Developing key success criteria for rural development initiatives in the context of sustainable land management

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UNDERTAKING

The research reported in this dissertation was undertaken in the Discipline of Geography, School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg, KwaZulu-Natal, 2013, under the Supervision of Professor H. R. Beckedahl and Professor Urmilla Bob. The work represents original work by the author and has not been submitted in any form for a degree to any other university. Where use has been made of the work of others it has been duly acknowledged in the text.

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ABSTRACT

An assessment of service delivery in rural areas is critical in understanding the impacts and extent of sustainable land management (SLM). It has been South Africa's main objective to improve and speed-up service delivery to eradicate poverty in rural areas as indicated in the 1994 constitution. Statistics and field surveys indicate that, despite apartheid having ended in 1994, grassroots development in remote rural areas is still poor, often due to weak service delivery. This situation has in turn resulted in increased pressure on the natural resources leading to severe deforestation and overgrazing, soil erosion and surface water degradation. To achieve sustainable land management, it is critical to ensure that services are disseminated to rural communities because this will reduce pressure on natural resources. The aim of this study is to provide an assessment of the state of development as measured by the effectiveness of current service delivery in the south eastern part of South Africa and its implications for sustainable land management. The results of the study indicate that there is a strong relationship between poor service delivery and SLM problems in rural areas. The underdeveloped rural areas with poor service delivery demonstrated high levels of land degradation as compared to areas with better service delivery. In this study four communities (i.e. Mangoloaneng, Mahohoho, Njane and Mazabekweni Central) were assessed. Two of the communities under study were developed (Njane and Mazabekweni Central) and the others were underdeveloped. World Overview of Conversation Approaches and Technologies (WOCAT) field guide manual was used to assess the level of land degradation associated with poor service delivery in each community. Results indicate that Mangoloaneng and Mahohoho communities have poor service delivery compared to Njane and Mazabekweni Central. The results indicate the 88% of people from Mangoloaneng and Mahohoho rely on unclean water from unprotected sources such as streams, rivers, wells or springs for domestic use. Residents from these two communities have no access to electricity, proper sanitation facilities and also live in mud houses which are shown to be susceptible to extreme weather events. Moreover, infrastructural access to these communities is very difficult, due to bad road conditions. The study has established that there is a strong relationship between poor service delivery and SLM problems in rural areas. In order to achieve sustainable development in rural areas, it is therefore important to have clearly defined criteria which can be

used as a base for rural development. The study identified the following services as key criteria for rural development; clean piped water, sustainable housing and sanitation facilities, well maintained roads, electricity provision and schools (primary and secondary).

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CBPWP	Community Based Public Works Programme
CGIAR	Consultative Group for International Agricultural Research
CIA	Central Intelligence Agency
CMIP	Consolidated Municipal Infrastructure Programme
CSI	Consortium for Spatial Information
DEM	Digital Elevation Model
DWAF	Department of Water Affairs and Forestry
GPS	Geographic Positioning Systems
HIV/AIDS	Human Immunodeficiency Virus infection/Acquired Immunodeficiency Syndrome
IDPs	Integrated Development Plans
IMR	Infant mortality rate
ISRDP	Integrated Sustainable Rural Development Programme
KZN	KwaZulu-Natal
NSDP	National Spatial Development
PHC	Primary Health Care
PRA	Participatory Rural Appraisal
PRIIF	Poverty Relief and Infrastructure Investment Fund
RDP	Reconstruction and Development Programme
SLM	Sustainable Land Management
SRTM	Shuttle Radar Topography Mission
WHO	World Health Organization
WOCAT	World Overview of Conversation Approaches and Technologies

CHAPTER 1

1.1 Introduction

Evaluating development in rural areas is critical in understanding the impacts and extent of sustainable land management (SLM) as well as developing criteria for its assessment. Sustainability in the context of sustainable land management is defined as a means of ensuring the provision of basic human needs through access to land resources and their services, and at the same time maintaining the long-term productivity of their environmental functions (Corbeels, 2012; Smyth and Dumanski, 1995). It is evident that reaching sustainable development objectives requires an in-depth understanding of what the term 'development' means. Drawing from Lewis and Brabec (2005) and the 2009 report from the World Bank on World Development Indicators (Easterly, 2009), the term 'development' is ineffective if there are no layers or categories as indicators to assess the change/growth of development. This is because currently 48.7 percent out of 7 billion people in the world are poor rural people (Wang et al., 2013) and therefore appropriate indicators are essential to measure and monitor progress in rural development (Crush and Frayne, 2010). An assessment of development levels in rural communities is associated with major limitations due to their difficulty in figuring the needs that constitute primary and secondary demands; hence no defined criteria (Chambers, 2009; Hajer, 2003).

The lack of criteria for rural development results in rural developers not having a basic framework and foundation to assess productive change and growth in development (Chambers, 2009; Hajer, 2003). According to Bryceson et al. (2009), not having a criterion for rural development in developing countries would have severe ramifications. South Africa is amongst many developing countries where rural development is uneven and lacks systematic planning (Adams et al., 2009; Turok and Parnell, 2009). This would result in a disproportionate distribution of resources among communities, subsequently affecting development (Bryceson, 2009; Kitano, 2009). Kitano (2009), states there are many factors which contribute to a

disproportionate distribution of resources; however, location and political history of the communities play a more critical role. As a result, rural communities where primary development is minimal are strongly reliant on resources and services provided by the natural environment (Egoh et al., 2012; Shackleton et al., 2001). Hence the prevalence of sustainable land management problems in many rural areas (Dent et al., 2012; Pašakarnis et al., 2013).

According to the South African constitution, everyone has the right to*; food, water, health care and social assistance, which the state must progressively realize within the limits of its resources (Section 27), the right to education, including a universal right to basic education (Section 29) and the right to a healthy environment and the right to have the environment protected (Section 24) " (SAGI, 1996).*

In South Africa, the major contributor to a disproportionate distribution of resources stems from the country's political history (Adedeji, 1994). The apartheid government in South Africa segregated racial groups and placed them in designated areas known as Bantustans (for example, Transkei, Ciskei and Kwa-Zulu) which were remote areas that lacked primary services (Clark and Worger, 2004). The common problem experienced in each Bantustan was high levels of poverty as a result of heavily populated areas with generally very minimal resources. South Africa's current statistics show that the Eastern Cape and Limpopo are the leading poverty stricken provinces in the country (Bhorat et al., 2012; Odhiambo, 2009). Poverty in these former Bantustans demonstrates the legacy of the impacts of the segregation (Bhorat et al., 2012).
Poverty in South Africa as a result of the lack of primary services is the main contributor to land management problems in rural communities (Aliber, 2003). The lack of service delivery in rural communities creates both direct and indirect pressure on the natural resources and goods and services related to these (Ahmad et al., 2005). For instance, wetlands in rural communities are utilized in an effort to meet the basic needs lacking, due to poor service delivery (Millennium Ecosystem Assessment, 2005; Dugan, 1990). According to Dugan (1990) and Millennium Ecosystem Assessment (2005), wetlands provide basic services such as water, fuel and construction material for many rural communities. The increasing population size in rural areas with poor service delivery results in the deterioration of natural resources such as wetlands (Dent et al., 2012; Mombo et al., 2012). Statistics for South Africa show that more than 70% of rural

communities rely fully on groundwater and 14% depend partially on it (Baker and Miller, 2013) in the form of either groundwater seeps or wind pumps.

Wetland crises are amongst some of the sustainable land management problems faced in South Africa's rural communities (Twala, 2012). Drawing conclusions from Twala (2012), it is evident that there is a strong relationship between sustainable land management problems and the lack of service delivery. South Africa has many strategies or programmes established post-1994 to help eradicate poverty in rural communities (Charlton and Kihato, 2006; Twala, 2012), namely the Community Based Public Works Programme (CBPWP), the Consolidated Municipal Infrastructure Programme (CMIP) and the Poverty Relief and Infrastructure Investment Fund (PRIIF). One of the very first programmes was the 1994 Reconstruction and Development Programme (RDP) that was aimed at meeting the basic needs of South African citizens (Cameron, 1996). Nevertheless, a number of rural communities that still relies on natural resources for their basic needs provides evidence of the ineffectiveness of the current strategies in place for rural development (Vetter, 2013). This research seeks to develop the basic criteria for effective primary level development of rural communities in South Africa. The purpose of developing the criteria is to assess, using four rural communities as a case study, whether there is a relationship between not having a criteria for rural development and sustainable land management problems in rural communities.

1.2 Rationale for the study

The literature review in the previous section suggests that lack of service delivery in rural areas of South Africa has been a stumbling-block affecting development in remote rural communities. In light of this, the extent of Sustainable Land Management (SLM) problems existing in rural areas reflects the need for effectiveness and efficiency in service delivery. More than 90% of land degradation problems prevalent in rural areas occur as a result of residents utilizing the environmental resources to meet their basic services (needs), without reference to the consequential damage to the environment, either through ignorance, need or greed (Nasreen et al., 2006; Rana, 2011). In this study, it is therefore hypothesized that poor service delivery contributes to sustainable land management problems in rural areas of South Africa.

1.3 Aims and objectives of the study

The aim of this study is to develop a set of clear criteria for rural development in order to measure whether there is a relationship between land degradation caused by land-use [in rural communities] and the lack of primary criteria for rural development. In so doing, the research hopes to benchmark criteria that need to be in place if successful rural development is to be achieved in future.

Objectives

1. To identify SLM problems as a result of land-use management in rural communities (in South Africa);
2. To identify rural communities affected by SLM problems as a result of land-use management;
3. To investigate the role of service delivery in SLM
4. To identify key criteria to benchmark the potential effectiveness of having a rural development primary criteria to reduce issues of SLM as a result of poor service delivery.

CHAPTER 2

An overview of the current state of Rural Development in South Africa

2.1 Introduction

Rural development, as defined by Chambers (1990) and Wong (2013), is the process of increasing the standards living and an ensuring economic welfare of people residing in remote and marginalized communities. Usually, rural development has been associated with the strong reliance on natural resources such as water, forest and land in order to improve living standards. Currently, there are various strategies and approaches adopted in order to achieve rural development, namely improving education, agricultural extension, retail facilities, information and communication technology, and physical and social infrastructure (Kim, 2012; Midgley, 1995; Stein and Horn, 2012). Although these strategies and approaches are important for rural development, their achievement is a major challenge faced by developing countries, particularly in Africa. This chapter will show that, in South Africa poor service delivery is one of the biggest problems affecting rural development. It will also show that, the lack of clearly defined criteria for primary level development of rural areas plays a key role in disproportionate distribution of services in these communities. Consequently, the chapter addresses various challenges that could help in developing standard criteria for assessing sustainable land management for rural development in South Africa.

2.2 Development challenges in rural areas of South Africa

According to the South African constitution Section 27 on the Bill of Rights; everyone has the *"right to food, water, health care and social assistance, which the state must progressively realize within the limits of its resources (SAGI, 1996)".*

South Africa is approaching the second decade under the democratic government and yet there is very little to show at grassroots development in remote rural areas (Neves and Toit, 2013; Teffo, 2012; Twine, 2013). What has gone wrong? Rural residents of South Africa are still deprived of their rights mentioned in the Bill of Rights section of the constitution and poor service delivery mainly the core to this challenge (Bond, 1999; Coovadia et al., 2009; May and Govender, 1998). In South Africa, service delivery in the form of primary health care, water and sanitation facilities, proper housing, education and energy (electricity) is a challenge in rural areas.

2.2.1 Primary Health Care Provision

Unattended health cases resulting in serious ramifications to rural people demonstrate the need to ensure that there are primary healthcare services (PHC) available and accessible to every remote community (Coovadia et al., 2009; Howson, 1996). For example, the lack of primary healthcare facilities in remote rural areas results in people being vulnerable and threatened by minor sickness. South African 2010 statistics indicate that IMR is at 54.8% (Buwembo, 2010), of which 87% occurs in rural areas (Kudamatsu, 2012; Sartorius et al., 2010). Drawing from these statistics it is evident that the IMR in rural areas far exceeds that of urban areas in South Africa. According to Wilson et al. (2009), Mayosi et al. (2009) and Moshabela et al. (2011), this disparity reflects the critical challenges experienced in urban versus rural areas as a result of poor service delivery.

After the democratic elections in 1994, one of South Africa's main objective was to improve and speed-up service delivery in order to reduce IMR and eradicate poverty apparent in rural areas (Aliber, 2003; Jokozela, 2012; Kehler, 2001). The Pholela Health Centre model was one of the very first community-oriented primary care facility established after 1994 to demonstrate the need to bring PHC services to remote rural areas in South Africa (Tollman, 2008). However, it is evident from the high figures of IMR that the lack of service delivery coupled with an increase in Human Immunodeficiency Virus infection/Acquired Immunodeficiency Syndrome (HIV/AIDS) in rural communities prevail as a dominant challenge which still requires much attention (Audet et al., 2012; Mayosi et al., 2009; Van Damme et al., 2006; Zachariah et al., 2009).

According to Starfield et al. (2005), Hicks (2008) and Sartorius et al. (2011), the high IMR in rural areas is primarily due to the shortage and lack of access to PHC facilities. Strasser (2003) and Mbambo (2010) state that 56% of rural people in South Africa live in a radius greater than 10 kilometers from the nearest PHC facility (clinic). These figures show devastating implications since more than 50% of South Africa's poor people reside in rural communities (Binns et al., 1997; Sender, 2012). Research conducted by Sartorius et al. (2011) in South Africa indicates that the KwaZulu-Natal (KZN) province has the highest infant mortality. The findings further emphasized that the shortage and lack of access to PHC facilities together with the alarming HIV/AIDS statistics in rural areas in KZN province were the main causes of high IMR (Sartorius et al., 2011).

High IMR in rural areas in South Africa is one of many challenges as a result of shortage and lack of access to PHC facilities such as clinics (Sartorius et al., 2011). Developing countries such as India, Uganda and Afghanistan are amongst many third world countries were poor PHC facilities has resulted in high IMR (McGuire, 2006; Shorvon and Farmer, 2007). King (2001), Starfield et al. (2005), Cramer et al. (2012) and Budde (2013) stress the importance of having PHC facilities such as clinics at a basic level of development of every rural community. Their emphasis stems from the experiences that rural communities are remote areas with very limited access to urban facilities, highly populated, economically unstable and less likely to have medical aid, have massive unemployment and are highly vulnerable to natural disasters (Budde, 2013; Cramer et al., 2012; King, 2001; Starfield et al., 2005).

2.2.2 Infrastructure Provision

Poor infrastructure such as road networks makes remote rural areas difficult to access and as a result binding them to poverty (Buwembo, 2010; Chamberlin and Jayne, 2012; Gibson and Rozelle, 2003; Starkey, 2002). Consequences resulting from poor transport facilities in remote rural communities directly impact on the social and economic freedom of residents in the affected areas. According to Satterthwaite and Tacoli (2003), Pan and Sung (2013) and Friederichsen et al. (2013), the importance of having effective transport systems in remote rural communities enables them to develop and sustain their livelihoods (socially and economically).

Furthermore, Ramirez (2000), Moseley (2003) and Kegler and Butterfoss (2012) state that transport systems in rural areas must be constructed effectively and remain one of the core objectives at grassroots development of remote communities. This is due to the fact that transport systems serve as a catalyst aiming at addressing poverty and development needs, and also dealing with spatial distortion challenges (Friederichsen et al., 2013).

The bulk of the challenges in South Africa as a result of poor infrastructure (roads) are faced in the 'deep' former homeland areas such the Eastern Cape, Limpopo and KwaZulu-Natal Province (Bornman et al., 2012; Gopaul, 2009). According to Bornman et al. (2012), these provinces are still experiencing inadequate investment in and maintenance of their transport systems. Consequently, rural areas within these provinces are amongst the poorest in South Africa. The government in South Africa has many strategies using tools such as the National Spatial Development (NSDP), Integrated Sustainable Rural Development Programme (ISRDP) and Integrated Development Plans (IDPs) to plan for urban and rural areas and yet poor transport facilities in remote communities is still a challenge.

Previous studies in Canada and Germany have shown the significance of having effective and well maintained transport systems as a core for rural development (Ellis and Britain, 1997; Howe, 1997; Howe and Richards, 1984; Mačiulis et al., 2009). Justifying this importance, Ellis and Britain (1997) state that poor transport facilities result in remote rural communities becoming highly isolated, powerless, physically weak and severely vulnerable to poverty. The outcomes of these challenges contribute to the deprivation trap and therefore, adequate supply of transport services in rural communities is essential to enable mobility and to promote economic development.

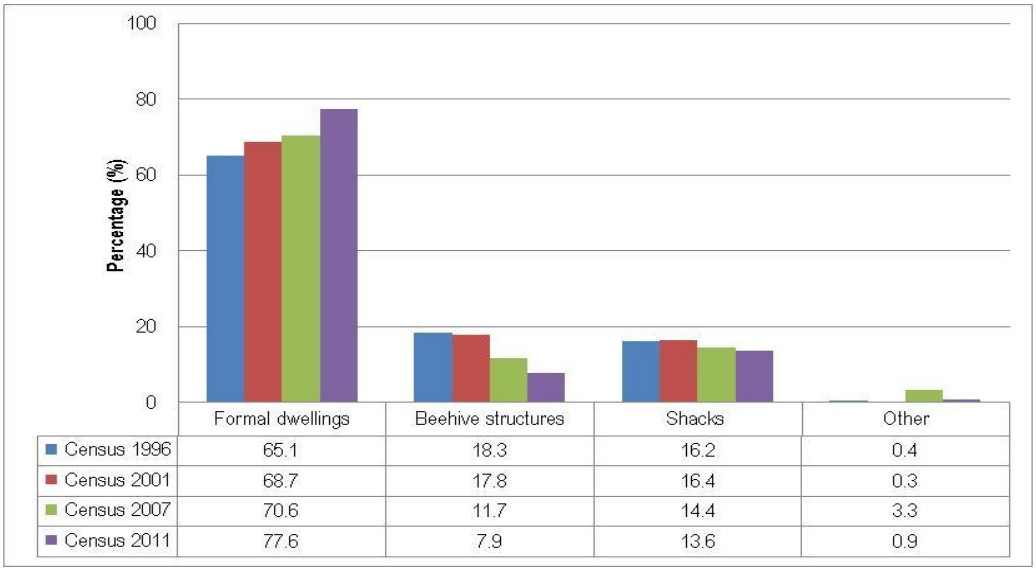
2.2.3 Housing

Provision of housing in rural communities is also a tremendous challenge reflecting poor service delivery in South Africa (Mhone and Edigheji, 2004; Schmid, 2012). Escalated population growth in rural areas has created a steeper mountain for South Africa to climb with regards to the provision of housing to the poor (Ramashamole, 2011; Sartorius and Sartorius, 2013).

