



Sustainable Livelihoods and Biodiversity in Developing Countries

Climate Smart Agriculture in the Mutale Basin, South Africa

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PREFACE

For my Masters study in Environmental Resource Management at the Vrije Universiteit (VU) Amsterdam, I took part in the EU funded LiveDiverse¹ project, which was carried out during the months April until June 2010 in cooperation with the Council for Scientific Industrial Research (CSIR) based in Pretoria, South Africa. The LiveDiverse project seeks to develop new knowledge on the interaction between livelihoods and biodiversity within the context of riparian and aquatic ecosystems. This knowledge should contribute to improve and assess value-based strategies that promote sustainable livelihoods, and biodiversity protection at the same time. This thesis is based on three months of field study in the Mutale Basin in South-Africa and eight months of data analysis and further research in The Netherlands.

I have started of my research analyzing the relationship between rural poverty and biodiversity but during the course of writing I changed my focus to potential adaptation strategies for communities in the Mutale Basin to reduce their vulnerability for climate change by investments in climate smart agriculture as a diversification of their livelihood strategy. This change of focus was inspired by my internship at the Environmental Department of the Ministry of Foreign Affairs in The Netherlands during the past six months. I became interested in climate smart agriculture as an upcoming adaptation strategy and wondered if this could be applied in the case study area of my research.

First of all, I would like to thank LiveDiverse and the communities of Mutale Basin for making this research possible. During the past year I have received a great deal of assistance and feedback from the CSIR team in South Africa and the IVM department in The Netherlands. I would like to thank my external supervisor Marius Claassen and CSIR colleagues Karen Nortje, Nikki Funke and Maronel Steyn, who have been both supportive and inspiring during the fieldwork. I would also like to thank the interpreters, who travelled with us translating for us for three weeks: Peter, Ndivhuwo, Tainy, Jeoffrey and Livhuwani. I would like to thank Karolina Weijers-Troup who helped me with the translation. Of course I cannot forget my fellow students Jelena Perunicic and Johanna Medvey for their inspiration and laughter. And last but not least, I would like to thank Jetske Bouma and Dave Huitema of IVM in particular, for their time and guidance during the writing of this thesis.

¹ For more information, see: www.livediverse.eu.

ABBREVIATIONS

CA	Conservation Agriculture
CSA	Climate Smart Agriculture
CSIR	Council for Scientific Industrial Research
CT	Conservation Tillage
CSD	Commission on Sustainable Development
DFID	Department For International Development
FANPRAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organization
ICARDA	International Center for Agricultural Research in the Dry Areas
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IIED	International Institute for Environment and Development
IPCC	Intergovernmental Panel on Climate Change
IVM	Institute for Environmental Studies
LDA	Local Department of Agriculture
LRAD	Land Redistribution for Agricultural Development
MDG's	Millennium Development Goals
ODI	Overseas Development Institute
SANCCRS	South African National Climate Change Response Strategy
SASSA	South African Social Security Agency
SLAG	Settlement Land Acquisition Grant
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
VU	Vrije Universiteit

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CHAPTER 1. INTRODUCTION

1.1. INTRODUCTION

We have arrived at a stage where we cannot deny that climate change is present. Results that have been published so far by the Intergovernmental Panel on Climate Change (IPCC) show that the impacts of climate change will lead to changes of temperature, prevalence of vector-borne diseases; decreased water security and an increase in floods and droughts. In practice this means that climate change will have an impact on livelihood strategies all over the world. The most affected livelihoods are in rural areas in developing countries, where poverty is widespread and agricultural productivity is low due to, amongst others, degrading natural resources, lack of markets and climate risks (Vermeulen et al., 2010). Especially farmers and landless laborers who depend on their direct natural environment and rainfed agriculture for food security are exposed to the impacts of climate change. According to Nhemachena et al. (2008) greater food and water stress due to climate change will worsen the vulnerability of the poor in three important ways:

1. Increased insecurity of livelihoods, due to depleted access to natural resources that include fertile soil and water, but it will also affect other social, financial and physical assets.
2. An increase of health risks as a lack of food and water will have serious implications for health.
3. Constrained economic opportunities due to long and short term impacts of droughts and floods.

The concept of vulnerability has its origins in geography, natural hazards research, the analysis of food insecurity and famine, and plays an even more important role in today's climate change research. In the field of climate change, vulnerability has been described as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2001).

