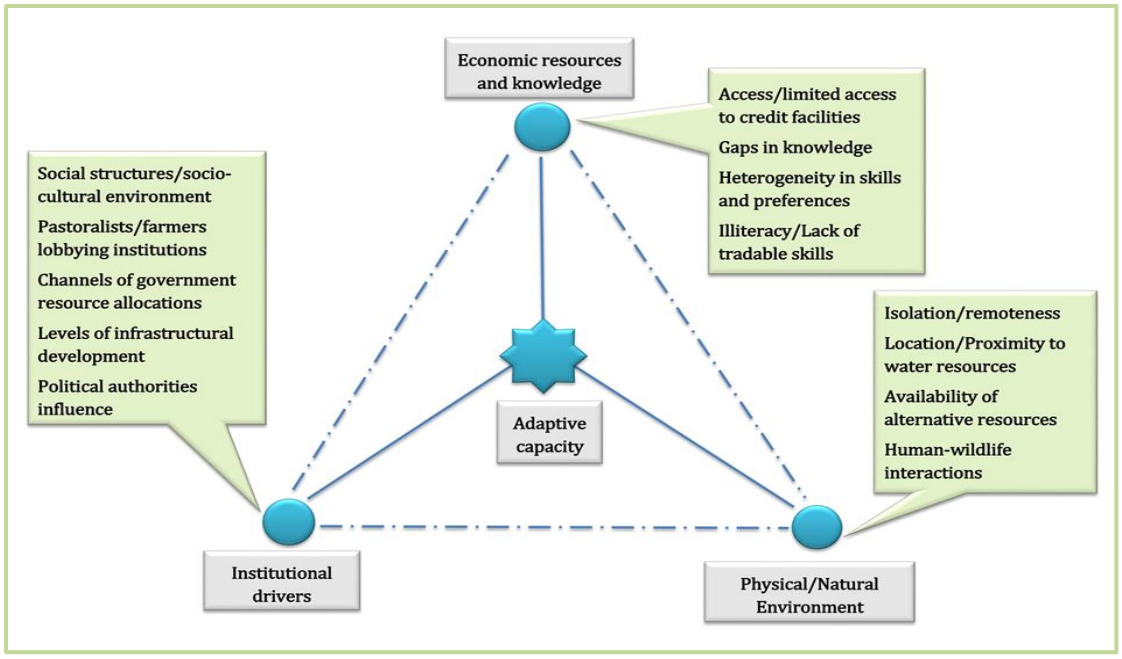

Figure 4.3: Adaptive capacity nexus in Ngamiland pastoral areas.

A clear disparity in adaptation strategies was noted between riparian villages (because of their proximity to Lake Ngami or main road) and the sandveld villages (Semboyo and Makakung) (as shown in Table 4.5). Villages closer to better roads

(riparian villages) had more frequent and direct contact with the market of Maun and were able to produce more systematically for the market (Maun is the District's administrative centre, a primary tourism hub and the gateway to the Okavango Delta). The majority of products produced by villagers, including artisan work such as handicrafts are sold in Maun. Good road infrastructure was perceived to reduce the cost of transport to markets as well as permitting entry into new and more profitable pursuits. Similarly, the resources of Lake Ngami were described as a pull-factor driving the transition to more intensive land-use around the lake and the few flood plains. Limited infrastructural development in the sandveld villages was noted as a key constraint to adaptation. Respondents in these villages discussed a lack of roads or seasonally impassable and poorly maintained gravel roads, which made it difficult to access critical resource areas. A marked distancing from government services was noted in these villages with focus group discussions and key informant interviews identifying a distinct lack of interest in providing assistance on the part of the government or political leaders. Noteworthy is that despite a recognition of the constraints related to pastoralism in these areas, inhabitants have not directly sought to deviate from or abandon pastoralism, with all the group discussions and key informant interviews pointing to a willingness to continue with pastoralism.

Table 4.5: Comparison of adaptation strategies between villages, complied from FGDs and key informant interviews

Village	Is pastoralism under threat?	Dominant adaption or coping strategies	Distance to the market of Maun	Access to the main road	Willingness to continue with pastoralism
Toteng	+	Fishing, FRA, LIPWP, Artisan works	65 km	+	+
Sehithwa	+	Fishing FRA, LIPWP, Artisan works	98 km	+	+
Bodibeng	+	Fishing, FRA, LIPWP	114 km	+	+
Bothatogo	+	Fishing, FRA LIPWP, Artisan works	95 km	-	+
Semboyo	+	MGR, LIPWP, Household splitting	145 km	-	+
Makakung	+	MGR, LIPWP, Household splitting	150 km	-	+
KEY = + YES - NO FRA = Flood Recession Agriculture MGR = Migration LIPWP = Labour Intensive Public Works Programme					

Communities were developing deliberate collective actions to self-organise through associations, such as women's social groups and farmer associations. The rise of pastoralist/farmer associations was a response by the pastoral community to address the deepening crisis of vulnerability due to limited sales of livestock products and fragmented landscapes. According to key informants, the primary mandate of these associations is to propose policy options which promote the development of pastoralism, safeguard pastoralists land rights and negotiate for market quotas with Botswana's Meat Abattoir. Three notable associations were identified in the study area; Nhabe Meat Farmers' association, Ngamiland Integrated Farmers' Association and Hainaveld Ranchers Association. While some respondents appreciated the initial role of associations, many argued that the associations have since become highly politicised and some have been usurped by opportunistic individuals who are now using the plight of poor pastoralists to their own advantage. *'…all we were trying to achieve through these associations is a collective voice to negotiate a stake in our communal lands and sales of livestock so that we may return some of our lost glory…*

but, those with influence and money make decisions for their own benefits…' (Key informant interview data, Bodibeng). Respondents argued that some of these associations have now limited themselves to issues of livestock sales and are charging pastoralists large sums of money to transport their livestock to markets. They do not address the broader patterns and nature of marginalisation. Such disjointed groups are unlikely to mobilise the necessary resources critical for pastoralists' adaptation or bring pressure on policy making processes to address pastoralists' needs.

4.4. DISCUSSION

This study investigated the ways in which pastoral communities respond to constraints due to changes in the environment and in policy. Here, a history of rangeland privatisation policies, animal health policies, and conservation policies have had a strong influence on the way in which rangeland resources are now accessed and managed by local pastoral communities (Basupi et al., 2017a). As illustrated in the theoretical framework (Figure 4.1), in addition to fragmented and disconnected landscapes, pastoralists must also contend with environmental problems such as droughts, livestock diseases, human-wildlife conflicts and rangeland degradation. While a combination of factors can be attributed to the increase in livestock diseases, for example, climate change (Bett et al., 2017, Rojas-Downing et al., 2017), increasing pastoralist vulnerability can also be attributed to weakened coping mechanisms especially decreased mobility resulting from rangeland enclosures and concentration of livestock on ever reducing communal lands. Continuous contact and intermingling of herds at crowded water points and stresses due to pasture shortages may account for higher prevalence of FMD in these pastoral systems. The FMD crisis, its impact and management has taken on a new urgency because it is now obviously driving people who have long been productive into poverty (Basupi et al., 2017a).

Understanding changes in livelihoods is important in understanding rural communities' vulnerability and response to change, be that either policy or environment driven (Twyman et al., 2004). In Ngamiland, pastoral communities demonstrated a range of alternative livelihood activities, such as flood recession agriculture, fishing, and petty trade. These are in turn bolstered by access to government social welfare programmes; old age pensions, LIPWP, and destitute and school feeding programmes. These coping and adaptation strategies are not without challenges. Like in many other pastoral areas (Greiner and Mwaka, 2016, Rettberg, 2010), the ability to adapt is influenced by such factors as access to resources, access to markets, the institutional environment within which adaptation occurs, political influence, financial resources and kinship networks. Households with limited access to resources and financial services were more vulnerable. Those with financial resources were able to buy fodder or pay for private access to pasture in arable fields and hence cope with the effects of constraints such as drought or limited grazing lands. However, this option was only available to a limited number of households. Similarly, remote villages in the sandveld had limited access to natural resources, such as water and infrastructural services, compared to riparian villages, limiting their diversification options. These examples illustrate how institutional and landscape changes are leading to further uneven capacities within the pastoral communities.

A key finding from this study is that landscape fragmentation and a lack of market access threaten the sustainability of rangelands and challenge the practice of pastoral mobility. While this might be fostering a rise in livelihood diversification through non-pastoral activities, some of these strategies might actually undermine the long-term sustainability of pastoralism and complicate responses to climate change in the future. This has been found to be the case for many dryland pastoral areas, such as in Kenya and Tanzania (Goldman and Riosmena, 2013, Galvin, 2009). In the specific case of Ngamiland, flood recession agriculture and expansion of rain-fed crop cultivation is based on the use of seasonally flooded plains and areas with

marginally higher productive potential, thus removing land from pastoralism that would otherwise be highly productive and would have been traditionally used for dry season grazing. Moreover, these strategies depend to a large extent on household labour availability and ability of a household to direct their investment options to strategies that add value to the household economy. Stiff competition for labour has been noted as the demand for wage labour and migrations to towns' increases, thus posing a threat to traditional systems of labour sharing. Migration was more pronounced in the sandveld villages where alternative livelihood options are limited. Similarly, involvement in petty trade has removed an important source of labour from the household and placed extra workload on the elderly. Most traders are either absentee pastoralists or ex-pastoralists who have lost interest in livestock and are now trying to make a living through informal income generating activities. This has direct impact on livestock management and diseases control. As noted by Adger and Vincent, 2005, adaptation may reduce risks over the short term yet cause an increase in exposure to risk in the long term.

Similarly to other research in Botswana (Sallu et al., 2010), this study has found that family involvement in social networks buffered the impacts of stress caused by ecosystem deterioration and lack of alternatives. In most African communities, informal associations are becoming increasingly important in shaping and mediating local adaptation practices (Rodima-Taylor, 2012). For example, in the Tanzanian Maasailand, pastoralists with access to the right social networks and sufficient labour are more likely to have higher adaptive capacity compared to those who do not (Goldman and Riosmena, 2013). However, despite the importance placed on these associations, they face a number of challenges including a lack of entrepreneurial skills, inadequate leadership skills, inadequate managerial ability, low levels of production by member households and low purchasing power. In this study, pastoral households struggled to balance between producing for their families and fulfilling their obligations to these social networks. However, in-spite of the challenges, in

most study villages, social networks were said to perform better than externally created initiatives.

Studies have shown how adaptive capacity is context specific, varies from community to community and that it is not equally distributed (Engle, 2011, Smit and Wandel, 2006). In this research, the capacity of the riparian villages to undertake adaptations was better than the more remote sandveld village communities who had limited access to resources and infrastructural services. Understanding the different adaptations that households implement and why provides some indication of adaptive capacity, and so the adaptation space within which adaptation decisions are likely to take place (Adger and Vincent, 2005, Twyman et al., 2004). It is important that policy makers accommodate the necessary preconditions for pastoral adaptation strategies in National Adaptation Programmes of Action (NAPAs). Therefore the argument is to develop meaningful scenarios of adaptive capacity rather than scenarios of adaptation per se. Often core causes of vulnerability such as poor access to land, especially by the marginalised and vulnerable, and poor infrastructural services need to be addressed first before impact-oriented adaptation efforts can be effective. Once the conditions are favourable, communities are likely to take the necessary steps to develop suitable adaptation strategies specific to their socio-ecological systems. In Ngamiland, there is a need for practical initiatives that improve pastoralists' adaptive capacity at appropriate spatial and temporal scales. This also includes the need for strengthening the knowledge base, improving data gathering, surveillance/forecasting systems and sharing insights more widely across the district and nationally.

4.5. CONCLUSION

Adaptation is a social process that requires attention to the structures that influence vulnerability and adaptive capacity, including local level (on-the-ground) actions that pastoralists conduct in order to address vulnerability. Understanding these

strategies, including their implications, through a participatory process could form the basis of better formulated policy intervention or development projects in pastoral areas. In Ngamiland, income from pastoralism is subject to great uncertainty arising from livestock diseases, market conditions and limited access to productive rangelands, and climate-related constraints such as droughts. Opportunities for wage labour are limited, and the high dependency on the Botswana government's labour intensive public works program suggests a society in dire need of alternative sources of income.

This study shows how social networks of self-help groups and farmers associations are now an important aspect of the vulnerability context and pastoralists adaptive capacity. Well managed networks provide solidarity within and across villages, and thus help manage multiple constraints collectively. Supporting pastoralists' adaptive capacity in this context is not about targeting one particular strategy but empowering local pastoral communities in acquiring flexibility and inclusiveness in their response system. Assistance from practitioners is essential in empowering and assisting pastoral communities to self-organise. The requirement on the part of practitioners is to provide a platform for the formalisation of these groups and ensure that they are backed by necessary legislative instruments and also supported to establish simple constitutional documents, functional leadership, formal registration and training. These groups, when functional, can then develop their own action plans that allow each community to identify their own situation-specific entry points and level of involvement in livestock and land management, including a long-term strategy for engagement with the government.

The capacity and options of pastoralists to adjust their livelihood options are shaped in turn by infrastructural development and institutional structures. Like in other dryland areas, Ngamiland drylands are disadvantaged in the distribution of public resources and provision of services. The availability of livelihood options that depend more on infrastructural development like inter-village trade is hence hampered by poor roads and other development policy biases against dryland areas. The dynamics

of household labour availability also comes into focus as pastoralists redirect their household labour with negative impacts on herd management strategies. Livelihood diversification is happening but some opportunities like fishing may not be feasible over the longer term unless backed by a more sustainable fisheries sector (e.g. improved fishing, processing and market access infrastructure) and an adequate legislative framework aimed at developing the livelihoods of communities around the lake and safe guarding the lake environs. As the ability to adapt has positive attributes for livelihood sustainability and resilience, there is a need for practical initiatives that improve pastoralists' adaptive capacity, such as reforming pastoralists' institutions and expanding infrastructural development in pastoral areas so as to enable access to markets. These also include the need to share insights more widely across the district, nationally and regionally.

4.6. ACKNOWLEDGEMENTS

This research was supported by funding from the Botswana International University of Science and Technology (BIUST), Government of Botswana and the University of Leeds Sustainable Agriculture Fund Bursary. The research was conducted with the permission of The Ministry of Environment, Wildlife and Tourism in Botswana (Now Ministry of Environment, Natural Resources Conservation and Tourism) (Government research permit number EWT 8/36/4 XXX (73)). This research would not have been possible without the active participation, support and cooperation of Ngamiland pastoral communities in the villages of Toteng, Bothatogo, Bodibeng, Sehithwa, Makakung and Semboyo. Many thanks to the anonymous reviewers for their insightful comments and suggestions. Thanks to Ms. Onkemetse Thelma Tabulawa for feedback on an earlier draft of this manuscript.

4.7. REFERENCES

ABEL, N., CUMMING, D. H. & ANDERIES, J. 2006. Collapse and reorganization in social-ecological systems: questions, some ideas, and policy implications. *Ecology and Society,* 11.

ADGER, W. N. 2006. Vulnerability. *Global Environmental Change,* 16**,** 268-281.

ADGER, W. N. & VINCENT, K. 2005. Uncertainty in adaptive capacity. *Comptes Rendus Geoscience,* 337**,** 399-410.

AGRAWAL, A. 2010. Local institutions and adaptation to climate change. *Social dimensions of climate change: Equity and vulnerability in a warming world,* 2**,** 173-178.

ANDERIES, J. M., JANSSEN, M. A. & OSTROM, E. 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society,* 9.

AU 2010. Policy Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities. *African Union, Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia*.

BASUPI, L. V., QUINN, C. H. & DOUGILL, A. J. 2017a. Historical perspectives on pastoralism and land tenure transformation in Ngamiland, Botswana: What are the policy and institutional lessons? *Pastoralism,* 7**,** 24.

BASUPI, L. V., QUINN, C. H. & DOUGILL, A. J. 2017b. Using participatory mapping and a participatory geographic information system in pastoral land use investigation: Impacts of rangeland policy in Botswana. *Land Use Policy,* 64**,** 363-373.

BATISANI, N. & YARNAL, B. 2010. Rainfall variability and trends in semi-arid Botswana: Implications for climate change adaptation policy. *Applied Geography,* 30**,** 483-489.

BETT, B., KIUNGA, P., GACHOHI, J., SINDATO, C., MBOTHA, D., ROBINSON, T., LINDAHL, J. & GRACE, D. 2017. Effects of climate change on the occurrence and distribution of livestock diseases. *Preventive Veterinary Medicine,* 137**,** 119-129.

BOLLIG, M. 2010. *Risk management in a hazardous environment: A comparative study of two pastoral societies*, Springer Science & Business Media.

BRIMP 2002. The Biomass Map of Botswana: Growing Season 2000/2001. *Botswana Range Inventory and Monitoring Project (BRIMP), Ministry of Agriculture, Gaborone.*

DAVIES, S. 1993. Are Coping Strategies a Cop Out? *IDS Bulletin,* 24**,** 60-72.

DEMOTTS, R. & HOON, P. 2012. Whose Elephants? Conserving, Compensating, and Competing in Northern Botswana. *Society & Natural Resources,* 25**,** 837-851.

DMS 2017. Weather and Climate Digest. *Department of Meteorological Services, Ministry of Environment, Natural Resources Conservation and Tourism, Gaborone, Botswana.*

DOL 2009. Department of Lands (DoL). Ngamiland Integrated Land Use Plan, Final Report, . *Ministry of Lands and Housing, Botswana.*

DOUGILL, A. J., FRASER, E. D. G. & REED, M. S. 2010. Anticipating Vulnerability to Climate Change in Dryland Pastoral Systems: Using Dynamic Systems Models for the Kalahari. *Ecology and Society,* 15.

DTRP 2003. Ngamiland District Settlement Strategy. *Department of Town and Regional Planning (DTRP), Gaborone, Botswana*.

DVS 2000. Livestock Report: CBPP, destocking and restocking. *Department of Veterinary Services, Maun, Botswana.*

DVS 2016. Department of Veterinary Services. Livestock Census Report - Ngamiland District. *Ministry of Agriculture, Gaborone, Botswana*.

ELLIS, J. E. & SWIFT, D. M. 1988. Stability of African pastoral ecosystems: alternate paradigms and implications for development. *Rangeland Ecology & Management/Journal of Range Management Archives,* 41**,** 450-459.

ENGLE, N. L. 2011. Adaptive capacity and its assessment. *Global Environmental Change,* 21**,** 647-656.