Inadequate housing and homelessness affects poor women in rural areas in such a manner that it erodes their dignity and possibly undermines their social wellbeing (Bashir, 2002; Fitchen, 2010; Leckie, 2003). According to Fitchen (2010), millions of women and children throughout rural areas in developing countries fall victim to consequences of inadequate housing. Women and children living in bad housing conditions suffer from ill-health problems. Statistics indicate that more than 10% of all ill-health problems today are as a result of bad housing (Burridge and Ormandy, 2013). Furthermore, Burridge and Ormandy (2013) state that children living in inferior housing conditions are more likely to have chronic health problems such as asthma and anemia as they grow. The 2001 Census shows that South Africa had a backlog of 7.5 million people still requiring formal housing despite the 5 million who were already catered for (Sylvester and Chanza, 2010). This backlog is a serious concern because the country has an average population growth rate of 1.05 annually (Linard et al., 2012). The increasing population is making matters worse with regards to reducing the housing backlog in South Africa (Cronje, 2012). The former Minister of Human Settlements, Mr Tokyo Sexwale reported during his press conference in June 2013 that over 2.1 million housing units affecting over 8 million people still need to be built in South Africa (Mabin, 2013). The Minister further states that although much has been done to reduce the housing backlog, rapid population growth still remains a stumbling block to service delivery, particularly in rural areas in South Africa.

Limitations to South Africa's census data indicate another major challenge which will affect the true reflection of service delivery at grassroots level of development in remote rural areas. The outcome of the result in figure 2.1 indicate that there is a steady increase in the percentage of households living in formal dwellings from 1996 (65.1%) to 2011 (77.6%). Households living in beehive structures and shacks over time show the required improvements. For instance, results indicate that the percentage of households living in beehive structures (old traditional huts) has almost halved and those in shacks have been decreasing from 1996 (16.2%) to 2011 (13.6%). However, the information provided is flawed due to the fact it does not classify the data into rural versus urban demographics. The data presented shows percentage figures for the entire country and not a true reflection of the change happening in rural versus urban areas. The true reflection of the state of service delivery is critical if the government in South Africa intends to

target primary needs required in developing remote rural communities compared to those in urban areas (Bosch, 2010).



	Formal dwellings	Beehive structures	Shacks	Other
Census 1996	65.1	18.3	16.2	0.4
Census 2001	68.7	17.8	16.4	0.3
Census 2007	70.6	11.7	14.4	3.3
Census 2011	77.6	7.9	13.6	0.9

Figure 2. 1: Percentage distribution of households by type of main dwelling: Censuses 1996, 2001, 2007 and 2011(SSA, 2012)

2.2.4 Access to clean water

A challenge with regards to infrastructure services in rural communities does not only entail the provision of proper housing structures but also reflects problems associated with poor access to clean water (potable), sanitation and reliable energy supply facilities (Agyei–Boateng, 2012; Bond, 1999; Cotton, 2013; Mbatha, 2010; Sovacool and Drupady, 2013; Tlali, 2012). According to Schwarzenbach et al. (2010), access to clean water is a major challenge that affects rural areas in developing countries, particularly in Africa. Research conducted by the World Health Organization (WHO) in 2004 on the percentage of people in Sub-Saharan Africa accessing their drinking water from households connections, shows that approximately 16% of the people in these regions had an indoor or outdoor tap for their water supply (WHO, 2006:13). The WHO further mentioned that although the 16% had access to water however, the state of the water posed risks to their health due to contaminants.

After the first democratic elections in 1994, South Africa's population was estimated at 46 million, of which 14 million people lacked access to formal water supply (Hirschowitz and Orkin, 1997). According to Hirschowitz and Orkin (1997), 93.6% of the people who lacked

access to formal water supply were rural residents. With reference to the 2010 results presented in Figure 2.2 below, access to safe water is a problem in tribal areas (Lehohla, 2011).

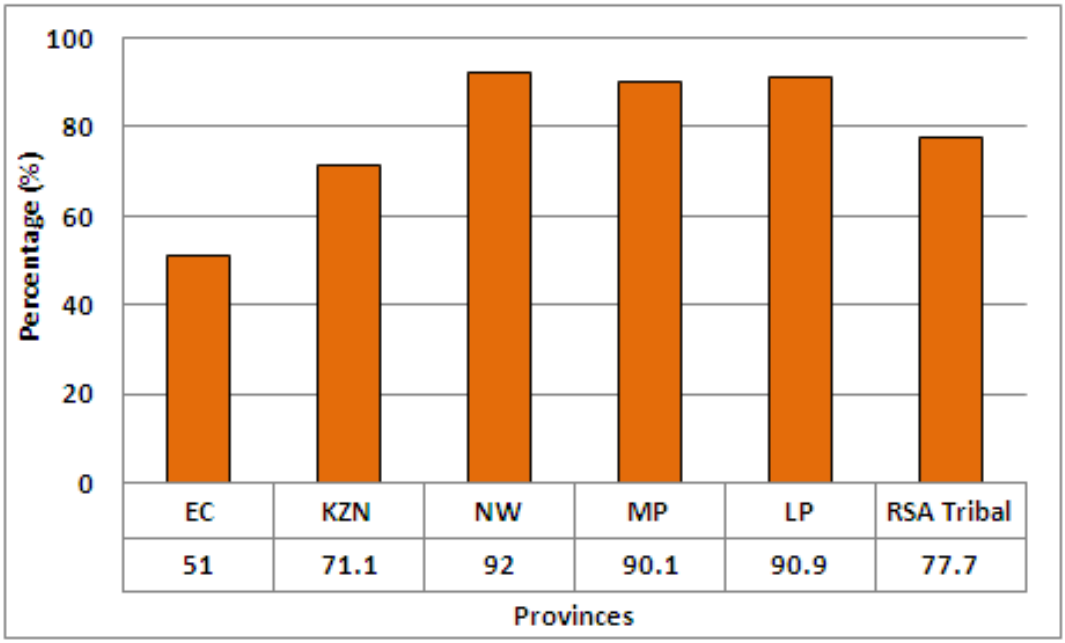


Figure 2. 2: Percentage of households living in tribal areas with access to safe water (Lehohla, 2011)

The statistics indicate that the North West, Mpumalanga and Limpopo province have the highest percentage of people with access to safe water, 92%, 90.1% and 90.9%, respectively. Furthermore, the Eastern Cape (51%) and KwaZulu-Natal (71.1%) provinces continue to have a greater backlog in terms of the provision of safe water during 2010 (Lehohla, 2011).

Statistics at the onset of 2013 indicate that the population has increased to an estimate of 52 million in South Africa (SSA, 2012)**.** This implies that the demand for service delivery will be at an accumulative rate with the population size. Analyzing the 2011 census results, it is notable that the government is facing difficulties with keeping up with service delivery in relation to the increasing rural population. The 2001 and 2007 census results from Sekhukhune one of the five district municipalities in the Limpopo province, situated in the deep rural areas; shows that the increase in population directly affects the percent of households having access to water. Table 2.1 uses the rural municipality of Elias Motsoaledi to illustrate the impacts of population growth and access to water (Lehohla, 2011).

Table 2. 1: Percentage distribution of households that have access to piped water and population size – Census 2001 and 2007 for Elias Motsoaledi Local Municipality (Lehohla, 2011)

Census Year	Access to water	Percentage (%)	Population size
Census 2001	Piped water inside dwelling	3.1	221 647
	Piped water inside yard	24.6	
	Piped water from access point outside the yard	31.2	
	Total piped water	**58.8**	
Census 2007	Piped water inside dwelling	10.7	247 488
	Piped water inside yard	18.2	
	Piped water from access point outside the yard	20.4	
	Total piped water	**49.3**	

The statistics shown in table 1 indicate a decline in the total percentage of households with access to piped water from 58.8% in 2001 to 49.3% in 2007 (This implies that there has been an exponential increase in population size compared to service delivery. The population size has increased by approximately 10% from 2001 to 2007, while the number of people obtaining water from access points outside the yard has decreased by 10%. In the case of rural areas with already limited water supply services, the demand for water worsens as the population increases.

2.2.5 Provision of sanitation facilities

An increase in the number of people in the rural areas without access to water, leads to implications in sanitation. For instance, the Department of Water Affairs and Forestry (DWAF) in 1994 estimated that 21 million people lacked access to formal sanitation services in South Africa and 78% were rural residents (Hemson et al., 2006). During the 2011 census, a number of categories were used to calculate the percentage of households in rural areas using different types of sanitation facilities. It was clear from the results that there were more households using pit systems with (33.7%) and without (47.7%) ventilation as their sanitation option (Lehohla, 2011).

Furthermore, 13% of the households used the bucket system and 5% had access to flush municipal or septic facilities. The breakdown of the results by provinces indicated that 49% of the households in KwaZulu-Natal use the pit system with ventilation pipes. In addition, Mpumalanga, Limpopo and North West were the dominating provinces in terms of the number of households using pit systems without ventilation pipes 61.6%, 57.8% and 53.1% respectively. The percentage of households reliant on informal sanitation facilities in rural areas has severe ramifications to public and environmental health (Saith, 2005).

2.2.6 Energy sources

The usage of conventional (e.g. firewood) energy sources over time has resulted in adverse human and environmental conditions in remote rural areas (Boyle et al., 2003; Farooq and Shakoor, 2013). Overall, the percentage of households in South Africa with access to and using electricity as their main source of energy has increased from 76.8% in 2002 to 82.7% in 2011 (Lehohla, 2011). The increase in electricity provision shows a great improvement for the overall country. However, quantifying the results into urban versus rural provision reflects that rural areas are still highly limited in relation to electricity supply. Rural statistics for 2011 indicate that households in Limpopo and Eastern Cape Province still dominate in the use of wood and paraffin as their primary source of energy, 47.2% and 36%, respectively (Lehohla, 2011). Ranking areas with very high poverty in the Eastern Cape Province, it was established that the Alfred Nzo District Municipality was the worst stricken area (83%), however, with only 34% of 831,043 people reliant on social welfare (Lehohla, 2011). Umzimvubu and Matatiele Local Municipalities under the Alfred Nzo District Municipality in 2007 had approximately 18.9% and 13%, respectively, of people using electricity for lighting and cooking. The provision of proper energy sources in remote rural areas in South Africa is vital because it can free large amounts of human time and labour and ultimately reduce pressure on the natural resources usage (Deichmann et al., 2011; Kartha and Leach, 2001; Kaygusuz, 2011).

2.2.7 Access to education

The constitution of South Africa is the main piece of legislation available to ensure basic delivery of education in order to improve previously marginalized communities (Fiske and Ladd, 2004). It is therefore clearly stated in the constitution that every citizen in South Africa has the right to education and this includes universal rights to basic education (SAGI, 1996). Nevertheless and according to Deshingkar (2011), poor service delivery and illiteracy perpetuates the levels of poverty in rural areas. Currently, challenges prevalent in rural areas regarding basic education delivery reflect key areas of stumbling-blocks limiting social and economic growth (Helge, 1992; Kuijs, 2012; Sengupta, 2011). The 2011 statistics from Children Count on Education indicate that more than 350 000 children of schooling-age do not attend school in South Africa, of which 75% are rural (Hall, 2011). Identifying the main contributing factors in rural areas, Hall (2011) states that distance to schools and availability and cost of transport and availability and quality of school buildings are the dominant primary causes of poor schooling in rural areas. According to Lehohla (2011), the 2011 census results indicate that the KwaZulu-Natal and Eastern Cape Provinces have the highest percentage of school children travelling a distance more than 30 minutes in order to get to school (primary or secondary), 24.8% and 16.4%, respectively. Long distances travelled by learners reflect the shortage of and access to schools in rural areas. They were other important challenges classified as secondary services which contributed to poor schooling in rural areas. These include availability and quality of teachers, number of learners versus that of teachers and infrastructure availability and quality (Hall, 2011).

2.3 SLM challenges in rural areas in South Africa

In light of the above background, this section will highlight the nature of SLM problems in rural areas in South Africa with the aim of understanding the driving forces, pressure, state, impacts and responses.

SLM is defined as a means of ensuring the provision of basic human needs through the use of land resources and at the same time maintaining long-term productivity of their environmental functions (Corbeels, 2012; Smyth and Dumanski, 1995). According to Barrow (2013), contemporary research in South Africa suggests that SLM problems in rural areas have intensified over the past few decades. This has been affiliated with the implications of increasing population growth and poor service delivery resulting in more rural people relying on natural resources and their services.

Overexploitation of natural resources such as trees and plants to provide basic human needs appears to be the main driving force exacerbating SLM problems (Beckedahl, 1998; Heath and Brown, 2007; Zur Heide, 2012). It is estimated that more than 3 million households in rural areas of South Africa use fuel wood generated from natural forests as their basic energy source (Lehohla, 2011). Statistics for 2011 indicate that rural households in Limpopo and Eastern Cape Provinces mainly rely on the use of wood and paraffin as their primary source of energy, 47.2 and 36%, respectively (Lehohla, 2011). Furthermore, it was established that 7.9% of the households in South Africa in 2011 were constructed using natural resources as building material (Lehohla, 2011). Elujoba et al. (2005) and Abraham (2013) state that poor access to in rural areas perpetuates the use of indigenous plants for medicinal purposes. For example, Strasser (2003) and Mbambo (2010), indicate that 56% of rural people in South Africa live in a radius greater than 10 kilometers from the nearest PHC facility (clinic). Consequently, this implies that more rural people rely on indigenous plants as primary medical options. Overconsumption of natural resources to substitute for basic services in rural areas has proved to be a major contributor to environmental problems (Millennium Ecosystem Assessment 2005, Beckedahl, 1998; Bob and Bronkhorst, 2010).

Deforestation and exploitation of natural forests for anthropogenic activities accounts for 37% of land degradation problems existing in rural areas of South Africa (Steinfeld et al., 2006). According to Olson et al. (1994), it is a challenge to quantifying the amount of soil loss associated with erosion. However, it is estimated that soil loss in South Africa ranges from 300 - 450 million tons annually (Beckedahl, 1998; Jie et al., 2002). Benayas et al. (2007) and Locke (2009) state that the impacts of deforestation coupled with recent climate change problems has

resulted in intensification in land degradation problems in rural areas. Consequently, the absence of canopy cover increases the rate and severity of soil erosion during heavy storm events.

According to Morgan (2009) and Goudie and Boardman (2010), the severity of soil erosion as a result of anthropogenic activities varies depending on the gradient and rainfall patterns experienced in different rural communities. Thus, rural communities receiving moderate-high annual rainfall and have moderate-steep gradient are common victims of adverse soil erosion. Although land degradation is not the only vital consequences of overuse of natural resources in rural areas, de Koning et al. (1985) and Ezzati (2012) state that the use of fuel wood as a primary energy source is also detrimental to the health of rural people. Frequent burning of fuel wood in houses with inadequate ventilation in rural areas leads to respiratory health problems caused by pollutants trapped indoors (Ezzati, 2012; Savage, 2007). Considering the land degradation and human health hazards associated with the consumption of natural resources for human use, the provision of basic needs such as electricity and housing is vital in order to sustain livelihoods and the environment in rural areas.

Consequences of using conventional methods to substitute for proper sanitation and water facilities have resulted in major environmental problems in rural communities (Jha, 2013). The 2011 census indicated that 61.6% of the households in Limpopo Province are still using a pit system without ventilation as their primary sanitation facility (Lehohla, 2011). Furthermore, 49% of the households in the Eastern Cape Province use conventional water sources for their domestic consumption. Consequently, this creates pressure on the natural water systems. According to Cothren (2013), more than 60% of the rivers in rural areas in South Africa are contaminated as a result of domestic use. As a result, contaminated rivers affect the living conditions of the aquatic species dependent on these systems. Conventional sanitation facilities such as pit systems contaminate groundwater aquifers in rural areas (Graham and Polizzotto, 2013b). Over time, waste products in the pit systems permeate into groundwater aquifers thus, contaminating groundwater. Contaminated groundwater aquifers eventually feed-off to nearby streams and freshwater sources (Graham and Polizzotto, 2013b). Contaminated water is detrimental to both environmental well-being and health standards of rural people dependent on these services (Bob and Bronkhorst, 2010). Poor infrastructure services such as transport facilities are detrimental to

land degradation problems existing in rural areas in South Africa (Assessment, 2005a). The use of poorly maintained gravel roads in rural areas poses major land degradation problems (Poudel, Undated). Turkey (2011) argues that inadequacy in drainage and poor road design are the main contributing factors associated with the nature of problems prevalent in rural roads. Ramos-Scharrón and MacDonald (2007) state that the gravel roads built cutting into hill-slopes leads poor drainage, facilitating runoff which produces rills and gullies.