The vulnerability analysis plays a key role in the LiveDiverse project², which is in line with the objectives of this research by assessing "climate smart agriculture" as a strategy to reduce rural communities vulnerability for climate change. LiveDiverse (2010) defines vulnerability as a concept that denotes a state of susceptibility to harm in which persons, communities, countries, technologies, infrastructures and ecosystems³ are said to be vulnerable when their current condition is potentially disturbed or exposed by internal and/or external threats. The greater the likelihood of this disturbance distressing the current condition of the system, the greater the vulnerability to that particular disturbance of the system in question (Bouma and Huitema, 2010:6).

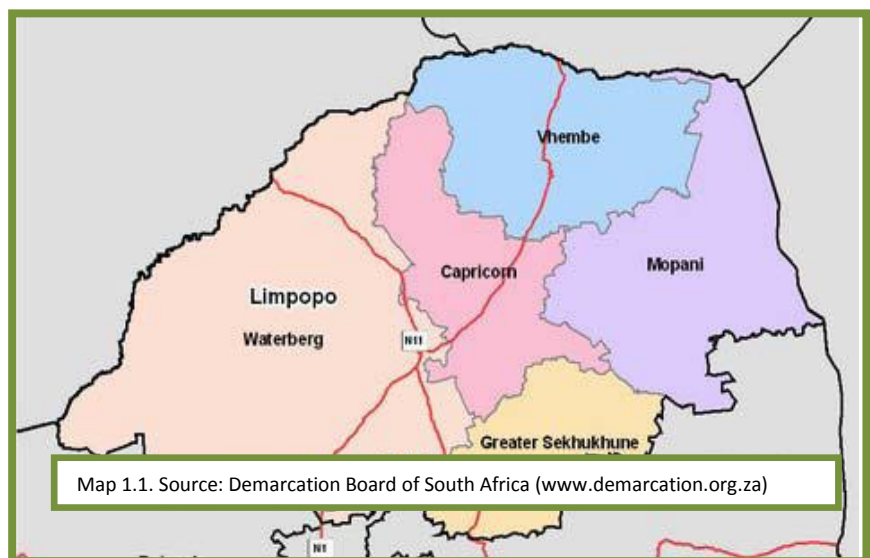
² Livediverse considers vulnerability from a combination of bio-physical, socio-economic, cultural and spiritual perspectives, where human ability to conserve and husband biodiversity meanwhile achieving sustainable livelihoods is of vital importance (www.livediverse.eu)

³ These could all be referred to as systems.

Climate smart agriculture is an upcoming climate change adaptation strategy to help small rural (subsistence) farmers adapt to climate change by an intensification or diversification of their livelihood strategy, thereby reducing their vulnerability. Climate smart agriculture is defined by the FAO (2010) as the “agriculture that sustainably increases productivity, resilience, reduces or removes Green House Gas emissions (mitigation), and enhances achievement of national food security and the Millennium Development Goals (MDGs)”. In this context resilience means the ability of a community to resist, absorb, and recover from the effects of hazards in a timely and efficient manner, preserving or restoring its essential basic structures, functions and identity (DFID, 2010). As the term climate smart agriculture suggests, new agricultural production systems are necessary to move towards higher productivity together with a lower output variability in the face of climate risks, which may be both of an agro-ecological and socio-economic nature. Examples of climate smart agriculture are: soil and nutrient management, water harvesting and use, pest and disease control or resilient ecosystems (FAO, 2010).

1.2. RELEVANCE FOR CASE STUDY AREA

The case study area of this research is situated in the Mutale Basin, belonging to the Vhembe District Municipality in the Northern part of Limpopo Province. It shares its borders with Zimbabwe in the North, Mozambique, through the Kruger National Park, in the East, and Botswana in the North-West (Map 1.1.). It lies within the summer rainfall region of South-Africa, with more than 90 percent of annual precipitation occurring between October and March. The region can be subdivided into three physiographic zones: Central, North and South. These zones show considerably different climatic conditions but overall the climate can be described as semi-arid.