FOLKE, C. 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change-Human and Policy Dimensions,* 16**,** 253-267.

FOLKE, C., CARPENTER, S., ELMQVIST, T., GUNDERSON, L., HOLLING, C. S. & WALKER, B. 2002. Resilience and sustainable development: Building adaptive capacity in a world of transformations. *Ambio,* 31**,** 437-440.

FORSYTH, T. & EVANS, N. 2013. What is Autonomous Adaption? Resource Scarcity and Smallholder Agency in Thailand. *World Development,* 43**,** 56-66.

GALVIN, K. A. 2009. Transitions: Pastoralists living with change. *Annual Review of Anthropology,* 38.

GOLDMAN, M. J. & RIOSMENA, F. 2013. Adaptive capacity in Tanzanian Maasailand: Changing strategies to cope with drought in fragmented landscapes. *Global Environmental Change,* 23**,** 588-597.

GREINER, C. & MWAKA, I. 2016. Agricultural change at the margins: adaptation and intensification in a Kenyan dryland. *Journal of Eastern African Studies,* 10**,** 130-149.

HARDIN, G. 1968. The tragedy of the commons. *Science,* 162**,** 1243 - 8.

HERRERO, M., THORNTON, P. K., GERBER, P. & REID, R. S. 2009. Livestock, livelihoods and the environment: understanding the trade-offs. *Current Opinion in Environmental Sustainability,* 1**,** 111-120.

HITCHCOCK, R. K. 2002. Coping with uncertainty: adaptive responses to drought and livestock disease in the Northern Kalahari. *Sustainable Livelihoods in Kalahari Environments: Contributions to Global Debates***,** 161-192.

IFEJIKA SPERANZA, C. 2010. Drought Coping and Adaptation Strategies: Understanding Adaptations to Climate Change in Agro-pastoral Livestock Production in Makueni District, Kenya. *The European Journal of Development Research,* 22**,** 623-642.

IPCC 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151.

MAGNANI, S. D., ANCEY, V. & HUBERT, B. Resilience, social-ecological system and pastoral mobility: the risk of simplification. Resilience Alliance 2014, 2014-05-04 / 2014-05-08 2014 Montpellier, France. restricted: Centre pour la Communication Scientifique Directe, 746-746.

MAGOLE, L. 2009. The 'shrinking commons' in the Lake Ngami grasslands, Botswana: the impact of national rangeland policy. *Development Southern Africa,* 26**,** 611-626.

MORITZ, M., GIBLIN, J., CICCONE, M., DAVIS, A., FUHRMAN, J., KIMIAIE, M., MADZSAR, S., OLSON, K. & SENN, M. 2011. Social Risk-Management Strategies in Pastoral Systems: A Qualitative Comparative Analysis. *Cross-Cultural Research,* 45**,** 286-317.

MOTSUMI, S., MAGOLE, L. & KGATHI, D. 2012. Indigenous knowledge and land use policy: Implications for livelihoods of flood recession farming communities in the Okavango Delta, Botswana. *Physics and Chemistry of the Earth,* 50-52**,** 185-195.

NARAYANASAMY, N. 2009. *Participatory rural appraisal: Principles, methods and application*, SAGE Publications India.

NEUMANN, R. P. 1995. LOCAL CHALLENGES TO GLOBAL AGENDAS: CONSERVATION, ECONOMIC LIBERALIZATION AND THE PASTORALISTS' RIGHTS MOVEMENT IN TANZANIA. *Antipode,* 27**,** 363-382.

NIAMIR-FULLER, M. 1999. Managing mobility in African rangelands. *Property rights, risk and livestock development in Africa***,** 102-31.

PAAVOLA, J. 2008. Livelihoods, vulnerability and adaptation to climate change in Morogoro, Tanzania. *Environmental Science & Policy,* 11**,** 642-654.

PATTON, M. Q. 1990. *Qualitative Evaluation and Research Methods.*, Sage Publications, Inc, Newbury.

PETERS, P. E. 1994. *Dividing the commons: politics, policy, and culture in Botswana,* Charlottesville, University Press of Virginia.

RETTBERG, S. 2010. Contested narratives of pastoral vulnerability and risk in Ethiopia's Afar region. *Pastoralism,* 1**,** 248-273.

ROB 1991. Republic of Botswana, National Policy on Agricultural Development (NPAD). *Government Printers, Gaborone, Botswana*.

RODIMA-TAYLOR, D. 2012. Social innovation and climate adaptation: Local collective action in diversifying Tanzania. *Applied Geography,* 33**,** 128-134.

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. *Environmental Science & Policy,* 9**,** 302-316.

ROJAS-DOWNING, M. M., NEJADHASHEMI, A. P., HARRIGAN, T. & WOZNICKI, S. A. 2017. Climate change and livestock: Impacts, adaptation, and mitigation. *Climate Risk Management,* 16**,** 145-163.

SALLU, S. M., TWYMAN, C. & STRINGER, L. C. 2010. Resilient or Vulnerable Livelihoods? Assessing Livelihood Dynamics and Trajectories in Rural Botswana. *Ecology and Society,* 15.

SCHNEGG, M. & BOLLIG, M. 2016. Institutions put to the test: Community-based water management in Namibia during a drought. *Journal of Arid Environments,* 124**,** 62-71.

SCOONES, I. 1995. *Living with uncertainty. New directions in pastoral development in Africa,* London, Intermediate Technology Publications Ltd.

SMIT, B. & WANDEL, J. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change,* 16**,** 282-292.

SPEELMAN, E. N., GROOT, J. C. J., GARCIA-BARRIOS, L. E., KOK, K., VAN KEULEN, H. & TITTONELL, P. 2014. From coping to adaptation to economic and institutional change - Trajectories of change in land-use management and social organization in a Biosphere Reserve community, Mexico. *Land Use Policy,* 41**,** 31-44.

STRINGER, L. C. & REED, M. S. 2007. Land degradation assessment in southern Africa: integrating local and scientific knowledge bases. *Land Degradation & Development,* 18**,** 99-116.

TLOU, T. 1985. *A history of Ngamiland: the formation of an African State,* Gaborone, Botswana, Macmillan Publishers.

TONGCO, M. D. C. 2007. Purposive Sampling as a tool for Informant Selection: Research Methods. *Ethnobotany Research and Application: A journal of Plants, People and Applied Research.,* 5.

TWYMAN, C., SPORTON, D. & THOMAS, D. S. G. 2004. 'Where is the life in farming?': The viability of smallholder farming on the margins of the Kalahari, Southern Africa. *Geoforum,* 35**,** 69-85.

WHITE, R. 1993. Livestock development and pastoral production on communal rangeland in Botswana. *The Botswana Society, Gaborone*.

CHAPTER 5:

Institutional Challenges in Pastoral Landscape Management: Towards Sustainable Land Management in Ngamiland, Botswana[10]

[10] **In Review**

Journal: Land Degradation and Development

ABSTRACT

Policies, institutions and governance structures have implications for the sustainable use of land resources. In dryland Africa, pastoral landscapes are faced with challenges of land degradation, livestock diseases, droughts and land use conflicts. In order to enhance resilience and integrity of pastoral societies and landscapes, Sustainable Land Management (SLM) requires that policies and institutions create an enabling environment that encourages sustainable use. This study analyses current policy, institutional and governance challenges in relation to SLM in Ngamiland, Botswana. We use a series of expert interviews, local stakeholder workshops, document and policy content analysis to analyse policy and institutional challenges. Key policy and institutional threats and thus challenges for SLM include: fragmented institutional and policy frameworks, conflicting policies and priorities, weak governance structures, lack of integrated planning and coordination between sectors, gaps in communication, knowledge gaps and fragmented pastoralists lobbying institutions. Harmonisation of sectoral policies requires institutional and policy design to consider institutional co-ordination and enhanced learning on other actors' perspectives and constraints. Findings in Ngamiland show that integrative geospatial approaches can play a role in facilitating inter-sectoral data sharing to enable successful development of pastoral landscapes and a supportive decision-making system for SLM.

Keywords: Rangelands; Pastoralism; Policy Analysis; Institutions; Co-management.

5.1. INTRODUCTION

In sub-Saharan Africa, pastoralism is the dominant livelihood activity for the majority of the rural populace (Catley et al., 2013). Pastoralists modes of production have been consistently portrayed as unproductive, responsible for land degradation and

threatening the survival of the system they depend on (Sinclair and Fryxell, 1985). Communal land tenure practices have been blamed for discouraging private investments and encouraging higher stocking rates (Rohde et al., 2006). As the evidence pointing to the limitation of this thinking has accumulated, discussions have moved from a narrow land tenure focus to a wider interdisciplinary discourse (Oba, 2013). A growing body of opinion now considers pastoralism as a viable form of land-use in drylands (Davies, 2008). This necessitates the need for policies and management strategies to move towards tackling institutional challenges in support of more SLM practices. SLM is concerned with the management of land and water resources in a manner that is capable of delivering solutions which integrate environmental, economic and social objectives without damaging ecological processes (UNEP, 2016). To realise SLM for rangelands requires an ability to overcome policy and institutional fragmentation and develop locally-appropriate, flexible and tailored solutions (Cowie et al., 2011). However, many governments, especially in sub-Saharan Africa, still face the challenge of properly assessing policy outcomes, and developing the right mix of policies and institutional frameworks that address and accelerate pastoral development while protecting biodiversity in rangelands (Notenbaert et al., 2012). The consequences of inadequate land management frameworks can be seen in unnecessary rangeland resource degradation, land use conflicts, and decisions that favour short-term, piecemeal responses (UNCCD, 2013).

Botswana's semi-arid rangelands make a significant contribution to the livelihoods and wellbeing of its rural communities, many of whom depend on cattle (SB, 2013). The country's national development plans from independence in 1966 to the present, indicate substantial government expenditure in agricultural production and wildlife conservation programmes (ROB, 2009). Significant expenditure has been invested in veterinary services and cordon fences, water-point policies, rangeland privatisation policies and the provision of livestock subsidies. Like many other sub-Saharan African countries, Botswana faces the significant challenges of land

degradation (DEA, 2006), land use conflicts, livestock diseases and drought (DoL, 2009). In parts of the country rangeland degradation has led to extensive bush encroachment, bare soils and a decline in the cover density of perennial and palatable grass species (Moleele et al., 2002). The persistence of dual grazing rights for those who have been allocated ranches promotes overgrazing on communal lands and livestock encroachment into wildlife management areas, impacting negatively on wildlife habitats (Rohde et al., 2006). Efforts have been made to address unsustainable practices, reduce rangeland degradation and improve rural livelihoods in communal areas (e.g. Favretto et al., 2016, Reed et al., 2015). However, the implementation of rangeland management strategies remains a challenge and this has prompted some studies to question the efficiency of the current institutional arrangements and legislative frameworks (Mulale et al., 2014, DEA, 2008).

Botswana's policy approach to management of land and water resources, as with other sub-Saharan African countries, is through a range actors with a multiplicity of policies, regulations, and legislative instruments (Mulale et al., 2014). To date, studies of Botswana's institutional frameworks and the capacities of actors to implement strategies that are geared towards the sustainable use of rangelands are limited. This study draws on a series of expert interviews, a local stakeholder workshop and content analysis of policy documents to analyse and assess the land management policies and institutional frameworks for SLM practices in Ngamiland district, Botswana.

5.1.1. Scaling-up SLM in pastoral areas through multi-sectorial collaboration and co-management

Scaling up SLM in pastoral landscapes focuses on adapting successful policies and programs that can reach greater number of pastoralists and communities. Institutional and policy changes are required to create an enabling environment to

promote adoption of SLM. Figure 5.1 illustrates how SLM in pastoral landscapes can be scaled up through effective institutional and policy support. Identifying the barriers (constraints in pastoral areas) from an array of contributing factors is a key first step. The second step involves identifying institutional, policy and stakeholders at nested spatial scales (Basurto, 2013, Osei-Tutu et al., 2015). By identifying stakeholders at nested spatial scales, it is possible to identify trade-offs arising from the adoption of certain strategies, for example, impacts of a fence on access to key resource areas for a certain pastoral community or on wildlife movement. Once such trade-offs have been identified, it is possible to facilitate a cost-benefit analysis and dialogue between affected stakeholders so as to manage conflict and mitigate the worst negative effects. The third step involves fostering institutional and multi-sectorial collaboration through collaborative co-management and capacity building at the local scale (Leys and Vanclay, 2011). Management of communal resources such as grazing lands, forests and wildlife are always too complex to be managed by a single agency (Berkes, 2009). This requires a strategy that engages key stakeholders; pastoralists, famers, NGOs, research teams and state-planners, through a continuous learning process. Such a strategy should include working were necessary with high level intermediaries to build momentum for policy change (Pahl-Wostl, 2009).

The concept of co-management realises that in order to deal with the shortcomings of a single agency and top down management, management activities must be collaborative in practice (Berkes, 2009). Co-management involves the sharing of responsibilities between government and resource users (Carlsson and Berkes, 2005). The concept works best when combined with learning based approaches such as adaptive management. Adaptive co-management emphasises innovative strategies that explicitly foster collaboration between stakeholders and learning, which contribute to trust building and the formation of social networks of all stakeholders; researchers, communities, NGOs and policy makers (Armitage et al., 2009). Such collaborative institutional frameworks are critical to the needs of this study.

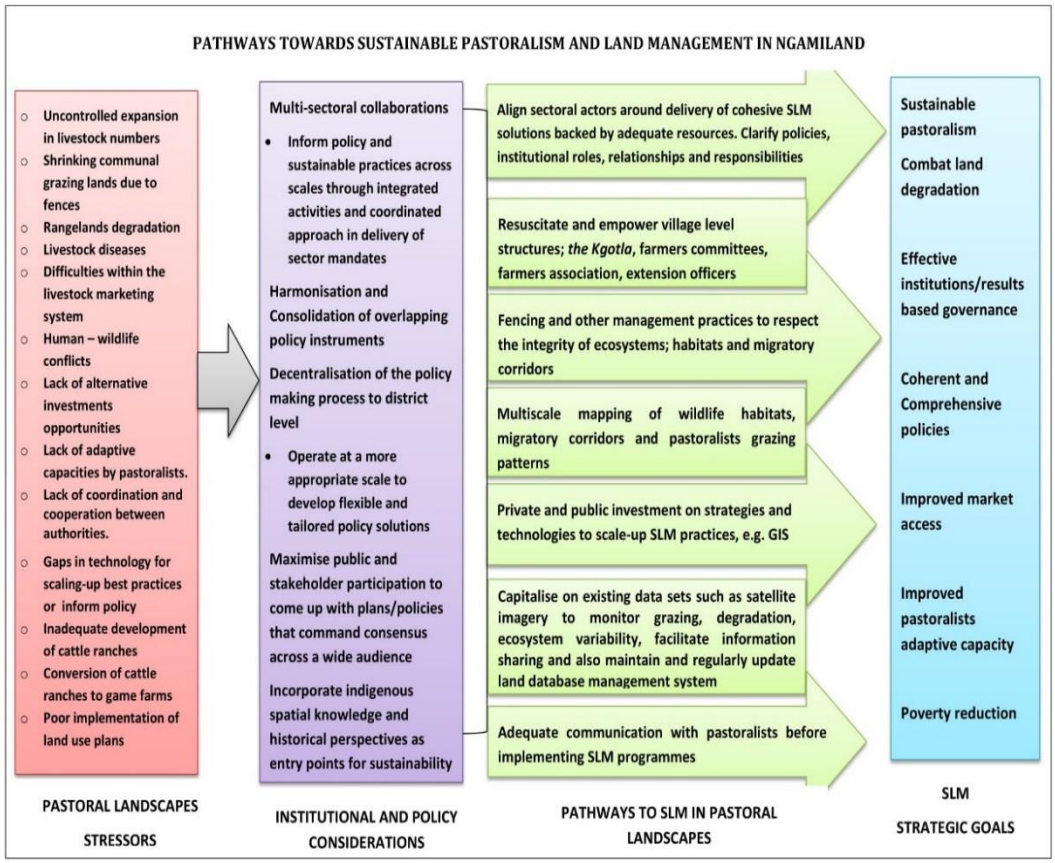

Figure 5.1: Effective institutional and policy support for scaling-up SLM in pastoral landscapes

The aim of the paper is to analyse current policy, institutional and governance challenges in relation to SLM and access to rangeland resources in Ngamiland pastoral landscapes. The objectives are to: (1) identify policies and legislative frameworks that have a direct or indirect impact on communal grazing lands and assess their stance on issues of SLM; (2) assess the district institutional frameworks and their implications for SLM in Ngamiland pastoral landscapes; and (3) determine how current arrangements for managing pastoral landscapes can be integrated into a more effective and accountable framework for SLM adoption in drylands.

5.2. MATERIALS AND METHODS

5.2.1. Study Area

Ngamiland district presents an interesting case to analyse policies and institutions due to its multifunctional landscapes. The focus area is populated by pastoralists; the Ovambanderu and Ovaherero ethnic groups who practice extensive livestock keeping across communally managed rangelands (Tlou, 1985). Due to the Okavango delta system, these rangelands are also home to a diversity of plants and animal species, including migratory wildebeests and elephants (DEA, 2008). Supported by a number of national agricultural policies notably the Tribal Grazing Land Policy of 1975 (TGLP), National Policy on Agricultural Development of 1991 (NPAD) and international trade agreements for access to international beef markets (Stevens and Kennan, 2005), former communal rangelands south of the delta are being privatized and fenced to create incentives for SLM. This has restricted resource access by local pastoral communities (Basupi et al., 2017). Pastoralism has been subject to frequent outbreaks of livestock diseases, notably Foot and Mouth Disease (FMD). Veterinary fences have been created to separate livestock from wild animals, especially buffaloes as carriers of the FMD virus. The district land use plans and other natural resource management strategies (DoL, 2009, DEA, 2008) recognise that competing land uses, land use conflicts and environmental degradation cannot be resolved by continuously extending the boundaries of one land use at the expense of the other. This calls for a clear strategy to ensure close integration of land management efforts and mechanisms to manage the pastoral landscape sustainably (DEA, 2008). Figure 5.1 shows the current land use zones in Ngamiland.