According to Assessment (2005a), anthropogenic induced land degradation challenges in rural areas reflect the level of education. Although, the level of education is not directly related to challenges of overgrazing and overexploitation of natural resources such as forest wood, however, literacy levels in rural areas to some extent are assumed to alleviate sustainable land management problems. The low levels of education which are somehow linked to job opportunities contribute to unsustainable practices as a result of overreliance on natural resources, hence are detrimental to the environment in the rural areas (Assessment, 2005a). Challenges of overgrazing, overexploitation of natural resources and poor farming practices resulting in SLM problems provide evidence of how illiteracy can be detrimental to unsustainable practices in rural areas (Assessment, 2005a). Increasing literacy in rural areas is vital for social, economic and environmental development (Briedenhann and Wickens, 2004).

In conclusion, an extensive review of literature has revealed that service delivery is still a major problem that hinders rural development and SLM in South Africa. Secondly, the review of literature further validates the earlier assertion that there is currently no clearly defined criterion for rural development in South Africa. Hence, the necessity of developing a standard criterion for assessing developments in rural areas is highly critical for sustainable land management.

CHAPTER 3

Methodology

3.1 Introduction

South African and international literature was explored in the context of understanding the main and common challenges facing SLM as a result of land-use in rural areas. The South African constitution and literature were used as the base for understanding primary needs required to be delivered by the government to all citizens. The aim is to assess the type of services which all citizens are entitled to for basic living. Thereafter, the focus was to highlight the current state of service delivery and challenges in rural areas of South Africa. The purpose has been to assess whether the lack of primary services contributes to SLM problems in rural areas. In so doing, four rural communities were investigated of which two were developed (Njane and Mazabekweni Central) and the other two underdeveloped (Mangoloaneng and Mahohoho).

3.3.1 Observing and documenting service delivery

During data collection the following methods were used; WOCAT field guide, questionnaires, GPS (Geographic Positioning Systems) and photographs. The WOCAT manual is a comprehensive kit developed in 1992 at the Centre for Development and Environment, Bern, Switzerland to assess land degradation in different land-use systems. It allows (1) the definition of mapping units which are different areas to be individually assessed and (2) the type, degree, extent, rate, impacts and causes of degradation in each mapping unit to be entered in a matrix table (Appendix) (WOCAT, 2010). Additionally, the manual provides an explanation for the type, degree, extent, rate, impacts and causes of degradation. Degradation is divided into different types namely: soil erosion by water or wind, chemical or physical soil deterioration and water or biological degradation (WOCAT, 2010). These categories are further subdivided into specific components of that particular degradation (WOCAT, 2010). For example, water

degradation is divided into acidification and change in quantity of surface water. In this study, the subcategories were used as indicators to assess degradation.

Even though the WOCAT field guide manual is time consuming, it has two vital advantages. Firstly, the manual is designed to assess land degradation using basic principles of field observations without the use of any instruments. Secondly, it enables the users to overlap different land degradation types. This is particularly important when dealing with dynamic environmental problems such as water pollution. This is due to the fact that factors influencing water pollution may require a holistic approach in their assessment (WOCAT, 2010).

Questionnaires were used to collect data on demographics and service delivery information for the communities under study. Photographs were used to ground-truth the SLM problems occurring as a result of poor service delivery in these communities. The GPS was used to map the distribution of households, services (for example schools, clinics, shops) and SLM problems. A total of 50 questionnaires (vetted by the University of KwaZulu-Natal ethics committee) per community were administered using the Participatory Rural Appraisal (PRA) methods/tools to engage the communities giving a total of 200 responses. PRA tools are interactive methods of engaging with communities to understand their environment (Chambers, 1994; Mikkelsen, 2005; Sinclair et al., 2009). The greatest strengths of PRA are in their richness of data, ownership of data and power to create awareness. Although the main disadvantage of PRA tools is that they are time consuming, they are however very important in ensuring that outsiders and community members both benefit from the experience (Chambers, 1994; Sinclair et al., 2009). For example, activities such as transect walks, social mapping, focus groups, night-halts and semi-structured interviews are some of the important methods which ensure collaborative learning between researchers and community members.

In this study, transect walks and interviews in the form of questionnaires were the main tools used. The transect walks were done during field observation to identify available services with some of the participants. The interviews were done throughout the data collection process in order to accommodate the participants. During these activities community members and outsiders were presented with the opportunity to share their knowledge, ideas and opinions.

3.3.2 Interviews

The systematic sampling technique was adopted during interviews. This technique allows one to start at any point within the parameters of the studied population and once the starting point is marked, a consistent frequency is then maintained throughout data collection (Cohen et al., 2011). Since the four communities under study have different number of households, a systematic structural procedure was adopted to achieve a representative sample for the entire population. For example, in Mangoloaneng and Njane communities with 243 and 271 households respectively, participants were interviewed at every 5^{th} household, whereas in Mahohoho (169 households) and Mazabekweni Central (193 households), interviews were conducted at every 3^{rd} and 4^{th} household respectively. The intervals were determined based on the number of households in each community.

During interviews, participants were visited at their homes and interviews were conducted using their mother tongue language (isiZulu and IsiXhosa). After introducing the purpose of the study, participants were then given the chance to engage and ask the interviewers questions. This was done in order to build trust and confidence between the interviewers and participants. Thereafter, questions (see Appendix A of the questionnaire) related to the research were posed to the participants and after getting feedback, the interviewers wrote on behalf of the participants. No formal appointments were made. For example, interviewers visited the households during the day and, if by any chance, there was no one present in that house the interviewers returned later in the day or on another day. Information gathered using questionnaires were verified using interviews of key respondents such as the headmen and chiefs. These procedures were followed in each community. Fortunately, community members were very obliging and were prepared to be interviewed, such that no case of non-responsiveness needed to be recorded.

3.3.3 Identifying Sustainable Land Management problems

After classifying land degradation into different types, namely water, soil and biological degradation, communities were thoroughly assessed to identify problems under these degradation types. In order to identify these problems, transect walks were done by all the field

assistants in the communities. Thereafter, the WOCAT manual (as seen in Appendix B) was used to assess the nature of degradation occurring and maps indicating the land use units and level of degradation in the four communities of study were generated from SPOT image. .To aid visualization, the land use units derived from the WOCAT approach were used for classification of the SPOT imagery. The aim here was to assess the nature of degradation through identifying the driving forces, pressures, state of the problem, impacts and possible responses in place to address the problems. In addition, information with regards to the type, degree, extent rate, impacts and causes of land degradation were collected following the WOCAT assessment criteria as presented in appendix B.

3.2 Data analysis

The questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) Version 17 (2009) to obtain descriptive statistics such as frequencies, cross tabulations and T tests. The data was analyzed for T tests; however, due to the fact that the results were distinguishable, the data from this application was not necessary for the study. Cross tabulation was used to summarize categorical data (primary services) in order to assess the variations in service delivery amongst the four communities. This informati on provided the baseline that enabled an evaluation of the relationship and the potential impacts of poor service delivery on SLM problems in these communities.

The distribution of households, services and SLM problems were mapped using a handheld Garmin etrex GPS with an accuracy of ±3m. The collected GPS coordinates were imported and displayed in a GIS environment using Arc GIS 10.1. This was done in order to visualize and assess the spatial distribution of services, households and SLM problems. Also, the results were validated using 2013 Google Earth maps. To achieve this, all households and services were digitized in Google Earth maps and thereafter imported into Arc GIS 10.1 and then overlaid on field based GPS coordinates.

Furthermore, SLM problems were classified into different categories using Satellite Pour l'Observation de la Terre (SPOT) images. The SPOT image was geo-referenced with a

geographic error (RMSE: root mean square error) of less than a pixel size, using ground control points collected using a hand-held GPS receiver with an accuracy ±3m and 90m Digital Elevation Model (DEM). The DEM was acquired from Shuttle Radar Topography Mission (SRTM) 90m Digital Elevation Database v4.1 via the Consortium for Spatial Information (CGIAR-CSI) of the Consultative Group for International Agricultural Research (CGIAR) (http://www.cgiar-csi.org/). In addition, since the image was acquired remotely for example, from space, atmospheric corrections therefore were done in ERDAS imagine using ATCOR 3 module (ERDAS, 2011). Atmospheric correction was done in order to eliminate non target effects such as haze and atmospheric aerosols which affect accurate information extraction.

CHAPTER 4

Description of study area

4.1 Introduction

The communities under study were selected based on the level of service delivery and apparent SLM problems. The research for the study was conducted in four rural communities, namely Mangoloaneng, Njane, Mazabekweni Central and Mahohoho in the Eastern Cape and KwaZulu-Natal Provinces, South Africa (Figure 4.1). Due to the nature of the research, two of the studied communities were investigated as a non-control (Mangoloaneng, Eastern Cape and Mahohoho, KwaZulu-Natal) and the other as the control (Mazabekweni Central and Njane, KwaZulu-Natal). Mahohoho and Mangoloaneng villages were selected as non-control in this study because they were characterised by Lehohla (2011) as the most affected communities by poor service delivery and sustainable land management problems while the control villages were chosen based on the higher level of services provided e.g. piped water, electricity etc. This was done in order get a better understanding of the dynamics of service delivery and SLM problems in rural communities in South Africa.

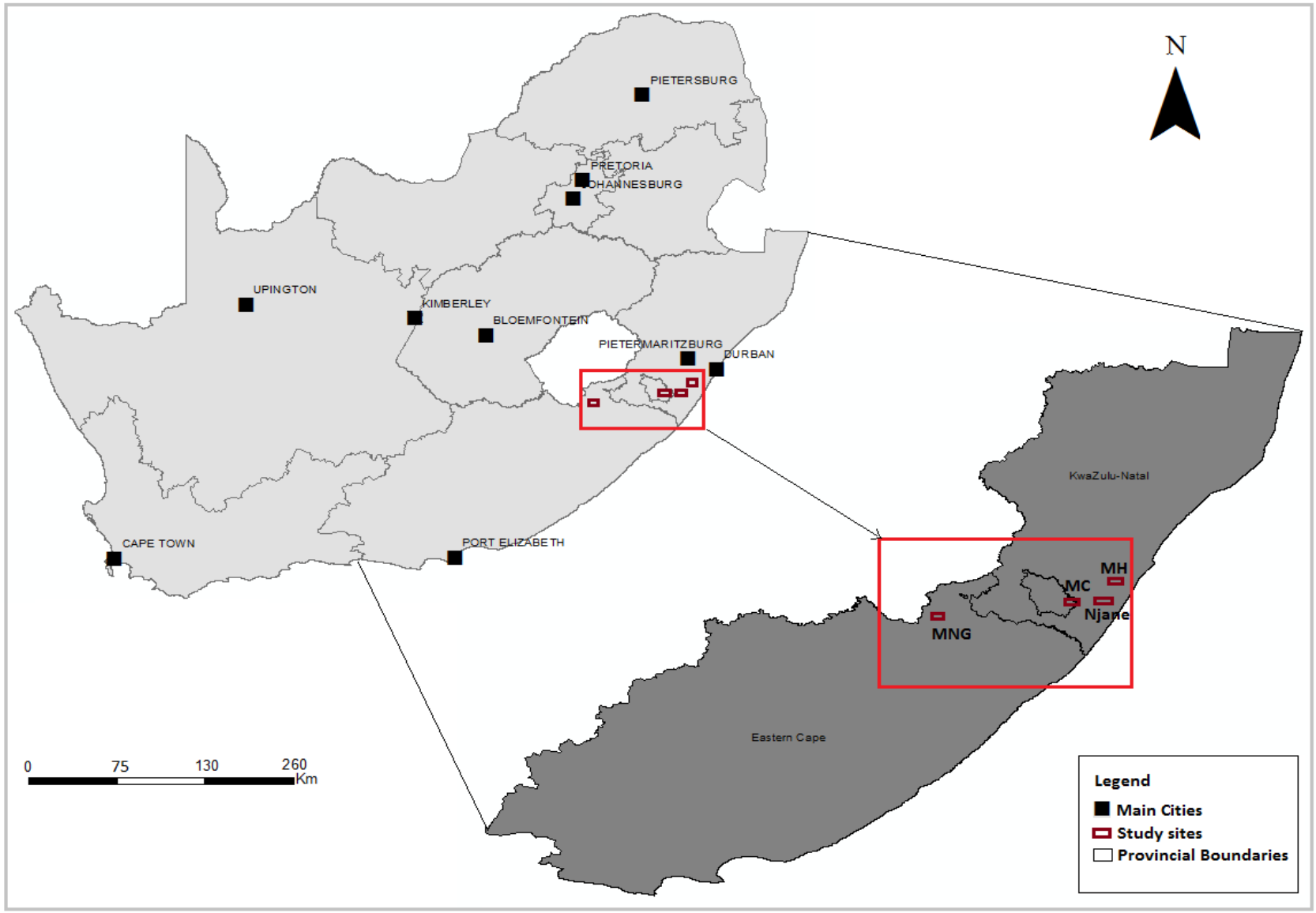


Figure 4. 1: Map of South Africa indicating the area under study. From the map MH stands for Mahohoho Village, MC stands for Mazabekweni Central village, MNG stands for Mangoloaneng Village. These maps were generated in ArcGIS 10.1.

4.1.1. Mahohoho and Mangoloaneng Village

Mahohoho is a rural community situated under Ingwe Local Municipality, with ± 169 households. The community is one of the five municipalities forming part of the Sisonke District Municipality. The nearest towns to the community are Bulwer and Donnybrook which are approximately 50km away. The exact location of this community on the map is at Latitude/Longitude: S 29° 50' 4.00" E 29° 57' 5.00". This rural community is tribally governed and is one of the poorest in this municipality. Poor service delivery and population growth are the key contributors to the level of poverty in the community (Lehohla 2011). Primary services such as clean piped water, electricity, clinics and schools are lacking in the community. Figure 4.2 (a) below shows a map of services and the approximate number of households in the community.

Mangoloaneng is a remote rural community situated on Latitude -30.5 / -30° 30' 0.0" and Longitude 28.4666667 / 28° 28' 0.0012", close to Mount Fletcher town located in the Eastern Cape Province. The community has approximately ± 243 households. The community is under Elundini Local Municipality which is part of the four municipalities within the Joe Gqadi District Municipality. This community is governed by tribal authorities and it is one of the poorest communities in this region. Poor service delivery and population growth are the key contributors to the high levels of poverty as indicated in Figure 4.2 (a) which illustrates the spatial distribution of households and the available services within the community.

4.1.2. Mazabekweni Central and Njane Village

Mazabekweni Central (± 193 households) and Njane (± 271 households) are both rural communities situated in the uBuhlebezwe Local Municipality. UBuhlebezwe Local municipality is one of the five municipalities forming part of the Sisonke District Municipality. Both the communities are situated along the R612 main road, towards Highflats and Ixopo, which are approximately 20km away. Geographically, Mazabekweni Central and Njane Village are both

located at Latitude/Longitude: S 30^0 26' 66" E 30^0 06' 66" and S 30^0 34' 72" 'E 30^0 28' 13", respectively. Population growth is one of the key factors contributing to poverty existing in these communities. However, the availability of primary services such as clean piped water, electricity clinics and schools reduce the levels of poverty experienced. Thus, Figure 4.2 (b) and 4.3 (b) below show a map of services and households distributions in these communities.

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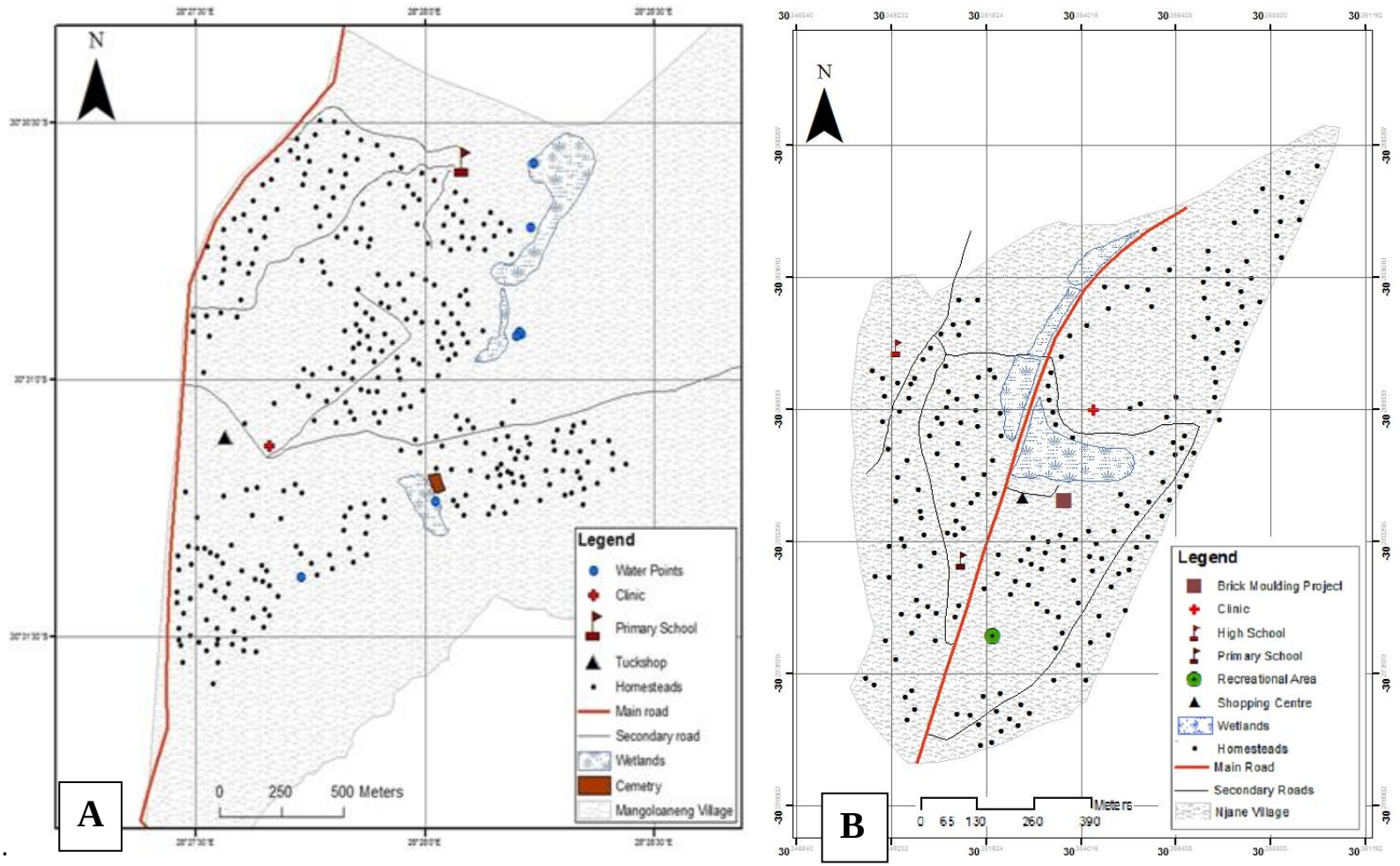