Vhembe District has a population of approximately 1.2 million people and, according to the Local Economic Analysis of Vhembe District (2006), a poverty rate of 65.2 percent. The economy of the Vhembe District relies mostly on mining, tourism and agriculture; all three sectors are highly dependent on access to water. Although these sectors are mentioned as the main drivers of the local economy, unemployment rates are high in the Mutale Basin, most rural households depending on social grants and on their direct natural environment for the collection of fruits, fodder, vegetables, medicinal plants, firewood and water (Bouma et al., 2011).

Farming is a challenge as the region faces severe land degradation. The soils are very susceptible to erosion, both croplands and grazing lands are affected by sheet erosion⁴ and by gully erosion⁵ (LDA) and floods recur on a roughly ten-year basis (Lahiff, 2001).

Poor environmental conditions in the region are due to climate conditions but also to geological factors like very poor soils. The Apartheid regime further worsened the conditions for agricultural production by redistributing the land: The Apartheids Regime which was implemented in 1948, introduced new laws based on the principle of race segregation. One of the biggest segregation legislations and a predecessor of the Apartheid system was “The Native Lands Act of 1913” (1913-1991). Many black Africans were forcibly removed and relocated to The Northern Region, increasing land concentration and scarcity, which resulted in competition over land use, and environmental degradation. The Land Act also excluded black Africans from buying land from white people and prohibited them from sharecropping, denying many rural households access to adequate resources for survival. The result was an increase of migrant labour to urban areas, commercial farms or mining sites and a decrease of subsistence farming (Bradstock, 2005). Women were left behind to manage the household and cope with extreme hardships in rural areas lacking access to land, as most land in Venda District is classified as “communal land”. This is nominally owned by the state, but held “in trust” by traditional leaders, like the chief, headman or woman. Under customary law, the right to land usually applies only to the male head of the household. (Lahiff, 2000).

According to the IPCC climate change is expected to increase the events of droughts, floods, pests, animal diseases, and soil and land degradation. This will most likely increase the vulnerability of communities in the Mutale Basin. Temperatures are expected to increase in the range of between 10C and 30C by the mid 21st century and water will become even more scarce, as a broad reduction of rainfall is predicted (in the range of 5% to 10%) in the summer rainfall region in South Africa (SANCCRS, 2004). The lack of water will limit subsistence farming even further but it will also challenge livestock keeping, due to a lack of fodder and water. This will most likely affect the vulnerability of the entire communities as livestock keeping is still widely practised in the Mutale Basin and offers many benefits for poor people in terms of financial, physical and social capital (Stroebel et al., 2011; Lahiff, 2001).

Climate change will especially increase the vulnerability of women as they are for instance responsible for taking care of the livestock when the men or boys are out for work and school, even though women rarely own livestock themselves. The different impacts of climate change on women and men is due to social norms, traditional roles and different power structures (Schalatek, 2009:14; CARE, 2010). Absence of recognized ownership to land and livestock can limit the women’s ability to obtain credit and to adapt to climate change by means of undertaking investments in agriculture. A consequence could be that women might withdraw their time and effort in response due to a lack of incentives, when their rights are not recognized.

⁴ Sheet erosion involves the removal of a uniform thin layer of soil by raindrop splash or water run-off. This thin layer of topsoil often disappears gradually, making it difficult to monitor because the damage is not immediately perceptible.

⁵ Gully erosion is a highly visible form of soil erosion that affects soil productivity, restricts land use and can threaten roads, fences and buildings.

1.3. RESEARCH QUESTION AND SUB-QUESTIONS

According to the World Bank's Special Envoy for Climate Change, Andrew Steer, climate smart agriculture is considered a triple win concept. Besides more productive and resilient agriculture for the global arena, more importantly in the context of this research is that climate smart agriculture can contribute to a reduction of local vulnerability by: reducing food insecurity, increasing health conditions and enabling a diversification of the household income by generating surplus for the market, thereby addressing two MDGs directly and four MDGs indirectly⁶. Therefore the World Bank has decided to increase their financial support for agriculture by 60 percent. Their main focus will be on reducing risk and vulnerability, raising agricultural productivity, linking farmers to markets and strengthening value addition, and enhancing environmental services and sustainability. Reducing risk and vulnerability, enhancing environmental services and sustainability are extremely important for communities in the Mutale Basin. Therefore I wondered if climate smart agriculture could be applied in the case study area of my research, as a livelihood diversification strategy to adapt to the challenges of climate change. The aim of this research is to provide a critical analysis of the feasibility to invest in climate smart agriculture. More specifically in land and livestock addressing gender relations, thereby reducing the vulnerability of rural communities in the Mutale Basin and increasing their food security.