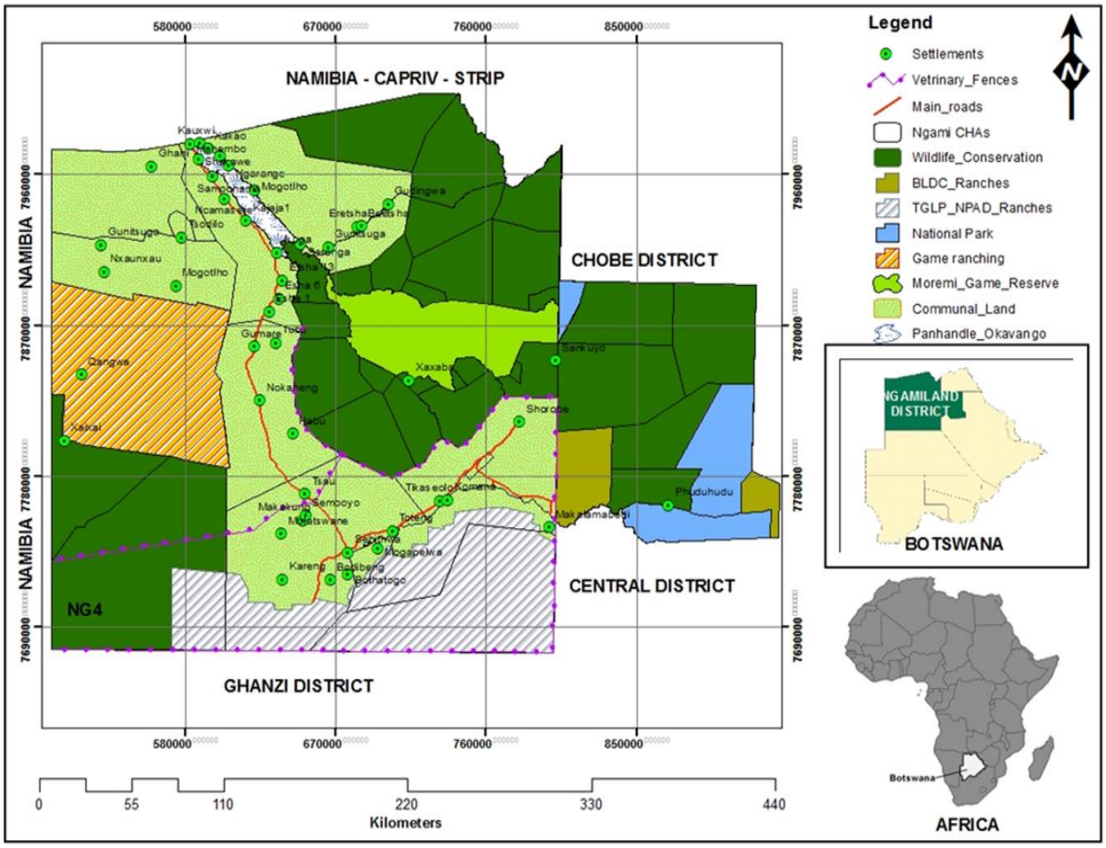

Figure 5.2: Ngamiland District Land Use Zones Data source: Department of Lands, Ministry of Agriculture.

5.2.2. Conceptual framework

The political modernisation and policy arrangements framework (Arts et al., 2006) helps explain the structure of environmental policy arrangements in terms of policy content and organisation. We adopted this framework and modified it for Botswana's environmental policy context (Figure 5.2). The emphasis of the framework is on policy actors, policy discourses and policy processes. Policy actors are the authorities, their powers, influence, and coalitions in the policy domain (Rogge and Reichardt, 2016). The notion of discourse refers to actual policy content and how the views of actors are embedded within policy (Arts et al., 2006) and considers the comprehensiveness of policy elements (Rogge and Reichardt, 2016).

Policy processes are concerned with policy making and implementation processes, which contribute directly or indirectly to the achievement of objectives (Rogge and Reichardt, 2016). Resources such as money, information or support are required for a successful implementation process (Runhaar et al., 2006). As such, coherent policy processes should include a clear implementation strategy outlining funding of activities within it.

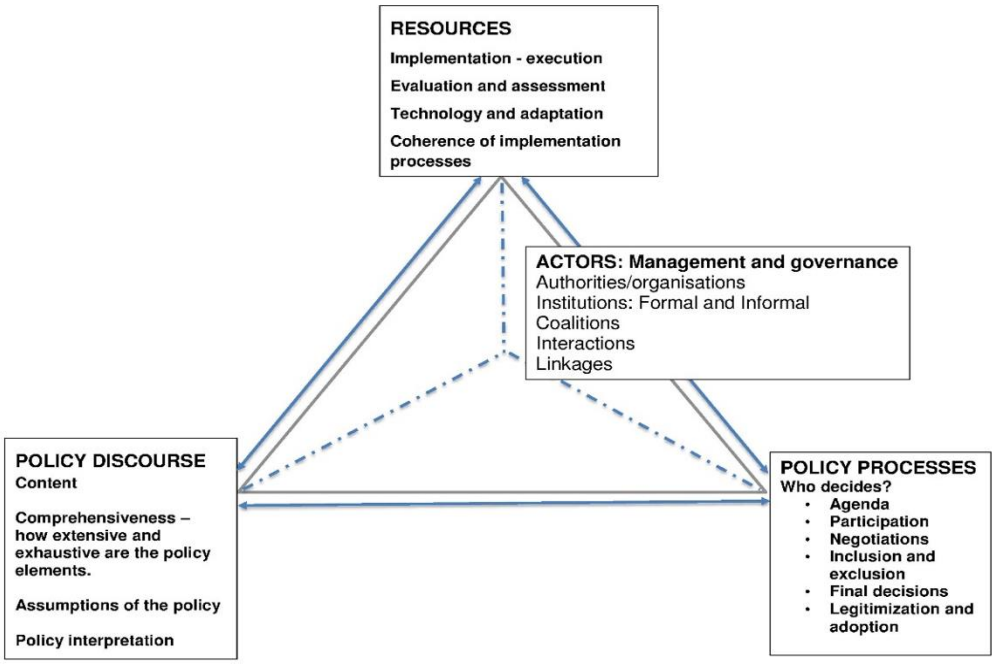

Figure 5.3: Conceptual framework for analysing policy arrangements and connections (adapted from Arts et al., 2006).

5.2.3. District Stakeholder workshop & Expert Interviews

A local level stakeholder workshop was held with 13 government officials from the Ngamiland District Land Use Planning Unit (DLUPU). DLUPU is an integrated committee comprising government departments; Land Board official, Senior Lands Officer (Tawana Land Board), Council Physical Planner, Scientific officer (Animal Production), Council Planning officer (Economic), District Officer (Development),

Land Use Officer (Crops), Wildlife Biologists, Scientific Officer (Veterinary Services), Secretary to the District Conservation Committee, Range Ecologist, District Tourism Officer, District Environmental Coordinator. We divided the workshop into two sessions. The first discussion focused on exploring issues and challenges experienced in communal grazing areas, compiling a list of policies, legislative frameworks, and institutions that directly or indirectly influence land management and pastoralism in Ngamiland communal areas and identifying policy and institutional challenges. The second part of the discussion explored solutions and measures that could address the identified issues and challenges. Each discussion lasted for approximately 90 minutes. In addition, expert interviews were held with professionals from government offices both before and after the stakeholder workshop. These interviews enabled assessment of the relationship between the district land management institutional framework and the organizational structures. Respondents were as follows; Department of Environmental Affairs (n = 2), Tawana Land Board (n = 4), Department of Wildlife and National Parks (n = 4), Department of Veterinary Services (n = 4), Department of Forestry and Range Resources (n = 2), District Administration (n = 2) and Tribal Administration (*'Dikgosi'* or Village Chiefs and chairpersons of Farmers' Committees (n = 11)). The data from stakeholder workshop discussions and expert interviews were analysed using qualitative content analysis (Flick, 2015)

5.2.4. Policy content analysis

The stakeholder workshop identified policies that have a significant impact on pastoralists' issues and communal areas in the district. Copies of relevant policies and management plans were obtained from district offices and the Government publishing agency. The documents were analysed using iterative content analysis, examining narratives in relation to SLM within each policy document (Forbes, 2000). The policy evaluation and appraisal criteria in Table 5.1 were identified based on

decision support needed for upscaling SLM best practices in pastoral landscapes (Liniger et al., 2011); addressing the root cause of land use conflicts and land degradation; multi-stakeholder involvement and multi-sectorial approaches. We examined policy stances that provide for cross-sectoral and collaborative management of communal lands.

Table 5.1: Criteria for determining policy stance towards SLM

No support for SLM (-)	No co-management, top-down imposition, no reference or inference to SLM
Weak support for SLM (+)	Single sector focus, no references to other sectors, no clear implementation strategy
Medium support for SLM (++)	Has potential for co-management hence SLM, however, activities towards SLM and implementation strategies are not explicit
Strong support for SLM (+++)	Strong on co-management, equitable access, participation, extensive decision-making, clear implementation strategy

5.2.5. Institutional capacity assessment

Barley and Tolbert (1997: 6), define institutions as 'shared rules and typifications that identify categories of social actors and their appropriate activities or relationships'. Understanding the nature of resource institutions helps explore links between various institutional arrangements involved in natural resource management. Organisations are structures made up of individual actors some with conflicting objectives (Hodgson, 2006). Hence institutions are socially constructed templates for actions, produced and maintained through ongoing interactions and collaborations between organisations (Barley and Tolbert, 1997). Ostrom (1990) proposed a set of conditions (Ostrom's eight design principles) that could influence the likelihood that

self-governing institutional arrangements will be long-lasting and improve management of Common Pool Resources (CPRs). Design principle 8 states that appropriation, provision, monitoring, enforcement of rules, conflict resolution and governance activities must be organised in multiple layers of nested enterprises in order to achieve sustainable management of CPRs. Understanding the relationship between multi-level institutional linkages and conditions influencing the likelihood of successful co-management has practical relevance to SLM upscaling and local resource governance (Basurto, 2013). Since it is argued that SLM must be mainstreamed into broader sectorial institutional frameworks (WOCAT, 2009), we assessed organisational structures and institutional frameworks based on their capacities and efficiency in supporting SLM through collaboration between actors involved in implementing land use policies and resources management plans, i.e. co-management. Efficiency was determined by clear institutional arrangements, clear cross-sector collaboration or communication linkages, traceable budgets towards SLM activities, technologies in place to upscale SLM best practices (Liniger et al., 2011) and evidence for engagement and involvement of pastoralists communities in the planning of activities. At the local level, linkages are between local level institutions and district actors through direct involvement in decision making and developing co-management arrangements to increase political support for local/village level livestock management institutions (Armitage et al., 2008). Linkages at the national level are between district actors, local level structures and the central government through active participation in national-level policymaking on SLM and pastoralism issues. These linkages are thought to create interdependencies by which local level institutions can shape their bargaining power with the central government on a variety of issues including autonomy in resource management (Armitage et al., 2009). Autonomy in this case means local institutions are able to exercise self-governance over decision making and implementation without being constantly overruled by the central government (Bodin and Crona, 2009)

5.3. RESULTS

5.3.1. Policies and legislative frameworks

During the stakeholder workshop, a number of policy-related factors were identified as critical (Table 5.2).

Table 5.2: Summary of issues from stakeholder workshop

Issue	Area of concern
Livestock and Land management	• Uncontrolled expansion in livestock numbers. • Difficulties within the livestock marketing system. • Outbreak of livestock diseases. • Shrinking communal grazing lands • Lack of alternative investments opportunities and adaptive capacities. • Presence of invasive species observed around villages and Lake Ngami. • Issues related to the position, operation, maintenance, effectiveness and impact of the veterinary fences.
Policies and Institutions	• Legal pluralism - traditional management institutions operate alongside modern legislative frameworks. • Lack of integrated planning, coordination, and cooperation between the many actors with responsibilities for rangeland management. • Lack of enforcement of existing land use policies. • Knowledge and technological gaps.
Consultation and participation	• Pastoralists' opinions are not taken into consideration in policy making. • Information not communicated in a way that is practical for local communities to apply. • No motivational incentives for improved livestock and land management.

5.3.2. Policy processes

Key stakeholders, including chiefs and members of the Farmers' Committees, had only a vague impression of policies, some of which have important impacts on communal grazing lands and pastoralism. For instance, village level representatives from Village Development Committees (VDC) did not know of the existence of any Integrated Land Use Plan for the district. They argued that policy making processes remain top-down and communities tend to be aware of only basic services or information which are acquired through one-of village-level *Kgotla* consultation meetings or via state radio. Communities are consulted after the policy process and agenda has been discussed and agreed at central government level by elites who often do not understand the policy implications*. 'The issue is we as the people only get to talk about the policy in terms of how it can work best for us, the other aspects like whether the policy is necessary, why and what kind of policy, are reserved for the government and the political elites…' (Interview data, Member of the Farmers' Committee, Toteng, 2016).*

Participants stressed the implementation challenges brought about by centralized policy making processes which do not take into consideration the spatial heterogeneity of different pastoral landscapes. Policy makers tend to treat the country as a homogenous landscape such that the same policy instrument can be applied throughout the country *'…we need to say at the policy level: this is how we can use opportunities available in the district to help pastoral communities, but we can't because the policy making process is centralised….' (Expert interview data, DVS, Maun, 2016).* Some extension officers felt that they are given policies and programmes to implement without being asked whether they will work. One example given was wildlife compensation within the Wildlife Conservation Policy of 1990, where the compensation for wildlife damage to livestock or crops is significantly lower than the value of the lost crop, animal or property. Officers argued that the issue negatively affects the attitude of communities towards wildlife as people feel the government cares more for wildlife than people or livestock.

5.3.3. Policy discourse

The policies and statutes analysed (Table 5.3) relate to management of communal areas and have implications for SLM and pastoralism. Using the criteria in Table 5.1, the instruments were assessed to identify their support for SLM. Botswana's long-term vision for management of environmental resources, '*a fully integrated approach towards conservation and development of resources…including equitable distribution of these resource between its people'* (RoB, 1990) is consistent with the principles of co-management. It is evident from Table 5.3 that the intentions of policy or legislative instruments as far as management of communal resources is concerned are based on key sustainable development principles; equity and fairness in allocation of land resources (RoB, 1968), sustainable use of natural resources through a coordinated policy approach (RoB, 1990) or effective Livestock disease control (RoB, 1977) among others.

The first legislative instrument which considered management of communal areas was the Tribal Land Act of 1968, which replaced customary institutions for land management. The change in land management institutions with the transfer of responsibility for land allocation from Chiefs to Land Boards has affected the land use system. Though the Act advocates equity and fairness, land management decisions and powers of control lie solely with select Board Members who are answerable to the 'Minister of Lands' (RoB, 1968). *'In most cases, Land Board Members do not have expertise in the field of land use, they are therefore not well equipped to guide the implementation of programmes that promote SLM' (Expert Interview, TLB, 2016).*

The TGLP (1975) was introduced with the intention of reducing rangeland degradation by demarcation and allocation of ranches to individual farmers. TGLP objectives were expanded by the National Policy on Agricultural Development (NPAD) of 1991 (RoB, 1991). While TGLP targeted what was deemed 'unoccupied land', NPAD targeted the land around communal grazing areas or cattle posts owned by individuals or syndicates (RoB, 1991). The policy restated the TGLP assertion that

growth in livestock numbers had caused significant overgrazing and degradation and recommended fencing of a significant amount of the communal areas as commercial leasehold ranches (RoB, 1991). The policy does not provide any technical guidelines or protocols on how to create and allocate these ranches without negatively impacting on issues of sustainability and equity in pastoral areas. Instead, the policy loosely recommends an Inter-Ministerial Technical committee to oversee the preparation of feasibility studies and implementation, despite existing land use planning structures such as DLUPU.

Numerous land and natural resource management policies and legislation exist (Table 5.3). The Okavango Delta Management Plan (ODMP) through its components addresses the conflicts between pastoralism and wildlife conservation by recognizing the role of pastoralism in conserving biodiversity and sustainable livelihoods. The plan identifies issues in the livestock sector and proposes measures or relevant departments that can develop programmes to tackle these issues. The National Conservation Strategy provides for a national conservation strategy advisory body with broad membership across all structures, a coordinating unit and environmental liaison officers in other Ministries (Table 5.3).

Table 5.3: Analysis of policies and legal instruments

Instrument	Objective/policy problem definition	Policy stance on SLM and rangeland access	Support for SLM	Comments on policy effects / implementation
Tribal Land Act, 1968, amended 1993	Provides for the establishment of tribal Land Boards to manage all communal lands.	Equity and fairness in allocation of land resources and access to communal land.	++	Collapse of customary or village level management institutions. Management duties taken from the chiefs and village level institutions.
Disease of Animal Act, 1971	Prevention and control of diseases.	Food security through appropriate prevention and control of livestock diseases.	+	Emphasis on decisions taken by political administrative elites e.g. 'the minister may at any time cause fences to be erected on any land'.
Agricultural Resources Conservation Act, 1974	Conservation and wise use of agricultural and rangeland resources.	Establishment of district level conservation committees under the ministry of agriculture.	+	The selection of Board Members solely by the Minister of agriculture means that the Act provides weak support for SLM.
Tribal Grazing Land Policy, 1975	Fenced rangelands - grant exclusive rights to groups and individuals.	Reduce rangeland degradation by decongesting the communal areas, give farmers incentives to manage their land.	+	Deficiencies in the data or information on which planning and management decisions were based led to poor performance.
Wildlife Conservation Policy, 1990	Wildlife co-management through CBNRM and private concessions, Wildlife Management Areas (WMAs)	Establishment of community wildlife utilisation through WMAs and private concessions. Local advisory committees.	++	Potential for SLM due to its emphasis on co-management for wildlife through CBNRM. Emphasis on a single sector; wildlife. Pastoralists' issues, especially those utilising WMAs, are not fully integrated.