Figure 4. 2: Distribution of services and households in (a) Mangoloaneng and (b) Njane communities. These maps were generated in ArcGIS 10.1 on the basis of the data captured using a GPS

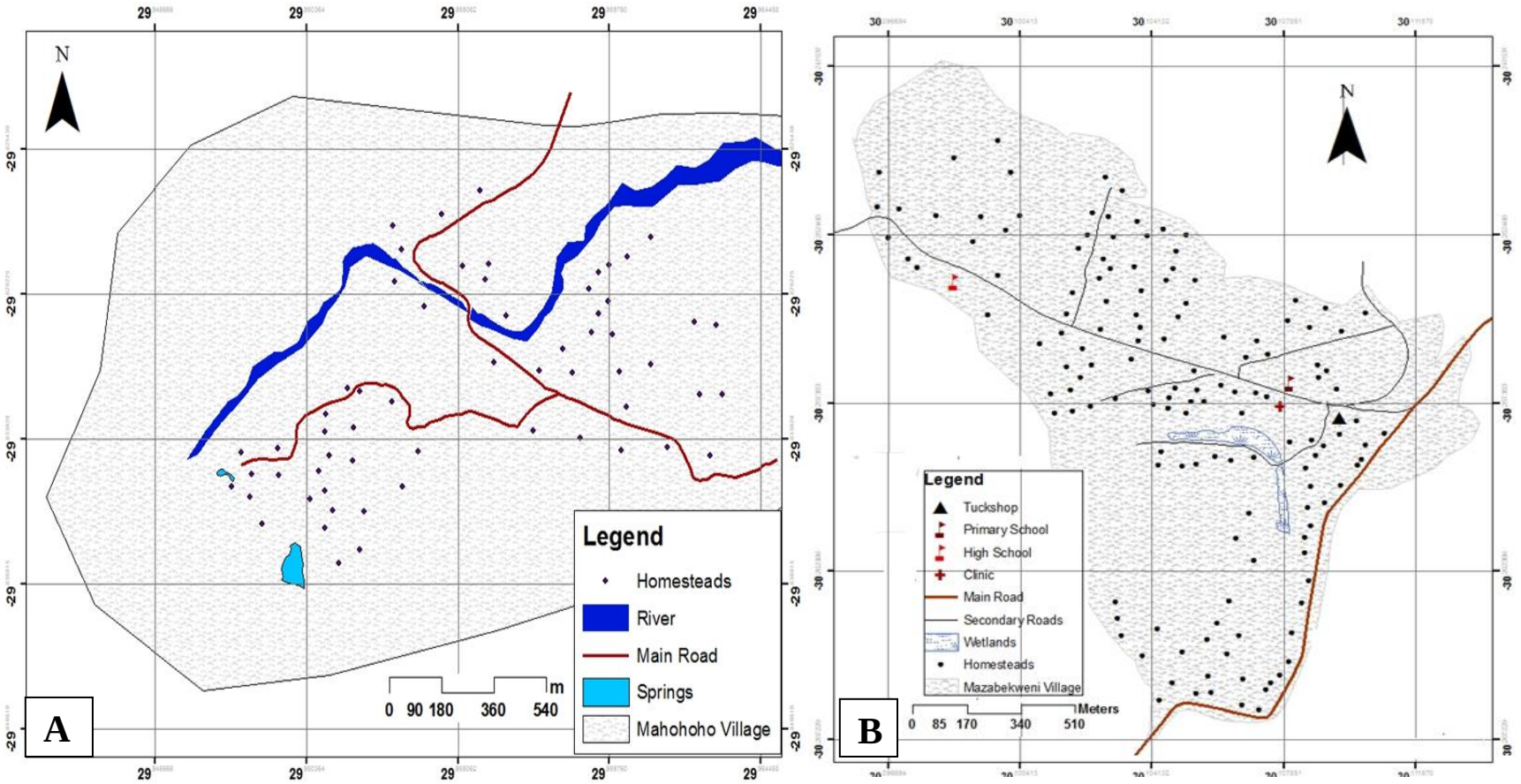

Figure 4. 3: Distribution of services and households in (a) Mahohoho and (b) Mazabekweni Central communities. These maps were generated in ArcGIS 10.1 on the basis of the data captured using a GPS.

CHAPTER 5

Results and Analysis

The findings obtained from the interviews conducted in four rural communities (Mangoloaneng, Mahohoho, Njane and Mazabekweni Central) are presented in this chapter. The purpose of this study was to assess whether poor service delivery contributes to SLM problems in rural areas. An overview of the studied communities and their access to primary services which are water, electricity, sanitation, housing and access roads are presented.

5.1 Overview of the four communities

In this study, 50 participants were drawn from each of the four communities (Mangoloaneng, Mahohoho, Njane and Mazabekweni Central). The demographic results across the four communities indicate that females were more than males among the respondents. In Mangoloaneng 70% of the participants were females, 82.4% in Njane, 74.5% in Mazabekweni and 86.3% in Mahohoho (Figure 5.1). According to the participants, the absence of males in these communities was as a result of men migrating to nearby towns and cities to seek for work.

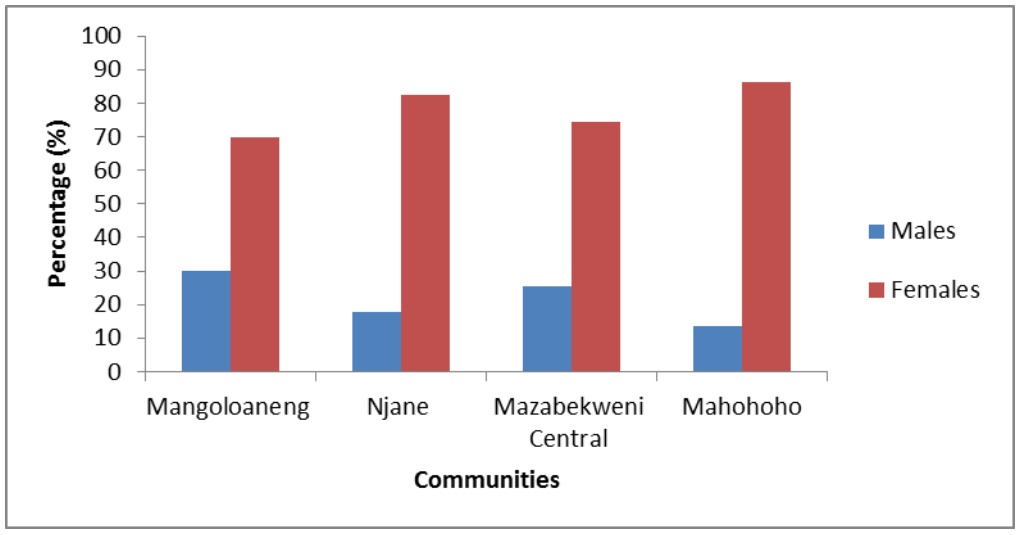

Figure 5. 1: Gender of participants in each community (n= 50 for each community)

The results indicate that most interviewed participants in the four communities, except Mahohoho, were within the age of what is traditionally seen as the active working age group. This is due to the fact the 48% of the participants in Mangoloaneng, 74.5% in Njane and 49% in Mazabekweni Central were between the ages 31-60 years (Figure 5.2). In the Mahohoho community, more than 70% of the participants were above 61 years of age which is beyond the active working group. This may be due to the fact that the economically active age group migrated to the urban areas.

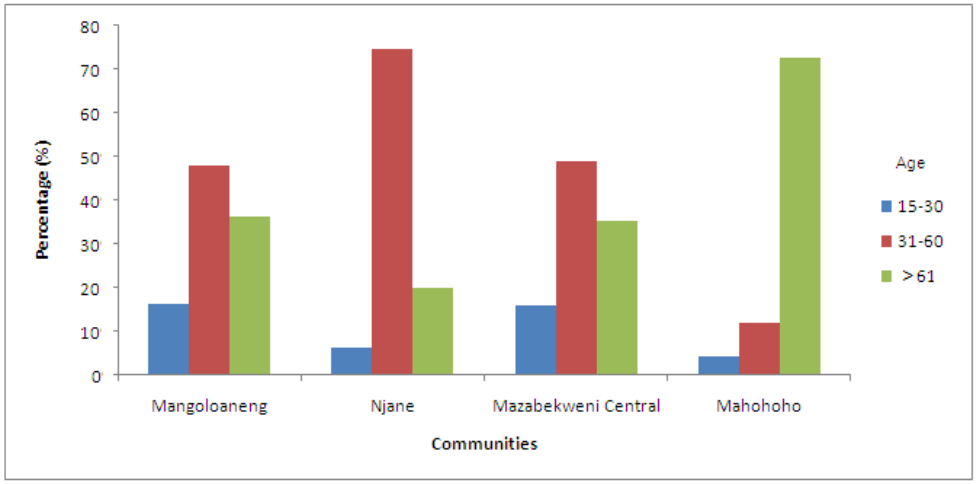

Figure 5. 2: Age distribution of participants in each community (n= 50 for each community)

The results for household size as shown in Figure 5.3 indicate that 54.7% of the participants live in households with 4-6 members, were less than 5% of the households have 10-12 members.

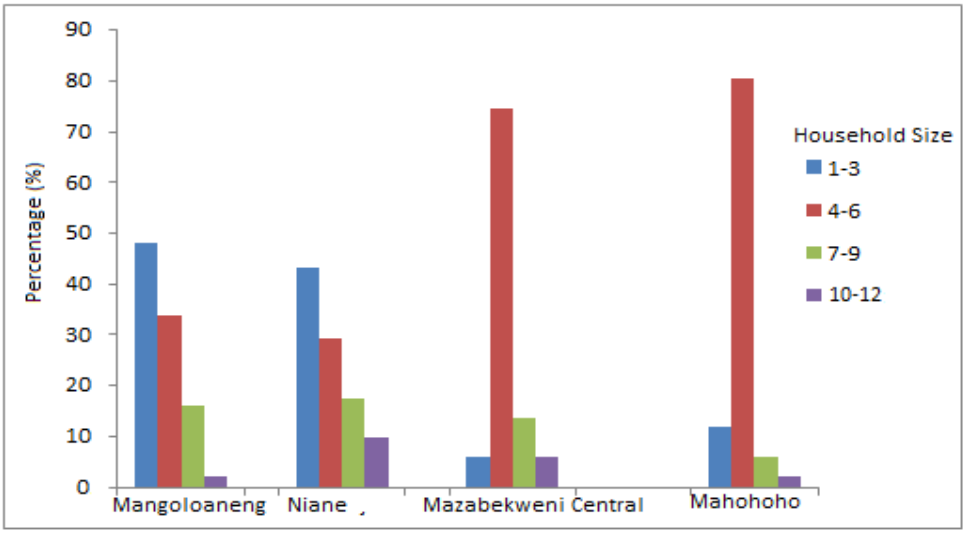

Figure 5. 3: Number of people per household in each community (n= 50 for each community)

More than 60% of the participants in Mahohoho lived in the community for 40-59 years and more than 68% in Njane lived in the area for 20-39 years (Figure 5.4). In light of this, 61% of all the participants were born in their respective communities and less than 17% settled there without a choice. The percentage of participants who settled without a choice was due to forced removal and relocation during the apartheid period.

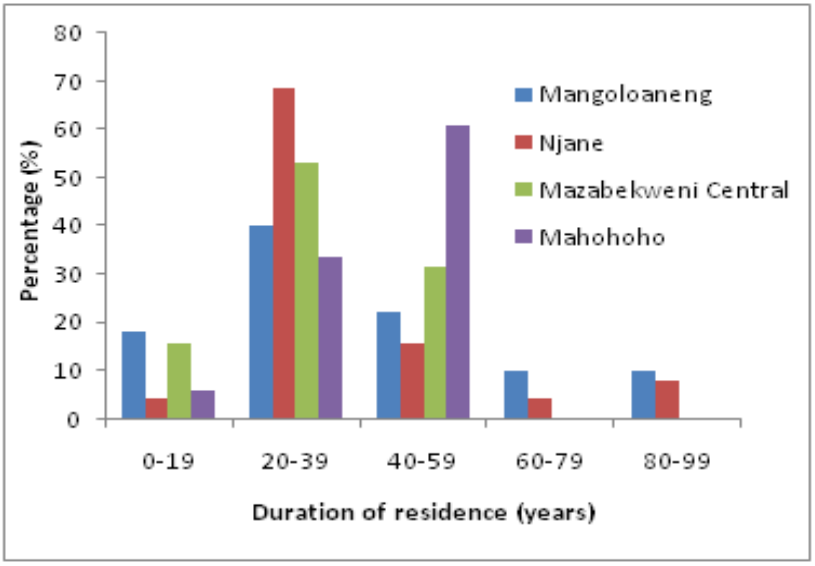

Figure 5. 4: Duration of residence among participants in their communities (n= 50 for each community)

Illiteracy was higher in Mangoloaneng and Mahohoho community. The results indicate that 52% of the participants in Mangoloaneng left school at primary level and 37% in Mahohoho never attended school (Figure 5.5). Furthermore, none of the participants from Mahohoho community have tertiary education. The level of education is higher in Mazabekweni and Njane when compared to the other two (Figure 5.5). This could be as a result of these communities having access to primary and secondary education (See Table 5.1).

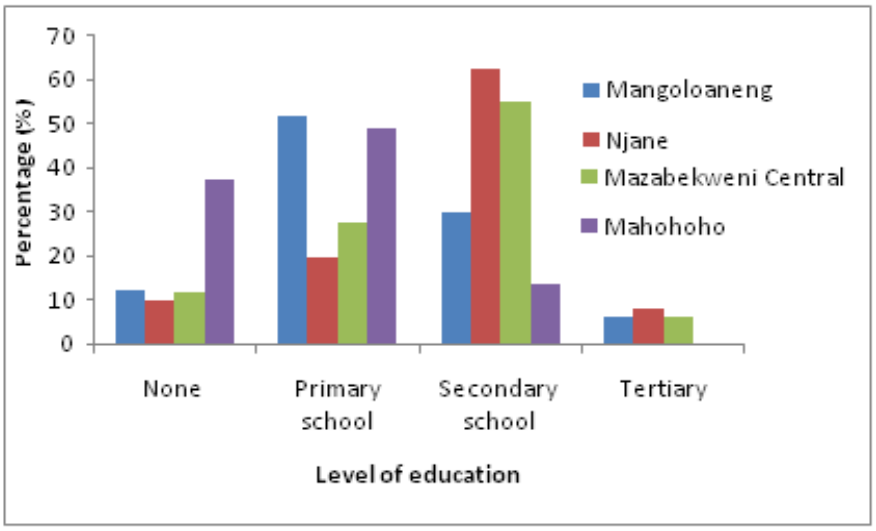

Figure 5. 5: Level of education among participants in each community (n= 50 for each community)

Figure 5.6 illustrates that 65%, 18.7% and less than 5% of the participants were unemployed, employed and self-employed, respectively. The level of unemployment is high for all the four communities. The highest level of unemployment is in Mahohoho (96.1%) and Njane (68.6%). Illiteracy in Mahohoho could be the main problem contributing to such high unemployment in this community. The highest level of employment is in Mazabakweni Central (Figure 5.1) which could be explained by the fact that the level of secondary education is high.

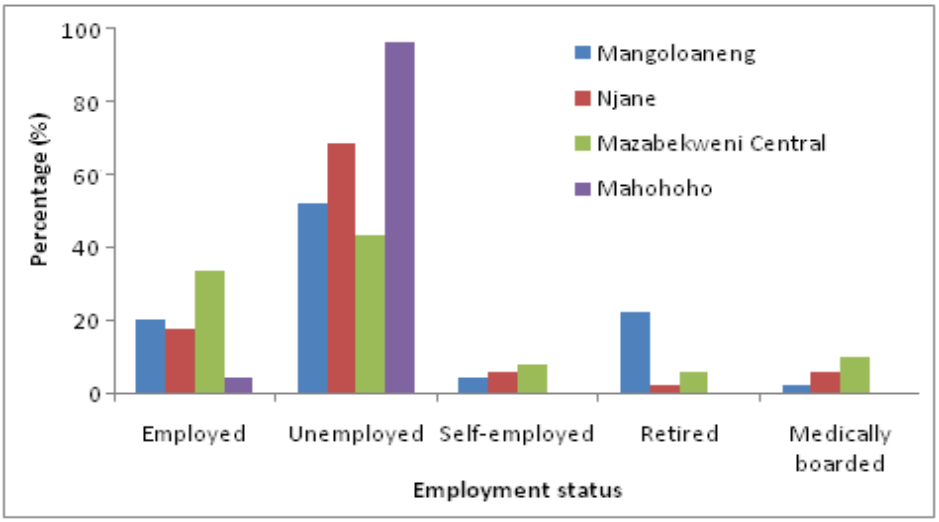

Figure 5. 6: Employment status of the participants in each community (n= 50 for each community)

5.2 Access to primary services

Service delivery is a problem in Mangoloaneng and Mahohoho communities. Table 5.2 demonstrates that half of the households interviewed in these communities have no access to clean piped water. Furthermore, 88% of the participants interviewed in Mangoloaneng and Mahohoho state that they access their domestic water from flowing water, streams, rivers, wells or springs and 10% use rain-water tanks (Table 5.2). This suggests that the majority of this population rely on natural water sources that are found within and near their villages.