This thesis should provide an answer on the following research question:

“Are climate smart investments in land and livestock a feasible solution for reducing vulnerability and establishing climate change resilience for up- and downstream villages in the Mutale Basin?”

To answer my main research question it is necessary to ask the following sub-questions:

1. *How will climate change affect the vulnerability of up- and downstream communities in the Mutale Basin?*
2. *What are Climate Smart Agricultural Investments in land and livestock?*
3. *In what ways do gender relations affect investments in Climate Smart Agriculture?*
4. *Does the case-study area have the capacity to implement Climate Smart Investments in land and livestock?*

⁶ Directly: 1: Eradicate extreme poverty and hunger, 7: Ensure environmental sustainability. Indirectly: 3: Promote gender equality and empower women, 4: Reduce Child Mortality, Improve maternal health, 6: Combat HIV/AIDS, malaria and other diseases (UNDP, 2000).

1.4. THESIS STRUCTURE

The following chapter will introduce the concept and the relevance of climate smart agriculture and discuss the framework provided by the coalition Farming First for a capacity assessment of the case study area for investments in climate smart agriculture. Chapter three will describe and elaborate on the methodology used. The results of my research will be discussed in chapter four till seven. Chapter four will discuss the vulnerability for climate change impacts for communities in the case study area. Opportunities for investments in land and livestock will be analyzed in chapter five, making a distinction between up- and downstream villages given the different impacts of climate change. Chapter six will discuss the importance of understanding gender relations for climate smart agriculture. Chapter seven will evaluate whether investments in climate smart agriculture are possible in up- and downstream villages by using the capacity assessment framework provided by the coalition Farming First. I will conclude in chapter eight by providing an answer to my main research question, thereby providing recommendations for future policy makers regarding climate smart investments strategies in the Mutale Basin.

CHAPTER 2. CONCEPTUAL FRAMEWORK

2.1. INVESTING IN CLIMATE SMART AGRICULTURE

Investing in climate smart agriculture is a new strategy to meet the need for the growing global demand for food in a climate smart manner, while at the same time reducing the socio-economic vulnerability of rural communities in developing countries thereby safeguarding the MDG's. Investing in increasing soil organic matter in cropping systems, mixed-species forestry or agro-forestry can improve the soil quality and reduce the impacts of droughts or floods thus reducing vulnerability. Although climate smart agriculture is a new strategy for rural farmers to adapt to climate change and to increase agricultural production in a sustainable manner, it is not a completely new concept. For instance Conservation Agriculture (CA) one of the climate smart practices, has its origins in Conservation Tillage (CT) which was introduced in the 1930s (Hobbs et al., 2007). The FAO however added some new practices to CT in the course of the years and introduced CA as a new concept for resource-efficient agricultural crop production based on an integrated management of soil, water and biological resources combined with external inputs. Its concept is based on three main principles to achieve more sustainable agricultural production: 1) minimum or no mechanical soil disturbance; (2) permanent organic soil cover (consisting of a growing crop or a dead mulch of crop residues); and (3) diversified crop rotations. Besides CA, the FAO (2010) suggests that strategies like agro-forestry, increased livestock production efficiency and resilience, diversified and integrated food - energy systems and finally; improved food production system elements are climate smart agricultural strategies as well (see table 2.1.).

Strategy	Description
Conservation Agriculture	CA is a term encompassing farming practices which have 3 key characteristics: 1. Minimal mechanical soil disturbance; 2. Maintenance of a mulch of carbon-rich organic matter covering and feeding the soil; and 3. Rotations or sequences and associations of crops including trees which could include nitrogen-fixing legumes. CA offers climate change adaptation and mitigation solution while improving food security through sustainable production intensification and enhanced productivity of resource use.
Agro-forestry	Agro-forestry is the use of trees and shrubs in agricultural crop and/or animal production and land management systems.
Livestock production efficiency and resilience	Livestock provide food and livelihoods for one billion of the world's poor, especially in dry and infertile areas where other agricultural practices are less practicable. They play an important multifunctional role in many developing regions providing food, income, draught power and transport. They can also provide valuable asset functions, such as a collateral for credit, and emergency cash flow when sold in times of need.
Diversified and Integrated food /energy systems	Integrated Food Energy Systems (IFES) aim at addressing problems resulting from encroachments into natural ecosystems by simultaneously producing food and energy. This generally translates into two main methods. <i>The first</i> combines food and energy crops on the same plot of land, such as in agro-forestry systems for example: growing trees for fuel wood and charcoal. <i>The second</i> type of IFES is achieved through the use of by-products/residues of one type of product to produce another.
Food production system elements	By improving the various components of food production systems the efficiency, resilience, adaptive capacity and mitigation potential of the production systems can be greatly enhanced. Strategies are: <ol style="list-style-type: none"> 1. Soil and nutrient management 2. Water harvesting and use 3. Pest and disease control 4. Resilient ecosystems 5. Genetic resources 6. Harvesting, processing and supply chains