National Conservation Strategy, 1990	Policy coordination, Coordinate Environmental Impact Assessments and Strategic Environmental Assessments, Improved livestock management Restoration of degraded lands.	Integrated environmental management through the formulation of a National conservation strategy advisory body with a multiplicity of stakeholders.	+++	Emphasis on co-management with representation across stakeholders. Special attention is given to local structures and other interest groups. Implementation remains weak.
National Policy on Agricultural Development, 1991	Fencing of grazing lands. Improved management is considered impossible under the communal management system.	Proposes detailed mapping of grazing areas.	+	Land is allocated de facto to an elite of cattle owners with boreholes, at the expense of poor communal area pastoralists.
Community-Based Natural Resource Management (CBNRM) Policy, 2007	Community involvement in the management of natural resources to diversify the rural economy away from livestock.	Communities receive user or proprietary rights over resources, incentives for local communities to manage wildlife resources and alleviate poverty.	++	A single sector focus; wildlife, means it may not support strategies for SLM in communal lands.
Okavango Delta Management Plan, 2008	Protection, sustainable use and integrated management of natural resources on the Delta and its fringes.	Government departments have activities in the plan which they are to budget for. Continuous dialogues in the form of workshops	++	Supports institutional collaboration. Coordination between sectors is a challenge, most departments still do not have a budget for their components in the plan.
Ngamiland Integrated Land Use Plan, 2009	Sustainable use of land, equitable distribution, harmonizing land allocation with ecosystems, guiding the Land Board.	Proposes communal area-specific management plans. Proposes yearly workshops and evaluation seminars. Sectors to budget for their specific plan mandates.	++	No clear implementation strategy that can guide actors to implement their components. Activities within the plan are not budgeted for.

(-) No support for SLM (+) Weak support for SLM (++) Medium support for SLM (+++) Strong support for SLM

5.3.4. Institutional capacity assessment; actors in rangeland resource management

Group discussions and subsequent interviews all stressed the lack of involvement at the local level by the Tawana Land board (TLB) despite various development planning and land management structures. These include local authorities and their operational sub-committees such as District Council Planning Committee (DCPC), Tribal Administration – the Kgotla, VDC and District Land Use Planning Unit (DLUPU). Working parallel to these local authorities are government departments such as the Department of Environmental Affairs (DEA), Department of Veterinary services (DVS), Department of Animal Production (DAP), Department of Crop Production (DCP), Department of Forestry and Range Resources (DFRRS), Department of Wildlife and National Parks (DWNP) and Department of Tourism (DOT), which could provide technical support and advice to the Land Board.

One of the strategic objectives of the National Conservation Strategy is to harmonise natural resource management policies and legislation to facilitate implementation, with DEA as the coordinating agency. The general view from interviews and workshop is that DEA is under-resourced in terms of staff and resources to successfully carry out this mandate.

A multiplicity of government departments have responsibilities for implementation of various land management programmes, policies and legislation. While this has its advantages, participants' argued that the arrangement limits integration of SLM efforts and fosters an issues-driven approach to implementation on a department by department basis whereby departments are not accountable to each other. For example, officials from the Ministry of Agriculture reported that the Ministry is totally against conversion of cattle ranches to other uses such as game farms or tourism related activities because this defeats the purpose of TGLP and NPAD of reducing pressure in the communal areas and commercialising the livestock sector. Conversely, the Tawana Land Board has no objection to individuals transferring their

ranches or introducing wildlife on their ranches and changing use as long as it is done in accordance with the Department of National Parks (DWNP) requirements.

Group discussions and interviews all stressed that problems experienced in the communal areas, such as livestock congestion and human-wildlife conflicts, are exacerbated by a lack of coordination and conflicting priorities by authorities. For example, the Ministry of Agriculture's Livestock Management and Infrastructure Development Programme (LIMID) and the Ministry of Youth Development Fund continue to fund livestock projects despite disease outbreaks. This is worsening the problem of intensive grazing leading to degradation, in the form of bush encroachment or reduced fodder availability.

Figure 5.3 identifies the actors in communal land management and their communication linkages. A strong vertical line of accountability is noted between district departments and their ministries at the national level but district departments are only loosely connected and do not often collaborate on issues that affect pastoral areas. There is also a weak communication linkage between these actors and village level structures which are supposed to spearhead SLM efforts. Respondents highlighted limited consultation, delays and lack of feedback on issues of concern to pastoral communities as major communication issues in pastoral areas. Little information is shared among these various actors resulting in uncoordinated planning. '*To a certain extent as departments, we fail local communities in terms of addressing their concerns/issues adequately and within a reasonable timeframe. The unavailability of information to communities makes them hostile to interventions that would have otherwise sailed smoothly to aid SLM...*' (Expert interview, DEA, 2016).

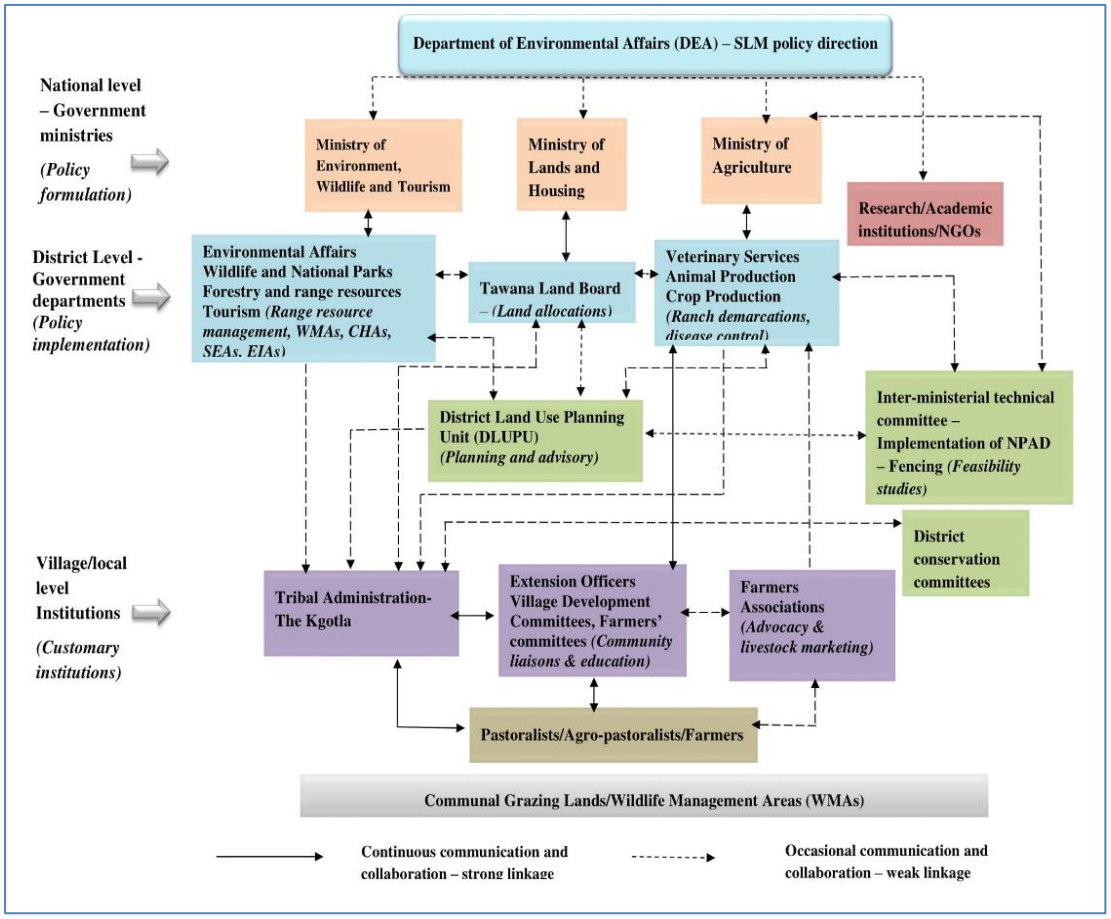

Figure 5.4: Structures in management of pastoral landscapes and communication linkages.

5.3.5. Tawana Land Board

The Tawana Land Board is the authority responsible for the overall management of all communal/tribal land in the district, in trust for the community. The Board falls under the Ministry of Lands, Water and Sanitation Services and under the provisions of the Tribal Land Act of 1968 (amended 1993). It is mandated to deal with issues regarding the allocation of tribal land for residential purposes, grazing of livestock, ploughing purposes, commercial and industrial uses and zoning of wildlife management areas in conjunction with Department of Wildlife and National Parks.

The Land Boards are required under section 17 of the Tribal Land Act to determine and define land use zoning within tribal land which once approved and codified by the Minister, then prohibits any granting of land that is contrary to the land use zoning plan. It is provided under the same section that the Boards may determine management plans and their revision for purposes of assisting or providing guidance on the use and designation of land use zones. Boards make strategic decisions while the Secretariat makes administrative decisions. While the Board may seek advice from institutions such as DLUPU, such advice is not binding and the Board may disregard them if they so wish. Stakeholder workshop participants were of the view that members of the Board are mostly unqualified and do not have capacity to deal with complex issues, hence mismanagement of the communal lands and land use conflicts are on the rise.

5.3.6. District Land Use Planning Unit

The central mandate of DLUPU is to play a coordinating role for management of land and other natural resources at the district level. Further, DLUPU is charged with the responsibility of advising Land Boards regarding land allocations and management, assisting in the resolution of land use conflicts and implementation of government policies, advising community-based organisations including Farmers' Committees and drafting agricultural land use and zoning plans. Theoretically, DLUPU works to align and synergise sectorial policies and strategies of district level departments to that of the National Land Policy, the Tribal Land Act and National Conservation Strategy as well as ensuring effective communication with Village Extension Officers, local communities, and pastoralists. Workshop participants argued that the committee does not function in this manner and continues to decline in value due to poor attendance. It is not backed by any statutory provision or powers which it can use to compel members to attend meetings or carry out projects regularly. The fact that the committee is not capable of operating like a viable institution means that it

cannot effectively deal with issues of SLM. The committee does not have a budget but relies on resources from the secretariat whose office has other core mandates. The absence of a viable institution has created an implementation gap for policies and strategies which require integrated efforts. This was particularly felt during the implementation of NPAD's fencing component when an *ad–hoc* Inter-Ministerial Technical committee had to be formed to deal with policy implementation.

5.3.7. Village level institutions – The Kgotla

In Botswana community level structures exist, notably the tribal chiefs and council of elders who make up Village Courts, the Kgotla. The Kgotla is an institutionalised traditional system of governance headed by the Village Chief. It serves as a forum for community consultations, village level development planning and as a social platform for interaction and learning. It is also a place where political and economic decisions are made (Moumakwa, 2010). The Kgotla and its associated institutions such as the VDCs and Farmers' Committees offer potential for community mobilisation and involvement in SLM activities. The policy and government institutional framework for management of communal lands has yet to take full advantage of these traditional institutions. Workshop participants argued that the power of these structures has declined and they are now used for one-off consultation by authorities. The issue of legal pluralism occurs mainly because traditional pastoral institutions are not thoroughly integrated into policy. Where they are mentioned, such as in the District Integrated Land Use Plan (DILUP) and ODMP, an overall framework on how to effectively integrate traditional institutions, pastoralist rights; and their knowledge of the environment, is absent.

5.4. DISCUSSION: TORWARDS SLM

5.4.1. Policy discourse

Findings from the workshop and policy content analysis reveal that privatisation of communal lands is still viewed as a superior solution to the rangeland management problems in communal areas. Several studies point out that TGLP was implemented based on questionable epistemological grounds, and has yielded little evidence that it has achieved its intended SLM objectives (Basupi et al., 2017, Makepe, 2006, Perkins, 1996, White, 1993). Political 'lock-in' to a policy of land privatisation limits efforts to empower local communities to manage communal rangelands. As noted in Table 5.3, most policy support for SLM is weak, except for the National Conservation Strategy which provides for a coordinated multi-sectorial approach. Provision for SLM in key policy instruments such as the DILUP is also weak. SLM requires multi-sectoral institutions that are carefully coordinated (UNCCD, 2008). All experts interviewed agreed that their operations require such a body, however such a body does not exist. Findings from this study add insights to the thesis advanced by Mulale et al (2014: 88), that land degradation may be partly promoted by '…failure to exploit the synergy between mutually reinforcing legislative and policy instruments to promote SLM and more sustainable livelihoods…' We have expanded this by assessing the various actors in the management of pastoral landscapes and their communication linkages.

5.4.2. Communication gaps and fragmented institutional coordination

Findings from this study show that policy processes remain predominantly top-down such that pastoral communities perceive local governance structures as inefficient and unable to meet their needs. The reluctance of district departments to work with

DLUPU, and also to view DLUPU as part of their mandates, is a compelling manifestation of a sectorial and fragmented institutional framework. Where land management responsibilities involve multiple stakeholders, each accountable to a different government department, it is difficult to secure accountability. Analysis of local level institutions shows that they are not empowered to participate in SLM activities. Like in other sub-Saharan Africa communal areas (e.g. Bennett et al., 2013), there is very limited institutional interactions between village level structures and government departments. There is currently no strong operational mechanism at the district or national level that links relevant actors and provides oversight for ensuring SLM across scales. Institutional and legislative frameworks do not assign local level institutions with any role or financially resources to participate in land management activities. Integrated management systems such as SLM call for consultation, involvement, participation and a level platform for negotiation by all actors in land management especially at grass-roots level (UNEP, 2016).

Timely availability of information is important for decision-making processes in SLM (Hurni, 2000). The communication gap between actors reflects constraints in the capacity of sectors to successfully implement SLM initiatives and disseminate information to pastoralists. The challenges discussed throughout this paper will constrain prospects and opportunities for SLM in Ngamiland unless they are recognised and addressed through a more holistic institutional and policy framework. Most CPRs are contested by multiple stakeholders and management structures are often internally divided. The concept of CBNRM currently has a strong wildlife focus, which means it may not support strategies for SLM in pastoral landscapes. New institutional reforms and rearrangement of existing structures are needed to bring in platforms for negotiations and greater collaborative co-management. The priority should be to fix the uncoordinated institutional operational situation of the many actors as demonstrated in this study. Lack of cross-sectorial coordination is having a negative impact on service delivery at the local level which in turn affects implementation of SLM programmes and strategies in

communal areas. The recommendation is to strengthen the existing integrated institution (i.e. DLUPU), which operates at the district level. What is important and practical is to ensure that there exist a platform for stakeholders to create a shared vision and assign each other roles that improve the ability of others to carry out their core-mandates. Empowering a collaborative structure such as DLUPU will help build trust and capacity for local institutional stakeholders, allowing for social learning to take place at all scales. Through this arrangement, we hope for a self-organising process of adaptive co-management which is facilitated by a legislative framework and incentives of higher levels .

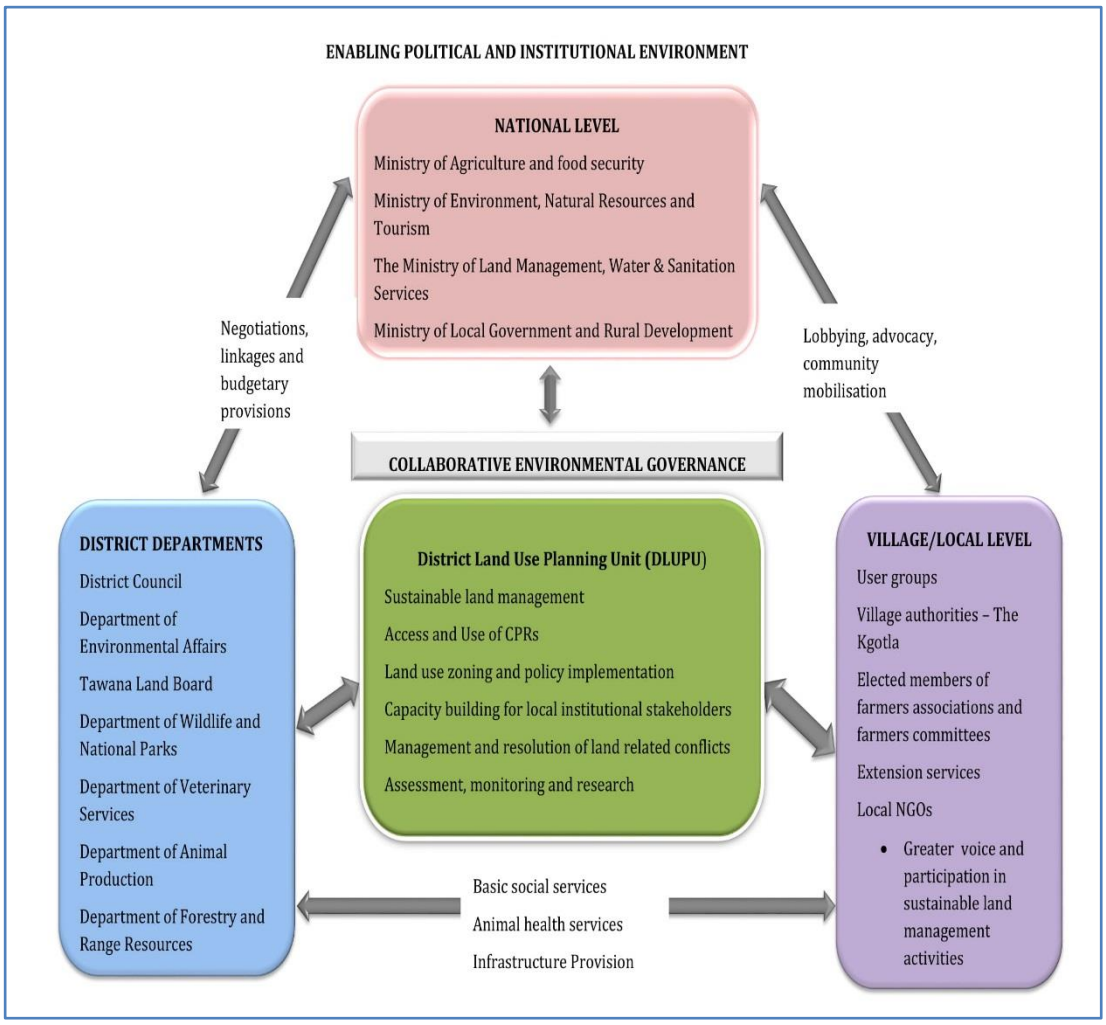

Figure 5.5: Proposed multi-level institutional arrangements for collaboration in resource governance

Figure 5.5 illustrates a potential multi-level institutional structure for collaboration in which different networks of actors are connected in a process of social learning and collaborative resource governance with local institutions collaborating directly with DLUPU. In this institutional arrangement, local level actors should have an increasingly central role in CPR management decisions, with high level organisations providing an enabling environment under which this can prevail. Currently, priorities regarding local land resource managements are set at the national level (Departmental headquarters). As such, resources and operational tools necessary for SLM such as communication strategies and staff are concentrated at headquarters for most government departments. Local level institutions are rarely involved in planning and design of these strategies. This may be resolved by a strong integrated planning structure at the district level which draws the attention of headquarters to local issues. DLUPU should be empowered through legislative frameworks to become an environmental governance institutions that can develop explicit strategies for collaborative processes, multi-stakeholder engagement, public participation, produce annual activity plans including funds for a yearly budget. Moreover, DLUPU should be provided with a full time secretariat, dedicated and qualified staff that is expanded to include primary and secondary stakeholders as appropriate so that it produces desired outcomes in terms of materials and institutional culture.