Table 5. 1: Percentage of community members depending non-piped water sources

Communities	Non-piped water sources used			
	Rain-water tank	Neighbour's tap/public taps	Flowing water/stream/river well/spring	Dam/pool/stagnant water
Mangoloaneng	10	2	88	0
Njane	0	0	0	0
Mazabekweni	0	0	0	0
Central Mahohoho	6	0	88	6

NB: (n= 50 for each community)

None of the participants had access to proper sanitation facilities such as flush toilets (as seen in Table 5.1). However, all the participants from Njane and Mahohoho use the pit latrine system with ventilation pipes. Participants from Mangoloaneng (78%) and Mazabekweni Central (100%) use the pit latrine system without ventilation pipes. Table 5.3 shows the alternative sanitation sources used in each community due to lack of flush toilets.

Table 5. 2: Percentage of participants per community depending on improper sanitation facilities

Community	Improper sanitation facilities			
	Chemical toilet	Pit latrine/toilet with ventilation pipe	Pit latrine/toilet without ventilation pipe	None
Mangoloaneng	2	0	78	20
Njane	0	100	0	0
Mazabekweni	0	0	100	0
Central Mahohoho	0	100	0	0

NB: (n= 50 for each community)

Mahohoho community has no primary healthcare facilities such as clinics. As a result, 76% of the participants from Mahohoho travel for approximately one hour before accessing the nearest primary healthcare facilities. Clinics are available in the other three communities and members (less than 20%) living the furthest (approximately 5km) walk less than 30 minutes to access them. Furthermore, Mangoloaneng and Mahohoho both have no high schools. However, all communities excluding Mahohoho have a primary school. Due to the fact that there is no electricity in Mangoloaneng and Mahohoho, the results indicate that all participants from individual households from these communities use a combination of energy sources for their domestic supply. Thus, alternative sources such as fire wood, paraffin, gas, cow manure and solar energy are used. Firewood, however, is the mainly used energy source. This implies that there is a high reliance on forest resources in the two communities.

With regards to housing, 57% of the participants live in traditional houses such as mud huts. In Mahohoho and Mangoloaneng, 100% and 84% respectively of the participants live in traditional houses. This suggests that the majority of this population has no access to proper brick houses. Less than 16% of the participants from Njane and Mazabekweni Central live in traditional houses indicating that the majority have proper housing. Moreover, from the participants living in traditional houses, 61% experience difficulties with the use of such housing structures since they require continuous maintenance and are often very susceptible to extreme weather events (Table 5.3).

Table 5. 3: Percentage of participants facing difficulties using traditional houses per community

Community	**Difficulties experienced with using traditional houses**			
	No problems	Requires continuous maintenance	Vulnerable to extreme weather events; floods, rain etc.	Combination of problems
Mangoloaneng	16	0	0	84
Njane	0	20	6	74
Mazabekweni Central	0	6	8	86
Mahohoho	0	0	0	100

NB: (n= 50 for each community)

All the participants use gravel roads in their communities to access their homes. With regard to the state of the roads, 82% of the participants from Mangoloaneng state that the conditions of the

roads are difficult to use. However, participants from the other communities state that their roads were manageable and some well-maintained (Table 5.4).

Table 5. 4: The percentage of community perceptions on the state of their roads

Community	Total roads distance(km)	State of the gravel roads			
		Well maintained	Manageable	difficult to use	Extremely difficult to use
Mangoloaneng	15	0	0	82	18
Njane	17	100	0	0	0
Mazabekweni Central	14	100	0	0	0
Mahohoho	11	0	100	0	0

NB: (n= 50 for each community)

The results from the four communities indicate that only Njane and Mazabekweni Central have access to services such as water, electricity, proper housing and sanitation. Furthermore, Mangoloaneng and Mahohoho are experiencing land and water degradation since the participants from these communities noticed a change in the state of the environment (resources mainly) with time in their communities. However, from those that noticed a change, 80% of them noted a change in multiple variables which are: increase in soil erosion (for example more gullies forming), decline in water quality and quantity, and frequent occurrence of droughts. The other 20% indicated that climate has changed drastically and this is affecting their food production methods. This may be attributed to the lack of and poor service delivery as seen in Table 5.1.

Table 5. 5: Number of households and services in each community

		Services							
Communities	**Households NO.**	Primary School	Secondary School	Piped water	Sanitation facilities	Clinics	Shops	Community hall	Recreational facilities
Mangoloaneng	243	✓	X	X	X	✓	X	X	X
Njane	271	✓	✓	✓	✓	✓	✓	✓	✓
Mazabekweni Central	193	✓	✓	✓	✓	✓	✓	X	✓
Mahohoho	169	X	X	X	✓	X	X	X	X

Note that the ticks represent presence of services and "X" represent absence of services.

It can be noted from Table 5.1 that Njane and Mazabekweni Central communities have better service delivery when compared to Mangoloaneng and Mahohoho communities. The following chapter provides a detailed discussion on the relationship between poor service delivery and SLM problems in rural areas. However, before that can achieved Figure 5.7 and 5.8 present maps

showing land use units derived using the WOCAT approach for the four communities under study. Also the results in Fig 5.7 and Fig 5.8 provide a better visual interpretation and understanding of implications of service delivery on SLM problems in these areas. It can be noted from Figure 5.7 (A and B) that unlike the other two communities (Mazabekweni Central and Njane) in Fig. 5.8 (A and B), Mangoloaneng and Mahohoho communities have severe soil erosion problems in the form of gullies. The amount and severity of gullies apparent in these communities indicate extreme levels of land degradation. A detailed explanation of the causes of land degradation apparent in the aforementioned communities is discussed in the following chapter.

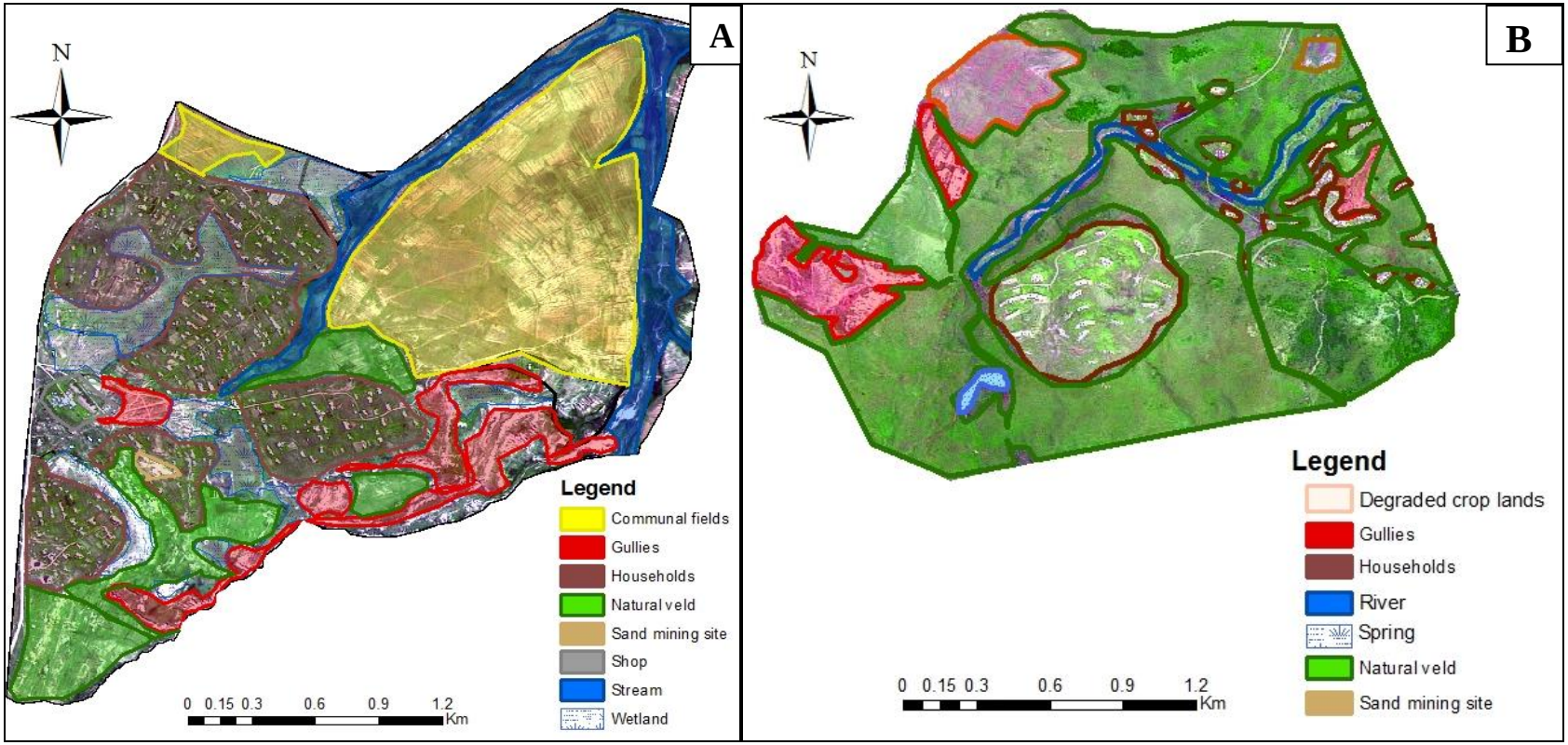

Figure 5. 7: Different land use units and severely degraded areas overlaid onto an aerial image of the rural communities of (a) Mangoloaneng and (b) Mahohoho

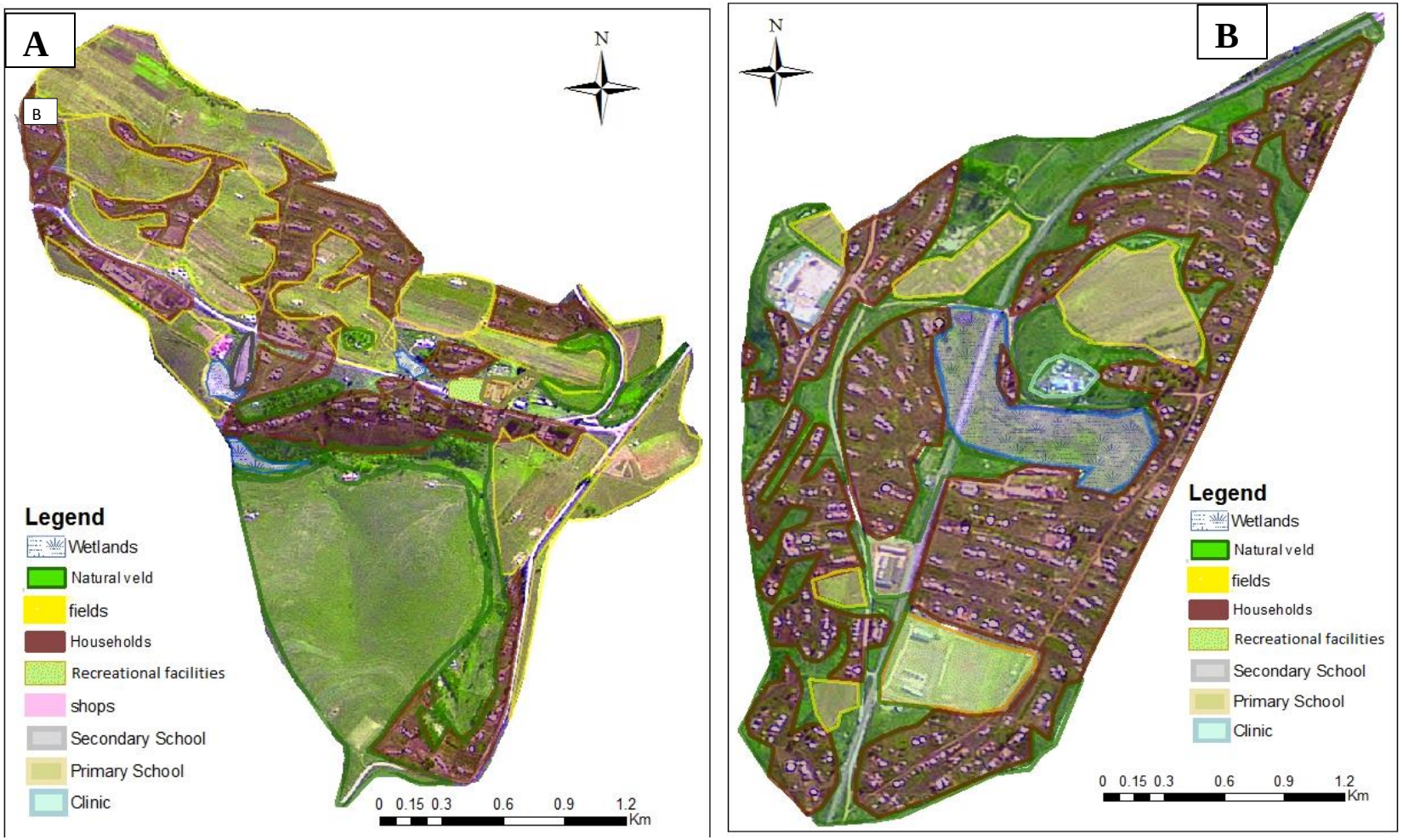

Figure 5. 8: Different land use units overlaid onto aerial image of the rural communities of (a) Mazabekweni Central and (b) Njane illustrating sustainable land management

CHAPTER 6

Discussions

The relationship between poor service delivery and SLM problems in rural areas

The findings from the interviews have been presented and analysed in the previous chapter. It is now possible to assess the original aims and objectives of the research in relation to SLM specifically. The potential effect of poor service delivery, if significant, should have an influence on SLM problems in rural areas. To assess this, the relationship between poor service delivery and SLM problems were analysed. The following sections show the different land-use and land degradation types prevalent in the four communities under study. Figure 5.7 (a and b) and 5.8 (a and b) present the different land use units with areas of severe degradation and those with SLM.

6.1 Water degradation

According to Millennium Ecosystem Assessment (2005) and Glicksman (2013), water degradation is the pollution of natural water sources as a result of direct or indirect contamination. It occurs as a result of natural and anthropogenic activities (Glicksman, 2013). The level of water degradation differed from one community to the other, it was noted from the results that the extent of water degradation for the different water sources is dependent on the demand for its service. Mangoloaneng and Mahohoho communities have very limited services and as a result residents strongly rely on the natural resources such springs, wells, rivers and wetlands for domestic needs (Figure 6.1 a and b and Figure 6.2 a and b).

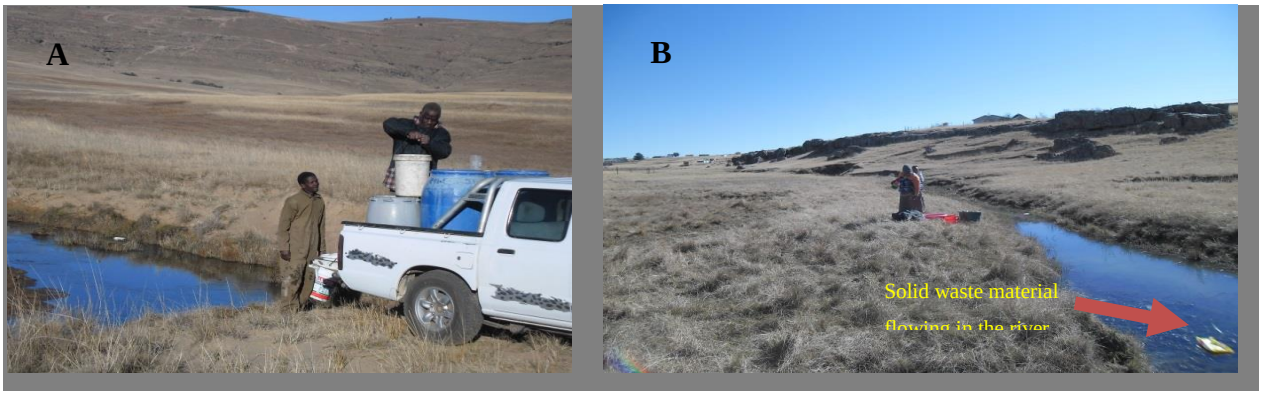

Figure 6. 1: Mangoloaneng residents (a) collecting water from the river and (b) doing washing at the river

Figure 6. 2: Mohohoho residents (c) collecting water in a spring and (d) transporting water to their homes

Kula (1992) and Turner and Daily (2008) state that over reliance on natural resources depletes their service over time. Thus, Table 5. 2 indicates that 88% of the participants in Mangoloaneng and Mahohoho communities access their domestic water from flowing water, streams, rivers, wells or springs and 10% use rain-water tanks. The majority of these water sources in both the communities have been degraded, as shown in Figures 6.3 a and b, and Figures 6.4 a and b.