Table 2.1. Source: FAO 2010 website: Climate Smart Agriculture

Climate smart agriculture could strengthen the natural asset base for up- and downstream villages in the Mutale Basin thereby improving their adaptive capacity to climate change. It can contribute by means of conserving and enhancing the soils so rural households can diversify their livelihood strategy by growing crops again increasing their food security, health conditions and even produce surplus for the market. Climate smart agriculture can also contribute by harvesting water to adapt to water shortages which are expected to increase due to climate change. Though climate smart agriculture is at this very moment high on the global climate change development agenda, we should not forget that African policymakers have been bombarded with advice on agricultural development strategies since the 1960s (Delgado, 1995), and that over the course of years many agricultural development initiatives have failed to succeed due to, among others, a lack of land ownership, technology, infrastructure, finance and gender inequality (Delgado, 1995; Ferguson, 1994; Lahiff, 2001; Macleod et al., 2008). Advances in the fight against poverty and hunger have even begun to slow or reverse progress made (UNDESA, 2009). Though it is not my intention to discuss different dominant paradigms⁷ for promoting agricultural and rural development initiatives I do want to point out that climate smart agriculture does come with a list of necessary preconditions in order to succeed. Understanding the local context of up- and downstream villages in the Mutale Basin and their capacity to adapt is fundamental as climate smart agriculture concepts are knowledge intensive and not suitable for every region.

The need for local capacity to uptake investments like the one suggested has been extensively discussed in the literature, see for example Farmer First by Chambers et al. (1989). The publication of Farmer First emphasized on the need to move away from the older agricultural development approaches, in which farmers were often considered the research subjects under investigation instead of the key informer and practitioners. The literature discusses the relevance of accepting and using farmers knowledge, instead of using a “transfer to technology” top down approach by putting the “farmer first”. Since the publication of Farmer First, farmers participatory research has received increasing attention (Van der Ploeg, 2008; Bryceson and Kay, 2000). Besides working from a participatory approach; secure access to land, water, livestock, finance, infrastructure and supply input were mentioned as important preconditions for agricultural development initiatives. Twenty years later, these preconditions remain high on the global agricultural development agenda and the most important for climate smart agriculture strategies. The coalition Farming First⁸ builds further on the agricultural development agenda by articulating, endorsing and promoting practical, actionable programmes and activities to stimulate sustainable agricultural development worldwide. The coalition highlights the importance of improving farmers’ livelihoods, and agriculture’s potential contribution to global challenges like food security, climate change and biodiversity. Learned from mistakes made in the past, Farming First’s call-to-action for policy makers is based on six principles⁹ for developing locally sustainable value chains for global agriculture. One of the six principles provided by the coalition Farming First is: building local

⁷ For an overview of dominant paradigms on agricultural and development see Delgado (1995:4).

⁸ www.farmingfirst.org

⁹ 1. Safeguard natural resources, 2. Share knowledge, 3. Build local access and capacity, 4. Protect harvests, 5. Enable access to markets, 6. Prioritize research imperatives (www.farmingfirst.org).

access and capacity. This principle consists out of five fundamental resources which I will use to assess the capacity for climate smart agriculture for communities in the Mutale Basin.

2.2. CAPACITY FRAMEWORK FOR CLIMATE SMART INVESTMENTS

The principle *building local access and capacity* describes the five most *fundamental* resources, indicators, necessary for agricultural innovation according to the coalition farming First. These indicators touch upon the necessary preconditions highlighted by Farmer First (Chamber et al., 1989) and are in line with recent suggestions provided by the FAO (2010) and policy recommendations by the IIED (2011) to support the transition to climate-smart agriculture, see figure 2.1.