Land use intensification and restrictions on livestock mobility mean that conflicts over rangelands are getting more severe and complex. Sustainable solutions to these complexities will require management institutions that account for differences in bargaining power among stakeholders and user groups (Bennett et al., 2013, Adger et al., 2003). Moreover, this reality requires strategies that are in harmony with the local context, hence the need to collect and model both local and aggregated information about CPR condition and to use that information to design policies at the appropriate scale (Dietz et al., 2003) through DLUPU.

Reinforcement of local level structures and indigenous management institutions is required to achieve sustainable land use and resource management planning that

accounts for the changed conditions (Homann et al., 2008). Effective spatial planning and regulation of chaotic or opportunistic land use activities is crucial. A district multi-stakeholder workshop suggested that future research should focus on exploring various means under which DLUPU can become a robust integrated and collaborative environmental governance structure that incorporates indigenous environmental governance systems and enables environmental information systems.

5.5. CONCLUSION

This paper set out to examine current policy, institutional and governance challenges that constrain SLM uptake in Ngamiland pastoral landscapes. Of significant importance is the communication gap and lack of inter-sectoral cooperation and coordination between the many actors involved in pastoral landscape management. There exists a multiplicity of sectorial policies with their own resource management objectives, loosely or poorly connected with other sectorial policies and crafted along sectorial lines. Most policies are not area specific and do not adequately address pastoralists' issues in different heterogeneous environments. Drawing on our findings, we set out a potential multi-level institutional collaborative structure to facilitate a process of adaptive co-management in Ngamiland pastoral areas. This will involve aligning sectorial policies around delivery of cohesive SLM solutions and building consensus at the local level under the auspices of DLUPU. With appropriate capacity building (education and training), village level institutions can play an active role in common resource governance (e.g. early warning systems for predicting drought, rangeland conditions and community mobilisation for SLM upscaling). Strong policy and institutional support is required to ensure uptake and effective dissemination mechanisms that support inter-sectorial data sharing and collaborative management efforts.

5.6. ACKNOWLEDGEMENTS

The research was carried out under research permit number EWT 8/36/4 XXX (73) of the Government of Botswana. We are thankful for funding provided by the Botswana International University of Science and Technology (BIUST), Government of Botswana and University of Leeds Sustainable Agriculture Bursary.

5.7. REFERENCES

ADGER, W. N., BROWN, K., FAIRBRASS, J., JORDAN, A., PAAVOLA, J., ROSENDO, S. & SEYFANG, G. 2003. Governance for sustainability: towards a 'thick'analysis of environmental decisionmaking. *Environment and planning A,* 35**,** 1095-1110.

ARMITAGE, D., MARSCHKE, M. & PLUMMER, R. 2008. Adaptive co-management and the paradox of learning. *Global environmental change,* 18**,** 86-98.

ARMITAGE, D. R., PLUMMER, R., BERKES, F., ARTHUR, R. I., CHARLES, A. T., DAVIDSON-HUNT, I. J., DIDUCK, A. P., DOUBLEDAY, N. C., JOHNSON, D. S. & MARSCHKE, M. 2009. Adaptive co-management for social–ecological complexity. *Frontiers in Ecology and the Environment,* 7**,** 95-102.

ARTS, B., LEROY, P. & VAN TATENHOVE, J. 2006. Political Modernisation and Policy Arrangements: A Framework for Understanding Environmental Policy Change. Public Organization Review, 6, 93-106. DOI: 10.1007/s11115-006-0001-4

BARLEY, S. R. & TOLBERT, P. S. 1997. Institutionalization and structuration: Studying the links between action and institution. Organization Studies, 18, 93-117. DOI: 10.1177/017084069701800106

BASUPI, L. V., QUINN, C. H. & DOUGILL, A. J. 2017. Using participatory mapping and a participatory geographic information system in pastoral land use investigation: Impacts of rangeland policy in Botswana. Land Use Policy, 64, 363-373. DOI: http://dx.doi.org/10.1016/j.landusepol.2017.03.007.

BASURTO, X. 2013. Linking multi-level governance to local common-pool resource theory using fuzzy-set qualitative comparative analysis: insights from twenty years of biodiversity conservation in Costa Rica. *Global Environmental Change,* 23**,** 573-587.

BENNETT, J., AINSLIE, A. & DAVIS, J. 2013. Contested institutions? Traditional leaders and land access and control in communal areas of Eastern Cape Province, South Africa. Land Use Policy, 32, 27-38.

BERKES, F. 2009. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of environmental management,* 90**,** 1692-1702.

BODIN, Ö. & CRONA, B. I. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global environmental change,* 19**,** 366-374.

CARLSSON, L. & BERKES, F. 2005. Co-management: concepts and methodological implications. *Journal of environmental management,* 75**,** 65-76.

CATLEY, A., LIND, J. & SCOONES, I. 2013. Development at the margins: Pastoralism in the Horn of Africa. In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege., 1-26.

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, 248-260. DOI: 10.1002/ldr.1086

DAVIES, J. 2008. Turning the tide: Enabling sustainable development for Africa's mobile pastoralists. Natural Resources Forum, 32, 175-184. DOI: 10.1111/j.1477-8947.2008.00190.x

DEA 2006. Botswana National Action Programme to Combat Desertification. Department of Environmental Affairs , Gaborone.

DEA 2008. OKAVANGO DELTA MANAGEMENT PLAN Department of Environmental Affairs , Gaborone, Botswana Notes and Records.

DIETZ, T., OSTROM, E. & STERN, P. C. 2003. The struggle to govern the commons. *science,* 302**,** 1907-1912.

DOL 2009. Department of Lands (DoL). Ngamiland Integrated Land Use Plan, Final Report, . Ministry of Lands and Housing, Botswana.

FAVRETTO, N., STRINGER, L. C., DOUGILL, A. J., DALLIMER, M., PERKINS, J. S., REED, M. S., ATLHOPHENG, J. R. & MULALE, K. 2016. Multi-Criteria Decision Analysis to identify dryland ecosystem service trade-offs under different rangeland land uses. Ecosystem Services, 17, 142-151.

FLICK, U. 2015. Qualitative Inquiry2.0 at 20? Developments, Trends, and Challenges for the Politics of Research. Qualitative Inquiry, 21, 599-608. DOI: 10.1177/1077800415583296

FORBES, D. 2000. Reading texts and writting geography. In I. Hay (Ed), Qualitative research methods in human geography. Oxford: Oxford University Press.

HODGSON, G. M. 2006. What Are Institutions? JOURNAL OF ECONOMIC ISSUES, XL, 1-25.

HOMANN, S., RISCHKOWSKY, B. & STEINBACH, J. 2008. The effect of development interventions on the use of indigenous range management strategies in the Borana Lowlands in Ethiopia. *Land degradation & development,* 19**,** 368-387.

HURNI, H. 2000. Assessing sustainable land management (SLM). Agriculture Ecosystems & Environment, 81, 83-92. DOI: http://dx.doi.org/10.1016/S0167-8809(00)00182-1.

LEYS, A. J. & VANCLAY, J. K. 2011. Social learning: A knowledge and capacity building approach for adaptive co-management of contested landscapes. *Land use policy,* 28**,** 574-584.

LINIGER, H. P., MEKDASCHI, S., 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)*.

MAKEPE, P. M. 2006. The Evolution of Institutions and Rules Governing Communal Grazing Lands in Botswana. Eastern Africa Social Science Research Review, 22, 39-61. DOI: https://doi.org/10.1353/eas.2006.0005

MOLEELE, N. M., RINGROSE, S., MATHESON, W. & VANDERPOST, C. 2002. More woody plants? The status of bush encroachment in Botswana's grazing areas. Journal of Environmental Management, 64, 3–11. DOI:10.1006/jema.2001.0486

MOUMAKWA, P. C. 2010. The Botswana Kgotla System: A mechanism for Traditional Conflict Resolution in modern Botswana. Case study of the Kanye Kgotla. Master's Thesis in Philosophy of Peace and Conflict Transformation Faculty of Humanities, Social Sciences and Education University of Tromsø.

MULALE, K., CHANDA, R., PERKINS, J. S., MAGOLE, L., SEBEGO, R. J., ATLHOPHENG, J. R., MPHINYANE, W. & REED, M. S. 2014. Formal institutions and their role in promoting sustainable land management in Boteti, Botswana. Land Degradation & Development, 25, 80-91. DOI: 10.1002/ldr.2274

NOTENBAERT, A., DAVIES, J., DE LEEUW, J., SAID, M., HERRERO, M., MANZANO, P., WAITHAKA, M., ABOUD, A. & OMONDI, S. 2012. Policies in support of pastoralism and biodiversity in the heterogeneous drylands of East Africa. Pastoralism, 2, 1-17. DOI: 10.1186/2041-7136-2-14

OBA, G. 2013. The sustainability of pastoral production in Africa. In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege, 29-36.

OSEI-TUTU, P., PREGERNIG, M. & POKORNY, B. 2015. Interactions between formal and informal institutions in community, private and state forest contexts in Ghana. *Forest Policy and Economics,* 54**,** 26-35.

OSTROM, E. 1990. Governing the commons: the evolution of Institutions for Collective Action. *Cambridge University Press, New York*.

PAHL-WOSTL, C. 2009. A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change,* 19**,** 354-365.

PERKINS, J. S. 1996. Botswana: Fencing out the equity issue. Cattleposts and cattle ranching in the Kalahari Desert. Journal of Arid Environments, 33, 503-517. DOI: https://doi.org/10.1006/jare.1996.0086

REED, M. S., STRINGER, L. C., DOUGILL, A. J., PERKINS, J. S., ATLHOPHENG, 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.

ROB 1968. Republic of Botswana, Tribal Land Act, Chapter 32:02. Government Printer, Gaborone.

ROB 1977. Republic of Botswana, Diseases of Animals. government Printer, Gaborone.

ROB 1990. Republic of Botswana, National Conservation Strategy. Government Printers, Gaborone, Botswana.

ROB 1991. Republic of Botswana, National Policy on Agricultural Development (NPAD). Government Printers, Gaborone, Botswana.

ROB 2009. National Development Plan 10 Republic of Botswana, Government Printing and Publishing Services, Gaborone.

ROGGE, K. S. & REICHARDT, K. 2016. Policy mixes for sustainability transitions: An extended concept and framework for analysis. Research Policy, 45, 132-147. DOI: http://dx.doi.org/10.1016/j.respol.2016.04.004

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. Environmental Science & Policy, 9, 302-316 DOI: http://dx.doi.org/10.1016/j.envsci.2005.11.009.

RUNHAAR, H., DIEPERINK, C. & DRIESSEN, P. 2006. Policy analysis for sustainable development. International Journal of Sustainability in Higher Education, 7, 34-56.

SB 2013. Annual Agricultural Survey Report. Statistics Botswana, Gaborone. DOI

http://dx.doi.org/10.1108/14676370610639236

SINCLAIR, A. R. E. & FRYXELL, J. M. 1985. THE SAHEL OF AFRICA - ECOLOGY OF A DISASTER. Canadian Journal of Zoology-Revue Canadienne De Zoologie, 63, 987-994.

STEVENS, C. & KENNAN, J. 2005. Botswana Beef Exports and Trade Policy Institute of Development Studies, University of Sussex, Brighton, BN1 9RE, UK

TLOU, T. 1985. A history of Ngamiland: the formation of an African State, Gaborone, Botswana, Macmillan Publishers.

UNCCD 2008. HUMAN RIGHTS AND DESERTIFICATION: Exploring the Complementarity of International Human Rights Law and the United Nations Convention to Combat Desertification, Secretariat of the United Nations Convention to Combat Desertification in cooperation with the Swiss Agency for Development and Cooperation.

UNCCD 2013. The Economics of Desertification, Land Degradation and Drought: Methodologies and Analysis for Decision-Making. Background document. UNCCD 2nd Scientific Conference. .

UNEP 2016. Unlocking the Sustainable Potential of Land Resources: Evaluation Systems, Strategies and Tools. A Report of the Working Group on Land and Soils of the International Resource Panel., Job Number: DTI/2002/PA, ISBN: 978-92-807-3578-9.

WHITE, R. 1993. Livestock development and pastoral production on communal rangeland in Botswana. *The Botswana Society, Gaborone*

WOCAT 2009. Benefits of sustainable land management. *World Overview of Conservation Approaches and Technologies, http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/CSD_Benefits_of_Sustainable_Land_Management%20.pdf*.

CHAPTER 6:

Discussion and Conclusions

6.1. INTRODUCTION

Through the four results chapters, the thesis aims to make a wide range of contributions to current knowledge which can serve to enhance our understanding of pastoral livelihoods and pastoral landscape management in Botswana and drylands more generally. In this chapter, key findings and contributions to knowledge are discussed, the linkages between the different objectives are highlighted and explained in terms of their implications for policy. In the following section (6.2), the chapter reflects on each of the objective to draw out the key findings and then discusses the extent to which the objectives have advanced our understanding of pastoralists' tenures and linkages to the broader pastoralism issues. After having reflected upon the findings of the four result chapters, section 6.3 return to the issues raised in the literature (Chapter 1), and discusses linkages between the chapters and lessons through the research process. These linkages and lessons are closely related to both methodological aspects of studying pastoralists' issues and empirical evidences to inform policies in drylands more generally. Section 6.4 discusses in detail the main cross-cutting themes arising from this research. This inform Section 6.5 which highlights the implications of the thesis findings for policy and future research needs (6.6). The chapter concludes by summing-up in terms of key messages from the thesis as a whole (6.7).

6.2. REFLECTIONS AND SUMMARY OF MAIN FINDINGS

Objective 1: Providing a synthesis of critical historical perspectives on pastoral land use and tenure transformations in Ngamiland, south of the Okavango Delta, Botswana

This objective was intended to fill the first gap in the literature (Chapter 1, section 1.2), concerning the use of historical perspectives as an important element in policy design. Few studies have had the use of historical perspectives as their point of departure in framing environmental problems in pastoral social – ecological system. Findings revealed how a range of political, socio-economic and ecological (diseases and droughts) changes have over the years dramatically shaped land use and resource access in Ngamiland. Moreover, findings demonstrate how pastoral communities were able to cope with constraints through temporary migrations and flexible resource access. One of the striking findings was that despite increasingly fragmented and fenced landscapes, the frequency and duration of livestock disease outbreaks has increased significantly, especially FMD. This happening at a time when communal management institutions and pastoral landscapes are least structured to cope with such crises. This reality shows that existing disease control practices are failing in the face of constrained livestock mobility, diminishing communal lands and human-wildlife conflicts. As the area remained politically and economically marginalised, livelihood vulnerability increased as market for livestock products is severely restricted due to livestock diseases.

The objective's major contribution was in exploring the possibilities for an alternative framing of environmental realities and problems in a socio-ecological system using historical narratives. Previously, the pastoralism discourse in drylands has portrayed pastoral landscapes as marked by a state of 'crises that can challenge and hinder environmental sustainability at the local level (chapter 1, section 1.2). Existing pastoral livelihoods have as a result been treated as a problem to overcome rather than an asset on which to build (Oba, 2013). However, such limited narratives have been critiqued and found to be insufficient in recognising and dealing with the established nature of many environmental problems as experienced in pastoral areas

in a variety of locations and circumstances (Cousins and Scoones, 2010). As demonstrated in this thesis, pastoral communities more often have very little political space to challenge such narratives because the policy environment does not provide such space (chapter 5). A more robust and better understanding of the land degradation and tragedy of the commons narratives has led to a call for a more balanced explanation of environmental problems by providing greater accountability for how scientific conclusions, especially about problems in pastoral landscapes, have evolved (e.g. Davies, 2008, Ellis and Swift, 1988). This thinking allows for more realist, pragmatic and socially relevant methodologies and explanations that consider local histories and ecological realities from the view point of both local communities (people experiencing the problem), scientists, researchers and/or development practitioners (Rennie, 1998, Ericksen et al., 2013).

Objective 2: Exploring local spatial knowledge through participatory mapping and PGIS to understand and analyse pastoralists' grazing spaces and patterns of spatial mobility

The integration of pastoralists spatial knowledge in research agendas remains limited (Chapter 1, section 1.3). A lack of spatial information on pastoralists' events and deficiencies in the data or information on which planning and management decisions were based was mostly blamed for poor performance of most rangelands policies in SSA (Chapter 1, 3 and 5). In order to fill this gap, this objective explored the possibilities of using participatory mapping and PGIS to gather information on pasture resource use and pastoralists events in drylands. These were employed to study the spatial events of pastoralists before and after the fences; temporary migrations, location and access to dry season and wet season grazing areas and land use pressure zones. Spatial comparisons revealed two distinct land use patterns (before and after the fences). Before the fences, pastoralists were involved in seasonal movements between the riparian rangelands (dry season) and sandveld rangelands (wet season). The PGIS exercise clearly revealed that after the fences,

land use overlaps became prominent resulting in pressures and conflicts in communal areas especially around water resources. Since livestock mobility is the principal means by which communities cope with risks and vulnerability within the dryland pastoral landscapes (Nori et al., 2008), the findings underscores the impact of rangeland enclosures on societal resilience to natural environmental variability and risk factors such as livestock diseases. Human – wildlife conflicts have increased as access to critical pasture and water resources is restricted.

Findings from this objective, suggest that local communities can work with researchers or development practitioners to transform their spatial knowledge into forms that can inform policy (chapter 3). Therefore, before developing policies that support sustainable pastoralism and land management, development practitioners must draw upon such evidence-based analysis to identify and separate different pastoralists' spatial events on the land, thereby developing targeted solutions. Proponents of such an approach argue that it has the possibility of increasing the visibility of the marginalised, breaking down entrenched planning structures (Bauer, 2009), thereby allowing community members to strengthen the legitimacy of their customary claims to natural resources (McCall and Minang, 2005).

Objective 3: Investigating the ways in which pastoral communities cope and adapt to constraints due to environmental and policy changes in Ngamiland, Botswana.