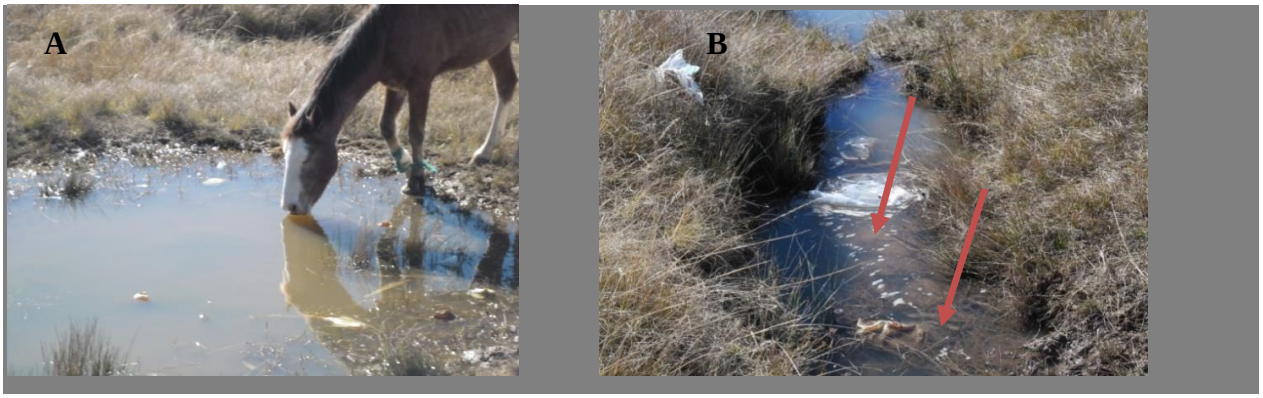

Figure 6. 3: Polluted (a) well and (b) stream in Mangoloaneng community

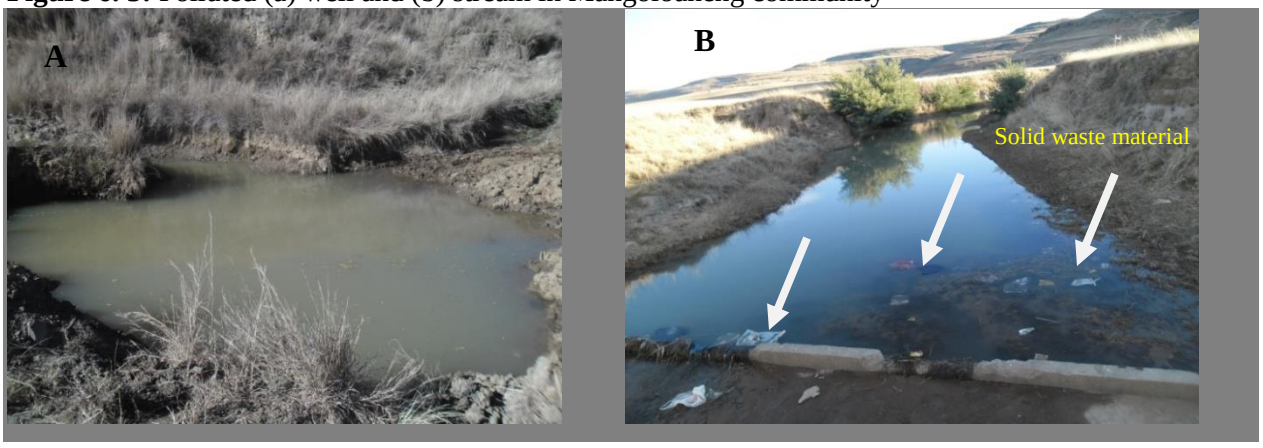

Figure 6. 4: Polluted (a) well and (b) river in Mahohoho community

There are many factors responsible for the level of water degradation seen in Mangoloaneng (Figure 6.3 (a) and 6.4 (a)). According to residents located near the wells, these water features were dug-out by the community members and were used as a primary source for their domestic needs. Due to the lack of piped water in these communities, the demand for the wells became high for both nearby residents and animals. Thereafter, the state of the wells deteriorated because residents and animals began to pollute them. The main forms of pollutants to the wells were solid waste and animal trampling. Solid waste polluting water sources in rural areas occurs as a result of human activities such as littering (see Figure 6.4a) in natural water sources, human waste as well as animal droppings (Dzikiewicz, 2000).

To assess the level of degradation, the WOCAT (2010) approach was adopted during field observation. The degree and rate at which the degradation is taking place is moderate according to the WOCAT standards. This is due to the fact that the level of degradation apparent is controllable and can be rehabilitated. However, this is only possible if the residents and animals have access to clean water. The type of degradation occurring in the wells and streams in Mangoloaneng (Figure 6.3 (a) and 6.4 (a)), according to the WOCAT assessment criteria, could result in the decline of surface and groundwater quality. According to Cothren (2013), more than 60% of the rivers/streams in rural areas in South Africa are contaminated as a result of domestic use. Due to poor service delivery, rural residents rely on natural resources such as streams and over time degraded their service as seen in Figure 6.3 (b) and 6.4 (b). The type of degradation occurring in the aforementioned figures according to the WOCAT assessment criteria, results in change of quality and quantity of the surface and groundwater.

Domestic needs and poor disposal of solid waste are the main forms of pollutants degrading these water sources. The portion shown in Figure 6.3 (b) is the lower part of the stream. At the time when the picture was taken, some of the community members were doing washing upstream. The arrows shown in figure 6.3 (b) are pointing out the soapy water which is contaminating the water downstream. According to Ma et al. (2009), the release of substances such as these leads to high concentrations of phosphates and nitrates that could lead to water quality deterioration.

The degree and rate at which the degradation is taking place in Mangoloaneng and Mahohoho (Figure 6.3 (b) and 6.4 (b)) is moderate to severe, according to the WOCAT standards. This is

due to the fact that the level of degradation apparent is controllable but very difficult to restore within reasonable time limits. However, this is only possible if the residents can have access to clean piped water for their domestic needs. The advantage of having clean piped in rural areas does not only entail reducing pressure on natural resources, other benefits are time-saving and good health (Bartram and Cairncross, 2010; Hunter et al., 2010). Positive implications of improved service delivery (as seen in Figure 6.5) is the reduced pressure on the environment and water degradation as seen in the other two communities (Njane and Mazabekweni Central) under study.

Figure 6. 5: Potable piped water in (a) Njane and (b) Mazabekweni communities

Issues of water degradation such as seen in Mangoloaneng and Mahohoho are limited in these two communities. This is due to the residents having access to clean piped water. Furthermore, the natural water sources are still in good condition because the demand for their services is limited (as illustrated in Figure 6.6).

Figure 6. 6: A well fenced wetland in Njane community

The wetland in Njane community is well protected and looked after (Figure 6.6). According to nearby residents, the fence around the wetland was constructed to prevent livestock from entering and causing degradation. However, for a wetland to maintain a fairly good state as the one illustrated above in this rural community, it is evident that this can only be possible if human and livestock water needs are met. In light of the above, it can be noted that there is a need to increase service delivery and improve land-use planning in rural areas in order to reduce pressure on the environment. The communities of Njane and Mazabekweni Central clearly indicate that proper land-use planning and good provision of primary services plays a major role in ensuring SLM.

Domestic needs and livestock are not the only problems degrading the water sources in rural communities other factors such as poor land-use planning indirectly contributes to water degradation in these communities (Mangoloaneng and Mahohoho). For instance,approximately 4 hectares of blue gum trees are planted within 5m from natural water sources in Mangoloaneng community (Figure 6.7.a).

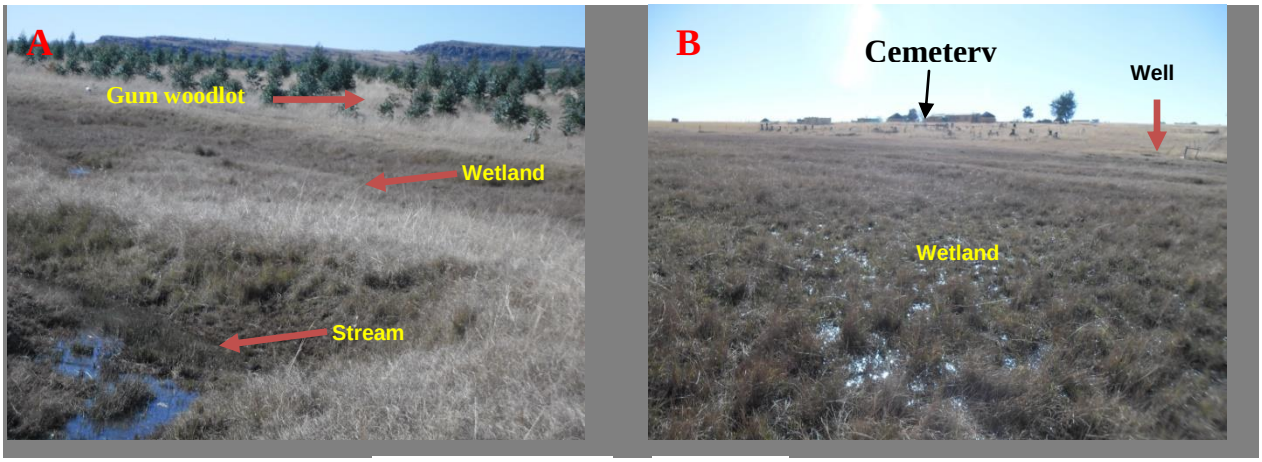

Figure 6. 7: Young blue gum (*Eucalyptus species)* (a) plantations and (b) cemetery near the wetland in Mangoloaneng community

Research conducted in Kenya to the assess impacts of different tree species on water sources indicates that, on average, the *Eucalyptus* species consumes approximately 785 litres of water before maturing (Scherr, 1997). Furthermore, the gum trees pose a serious threat to the surrounding environment. According to Lefroy and Stirzaker (1999) and Overton and Doody (2013), gum trees lower the groundwater table due to excessive extraction of underground water. In this community the implications of having these gum trees could lead to the degradation of the wetland and the stream due to excessive usage. Hence, these will further impact on the limited and already degraded natural water sources. Depletion of water is not the only problem associated with these gum trees in this community. Concerned residents emphasized that the space used to plant these gum trees was once grazing land for their livestock. Consequently, reducing grazing space might further exacerbate degradation problems because the livestock might overgraze due to limited space. This poorly planted gum forest shows the extent and impact of ineffective land-use planning in rural communities. Similarly, the location of the cemetery (Figure 6.7.b) in close proximity to the wetland in Mangoloaneng poses a serious problem to the environment and human health. Statistics show that 40% of the cemeteries in South Africa pose a serious threat to natural water sources (Żychowski, 2012). In this community, the cemetery is located less than 10m from a natural wetland and a well (as shown in Figure 6.7 (b)). According to the WOCAT assessment criteria, this will result in the degradation of surface and groundwater caused by the decomposing products (WOCAT, 2010). The state (viz water quality) of the wetland might deteriorate with an increase of ions in water as products decompose. As the concentration of ions increase, the health of the residents and animals dependent on the well for their domestic needs will be affected.

Research conducted in Canada, South Africa, Rwanda and the United States of America shows that communities who are utilizing water in close vicinity to cemeteries are high likely to be affected by typhoid fever diseases (Amuno and Amuno, 2013; Bouwer and Bouwer, 1978; Engelbrecht, 1998). The extent and the rate at which the water degradation is occurring is classified as moderate to severe, according to the WOCAT assessment criteria (WOCAT, 2010). This is due to the fact that the cemetery cannot be removed and also the by-products will continue decomposing. A similar problem contributing to water degradation in Mangoloaneng is the erection of pit latrines upstream from water sources (Figure 6.8).

The community of Mangoloaneng is located on a fairly steep slope. Due to the lack of proper sanitation facilities and poor land-use planning, residents have erected pit latrines without ventilation pipes inappropriately and with very little knowledge of their potential impacts on the environment. Graham and Polizzotto (2013a) and Tillett (2013) state that the pit latrines cause the release of microbes and chemical contaminants into underground water and can travel a distance of approximately 20m. In Mangoloaneng, some of the pit latrines are located in a radius of approximately 10m from the main water sources (Figure 6.8).

Figure 6. 8: Pit latrines erected in close vicinity to the stream in Mangoloaneng community

The impact of these pit latrines threatens the quality of underground water and as well as the stream below. Consequently, this will affect the aquatic species, livestock and residents who are dependent on it. Moyle and Leidy (1992) and Gordon et al. (2013) state that pollution in water reduces oxygen which is needed for aquatic species such as fish to survive. According to the WOCAT assessment criteria, the rate and the extent of water degradation occurring as a result of the problem apparent is moderate (WOCAT, 2010). This is due to the fact that this problem can

be reduced once there are proper sanitation facilities available to the residents (as seen in Figure 6.9).

Figure 6. 9: Ventilated pit latrine systems in (a) Njane and (b) Mazabekweni Central communities

The two sanitation facilities seen in Figure 6.9 are examples of pit latrine systems with ventilation and rapid bio-capacity of feces, limits out infiltration. The advantage of using ventilated pit latrine systems is that they allow for the release of hazardous gas such as methane (Chikoto, 2010). Pit latrine systems without ventilation pose a serious problem to the groundwater. Thus, hazardous gases such as methane seep into groundwater aquifers and contaminate the water. Consequently, this results in the contamination of nearby fresh water sources (Chikoto, 2010). Although pit latrine systems such as these seen in Figure 6.9 have an impact on the surrounding environment, their contribution is minimal if compared to the ones without ventilation pipes (Figure 6.8).

6.2 Soil and biological degradation

In remote rural areas with limited service delivery, soil and biological degradation becomes the main threat to food security (Alston et al., 2012; Scialabba and Hattaam, 2002). This is as a result of decreasing soil fertility which in turn affects food production. The extent and rate of soil and biological degradation for the four communities varied as a result of variation in the level of development. For the purpose of this study, biological degradation focuses on vegetation cover loss through anthropogenic influences rather than alien invasive species. Infrastructural access and provision of primary services in these communities were seen as good indicators showing

low levels of soil and biological degradation. The lack of services and infrastructure contributes tremendously to soil and biological degradation in remote rural areas (Figure 6.10)

Figure 6. 10: Widening of poor roads in Mangoloaneng Community due to the creation of multiple tracks in the absence of an armored surface and correct drainage

The results in Table 5.2 b (pg.34) indicate that all four communities investigated have gravel roads. The state of the roads in three of the communities (Njane, Mahohoho and Mazabekweni Central) are in good condition and in Mangoloaneng they are very difficult to use. Figure 6.10 shows how the road has widened as a result of users avoiding difficulties during wet periods. As a result, the road has widened at least 15m from its original position. Consequently, there is an increase in soil and biological degradation (Figure 6.11 (a and b)) caused by vehicles. For instance, destruction of vegetation has resulted in the formation of rills along the road and in some parts gullies have developed. This problem is very common in remote rural areas with poor roads and the impacts on the environment are vegetation and soil loss.

Poorly designed dirt roads reduce water drainage during rain events and this results in scouring of soil particles as water channels on the road (Arnaez et al., 2004; Jungerius et al., 2002). Over time, rills begin to develop and if not rehabilitated become gullies. According to the WOCAT assessment criteria, the extent and the rate at which this problem is occurring is moderate to severe (WOCAT, 2010). This is due to the fact that the rills and gullies will continue to develop as the state of the road deteriorates. However, this problem can be rehabilitated if the state of the road can be improved and maintained. Figures 6.12 (a and b) show a good example of improved and maintained gravel roads in Njane and Mazabekweni Central communities.

Figure 6. 11: (A) Rills and (b) gullies developing on the side of the road leading towards Mangoloaneng community as result of poor maintenance and incorrect drainage

Figure 6. 12: Well-maintained gravel roads in (a) Njane and (b) Mazabekweni Central communities

Soil degradation in Mahohoho and Mangoloaneng communities are further exacerbated by deforestation and sand mining. The increasing demand for environmental resources such as forests and sand has resulted in severe soil erosion problems in poor rural areas (Bilsborrow and DeLargy, 1990; Goudie, 2013). Excessive removal of vegetation causes erosion by concentrating runoff due to low infiltration. As a result of poor service delivery, residents from these two communities utilize environmental resources in order to meet their basics needs. For instance, forests are used as the main source of energy in these communities (Figure 6.13 (a and b)).

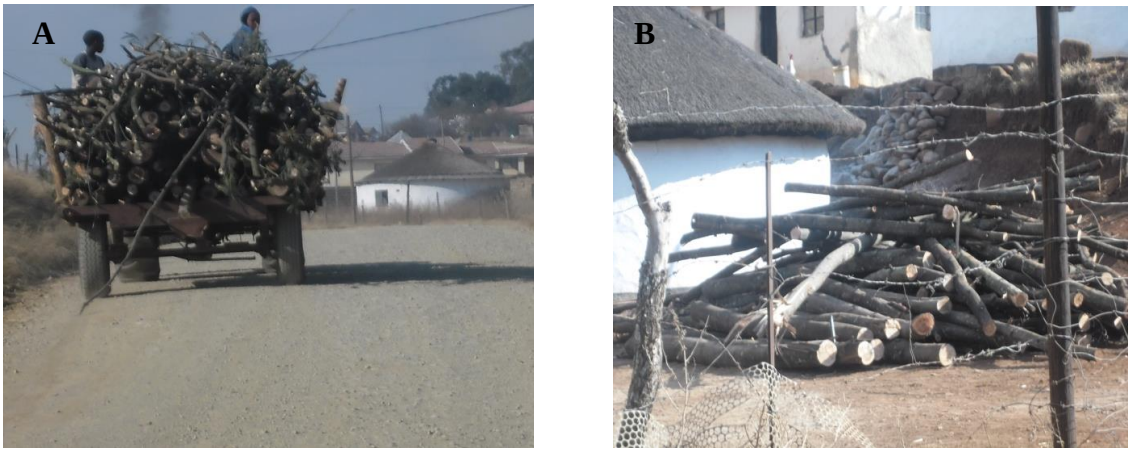

Figure 6. 13: Wood being (a) transported and (b) stored in Mahohoho and Mangoloaneng communities, respectively

During the field campaign, residents in these communities stated that forest areas have declined significantly in the last two decades and the main reasons are climate change problems and increasing population demands. Older residents in these communities have emphasized that climate patterns in winter and summer seasons have changed drastically. For example, winter months have become colder and summer rainfall has increased. This has resulted in intense deforestation because the demand for firewood has increased in winter. Residents have stated that in winter they require a minimum of two tractor loads of wood per month. Increasing deforestation in these communities has resulted in major soil and biological degradation during summer months (Figure 6.14 (a and b)). Removal of vegetation on steep slopes reduces slope stability because the underlying soil material becomes exposed and eroded during concentrated runoff (Morgan, 2009).