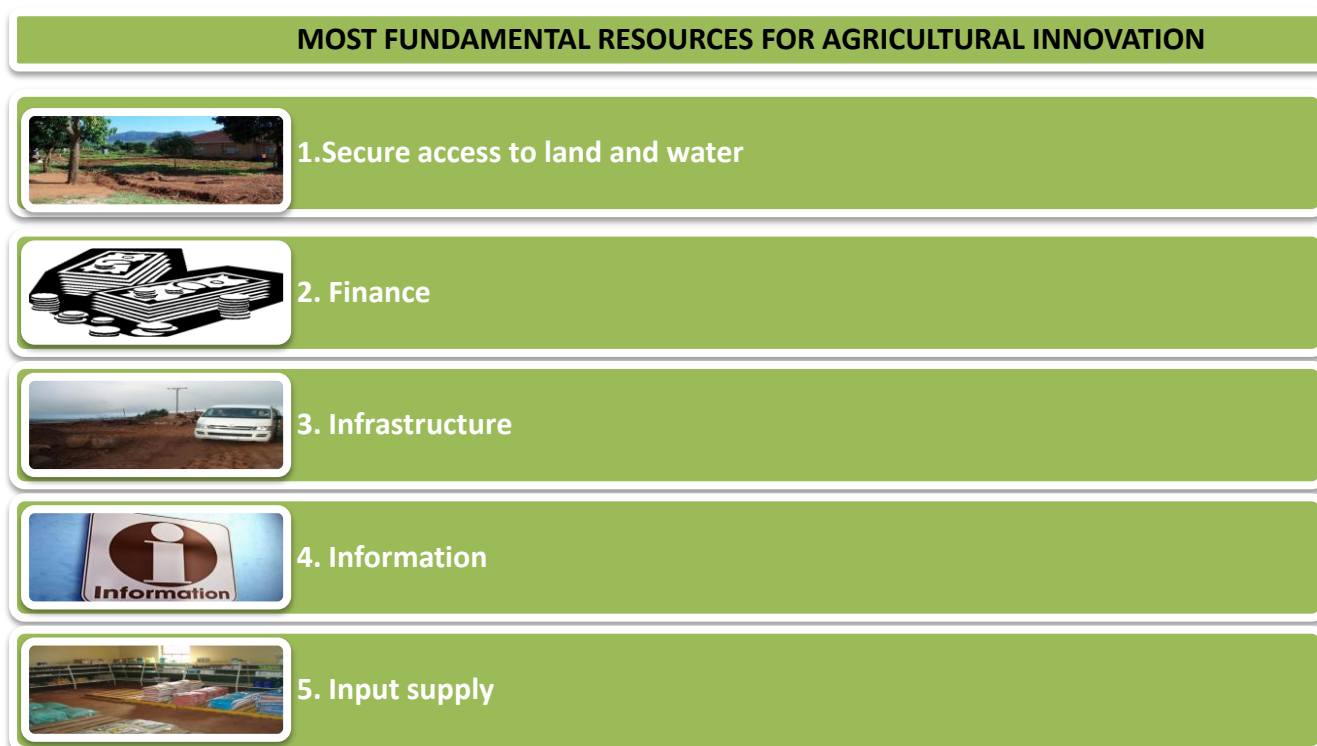


Figure 2.1. Fundamental resources for “*building access and capacity for farming*” according to Farming First.

First of all secure access to land, livestock and water resources are essential for investments in climate smart agriculture as they represent the foundation for rainfed subsistence agriculture. Access to land and water is not a given fact, especially not in South Africa as the land is communally owned. Secure access is to land and livestock for women is problematic as they often do not have secure rights even though they are responsible for subsistence farming or livestock keeping when their men leave to migrate. A lack of secure access to land and water could constrain women’s efforts to invest in agriculture. Second; access to finance is necessary as it provides access to agricultural tools and resources. It also serves as a “buffer” in times of need , which makes it less risky to invest in alternative livelihoods (FAO, 2010; CARE, 2010). Third; to make agricultural supplies and services available for rural households, infrastructure is a prerequisite. There is no point in producing surplus for the market if people cannot transport their goods. Travelling long distances on poor quality roads is for many people too expensive and time consuming, not stimulating crop production for the market (Sieber, 2005; AGRI SA, 2010). Fourth; investing in