The proliferation of fenced enclosures around drylands is a widespread practice in SSA (e.g. Bennett et al., 2010, Rohde et al., 2006). These trends affect responses to temporal and spatial variability in pasture availability and disease outbreaks (Næss, 2013). In making decisions on whether to continue with livestock production amid these uncertainties or to pursue alternative livelihood generating activities, pastoralists are evaluating these multidimensional trade-offs and their choices ultimately shape the landscape level trends affecting the viability of a pastoral ecological system. However, as outlined in chapter 1 (section 1.4), besides adaptation

to climate variability and climate change, pastoralists adaptation to policy related impacts in these marginal environments remain poorly understood. In order to focus on these ideas of adaptive capacity and resilience, or the lack of it in pastoral socio-ecological systems, this analyses focused on the small scale variations of pastoralists' adaption and coping strategies in the different villages. In an attempt to mitigate their increased vulnerability, some households have adapted by intensifying flood recession agriculture, fishing, herd splitting and involvement in associations of self-help groups. However, higher dependency on social welfare programmes including the government's Labour Intensive Public Works Programme was noted in all the study villages. Moreover, pastoralists' adaptive capacity is challenged by multiple factors; infrastructural services, access to markets, insecure property rights and lack of political will to address pastoralist problems in marginal areas.

These findings point to the complexity of adaptation processes in drylands, above all to their small scale variations between villages and locations. Understanding such variations is a key element in adaptation planning. In SSA there is little empirical understanding of how these livelihood adaptation strategies unfold and operate at the village or household level and how they impact directly on livelihoods and pastoralism in general. As adaptation planning is expected to lower the cost of environmental and policy related impacts (Woodruff and Stults, 2016), it follows that planned adaptation should take into consideration the full range of existing adaptation practices, the opportunities and barriers at all levels (McLeman et al., 2011), including the resultant impacts associated with each strategy. Scoones (2009), argue that in order to understand or solve these complex rural development problems requires practitioners and researchers to look at the real world and try to understand things from the local perspectives.

Objective 4: Analysing current policy, institutional and governance challenges in relation to SLM and access to rangeland resources in Ngamiland pastoral landscapes

In SSA, it has been argued that structural defects in how policies are formulated, especially policies formulated through external influence with limited involvement of local level structures fail to reflect the complexity and necessary flexibility of customary tenure arrangements (e.g. Vedeld, 2014, Lengoiboni et al., 2010). This complexity is exacerbated by poor implementation and institutional frameworks that fail to balance and appreciate the need of critical pastoral areas (chapter 5). As outlined in Chapter 1 (Section, 1.4), studies of institutional frameworks and the capacity of actors to design and implement strategies that are geared towards the sustainability of pastoral landscapes are limited. To address this gap, this analysis put the spotlight on policy processes, policy content, institutions and collaborations between organisational structures for SLM in pastoral landscapes. One of the most important finding was that of a fragmented and disjointed institutional framework (Chapter 5, section 5.3.4). A lack of appropriate land use planning and cross-sectoral collaboration between actors and stakeholders further escalate problems of rangeland resource mismanagement and conflicts especially where policies are formulated and implemented along sectorial lines with little regard to other actors' interests.

As noted in chapter 5 (section, 5.3.2), local communities were particularly wary of a failure by decision makers to communicate with affected pastoral communities before a major decision is taken. Land use conflicts including those between traditional pastoral land rights, human-wildlife conflicts, livestock predation and crop losses were attributed to conflicts in policies and priorities of actors. Demarcation of ranches and the provision of veterinary cordon disease control fencing were said to have exacerbated conflicts, particularly when the fence lines have bisected key pastureland, wildlife habitats and movements, rather than strengthening existing land uses (chapter 3, section 3.3.2). These conflicts manifest themselves in encroachment of land uses such as settlements into arable land, arable into communal grazing lands, commercial ranching into communal grazing lands and grazing into wildlife areas (chapter 3, section 3.3.4). Land use competition is a

problem in that where market forces are left to prevail, essential land uses, perhaps with lower economic rents, run the risk of being out-competed and relegated to less suitable areas. Expansion of competing land-uses has reduced the net availability of rangeland resources. Wildlife conflicts, especially elephants related conflicts, were viewed as a permanent threat to pastoralism as they compete for available water resources, and also destroy veterinary fences that separate livestock from wildlife. As discussed in chapter 2 and 3 the blockage of wildlife migratory corridors by barrier fences was blamed for elephant threats as fences were said to have bisected traditional wildlife migratory corridors thus diverting elephants into communal areas. Like in other pastoral areas (e.g. Okello, 2005) the concern for pastoralists was that while wild animals are protected by national and international laws and enjoy long-term security in wildlife management areas, game farms, national parks and game reserves, pastoralists do not enjoy such security.

The new pastoral environment where complex sectorial based institutions are used to manage livestock and land resources is such that pastoralists have relinquished control of the management of communal areas. They do not regard themselves as responsible, which in turn has created a liability gap in communal resource management and fight against livestock diseases. Pastoralists blamed government departments for problems in communal areas.

Policies and land management strategies are needed to tackle the interconnected dryland challenges of land and water resource degradation, human wildlife conflicts, biodiversity loss, climate change, population growth and local communities' adaptations. The literature demonstrates that there are several strategies designed to improve livelihoods and land management in drylands (e.g. Akhtar-Schuster et al., 2017, Schwilch et al., 2012, Enfors and Gordon, 2008). However, these strategies are not always successful due to numerous institutional and policy barriers preventing their adoption at the local scale (Antwi-Agyei et al., 2015, Akhtar-Schuster et al., 2011). The analysis under this objective demonstrated how governance structures and pastoralists interact and how policies and legal instruments affect the processes,

measures, and conditions for facilitating SLM in pastoral landscapes. Much less research has explicitly considered these issues at both the national or local scales. The chapter argued that, a lack of integrated planning, coordination, and cooperation between the many actors with responsibilities for the management of the same rangeland including fragmented policy framework hampers prospects for SLM in semi-arid drylands such as Botswana. In order to realise benefits of SLM (increases in primary productivity of rangelands), requires an ability to overcome policy and institutional fragmentation and ability to develop locally-appropriate, flexible and tailored solutions.

6.3. LINKAGES BETWEEN THE CHAPTERS

The expansion in privatised ranches and veterinary fences raises both socio-economic and environmental concerns (chapter 2 and 3). This thesis employed a multiplicity of methods to investigate both the spatial changes and socio-economic challenges in parallel. It was hoped that such an approach would yield insights additional to that which would have emerged from investigating these issues in isolation. In seeking to understand the impact of privatisation and subdivisions of communal lands on pastoralists wellbeing, the thesis developed a detailed understanding of landscape and pastoral management changes (Chapter 2 and 3), which then provided justification for investigating pastoralists adaptations and institutional challenges in pastoral landscape management (Chapter 4 and 5). By preceding the spatial impact assessment with a detailed account of local histories of major landscape changes, this thesis benefited in several ways; the detailed historical perspectives and local knowledge in relation to land use and livelihoods enabled a more targeted spatial assessment, with participatory mapping exercises focused on issues raised through historical perspectives. This methodological approach proved that the enquiry can yield substantial insights into the policy impacts.

It is hoped that by exploring historical perspectives and local spatial knowledge, this thesis gained a more socially-relevant interpretation of landscape changes and socio-economic impacts than that which may have emerged if these issues were investigated in isolation. It emerged from both objective 1 and 2 (chapter 2 and 3) that in land use planning, a more accurate account of land use and environmental dynamics could be gained by exploring local spatial knowledge and historical perspectives as a starting point. Using modern scientific methods, researchers and planners could then extend local observations to wider areas for SLM. The only limitations observed was that the process of exploring and situating such local environmental perspectives within different communities and comparing knowledge can be time consuming. Despite this challenge, this knowledge proved essential in complementing, supporting and even enhancing scientific understanding emerging from the field data and the literature more generally.

Beyond the direct benefits related to the methodological approach, the study revealed several interesting additional empirical insights into the pastoralism, land tenure and policy discourse. This research has demonstrated the importance of rangeland enclosures as a mechanism, structuring and determining patterns of resources access and influencing the intensification of land use in Botswana's communal lands. Further analysis of land use in communal areas revealed that land use pressures and conflicts have begun to intensify in communal areas and between the ranchers and pastoralists over the increasingly scarce resources. Such pressures and conflicts are likely to increase if access to pasture and water remains restricted and if the FMD epidemic is not effectively controlled.

It emerged from this study that, both TGLP and NPAD represent policies whose poor results could be attributed to structural defects that characterised their formulation and implementation. After more than three decades the TGLP has not yet realised its objectives especially of reducing pressure on communal grazing land or promoting equality and incomes in the rural areas (e.g. Magole, 2009, White, 1993, Tsimako, 1991). Some studies have argued that the policy has reduced both environmental

and societal resilience to environmental variability (e.g. Thomas et al., 2000). The idea that they were ample empty land that could be reserved for future use was misleading (chapter 2 and 3). During the planning phase of TGLP, potential conflicts in accessibility to grazing resources between ranch owners and communal land dwellers were identified and a regulation was imposed to protect villages with a 20-km buffer zone within which no ranch would be allocated. This was done to prevent the ranches from encroaching into the village grazing areas so as to reduce land use pressure and conflicts areas around villages by allowing some space for village grazing, settlements expansion and arable farming (RoB, 1975). This was further reiterated by the NPAD and subsequent feasibility studies which stated that in order to safeguard the interest of the poor households, the village grazing area should cover a radius of 20 km (RoB, 1991). However, with an emphasis on rangeland enclosures and commercialisation and without the use of a proper spatial technique to monitor the expansion of the demarcation of ranches the buffer zone was difficult to enforce as some ranches are now less than 10 km from the villages (chapter 3).

In view of the issues discussed in chapter 2 and 3, chapter 4 expand on these issues by examining pastoralists' adaptation processes. Further, the chapter reveals that in light of the increased vulnerability, pastoralists have started forming lobbying institutions. In order to support pastoralists in these initiatives, this thesis recommend that both pastoral communities and stakeholders: development agents, service providers and policy makers enter into a regularised process of negotiation and learning that builds on local conditions, indigenous knowledge and pastoralists organisational structures. Such an arrangement will help facilitate a continuous learning process and implementation of new knowledge and initiatives. Involving communities in such joint learning structures can enhance their adaptive capacity to changing environmental and policy conditions (Thi Hong Phuong et al., 2017, Armitage et al., 2008). Diversification of livelihoods activities is a typical adaptation strategy described in many rural development research and studies (e.g. Berhanu et al., 2007). For pastoral livelihoods, policies and strategies that are informed by

evidence about the ways in which socio-ecological systems respond and adjust to change seems necessary. The challenge for development practitioners is to specify clearly the goals of adaptation (adaptation for what purpose?) in order to move policy away from generalisation and to focus on particular issues, locations, communities and groups at risk. In doing so, understanding more clearly the values that communities' hold that are likely to be associated with decisions about adaptation is necessary. Such a process can help identify possibilities of maladaptation, and therefore highlights the consequences that may arise from certain adaptation strategies. Programmes can therefore outline initiatives that are aimed at enhancing strategies that positively impact on livelihoods and the ecological systems.

Building on the findings from chapter 2 to chapter 4, chapter 5 provided an illustrative scenario of pastoral and natural resource management institutional and organisational structures in the district. A stakeholder feedback workshop was held in Maun, Botswana on the 29th of November 2017. One of the important recommendation from this workshop was the need for collaborative approaches that underscores the importance of district coordinated and multi-scale approach in addressing pastoralists' issues and SLM upscaling. While such a structure existed in the form of DLUPU (chapter 5), participants were of the view that the committee is not backed by any legislative instruments and does not involve village level structures, hence it fails to provide an effective oversight of complex planning and pastoralism issues in the district. Workshop participants further emphasised the importance of evidence based research to help support and convince policy makers to invest and re-direct policy towards sustainable pastoralism and land management options in drylands.

6.4. CROSS-CUTTING THEMES

6.4.1. Landscape fragmentation (reduced livestock mobility)

Rangelands in sub-Saharan Africa are held as common pastures and managed through common property regimes (Bollig and Lesorogol, 2016, Wairore et al., 2015). It is against this background that much of sub-Saharan African common pastures have served as a prominent basis for the studies and arguments of the 'The tragedy of the commons'. This thesis has demonstrated that the erosion of pastoral livelihoods as a result of privatisation of common pastures, conservation policies, massive landscape fragmentation and the constriction in livestock mobility has continued to accelerate with significant social and ecological implications. Firstly, the confusion surrounding pastoralism, customary management regimes and the ecological dynamic of rangelands led to poor policies with poor understanding of pastoral herd management strategies. A number of interrelated trends have been observed that have implications for both grazing management and livelihoods; livestock diseases, land use pressures and conflicts, human-wildlife conflicts, uneven distribution of livestock leading to greater year round presence of livestock around water resources and village grazing areas, overgrazing and land degradation.

Since the 1990s, a new pastoral development paradigm of non-equilibrium dynamics has emerged based on the appreciation of livestock mobility, opportunistic stocking strategies and the abilities of pastoral communities to self-organise to manage common pastures in drylands through common property regimes (Turner et al., 2014, Turner, 2011). From this, researchers and scholars have encouraged recognition of pastoralism as a sustainable livelihood strategy and the creation of community based land management in drylands (Reed et al., 2007, Reynolds et al., 2007). However, despite this appreciation and emphasis on livestock mobility, many SSA pastoral systems continue to be fragmented. In other areas, pastoral lands have been alienated to become state property from which pastoralists are excluded. Others have been converted to open access situations whereby access and use is unregulated resulting in negative ecological and social consequences..

6.4.2. Unanticipated consequences of grazing policies

In SSA, many land reform policies failed to achieve expected outcomes; increases in agricultural investment, poverty reduction, combating land degradation, among others (Manji, 2001, Peters, 2009). Assumptions about land availability led to loss of drought grazing, relocation of people, pervasive competition and conflicts over land, exclusion of the poor and deepening social divisions and class formation (Peters, 2004). These policies ignored overlapping and multiple rights and uses of land and in the process reinforced patterns of unequal and privileged access to land (German et al., 2013). Many of the challenges arose from practical issues concerning the execution and effective implementation of policies (Rohde et al., 2006). In Botswana, the implementation of both TGLP and NPAD was characterised by a number of problems. Some of these problems had been predicted by local communities and some researchers during the consultation campaign (Childers, 1981). The TGLP zoning process revealed that many parts of the country that had been assumed to be unutilised actually contained a substantial number of people. Many such 'unused' lands were actually rangelands that were critically important to pastoralists for managing routine drought cycles. When zoning was done, it was felt in most districts that there was too little land available to permit reserved areas to be set aside, so the reserved category as described in chapter 1, section was dropped. The establishment of commercial ranches became the major focus of attention in spite of the TGLP White Paper's (RoB, 1975) emphasis on ensuring 'safeguards for the future generation and poor members of the population'. A problem arose when it was found that many of the people residing in areas considered potential commercial zones were non stock holders, some of whom were mobile hunter gatherers (the *Basarwa*) (chapter 2). No provision had been made in the TGLP for people who lacked livestock and water rights. It was found during the course of the drylands surveys that the consultation campaign did not reach these people who were most likely to be affected (Childers, 1981); a case in particular here is the *Basarwa* community around

the Kgwebe hills in Ngamiland Hainaveld who were later relocated to Somelo (a Remote Area Dwellers' settlement) because they had been enclosed by TGLP ranches (Chapter 2). The problem of implementation of policies spill over into the problem of extension work at district and village level such that extension workers struggle to implement policies that were designed without grassroots involvement.

Elsewhere in SSA, the group ranch subdivisions in Kenya is said to have benefited elites and outside investors, undermining the traditional livelihoods of poor Maasai pastoralists who were left landless and impoverished (Galaty, 2013). While the formalisation and privatisation of the commonage under the Transformation of Certain Rural Areas Act of 1998 (TRANCRAA) in South Africa's rural Namaqualand has increased tenure security for individual plot holders, in respect to de Soto's hypothesised benefits of formalisation and privatisation, tenure security for users of the commons, especially pastoralists, has decreased (Wisborg and Rohde, 2005). Formalisation has led to privatisation, increased fencing, reduced communal rangelands and closed corridors so undermining local grazing patterns (Benjaminsen and Sjaastad, 2008).

6.4.3. Disempowerment of traditional institutions.

Following years of land tenure transformation in SSA, decentralisation of land management decisions and the emergence of new institutions and actors, the ability of rural communities to manage commonly held resources such as common pastures or shared water resources have significantly declined. While decentralisation was often described as of utmost importance in the management of CPR, in SSA decentralisation has created various new institutions in the field of CPR management which have effectively led to the demise of customary management regimes through alienation of land to private and state sectors (Alden Wily, 2012). This in turn has

undermined the management of the commons. In Botswana, the disempowerment of chiefs and indigenous institutions left a power vacuum in the management of common pastures. Despite being community leaders, traditional management institutions are not adequately included in CPR management except for in CBNRM programmes. This has led to the collapse of customary institutions; common pasture resources have been opened up to overexploitation as they have become open access. Resources boundaries have been dismantled. Today pressure on natural resources have increased significantly. Rules and regulations can no longer be enforced due the absence of clear boundaries and weak customary institutions.

Institutions are shaped by power relations and politics (Adger et al., 2005). These relations and power dynamics determine how resource related benefits and responsibilities are shared (Raik et al., 2008). Changing institutional arrangements in pastoral areas means norms, values, power and power relations are reshuffled (Jandreau and Berkes, 2016, Coleman and Mwangi, 2015). Where issues of poverty reduction and equity are of primary concern, the question of whose views are articulated in an institutional regimes is crucial (Ojha et al., 2016, Cullen et al., 2014). In SSA, current formal institutional arrangements are designed in a top down manner and do not account for social structures, heterogeneity in pastoral landscapes and diversity of traditional institutions in the management of CPRs (Mulale et al., 2014). Less powerful stakeholders are often marginalised leading to their vulnerability.

6.4.4. Pastoralists response to institutional change around pasture CPRs

In Ngamiland study area, the majority of the households were pastoralists and their livelihood was highly dependent on livestock production. This has begun to shift gradually as agro-pastoralism has expanded. This research has shown that land shortages, climate change and fluctuations in resource availability has increasingly

resulted in substantial intra-village livestock movement and the adoption of risk minimizing strategies such as the intensification of flood recession agriculture and grazing in arable lands. Current challenges in the area can therefore be described in terms of land scarcity, the loss of key grazing resources, the need to seek for alternative sources of food, increased resource competition and pressure of cultivation around seasonal flooded areas. The expansion and intensification of land use means watercourses and lakes will continue to suffer altered flows and elevated load of sediments and other pollutants detrimental to the freshwater ecosystem. While diversification is often promoted as a strategy for mitigating risks to livelihoods, and as a way of adapting to changes such as climate change, there may be consequences for doing so, such as reducing water availability, pollution and over exploitation of other resources (e.g. in fisheries).