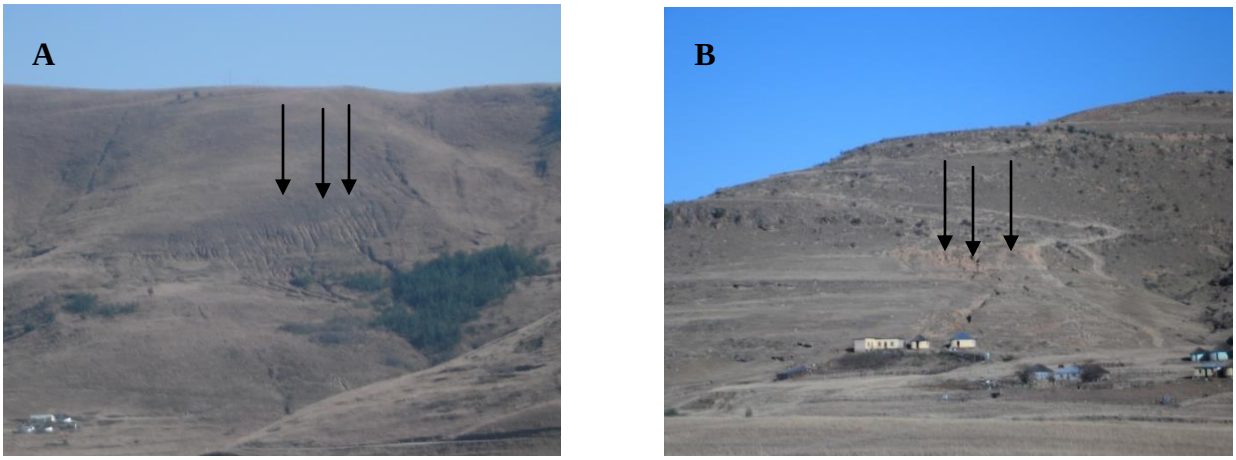

Figure 6. 14: (a) Soil erosion scars as a result of (a) deforestation and (b) human and animal paths in Mahohoho and Mangoloaneng communities respectively

The extent and rate of soil erosion and biological degradation as a result of deforestation in these communities are severe, according to the WOCAT assessment criteria. This is due to the fact that the degradation apparent is difficult to rehabilitate. However, it can be reduced if the communities can have alternative sources of energy. A similar problem to deforestation in Mahohoho community contributing to soil and biological degradation is the removal of vegetation for medicinal use. As indicated in the results above, this community lacks health care facilities and residents use natural herbs for their needs (Figure 6.15). Although the impacts on soil and biological degradation are dependent on the level of consumption, however if added with other contributing factors (such as deforestation and overgrazing) they become more critical. In Njane and Mazabekweni Central communities, these problems are limited because the communities have electricity and do not strongly rely on natural resources for energy supply.

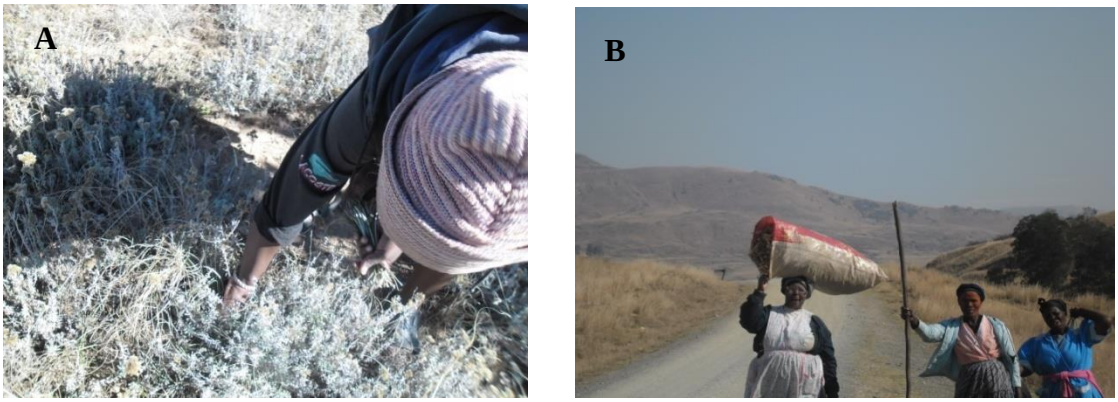

Figure 6. 15: Women (a) collecting and (b) transporting medicinal plants in Mahohoho community

As a result of poor service delivery such as unavailability of proper housing, residents in Mangoloaneng and Mahohoho communities continue to live in mud houses which are poorly made and highly vulnerable to extreme weather events. Extreme weather events have resulted in an increase in the demand for sand which is needed for continuous construction and maintenance of their houses (Figure 6.16b). According to the residents, in order to build a two room mud house, approximately 3 tons of sand is required (Figure 6.16a).

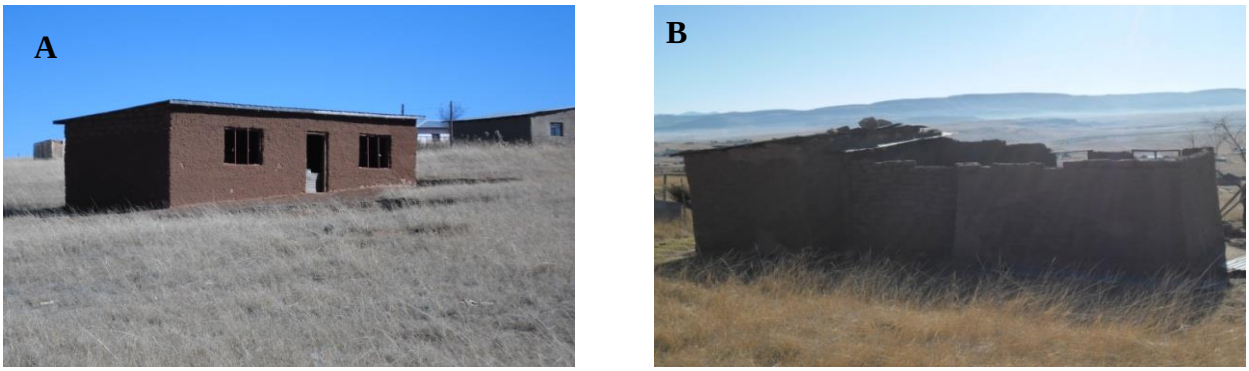

Figure 6. 16: Newly (a) built and a (b) damaged mud houses in Mangoloaneng and Mahohoho communties respectively. Poverty dictates against using a cement based plaster in favour of a mud coating, thus offereing little protection to the uderlying wooden and brick walls.

Excessive sand mining on slopes has resulted in severe soil and biological degradation in these communities (Figure 6.17).

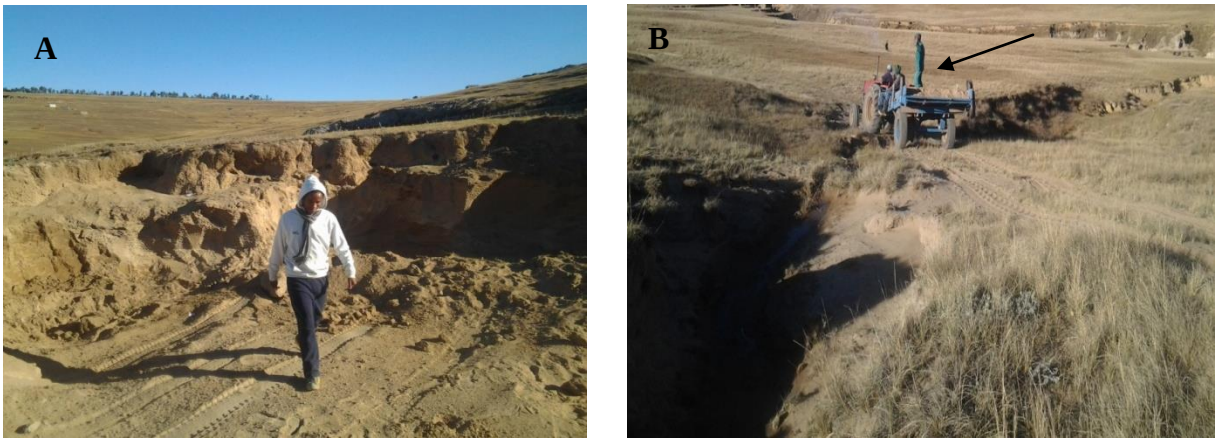

Figure 6.17: Sand mining (a) site and (b) residents transporting sand with a tractor in Mangoloaneng community

In Mangoloaneng, huge gullies have formed below the area where mining is taking place (Figure 6.18). This is as a result of removal of vegetation cover which is needed to intercept and reduce rain splash impacts. Lack of vegetation facilitates erosion by water since the surfaces are exposed to direct action of rainfall and high rates of water erosion. Growing plants and plant residues play an important role in reducing erosion by water on road slopes. Reduction of erosion has been attributed to a combination of factors. Vegetation hinders soil erosion by moderating and dissipating the energy exerted by water (Ande et al., 2009; Lal, 2001). Additionally, vegetation intercepts rainfall, increases infiltration of water, intercepts runoff and stabilizes the soil with roots (Bochet and Garcia-Fayos, 2004; Loch, 2000). The effectiveness of vegetation

cover and/or residue cover to reduce erosion, however, depends on the type, extend and quality of cover (Addisu, 2009). The extent and rate of soil and biological degradation according to the WOCAT assessment criteria, is severe. This is due to the fact that the degradation apparent is not easily rehabilitated, but can be reduced if the residents have alternative sources. Problems of soil and biological degradation as a result of sand mining are limited in Njane and Mazabekweni Central because less than 16% of the residents live in mud houses.

Figure 6. 18: Severe soil and biological degradation in Mangoloaneng community

This study indicates that there is a strong and direct relationship between poor service delivery and SLM in rural areas. This is due to the fact that two of the communities under study (Mangoloaneng and Mahohoho) have limited services hence severe SLM problems mainly soil erosion, water and biological degradation. Implications of the aforementioned SLM problems negatively impact on ecosystems goods and services as illustrated on Table 6.1 below. Whereas, the level of degradation is minimal in the other two communities (Njane and Mazabekweni Central) having basic services. It can also be noted that population growth and climate change problems can further exacerbate the SLM problems apparent in these communities. This is as a result of continuously increasing demand for natural resources and their services. Therefore, in order for the rural areas to reduce SLM problems, there must be a primary criteria put in place to ensure that basic needs of the people are met. As a result, this will reduce the pressure on the natural resources and their services.

Table 6.1: Degradation of natural resources and implications on ecosystem goods and services

Natural resource degradation	**Implications on ecosystem goods and services**
Soil	The deterioration of soil quality and quantity due to unsustainable land management practices has negative implications on the provision of ecosystem goods and services, particularly in rural areas (Kumar and Yashiro, 2014). This is due to the fact that good soils provide critical ecosystem goods and services which are important in sustaining life, water filtering and a growing medium for plants. Mostly importantly, soils form the basis for rural livelihoods and development through the provision of fiber, food and fuel (Assessment, 2005a).
Water	Surface and ground water quantity and quality deterioration affects natural ecosystems as well as human health (Assessment, 2005a). Sedimentation and pollution of ground and surface water as a result of solid waste and poor land-use management contributes to the decline of fresh water quality and quantity. Consequently, this impact on ecosystem goods and services as it reduces agricultural productivity, human health and loss of aquatic life (Pandey, 2013).
Biological	Biological degradation in the form of vegetation cover and rangeland loss as well as a decline in quality and species diversity through unsustainable land management practices negatively impacts on ecosystem goods and services (Assessment, 2005a). For instance loss in biodiversity e.g., natural species results in an increase in bare and unprotected soils and spread of invasive species (Flintan et al., 2013; Pimentel, 2010). Consequently, this contributes to soil erosion problems, loss of soil life and reduction of biological control.

CHAPTER 7

Conclusions and recommendations

7.1 Poor Service delivery and SLM problems in rural areas

The aim of this research was to develop a set of clear criteria for rural development in order to measure whether there is a relationship between land degradation caused by land-use in rural communities and the lack of primary criteria for rural development. The objectives developed for the achievement of this aim were to identify (1) SLM problems as a result of land-use management in rural communities (in South Africa); (2) rural communities affected by SLM problems as a result of land-use management; and (3) key criteria to benchmark the potential effectiveness of having a rural development primary criteria to reduce issues of SLM as a result of land-use management. The results of the study indicate that there is a strong relationship between poor service delivery and SLM problems in rural areas. The underdeveloped rural areas with poor service delivery demonstrated high levels of land degradation as compared to areas with better service delivery.

Mangoloaneng and Mahohoho communities are underdeveloped and relied on natural water sources for domestic use. The high level of water resources degradation in these communities was triggered by lack of piped water and over-utilization of springs, wells, rivers and wetlands. The level of water degradation was further exacerbated by solid waste and animal trampling. This indicates that lack of piped water is not the only factor influencing water degradation. Other anthropogenic activities such as solid waste dumping and increasing livestock may also influence water quality degradation. Additionally, unavailability of proper sanitation facilities and poor land-use planning contributes to water quality degradation directly and indirectly, respectively, in these two communities. The presence of improper placement of forests, pit latrines and cemeteries could negatively influence the water quality. Availability of clean piped water, however, reduces over-utilization and degradation of natural water sources. Well maintained and protected springs, wells, rivers and wetlands were characteristic of the Njane and Mazabekweni

Central communities. These two communities had clean piped water and relied less on the natural water source. These findings are in line with work of researchers in other parts of the world (for example Turner and Daily, 2008) which suggest over reliance on natural resources depletes their service over time.

Unavailability of other services such as good roads exacerbates soil and biological degradation. Poorly designed gravel roads in the community of Mangoloaneng resulted in rill and gully erosion, a condition that increased during high rainfall events as discussed in Section 5.5. The problem of soil and biological degradation in the communities of Mangoloaneng and Mahohoho was further increased by over-utilization of forests and sand since the two communities did not have electricity and proper brick houses. Forests in these communities are used for fuel wood and sand for building mud houses. Improved and maintained gravel roads in Njane and Mazabekweni Central communities did not show rilling or gullying. This suggests that provision of improved roads that are well maintained could reduce soil erosion. Erosion in the Njane and Mazabekweni Central communities may have further been lessened by the availability of electricity and proper brick houses that reduced pressure on nearby forests and available sand.

Using the WOCAT approach, the degree and rate at which water, soil and biological degradation is taking place in the underdeveloped communities of Mangoloaneng and Mahohoho is moderate to severe. This is due to the fact that the level of degradation apparent is controllable and can be rehabilitated. Access to clean piped water, proper roads, electricity and proper sanitation can reduce the level of degradation as noted in the communities of Njane and Mazabekweni Central.

7.2 Recommendations and direction for future research

The study has established that SLM problems in rural areas of South Africa are associated with poor service delivery. Furthermore, poor service delivery in rural areas is highly influenced by the lack of clearly defined primary criteria for rural development in South Africa. Therefore, if South Africa wants to achieve sustainable development in rural areas, it is important to have clearly defined criteria which can be used as a base for rural development. Based on the above

findings on challenges of service delivery in rural areas of South Africa, the following primary needs must be part of the fundamental criteria for rural development namely good roads, proper housing, clinics, schools (primary and secondary), proper sanitation facilities and clean piped water. As outlined in the literature chapter, these needs are seen to be a critical component of rural development throughout the literature from developed and developing countries. Based on the findings of the research, the relationship that exists between poor service delivery and sustainable land management problems in rural areas can be reduced or resolved by having these needs as part of the primary criteria for rural development. Table 7.1 provides a description of how the recommend criteria for primary rural development will have positive implications on SLM problems in rural communities.

Table 7.1: Basic rural development criteria and implications on SLM

Basic rural development criteria	**Criteria Definition**	***Description and implications on SLM***
Well maintained roads	Well maintained roads in this criterion are roads which are continuously managed, free of pot holes and have a good drainage system.	Having well maintained roads with effective drainage will have the following potential for rural development; Firstly, rural areas will become easily accessible and this will create better chances for them to become developed. Secondly, good roads with drainage will reduce soil and biological problems as outlined in the research
Proper housing	Proper housing according to this criterion refers to houses that made of real bricks instead of mud and dagga as well as roofed with long lasting material not vulnerable day to day weather changes.	The potential of having proper housing in rural areas will reduce the impact of soil and biological degradation occurring as a result of resident's informal sand mining
Healthcare facilities	Availability and accessibility of proper and basic health institutions such as clinics and hospitals	Providing rural residents with primary health facilities has the potential to reduce biological degradation and will ensure that minor sickness are addressed before worsening
Sustainable sanitation facilities	Provision of basic sanitation facilities such as toilets in every household as well as a well-managed sewage reticulation system.	These facilities will reduce water degradation as well as enable people to live in more socially and environmental healthier societies
Clean piped water	Provision of clean water for drinking and other household purposes in every household	Having this essential resource to rural residents will reduce problems of natural water sources becoming degraded and poor health issues as a result of polluted water sources

Reliable Electricity	Provision of a reliable source of electrical energy a reliable source of energy in for every household	Ensuring a sustainable and clean source of energy such as electricity provision at primary level development for rural areas can help reduce pressure on the residents and the environment. However, from an environmental perspective, it is important to move towards alternative and renewable energy sources in order to reduce the use of fossil fuels and resources such as dung that would be of greater value elsewhere in the system
Schools (primary and secondary)	Availability of primary and secondary schools in each village.	The potential of educating rural residents will allow them to develop skills which will enable them to become competitive for jobs and ensure that proper land-use, planning and management is achieved in their development strategies

7.3 Limitations and future prospects

While this research has contributed to the understanding of the relationship between poor service delivery and SLM problems in rural areas, explicit investigations are required that would help maximize the quality of observations. For example, quantifying the level and amount of soil, water and biological degradation will further improve the research. Due to the nature of the research, this was not necessary since the aim was to identify the relationship that exists between poor services delivery and sustainable land management problems in rural areas.