climate smart agriculture will only succeed if people understand the reasons why these investments are made, and what type of threats they are facing. Education, information and knowledge sharing should contribute to communication and thereby community involvement. Especially traditional and local knowledge, also known as *Indigenous Technical Knowledge* (Chambers et al., 1989), of poor farmers and resource users will prove vital in building more understanding of agriculture and the environment (IIED,2011). Finally; access to agricultural inputs and services should be widely available especially for women. According to the FAO, women's access to services, fertilizers, pesticides and improved seeds are limited. Asenso-Okyere and Davis (2009) emphasize that there is a high need for agricultural extension services in rural areas, as they are predominantly viewed as supply-driven and excluding the rural poor. Even more so for women as they only receive 5 percent of extension services, while research showed that agricultural productivity increases by 22 percent if women receive the same advisory services as men. As women still face many cultural restrictions on mobility it prevents them to access information and services by themselves (CARE, 2010).

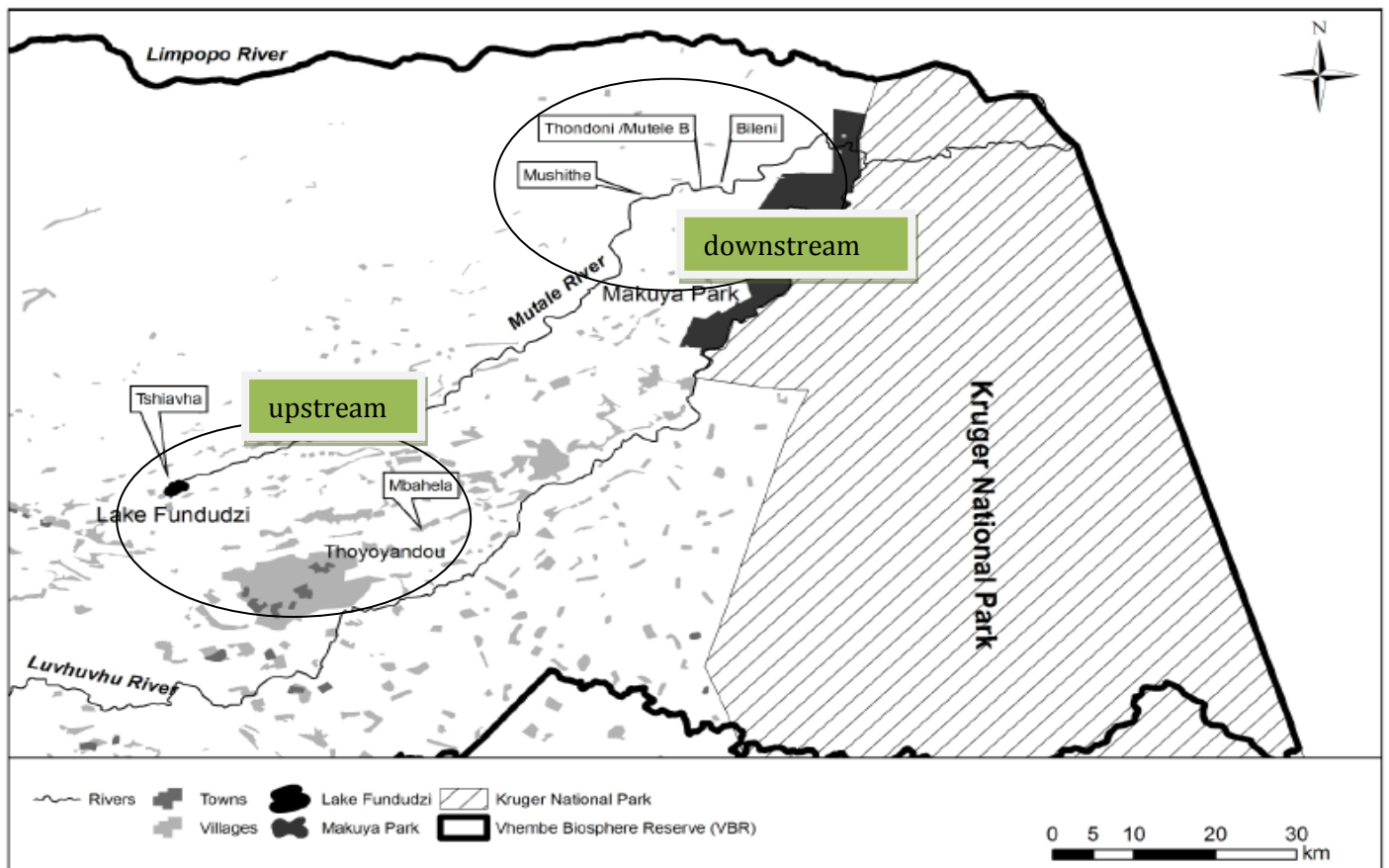
Though there are several strategies of climate smart agriculture suggested by the FAO (2010) (table 2.1), the indicators discussed above will be used to assess two climate smart agricultural strategies which have potential for communities in the Mutale Basin based on the quality and availability of fertile land, water and livestock. For upstream villages *Food Production System Elements* strategies could be effective as they specifically address marginal land and water scarcity, which are the main environmental constraints in their region. For downstream villages in the Mutale Basin especially the *Livestock Production Efficiency and Resilience* strategy has potential as most households depend more on their livestock than on crop production as soil conditions are poor, see chapter five for a broader discussion regarding above suggested climate smart strategies.