Similar to Ngamiland, the majority of Tanzanian pastoralists in communities around water bodies are also involved in some form of fisheries (Kihila, 2017). Whether such strategies are sustainable depend to a large extent on whether the strategy can improve the capacities of the communities in terms of livelihoods sustenance and environmental sustainability (Valdivia and Barbieri, 2014). These invariably depend on the availability of effective administrative tools within a community (Scoones, 2009). In Ngamiland, there was no evidence to the effect that fishing in Lake Ngami can provide such capacities because of the land use conflicts and other environmental related concerns around the lake (chapter 4, section 4.3.2.2). Though fishing has the potential to improve the socio-economic capacities of the communities around the lake, effective administrative tools were lacking. Thus policy frameworks with clear direction for action towards building adaptive capacity and socio-ecological sustainability are required. Strategies can improve livelihoods or the landscape provided the underlying barriers to adaptations are overcome (Kihila, 2017). Availability of infrastructure for example, especially access to water sources, accessible road networks, pasture land and access to markets could enhance

livestock productivity and transform pastoralists livelihoods by creating different economic opportunities (Ambelu et al., 2017).

Across SSA, research has shown that pastoralists' livelihood diversification is coupled to fragmentation of rangelands as arable agriculture, veterinary fences and wildlife conservation areas expands into grazing lands and multiple actors compete for land (Goldman and Riosmena, 2013, Hobbs et al., 2008). These changes reflect transformations occurring across pastoral rangelands, and pose the broader challenge of reconciling pastoralism adaptations with conservation and sustainable development objectives (Goldman and Riosmena, 2013). In realisation that their control over grazing lands and pastoral livelihoods have been lost, pastoral communities have started forming associations (Kamara et al., 2004). The main objectives being to regain control over grazing lands, negotiate conflicting claims with the formal administration and sales of livestock products. In Ethiopia, Borana pastoralists have developed adaptive management strategies to the new environmental and economic situations by integrating foreign concepts of crop cultivation and exclusive grazing rights into indigenous systems of control (Homann et al., 2008). This efforts indicate the potential of pastoralists local strategies and institutions to self-organise.

6.5. INSTITUTIONAL AND POLICY IMPLICATIONS

Effective common pasture and livestock management requires coordinated effort that pays particular attention to the roles of village level institutions and the processes of collaborative co-management. Elected members of farmers' associations and farmers committees need substantial decision making power over livestock and land management supported by both government officials and external actors. In Botswana, this can be realised if the Tribal land Act and the relevant legislative frameworks are amended to show the specific roles of these associations,

traditional village institutions and the role of DLUPU as a collaborative environmental governance organisation.

By devolving decision making to the most appropriate levels and scale through an integrated structure such as DLUPU, which is closer to the ground, rules can be applied in an adaptive way such that resource users and authorities can obtain rapid feedback on their strategies and policies and adapt them accordingly. Such an approach will require that the process of policy making is decentralised so that DLUPU is given more power to design and implement policies**.** As management of CPRs is characterised by challenges, institutional regimes that are tailored specifically to the local context are more likely to succeed (Agrawal, 2014, Araral, 2014). Such institutional arrangements can better tackle problems of overgrazing and rangeland degradation, livestock diseases and containment, they can foresee and prevent land use conflicts. The role and recognition of indigenous knowledge and traditional pastoral management regimes have received much attention in the literature (e.g. Tamou et al., 2018), as such, frameworks for strengthening the inclusion of pastoralists indigenous knowledge in policy are gaining widespread attention (e.g. Bonfoh et al., 2016). This thesis strongly advocates for institutional arrangements that strive for full stakeholder awareness and inclusion in decision making. Such institutions can contribute meaningfully to credible accepted rules that identify and assign responsibilities appropriately (Renn and Schweizer, 2009). The process of adaptive co-management understands that predicting the outcomes of institutional change is not always possible (Vatn, 2015), hence management interventions are always to some degree experimental as demonstrated under section 6.4.2 whereby policies are characterised by many unintended consequences. By acknowledging this reality stakeholders can learn how to improve and adapt the design of institutions to the specific local context. Continuous assessment of the current situation, monitoring and dialogue between DLUPU and stakeholders should bring together scientific information and indigenous knowledge to allow for a comprehensive understanding of the pastoral landscape.

This thesis has demonstrated that there is little evidence of effective mechanisms to guide the integration of indigenous knowledge, local land use practices and customs into policy. Chapter 3 demonstrates that not only were local knowledge and practices absent from tenure transformation policies, but the policy guidelines were often misleading as they did not reflect the actual reality of land users. Both the misunderstanding of customary land rights and pastoralists land use patterns, including the absence of clear rights over grazing, has worsened land degradation in the context of widespread privatisation of rangelands in SSA (Bedunah and Angerer, 2012, Reenberg, 2012). This thesis argues for policies that integrate local spatial knowledge (clear understanding of spatial patterns of traditional land tenure types that underpin land use activities under customary property regimes) in policy to better articulate and understand pastoral land-use. Participatory mapping and geographic information systems (GIS) can be used as part of integrated assessments to develop sustainable pastoral land management policy toolkits and to inform land tenure and management decision making for sustainable land management.

The challenge facing Botswana's rangeland policy and other SSA countries is to provide an empirically sound basis for formulating policies and strategies that ensures sustainable pastoral livelihoods while balancing the needs of other critical land uses. One of the challenges identified in chapter 3 was that of dual grazing rights. Effective range management strategies will have to be put in place to discourage this practice. Efforts therefore need to be directed at putting in place programmes to identify and define dual grazing rights, where it exist and why, and appropriate institutions to manage such problems. Similarly, as recommended in chapter 2, considerations should be given to establishing community managed game farming around the periphery of the Delta along the southern Buffalo fence. This would form a protective buffer against FMD while generating income opportunities for pastoral communities. Pilot studies may be needed to assess how policies and legislative instruments' can include this provision as well as being flexible enough to allow for improvement or adjustment when needed.

As discussed in chapter 4, implementing pro-pastoralism policies may require the provision of infrastructure to support pastoralist's adaptations and fight against livestock diseases. These include road networks, facilities for communication between the relevant stakeholders and accessible veterinary services. Moreover, policies for rangeland enclosures need to consider both wildlife migratory and livestock corridors. As discussed in chapter 5, a multi-scale mapping of rangelands, wildlife habitats and pastoralists grazing patterns is necessary before erecting any fence on the communal land.

Policymakers and government land managers need to reorient their relationship with pastoralists so as to overcome anti-pastoral prejudice. There is a need to focus on SLM goals (providing environmental, economic, and social opportunities, while maintaining and enhancing the quality of the land) in communal areas by establishing participatory negotiating and flexible frameworks that strengthen local communities' participation in decision-making arenas. This entails working with pastoral communities on the basis of understanding their livelihood system. There is also a need for an appropriate communication programme in pastoral areas where key stakeholders including those that represent pastoralists will share information about pastoral system functionality including mutual understanding of strategic choices for conservation and sustainable use.

Despite the participatory planning rhetoric, chapter 5 demonstrated that land use planning and policy making is still being carried out in a top-down, technocratic and one-size-fits all manner. Likewise facts that may influence the success and implementation of a policy, such as local environmental dynamics, dynamics of local users, their perceptions, trust, and access to information, interests and priorities are rarely taken into consideration. This therefore means that policies fail to differentiate and integrate variations in socio-economic and ecological conditions among different dryland pastoral landscapes. This study therefore emphasises local negotiated policies and programmes that deal directly with and appreciate heterogeneity in

pastoral landscapes, social and cultural conditions so as to develop policies that are tailored to the needs of a particular pastoral system.

6.6. FURTHER AREAS OF RESEARCH

This thesis has provided evidence for and a discussion of the impacts of structural land use changes and rangeland enclosures on a pastoral socio-ecological system. It is clear that policy provisions need to be made for pastoralists to be granted their communal access rights to pasture and water resources (chapter 1, 2, 3, 4 and 5). Their grazing space and rights need to be incorporated into land use plans and protected from expropriation through statutory systems (chapter 3). Moreover local communities' adaptive capacities need to be strengthened on all fronts (chapter 4). To do this, a number of questions need to be investigated in future research:

- How can problems caused by neglect of pastoralists grazing patterns during the land tenure transformation processes be corrected? Land reform debates remain pivotal in SSA (e.g. Moyo, 2011, Cousins, 2013). While there is increased acknowledgments of the importance of customary and communal land rights in the literature (e.g.Simbizi et al., 2014), there is also an increasing failure by most governments to comprehensively pursue land reform measures that ensures and maintains pastoralists access to land (chapter 1, 2 and 3). Against this background, pastoralism research should focus on strategies that are needed for pastoralists to be granted their access to seasonal grazing areas or legal provisions that need to be in place to guard against further expropriation of the remaining communal lands.
- What criteria must be met in development strategies to link conservation of wildlife and rangelands at the local scale in a way that will reduce human wildlife conflicts? Rangelands are currently undergoing irreversible changes caused by policies. Throughout the research, respondents blamed human wildlife conflicts and increased landscape fragmentations on increased

incidences of livestock diseases. More research is needed on ways of achieving effective integration of wildlife and livestock management so that the cost of competition, predation and diseases can be offset.

- What policy frameworks are required to help build resilience among pastoral communities faced with recurrent hazards like livestock diseases? Livestock disease were a major theme throughout this thesis. More research is needed to explore how policies and development strategies can help pastoral societies become more resilient and robust to growing uncertainties' as a result of livestock diseases.

Specifically focusing on Ngamiland study area, the following issues need to be investigated in future research:

- The extent and magnitude of land degradation between the lake and the ranches protection buffer fence. This is particularly important given land use pressures and the concentration of livestock activities around Lake Ngami as discussed in chapter 3.
- In Ngamiland pastoral areas, both short term coping strategies and longer term adaptation strategies were critical. What remains unclear is how current institutional frameworks can be transformed to help influence the transformation of some coping strategies to longer term adaptation strategies.
- In chapter 4, one of the main findings was that informal associations of social network groups are increasingly becoming important in shaping and mediating local coping and adaptation practices. Further studies are needed to examine the organisational features of these groups and their multi-scale connections with a view of enhancing their innovation, patterns of communication and sustainability.
- One of the livelihood diversification strategies mentioned by riparian villages was fishing in Lake Ngami. In order to help better inform development and conservation planning process, they is need for a detailed study on fishing in

the lake; on how important it is for livelihoods and resilience, and how sustainable it is. This also includes the need to develop a more robust fisheries programme, targeting the poor and marginalised.

6.7. CONCLUDING REMARKS

Protecting pastoral land rights and pastoral transhumance corridors requires deliberate policy interventions that recognise pastoralism as a productive and efficient use of resources. Land use planning should therefore support and provide for economic mobility of pastoralists. This thesis provided critical lessons on pastoralism issues in SSA drylands:

1. The need for adopting genuine participatory techniques for studying pastoralists' livelihoods and issues in drylands.
2. The interplay between pastoralists' interests, communal land management and larger national economic and conservation goals.
3. The importance of local context, local spatial knowledge, socio-cultural and environmental dynamics of rangelands in research, policy and land use planning.
4. That the loss of critical common property management regimes has impacted on pastoralists adaptations and coping mechanisms
5. That actors' priorities, conflicting interests and inadequate resources to support implementation of policies hampers prospects for SLM, and
6. The importance of local level structures and multi-sectorial collaboration in policy design and land use planning.

Moreover, this study contributes to the land tenure discourse by providing robust empirical evidence to deepen our understanding of the challenges of land tenure transformation on pastoralism in SSA. In SSA, the ongoing tenure transformation coupled with the impacts of changing climate means that many pastoral livelihoods are uncertain. While pastoral households are adopting some mixed strategies:

keeping one foot in pastoralism while exploiting other avenues of livelihoods, there are many constraints affecting pastoralists' adaptations in pastoral areas. These include remoteness, continuous livestock disease outbreaks, land use conflicts, tenure insecurity, poor infrastructural services and policies/institutional frameworks that undermine or even fail to understand innovative pastoral responses to change. The challenge for governments and development agencies is to develop and implement policies that protect pastoralists' access to key water and grazing resources and support pastoralists adaptations, even while investing in other activities like conservation and arable agriculture. This thesis support and expand on the African Union Policy Framework for Pastoralism (AU, 2010), that call for the involvement of pastoral communities and their local level institutions in policy making and implementation for greater SLM goals.

6.8. REFERENCES

ADGER, W. N., BROWN, K. & TOMPKINS, E. L. 2005. The political economy of cross-scale networks in resource co-management. *Ecology and society,* 10.

AGRAWAL, A. 2014. Studying the commons, governing common-pool resource outcomes: Some concluding thoughts. *Environmental Science & Policy,* 36**,** 86-91.

AKHTAR-SCHUSTER, M., STRINGER, L. C., ERLEWEIN, A., METTERNICHT, G., MINELLI, S., SAFRIEL, U. & SOMMER, S. 2017. Unpacking the concept of land degradation neutrality and addressing its operation through the Rio Conventions. Journal of environmental management, 195, 4-15.

AKHTAR-SCHUSTER, M., THOMAS, R. J., STRINGER, L. C., CHASEK, P. & SEELY, M. 2011. Improving the enabling environment to combat land degradation: Institutional, financial, legal and science-policy challenges and solutions. Land Degradation & Development, 22, 299-312.

ALDEN WILY, L. 2012. Looking back to see forward: the legal niceties of land theft in land rushes. *The Journal of Peasant Studies,* 39**,** 751-775.

AMBELU, A., BIRHANU, Z., TESFAYE, A., BERHANU, N., MUHUMUZA, C., KASSAHUN, W., DABA, T. & WOLDEMICHAEL, K. 2017. Intervention pathways towards improving the resilience of pastoralists: A study from Borana communities, southern Ethiopia. Weather and Climate Extremes, 17, 7-16.

ANTWI-AGYEI, P., DOUGILL, A. J. & STRINGER, L. C. 2015. Barriers to climate change adaptation: evidence from northeast Ghana in the context of a systematic literature review. Climate and Development, 7, 297-309.

ARARAL, E. 2014. Ostrom, Hardin and the commons: A critical appreciation and a revisionist view. *Environmental Science & Policy,* 36**,** 11-23.

ARMITAGE, D., MARSCHKE, M. & PLUMMER, R. 2008. Adaptive co-management and the paradox of learning. Global environmental change, 18, 86-98.

AU 2010. Policy Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities. African Union, Department of Rural Economy and Agriculture, Addis Ababa, Ethiopia.

BAUER, K. 2009. On the politics and the possibilities of participatory mapping and GIS: using spatial technologies to study common property and land use change among pastoralists in Central Tibet. Cultural Geographies, 16, 229-252.

BEDUNAH, D. J. & ANGERER, J. P. 2012. Rangeland degradation, poverty, and conflict: how can rangeland scientists contribute to effective responses and solutions? Rangeland Ecology & Management, 65, 606-612.

BENJAMINSEN, T. A. & SJAASTAD, E. 2008. Where to draw the line: Mapping of land rights in a South African commons. Political Geography, 27, 263-279.

BENNETT, J., AINSLIE, A. & DAVIS, J. 2010. Fenced in: Common property struggles in the management of communal rangelands in central Eastern Cape Province, South Africa. Land Use Policy, 27, 340-350.

BERHANU, W., COLMAN, D. & FAYISSA, B. 2007. Diversification and livelihood sustainability in a semi-arid environment: A case study from southern Ethiopia. The Journal of Development Studies, 43, 871-889.

BOLLIG, M. & LESOROGOL, C. 2016. The “new pastoral commons” of Eastern and Southern Africa. *International Journal of the Commons,* 10.

BONFOH, B., FOKOU, G., CRUMP, L., ZINSSTAG, J. & SCHELLING, E. 2016. Institutional development and policy frameworks for pastoralism: from local to regional perspectives. The future of pastoralism (J. Zinsstag, E. Schelling & B. Bonfoh, eds). Rev. Sci. Tech. Off. Int. Epiz, 35, 499-509.

CHILDERS, G. W. 1981. Western Ngwaketse Remote Area Dwellers: A Land Use and Development Plan for Remote Area Settlements in Southern Botswana. *Government Printers, Botswana*.

COLEMAN, E. A. & MWANGI, E. 2015. Conflict, Cooperation, and Institutional Change on the Commons. *American Journal of Political Science,* 59**,** 855-865.

COUSINS, B. 2013. Smallholder irrigation schemes, agrarian reform and 'accumulation from above and from below'in South Africa. Journal of Agrarian Change, 13, 116-139.

COUSINS, B. & SCOONES, I. 2010. Contested paradigms of 'viability' in redistributive land reform: perspectives from southern Africa. Journal of Peasant Studies, 37, 31-66.

CULLEN, B., TUCKER, J., SNYDER, K., LEMA, Z. & DUNCAN, A. 2014. An analysis of power dynamics within innovation platforms for natural resource management. *Innovation and Development,* 4**,** 259-275.

DAVIES, J. 2008. Turning the tide: Enabling sustainable development for Africa's mobile pastoralists. Natural Resources Forum, 32, 175-184.

ELLIS, J. E. & SWIFT, D. M. 1988. Stability of African pastoral ecosystems: Alternate paradigms and implications for development. Journal of Range Management, 41.

ENFORS, E. I. & GORDON, L. J. 2008. Dealing with drought: The challenge of using water system technologies to break dryland poverty traps. Global Environmental Change, 18, 607-616.

ERICKSEN, P., DE LEEUW, J., THORNTON, P., SAID, M., HERRERO, M. & NOTENBAERT, A. 2013. Climate change in sub-Saharan Africa. Pastoralism and development in Africa: Dynamic change at the margins, 71.

GALATY, J. G. 2013. Land grabbing in the Eastern African rangelands. In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege, 143 - 153.

GERMAN, L., SCHONEVELD, G. & MWANGI, E. 2013. Contemporary processes of large-scale land acquisition in Sub-Saharan Africa: legal deficiency or elite capture of the rule of law? *World Development,* 48**,** 1-18.