Regardless of the limitations, the results of this study should help local, provincial and national government authorities and rural residents to understand the relationship that exists between poor service delivery and sustainable land management problems. This will contribute to improved planning, implementation, monitoring, and evaluation of development in rural areas in order to ensure sustainable development.

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APPENDIX A

Investigating the role of key success criteria for rural development initiatives in the context of sustainable land-use management

Questionnaire

Section A: Demographic profile of respondents

A1.Gender

A2. Age (in years) _____

1. Male	2. Female

A3. How many persons currently reside in your household? _____

A4. How long have you been living here for? _____

A5. Why have you settled in this community?

1. Born	2. Allocated (without a choice)	3. Migrated (out of choice)

A6. What is your highest level of education?

1.None	2. Primary school	3. Secondary school	4. Tertiary

A5.What is your employment status?

1 Employed	2. Unemployed	3.Self-employed	4. Retired	5. Medically boarded	6. Student

Section B: Primary services available to the respondent

B1. Do you have access to clean piped water?

1.Yes	2. No

B1a. If not, where you accessing your water from?

1.Borehole off site/communal	2.Rain-water tank	3.Neighbour's tap /public taps	4.Water-carrier/Tanker	5.Flowing water/Stream/river well/Spring	6.Dam/Pool/Stagnant water

B2. Do you have access to proper sanitation facilities?

1.Yes	2. No

B2a. If not, what are you using?

1 Flush toilet connected to a septic tank	2. Chemical toilet	3. Pit latrine/toilet with ventilation pipe	4. Pit latrine/toilet without ventilation pipe	5. Bucket toilet	6. None

B3. Do you have access to a primary healthcare facility in your community?

1.Yes	2. No

B3a.If not, what are you using?

1 Traditional remedy's	2. Travel to a nearby clinic outside your community	3. District hospital	4. Private practices

B3b. How long do you think it takes you to access the above facility?

1. less than 30 minutes	2. An hour	3.More than an hour

B4a (i). Is there a primary school in your community?

1.Yes	2. No

B4a. If not, how far is the nearest primary school?

1. less than 30 minutes	2. An hour	3.More than an hour

B4b (ii). is there a high school in your community

1.Yes	2. No

B4b. If not, how far is the nearest high school?

1. less than 30 minutes	2. An hour	3.More than an hour

B5. Do you have electricity?

1.Yes	2. No

B5a. If not, what are you using as your source of energy?

1 Candles	2. Wood	3. Paraffin	4. Gas

B6. Is your house built out of blocks/bricks?

1.Yes	2. No

B6a. If not, what are the difficulties you facing with it?

1.Requires continuous maintenance	2. It is vulnerable to extreme weather events; floods, rain etc.,

B7. What type of roads you use to access your home in the community?

1.Tarred roads	2. Gravel roads

B7a. What are the states of the roads?

1 Well Maintained	2. manageable	3. extremely difficult to use	4. Difficult

B8. Have you notice any change in the state of the environment as time progressed in the community. If yes, explain (e.g. decline in water quality in the river)

Appendix B

WOCAT DATA ENTRY TABLE

Please fill out one table for each mapping unit

Mapping Unit Id: _____

Land Degradation							
Type	**Degree**	**Extent**	**Rate**	**Direct Causes**	**Indirect Causes**	**Impact on ecosystem services**	**Remarks**

Degradation Types

W: Soil erosion by water

Wt: Loss of topsoil / surface erosion

Loss of topsoil through water erosion is a process of more or less even removal of topsoil, generally known as surface wash or sheet / interrill erosion. Wt also includes

tillage erosion. As nutrients are normally concentrated in the topsoil, the erosion process leads to impoverishment of the soil. Loss of topsoil itself is often preceded by compaction and/or crusting, causing a decrease in infiltration capacity of the soil, and leading to accelerated runoff and soil erosion.

Wg: Gully erosion / gullying

Development of deep incisions down to the subsoil due to concentrated runoff.

Wm: Mass movements / landslides

Examples of this degradation type are landslides and mudflows, which occur locally but often cause heavy damage.

Wr: Riverbank erosion

Lateral erosion of rivers cutting into riverbanks.

Wc: Coastal erosion

Abrasive action of waves along sea or lake coasts.

Wo: Offsite degradation effects

Deposition of sediments, downstream flooding, siltation of reservoirs and waterways, and pollution of water bodies with eroded sediments.

E: Soil erosion by wind

Et: Loss of topsoil

This degradation type is defined as the uniform displacement of topsoil by wind action. It is a widespread phenomenon in arid and semi-arid climates, but it also occurs under more humid conditions. Wind erosion is nearly always caused by a decrease in the vegetative cover of the soil. In (semi)arid climates natural wind erosion is often difficult to distinguish from human-induced wind erosion, but natural wind erosion is often aggravated by human activities.

Ed: Deflation and deposition

Uneven removal of soil material by wind action. Leads to deflation hollows. It can be considered as an extreme form of loss of topsoil, with which it usually occurs in combination.

Eo: Offsite degradation effects

Covering of the terrain with windborne sand particles from distant sources ("overblowing").

C: Chemical soil deterioration

Cn: Fertility decline and reduced organic matter content

Aside from loss of nutrients and reduction of organic matter as a result of topsoil removal by erosion, a net decrease of available nutrients and organic matter in the soil may also occur due to "soil mining": nutrient outputs (through harvesting, burning, leaching, etc.) are not or insufficiently compensated by inputs of nutrients and organic matter (through manure / fertilizers, returned crop residues, flooding). This type also includes nutrient oxidation and volatilisation.

Ca Acidification

Lowering of the soil pH, eg due to acidic fertilisers or atmospheric deposition.

Cp: Soil pollution

Contamination of the soil with toxic materials. This may be from local or diffuse sources (atmospheric deposition).

Cs: Salinisation / alkalinisation

A net increase of the salt content of the (top)soil leading to a productivity decline.

P: Physical soil deterioration

Pc: Compaction

Deterioration of soil structure by trampling or the weight and/or frequent use of machinery.

Pk: Sealing and crusting

Clogging of pores with fine soil material and development of a thin impervious layer at the soil surface obstructing the infiltration of rainwater. Development of a water-repellent layer (eg beneath surface ashes after forest fire).

Pw: Waterlogging

Effects of human induced water saturation of soils (excluding paddy fields).

Ps: Subsidence of organic soils, settling of soil

Drainage of peatlands or low lying heavy soils.

Pu: Loss of bio-productive function due to other activities

Some land use changes (e.g. construction, mining) may have implications for the bio-productive
function of the soil and hence a degradation effect.

H: Water degradation

Ha: Aridification

Decrease of average soil moisture content (reduced time to wilting, change in phenology, lower
yield).

Hs: Change in quantity of surface water

Change of the flow regime: flood / peak flow, low flow, drying up of rivers and lakes.

Hg: Change in groundwater / aquifer level

Lowering of groundwater table due to over-exploitation or reduced recharge of groundwater; or
increase of groundwater table e.g. due to excessive irrigation resulting in waterlogging and/or salinisation.

Hp: Decline of surface water quality

Increased sediments and pollutants in fresh water bodies due to point pollution (direct effluents eg from industry, sewage and waste water in river water bodies) and land-based pollution (pollutants washed into water bodies due to land management practices eg sediments, fertilizers and pesticides).

Hq: Decline of groundwater quality

Due to pollutants infiltrating into the aquifers. Human induced pollution is mainly caused by
inappropriate land management practices or deposition of waste.

Hw: Reduction of the buffering capacity of wetland areas

To cope with flooding and pollution.

B: Biological degradation

Bc: Reduction of vegetation cover

Increase of bare / unprotected soil.

Bh: Loss of habitats

Decreasing vegetation diversity (fallow land, mixed systems, field borders).

Bq: Quantity / biomass decline

Reduced vegetative production for different land use (eg on forest land through clear felling,
secondary vegetation with reduced productivity).

Bf: Detrimental effects of fires

On forest (eg slash and burn), bush, grazing and cropland (burning of residues). This includes low
severity ("cold") fires (only understorey burns, trees survive) and high severity ("hot") fires
(reach the crown of the trees and may kill them).

Bs: Quality and species composition / diversity decline

Loss of natural species, land races, palatable perennial grasses; spreading of invasive, salttolerant,
unpalatable, species / weeds.

Bl: Loss of soil life

Decline of soil macro-organisms (earthworms and termites) and micro-organisms (bacteria and fungi, …) in quality and quantity.

Bp: Increase of pests / diseases, loss of predators

Reduction of biological control. If subcategories are not specified, a -" should be added instead of a letter.

Degree of land degradation

Degree is defined here as the intensity of the land degradation process, e.g. in the case of soil erosion: the amount of soil washed or blown away. Indicators of land degradation are used to measure the degree of degradation, e.g. the percentage of the total topsoil lost, the percentage of total nutrients and organic matter lost, the relative decrease in soil moisture holding capacity, shift in vegetation cover, decreasing ground water table etc. For the assessment of the degree of degradation, the following qualitative categories are used. In case a degradation type has different degrees of degradation within the same land use system in a mapping unit it can be split up and listed separately in two rows (e.g. Wt: extent 10% with degree 4; Wt: extent 40% with degree 1).

1. Light: there are some indications of degradation, but the process is still in an initial phase. It can be easily stopped and damage repaired with minor efforts.

2. Moderate: degradation is apparent, but its control and full rehabilitation of the land is still possible with considerable efforts.

3. Strong: evident signs of degradation.

Changes in land properties are significant and very difficult to restore within reasonable time limits.

4. Extreme: degradation beyond restoration.

Rate of degradation

Whereas the degree of degradation indicates the current static situation, the rate indicates the trend of degradation over a recent period of time. A severely degraded area may be quite stable at present (i.e. low rate, hence no trend towards further degradation), whereas some areas that are now only slightly degraded may show a high rate, hence a trend towards rapid further deterioration. At the same time, an identification of the rate of degradation can reveal areas where the situation is improving (e.g. through soil and water conservation measures). The average development over approximately the last 10 years should be assessed in order to level out irregular changes. Three classes are defined that show a trend towards further deterioration and three with a trend towards decreasing degradation, either as a result of human influence or natural stabilisation; one class indicates no changes.

3: rapidly increasing degradation

2: moderately increasing degradation

1: slowly increasing degradation

0: no change in degradation

-1: slowly decreasing degradation

-2: moderately decreasing degradation

-3: rapidly decreasing degradation

Extent of the degradation type: area percentage of mapping unit (state indicator)

For each identified land degradation type, the extent should be given as percentage of the US affected by that degradation type within the selected administrative unit

Direct causes of land degradation

Various types of human activities and natural causes may lead to land degradation. The emphasis in the degradation inventory is on human-induced degradation, but sometimes natural degradation also necessitates measures to be taken. More than one of the following causes (direct pressure indicators) may be entered in the matrix table.

s: Soil management: improper management of the soil this includes:

(s1) cultivation of unsuitable soils

(s2) missing or insufficient soil conservation measures/ runoff and erosion control measures

(s3) heavy machinery

(s4) tillage practice (ploughing, harrowing, etc.)

(s5) others

c: Crop management: improper management of annual, perennial (e.g. grass), shrub and tree crops. This includes a wide variety of practices:

(c1) reduction of plant cover and residues (including burning, use for fodder, etc.)

(c2) inappropriate application of manure, fertilizer, herbicides, pesticides and other agro-chemicals or waste (leading to contamination and washing out (non-point pollution))
(c3) nutrient mining: excessive removal without appropriate replacement of nutrients
(c4) shortening of the fallow period in shifting cultivation
(c5)inappropriate irrigation (full and supplementary): inefficient irrigation method, overirrigation,
insufficient drainage
(c6) inappropriate use of water in rainfed agriculture (eg excessive soil evaporation and runoff
(c7) others

f: Deforestation and removal of natural vegetation: extensive removal of natural vegetation (usually primary or secondary forest), due to:
(f1) large-scale commercial forestry,
(f2) expansion of urban / settlement areas and industry
(f3) conversion to agriculture
(f4) forest / grassland fires
(f5) road construction
(f6) others
Deforestation is often followed by other activities that may cause further degradation.

e: Over-exploitation of vegetation for domestic use: in contrast to "deforestation and removal of natural vegetation", this causative factor does not necessarily involve the (nearly) complete
removal of "natural" vegetation, but rather degeneration of the remaining vegetation, thus leading
to insufficient protection against land degradation. It includes activities such as:
(e1) excessive gathering of fuel wood, (local) timber, fencing materials
(e2) removal of fodder
(e3) others

g: Overgrazing: usually leads to a decrease in plant cover, a change to lower quality fodder, and/or soil compaction. This may in turn cause reduced soil productivity and water or wind erosion. It includes:

(g1) excessive numbers of livestock

(g2) trampling along animal paths

(g3) overgrazing and trampling around or near feeding, watering and shelter points

(g4) too long or extensive grazing periods in a specific area or camp leading to overutilization of
palatable species

(g5) change in livestock composition: from large to small stock; from grazers to browsers; from
livestock to game and vice versa

(g6) others

i: Industrial activities and mining: includes all adverse effects arising from industrialisation and
extractive activities, such as loss of land resource and their functions for agriculture, water
recharge, etc.. It includes land used for:

(i1) industry

(i2) mining

(i3) waste deposition

(i4) others

u: Urbanisation and infrastructure development: includes all adverse effects arising from
industrialisation and extractive activities, such as loss of land resources and their functions for
agriculture, water recharge. It can cause considerable run-off and erosion, as well as other types of degradation (eg pollution). It includes land used for:

(u1) settlements and roads

(u2) (urban) recreation

(u3) others

p: Discharges leading to point contamination of surface and ground water resources, or excessive runoff in neighbouring areas:

(p1) sanitary sewage disposal

(p2) waste water discharge

(p3) excessive runoff

(p4) poor and insufficient infrastructure to deal with urban waste (organic and inorganic waste)

(p5) others

q: Release of airborne pollutants from industrial activities and urbanisation leading to:

(q1) contamination of vegetation/ crops and soil

(q2) contamination of surface and ground water resources:

(q3) others

w: Disturbance of the water cycle leading to accelerated changes in the water level of ground water aquifers, lakes and rivers (improper recharge of surface and ground water) due to:

(w1) lower infiltration rates / increased surface runoff

(w2) others

o: Over-abstraction / excessive withdrawal of water:

(o1) irrigation

(o2) industrial use

(o3) domestic use

(o4) mining activities

(o5) decreasing water use efficiency

(o6) others

n: Natural causes: many occurrences of degradation are not caused by human activities. Although this assessment places the emphasis on human-induced degradation, natural causes may be indicated as well. They include:

(n1) change in temperature

(n2) change of seasonal rainfall

(n3) heavy/extreme rainfall (intensity and amounts)

(n4) windstorms / dust storms

(n5) floods

(n6) droughts

(n7) extreme topography

(n8) other natural causes (avalanches, volcanic eruptions, mud flows, highly susceptible natural
resources, etc.)

Indirect causes of land degradation

Socio-economic factors are often crucial in order to understand why land degradation occurs. They are
underlying causes - the driving forces of the direct causes of land degradation. More than one of the
following indirect pressure indicators may be entered in the matrix table:

p: Population Pressure: density of population can be a driving force for degradation. High
population pressure may trigger or enhance degradation, e.g. by competing for scarce resources
or ecosystem services, but a low population density may also lead to degradation, for instance
where it leads to a lack of labour force.

t: Land Tenure: Poorly defined tenure security / access rights may lead to land degradation, as
individual investments in maintenance and enhancement can be captured by others and land users
do not feel "owner" of the maintenance investments. Tenure systems are particular important factors when conservation practices have a long lag between investment and return, such as
terracing and tree planting.

h: Poverty / wealth: poor people cannot afford to invest in resource conserving practices, so instead they continue to use inappropriate farming practices (such as ploughing hillsides and overgrazing), which again will lead to increased land degradation and worsen poverty. Whether poverty plays a role in land degradation needs to be assessed.

l: Labour Availability: Shortage of rural labour (eg through migration, prevalence of diseases) can lead to abandonment of traditional resource conservation practices such as terrace maintenance. Off-farm employment opportunities may, on the other hand, help to alleviate pressure on production resources, in the sense that land users can invest more in conservation infrastructure as income increases.

r: Inputs and infrastructure (roads, markets, distribution of water points, etc.): inaccessibility to, or high prices for key agricultural inputs such as fertilizers, may render it difficult or unprofitable to preserve soil fertility or water resources. Access to markets and prices and good infrastructure may improve this. On the other hand, a road through a forest can lead to overexploitation and degradation.

e: Education, access to knowledge and support services: investing in human capital is one of the keys in reducing poverty (and thus land conservation practices). Educated land users are more
likely to adopt new technologies. Land users with education often have higher returns from their

land. Education also provides off-farm labour opportunities.

w: War and conflict: they lead to reduced options to use the land or to increased pressure.

g: Governance / institutional: laws and enforcements, organization, collaboration and support:
government induced interventions may set the scene and be indirect drivers for implementation of
conservation interventions.
o: Others (specify