GOLDMAN, M. J. & RIOSMENA, F. 2013. Adaptive capacity in Tanzanian Maasailand: Changing strategies to cope with drought in fragmented landscapes. *Global Environmental Change,* 23**,** 588-597.

HOBBS, N. T., GALVIN, K. A., STOKES, C. J., LACKETT, J. M., ASH, A. J., BOONE, R. B., REID, R. S. & THORNTON, P. K. 2008. Fragmentation of rangelands: Implications for humans, animals, and landscapes. *Global Environmental Change-Human and Policy Dimensions,* 18**,** 776-785.

HOMANN, S., RISCHKOWSKY, B., STEINBACH, J., KIRK, M. & MATHIAS, E. 2008. Towards endogenous livestock development: Borana pastoralists' responses to environmental and institutional changes. Human Ecology, 36, 503

JANDREAU, C. & BERKES, F. 2016. Continuity and change within the social-ecological and political landscape of the Maasai Mara, Kenya. *Pastoralism,* 6**,** 1.

KAMARA, A. B., SWALLOW, B. & KIRK, M. 2004. Policies, interventions and institutional change in pastoral resource management in Borana, Southern Ethiopia. Development Policy Review, 22, 381-403.

KIHILA, J. M. 2017. Indigenous coping and adaptation strategies to climate change of local communities in Tanzania: a review. Climate and Development, 1-11.

LAURANCE, W. F., SAYER, J. & CASSMAN, K. G. 2014. Agricultural expansion and its impacts on tropical nature. *Trends in ecology & evolution,* 29**,** 107-116.

LENGOIBONI, M., BREGT, A. K. & VAN DER MOLEN, P. 2010. Pastoralism within land administration in Kenya-The missing link. Land Use Policy, 27, 579-588.

MANJI, A. 2001. Land reform in the shadow of the state: the implementation of new land laws in Sub-Saharan Africa. Third World Quarterly, 22, 327-342.

MAGOLE, L. 2009. The 'shrinking commons' in the Lake Ngami grasslands, Botswana: the impact of national rangeland policy. Development Southern Africa, 26, 611-626.

MCCALL, M. K. & MINANG, P. A. 2005. Assessing participatory GIS for community-based natural resource management: claiming community forests in Cameroon. The Geographical Journal, 171, 340-356.

MCLEMAN, R. A., BRKLACICH, M., WOODROW, M., VODDEN, K., GALLAUGHER, P. & SANDER-REGIER, R. 2011. Opportunities and Barriers for Adaptation and Local Adaptation Planning in Canadian Rural and Resource-Based Communities. In: FORD, J. D. & BERRANG-FORD, L. (eds.) Climate Change Adaptation in Developed Nations: From Theory to Practice. Dordrecht: Springer Netherlands.

MOYO, S. 2011. Three decades of agrarian reform in Zimbabwe. Journal of Peasant Studies, 38, 493-531.

MULALE, K., CHANDA, R., PERKINS, J. S., MAGOLE, L., SEBEGO, R. J., ATLHOPHENG, J. R., MPHINYANE, W. & REED, M. S. 2014. Formal institutions and their role in promoting sustainable land management in Boteti, Botswana. *Land Degradation & Development,* 25**,** 80-91.

NÆSS, M. W. 2013. Climate change, risk management and the end of Nomadic pastoralism. International Journal of Sustainable Development & World Ecology, 20, 123-133.

OBA, G. 2013. The sustainability of pastoral production in Africa. In: Catley, A., Lind., J., and Scoones, I. (Eds). Pastoralism and Development in Africa: Dynamic Change at the Margins, Pathways to sustainability, Routlege, 29-36.

OKELLO, M. M. 2005. Land use changes and human–wildlife conflicts in the Amboseli Area, Kenya. Human Dimensions of Wildlife, 10, 19-28.

OJHA, H. R., FORD, R., KEENAN, R. J., RACE, D., VEGA, D. C., BARAL, H. & SAPKOTA, P. 2016. Delocalizing communities: changing forms of community engagement in natural resources governance. World Development, 87, 274-290.

OSTROM, E. 1990. Governing the commons: the evolution of Institutions for Collective Action. *Cambridge University Press, New York*.

PETERS, P. E. 2004. Inequality and social conflict over land in Africa. Journal of agrarian change, 4, 269-314.

PETERS, P. E. 2009. Challenges in Land Tenure and Land Reform in Africa: Anthropological Contributions. *World Development,* 37**,** 1317-1325.

RAIK, D. B., WILSON, A. L. & DECKER, D. J. 2008. Power in natural resources management: an application of theory. *Society and natural resources,* 21**,** 729-739.

REED, M. S., DOUGILL, A. J. & TAYLOR, M. 2007. Integrating local and scientific knowledge for adaptation to land degradation: Kalahari rangeland management options. Land Degradation & Development, 18, 249-268.

RENN, O. & SCHWEIZER, P. J. 2009. Inclusive risk governance: concepts and application to environmental policy making. Environmental Policy and Governance, 19, 174-185.

REENBERG, A. 2012. Insistent dryland narratives: portraits of knowledge about human-environmental interactions in Sahelian environment policy documents. West African Journal of Applied Ecology, 20, 97-111.

RENNIE, R. 1998. History and policy-making. The social science sphere, Oxford, Blackwell Publishers.

REYNOLDS, J. F., SMITH, D. M. S., LAMBIN, E. F., TURNER, B., MORTIMORE, M., BATTERBURY, S. P., DOWNING, T. E., DOWLATABADI, H., FERNÁNDEZ, R. J. & HERRICK, J. E. 2007. Global desertification: building a science for dryland development. science, 316, 847-851.

ROB 1975. Republic of Botswana, National Policy on Tribal Grazing Land: Government Paper No. 2 of 1975. Government Printers, Gaborone, Botswana.

ROHDE, R. F., MOLEELE, N. M., MPHALE, M., ALLSOPP, N., CHANDA, R., HOFFMAN, M. T., MAGOLE, L. & YOUNG, E. 2006. Dynamics of grazing policy and practice: environmental and social impacts in three communal areas of southern Africa. Environmental Science & Policy, 9, 302-316.

SCHWILCH, G., HESSEL, R. & VERZANDVOORT, S. 2012. Desire for greener land. Options for sustainable land management in drylands. Centre for Development and Environment, University of Bern (CDE): Bern, Switzerland.

SCOONES, I. 2009. Livelihoods perspectives and rural development. The Journal of Peasant Studies, 36, 171-196.

SIMBIZI, M. C. D., BENNETT, R. M. & ZEVENBERGEN, J. 2014. Land tenure security: Revisiting and refining the concept for Sub-Saharan Africa's rural poor. Land Use Policy, 36, 231-238.

TAMOU, C., DE BOER, I., RIPOLL-BOSCH, R. & OOSTING, S. 2018. Traditional ecological knowledge underlying herding decisions of pastoralists. animal, 12, 831-843.

THI HONG PHUONG, L., BIESBROEK, G. R. & WALS, A. E. J. 2017. The interplay between social learning and adaptive capacity in climate change adaptation: A systematic review. NJAS - Wageningen Journal of Life Sciences, 82, 1-9.

THOMAS, D. S. G., SPORTON, D. & PERKINS, J. 2000. The environmental impact of livestock ranches in the Kalahari, Botswana: natural resource use, ecological change and human response in a dynamic dryland system. Land Degradation & Development, 11, 327-341.

TSIMAKO, B. 1991. The Tribal Grazing Land Policy (TGLP) ranches: performance to date. Ministry of Agriculture, Gaborone.

TURNER, M. D. 2011. The New Pastoral Development Paradigm: Engaging the Realities of Property Institutions and Livestock Mobility in Dryland Africa. Society & Natural Resources, 24, 469-484.

TURNER, M. D., MCPEAK, J. & AYANTUNDE, A. A. 2014. The role of livestock mobility in the livelihood strategies of rural peoples in semi-arid West Africa. Human Ecology, 42.

VALDIVIA, C. & BARBIERI, C. 2014. Agritourism as a sustainable adaptation strategy to climate change in the Andean Altiplano. Tourism Management Perspectives, 11, 18-25.

ATN, A. 2015. Environmental governance: institutions, policies and actions, Edward Elgar Publishing, Cheltenham, UK.

VEDELD, T. 2014. Enabling Local Institution Building: Reinventing or Enclosing the Commons of the Sahel? Occasional Paper, 135-189.

WAIRORE, J. N., MUREITHI, S. M., WASONGA, O. V. & NYBERG, G. 2015. Enclosing the commons: reasons for the adoption and adaptation of enclosures in the arid and semi-arid rangelands of Chepareria, Kenya. SpringerPlus, 4, 595.

WHITE, R. 1993. Livestock development and pastoral production on communal rangeland in Botswana. The Botswana Society, Gaborone.

WISBORG, P. & ROHDE, R. 2005. Contested land tenure reform in South Africa: experiences from Namaqualand. Development Southern Africa, 22, 409-428.

WOODRUFF, S. C. & STULTS, M. 2016. Numerous strategies but limited implementation guidance in US local adaptation plans. Nature Climate Change, 6, 796.

Appendix

Appendix A: Ethical Approval

Performance, Governance and Operations
Research & Innovation Service
Charles Thackrah Building
101 Clarendon Road
Leeds LS2 9LJ Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk

UNIVERSITY OF LEEDS

Lenyeletse Vincent Basupi
School of Earth and Environment
Sustainability Research Institute
University of Leeds
Leeds, LS2 9JT

ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee
University of Leeds

22 April 2015

Dear Lenyeletse Vincent Basupi

Title of study: **Spatial Impacts of Subdivisions and Privatisation of Communal Grazing Lands in Ngamiland South of the Okavango delta, Botswana.**

Ethics reference: **AREA 14-091**

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
AREA 14-091 Committee Provisional.doc (researcher's response)	2	09/03/15
AREA 14-091 ETHICS_APPLICATION_VINCENT_signed.docx	3	10/03/15
AREA 14-091 Fieldwork RA form -Vincent_May_data_collection.doc	1	13/02/15
AREA 14-091 Semi - Structured Interview guide.docx	1	13/02/15
AREA 14-091 PROJECT BRIEF FOR PROFESSIONAL PARTICIPATS.docx	1	13/02/15
AREA 14-091 Informed Consent Form for Professional Participants.docx	1	13/02/15
AREA 14-091 INFORMED_CONSENT_VERBAL.docx	1	13/02/15

Committee members made the following comments about your application:

- In Section A10, confidentiality is mentioned, when based on my understanding of the terms, only anonymity can truly be provided: further information on the difference between the two terms is available at http://ris.leeds.ac.uk/ConfidentialityAnonymisation.

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at http://ris.leeds.ac.uk/EthicsAmendment.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at http://ris.leeds.ac.uk/EthicsAudits.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Jennifer Blaikie
Senior Research Ethics Administrator, Research & Innovation Service
On behalf of Dr Andrew Evans, Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor(s)

Appendix B: Research Permit

TELEPHONE: 3647900
TELEGRAMS: MEWT
TELEX:
TELEFAX: 3908076

REFERENCE: EWT 8/36/4 XXX (17)

MINISTRY OF ENVIRONMENT,
WILDLIFE AND TOURISM
PRIVATE BAG BO 199
GABORONE
BOTSWANA

REPUBLIC OF BOTSWANA

ALL CORRESPONDENCE MUST BE ADDRESSED TO
THE PERMANENT SECRETARY

20th May 2015

Mr. Lenyeletse Vincent Basupi
P. O. Box 850
Tutume

Tel: +26772126345/ +26771664197/ +447438827494
Email: vbasupi@gmail.com
eelvb@leeds.ac.uk

APPLICATION FOR A RESEARCH PERMIT: SPATIAL IMPACTS OF SUBDIVISIONS AND PRIVATISATION OF COMMUNAL GRAZING LANDS IN NGAMILAND SOUTH OF THE OKAVANGO DELTA, BOTSWANA: EWT 8/36/4 XXX (73)

We are pleased to inform you that you are granted permission to conduct a research entitled: **"Spatial Impacts Of Subdivisions And Privatisation Of Communal Grazing Lands In Ngamiland South Of The Okavango Delta, Botswana."**

The research will be conducted in **Government Offices in Gaborone and Maun (Department Of Veterinary Services, Department Of Environmental Affairs, Department Of Forestry And Range Resources, Department Of Surveys And Mapping, Department Of Animal Health And Production, Department Of Lands, Tawana Land Board, Tribal Administration, Department Of Wildlife And National Parks, Department Of Crop Production), Ngamiland Villages and Communal Grazing Lands: Toteng, Sehithwa, Karong and Semboyo.**

This permit is valid for a period effective from **25th May 2015 to 30th June 2017.**

This permit is granted subject to the following conditions:

1. Signing and submission of an Agreement between Government of Botswana and Independent Researchers.
2. Progress should be reported periodically to **the Department of Forestry and Range Resources.**

Our mission: To protect the environment; Conserve the country's renewable and natural resources, Derive value out of environment for the benefit of Botswana

BOTSWANA

3. The permit does not give authority to enter premises, private establishments or protected areas. Permission for such entry should be negotiated with those concerned.

4. You conduct the study according to particulars furnished in the approved application taking into account the above conditions.

5. Failure to comply with any of the above conditions will result in the immediate cancellation of this permit.

6. The research team comprises of **Mr. Lenyeletse Vincent Basupi and Tebogo Maphondo.**

7. The applicant should ensure that the Government of Botswana is duly acknowledged.

8. Copies of videos/publications produced as a result of this project are directly deposited with the Office of the President, National Assembly, Ministry of Environment, Wildlife and Tourism, Department of Forestry and Range Resources, Botswana Tourism Organization, National Archives, National Library Service, and the University of Botswana Library.

Thank you.

Yours faithfully

Gaosakanye Tapping

FOR/PERMANENT SECRETARY

cc: Director, Department of Forestry and Range Resources
District Commissioner, Ngamiland
District Commissioner, South East

Our mission: To protect the environment; Conserve the country's renewable and natural resources; Derive value out of environment for the benefit of Botswana

BOTSWANA

Appendix C: Interview guide (in Setswana language)

TSHEKATSHEKO YA TIRISO YA LEFATSHE, MAFUDISO LE DITSATHOLEGO

(PASTORALISM AND LAND TENURE TRANSFORMATION: POLICY IMPLICATIONS AND LIVELIHOODS ADAPTATIONS IN BOTSWANA)

RESEARCH PERMIT NUMBER: EWT 8/36/4 XXX (73)

OBJECTIVE NUMBER 3: Investigating the ways in which pastoral communities cope and adapt to constraints due to environmental and policy changes in Ngamiland, Botswana.

Village_____ Respondent Number_____

INTERVIEWER IDENTIFICATION NUMBER: _____

Respondent Household information

Gender	Male ☐ Female ☐
Age of the interviewee	
Household size	Adult men ☐ Adult women ☐ Children ☐
Ethnicity/Morafe	Herero / Mbanderu/Kgalagadi /Hambukusho/Tawana/ WaYeyi Other,specify_____
Education levels/ number of years spent in school	None ☐ Primary ☐ Secondary ☐ Tertiary ☐
Numbers and types of livestock owned	Cattle ☐ Goats ☐ Sheep ☐ Donkey ☐ Horses ☐

DITSELANA TSA ITSHETSO

1. Wena le ba lelwapa la gago le dira eng go itshetsa(livelihood activities or sources of income for the household)? (NB : interviewer - List livelihood activities according to order of importance)

2. Mo dingwageng tse di fetileng, a wena kana mongwe mo lelwapeng o kile a dira kgwebo ya itshetso mme e se ya temo thuo? (NB: interviewer- If the answer is yes, ask the respondent to elaborate)
3. A go na le mongwe mo lelwapeng la gago yo o dirisang ditsa tlholego go itshetsa?(NB: interviewer- If the answer is yes OR no, ask the respondent to explain why)
4. Fa o akanya ka ga gago le ba lelwapa la gago, tiriso ya ditsa tlholego e fetogile jang mo dingwageng tse di fetileng?
5. A gona le ditsatlholego tse o neng o didirisa bogologolo tse o sa kgoneng go di drisa gompieno?
6. Ke eng o sa kgone go dirisa ditsatholego tseo?
7. Ka kakaretso o ka re botshelo jwa gago bo fetogile jang mo dingwageng tse di fetileng

MAIKUTLO A BARUI KA SELEKANYO SA PHULO LE METSI A A NOSANG LERUO

8. A o na le moraka?
9. Ke diphetogo dife tse di nnileng mo merakeng mo dingwageng tse di fetileng?
10. A phulo e lekane leruo mo kgaolong ya lona? Tlhalosa ka botlalo.
11. A o na le sediba (Livestock borehole)? (Interviwer…..if the answer is no, ask the respondent to state where he/she waters his/her livestock).
12. A metsi aa nosang leruo a lekane mo kgaolong ya lona? Tlhalosa ka botlalo.
13. Fa re tshwantshanya gompieno le dingwaga tse di fetileng, o ka re seemo se a tokafala kana se golela pele?
14. A wena kana mongwe mo lelwapa la gago o kile a abelwa polase?
15. Maikutlo a gago ke eng mabapi le dipolase gotlhe le diterata tsa mathoko a leruo (veterinary cordon fences/ protection zone?

5.DITSELANA TSA GO ITEPATEPANYA LE SEEMO KANA DIKGWETLHO TSE DI LENG TENG MO MAFUDISONG

16. Ke maano afe a le a dirisang go itepatepanya le seemo sa tlhaelo ya mafudiso fa se le teng?
17. Ke eng o dirisa maano ao?
18. A o kile wa tlamega go fudusetsa leruo la gago ko go ba masika kana ditsala go go thusa mo leruong la gago ka dinako tse di rileng?
19. Fa o arabile mo potsong ee fa godimo o re ee, o dira jalo ga kae, gape kwa o fudusetsang leruo la gago teng go bokgakala bo kae?
20. A batho ba ba go thusang o ba leboga ka sengwe?
21. Go ya ka wena go ka dirwa eng go tokafatsa seemo sa mafudiso a morafe?
22. A o kile wa tsenelela mekgatlho mengwe e e itebagantseng le ts temo thuo? Sekai: farmers' association; Ngamiland intergrated association, Nhabe farmers' association, hainaveld farmers' association ?

23. Mekgatlho e, e le thusa jang le le balemi barui?
24. Ko bokhutong, le kare tirisanyo ya lona le le balemi barui le maphata a ga goromente ke e e ntseng jang, re lebile thata mo go tsa therisanyo?