Important to note is that there are more resources necessary for success full implementation of climate smart agriculture strategies, e.g. institutional capacity. However this thesis will only analyze the availability of the above described five fundamental resources provided by Farming First making use of primary data gathered and observed during fieldwork. Secondary data will be used but more to elaborate on the relevance of these indicators for the case study area.

CHAPTER 3. METHODOLOGY

3.1. INTRODUCTION

The results of this research are based on field research within the Mutale Basin, and on secondary data sources. Preliminary visits were made to the Mutale Basin in October 2009 and March 2010. These visits were made by the LiveDiverse team, which spent time in the field gaining familiarity with the physical and social geography of the area. Five villages have been chosen for this research because of their socio-economic vulnerability which can be subdivided into upstream and downstream villages as they are located adjacent the Mutale River (see Map 3.1.). The Mutale River rises in the Soutpansberg range near Tshiavha, with an altitude of approximately 870 meters and it flows from there, passing Mbahela (upstream). When it leaves the Soutpansberg it enters the lower lying villages to the North-East: Mushithe, Thondoni and Beleni (downstream). Due to different geographic factors, downstream villages are more vulnerable for the impacts of climate change as they are more isolated, lack access to water, face frequent droughts and have poor soil conditions.



Map 3.1. Case study area by LiveDiverse 2011

Primary data on household information, livelihood strategies and their dependence on natural resources were collected through a combination of methods, including household surveys, semi-structured interviews, informal

discussions, focus-groups and participant behaviour. Secondary data focusing on background information consists of peer reviewed scientific articles, governmental documents and local media.

3.2. PRIMARY DATA

Household questionnaires were prepared by the LiveDiverse project team and cover forty-six close ended questions to measure the socio-economic vulnerability of local livelihoods and to understand public beliefs, perceptions, attitudes and preferences¹⁰ (see Appendix A). In addition to the questionnaires, I conducted several focus groups and semi-structured interviews to gain more information about access and ownership of land, water, livestock, gender roles and livelihood diversification strategies. Information gathered from these focus groups and semi-structured interviews were extremely useful for my research as I could more specifically address questions involving crop production, livestock keeping and gender relations within the household.

The household surveys conducted in five different villages, covered twenty percent of the total village population. Questionnaires were administered to randomly selected respondents, through face to face interviews, which were conducted by one researcher and one translator. Questions were asked to the head of the household, and if not present to another member of the household aged above eighteen years old. When nobody in the selected household was available to answer the questions, a second visit was made later that day or the following day. Collected data from the household surveys was recorded every night and analyzed using Excell or SPSS after the fieldwork, except if no electricity was available. In this case the data was recorded the next day.

The focus groups were organized in combination with participant behaviour and if possible with individual follow up interviews. The main goal of a focus group is to gather data about a specific set of issues, such as people's views and experiences of cultural spirituality, by the interaction of a group. Focus groups stimulate discussions and can therefore generate new ideas or perceptions (Kitzinger, 1994). Topics addressed were focused on cultural and spiritual well being, gender relations and livelihood diversification strategies. Focus groups consisted on average of five respondents. Each interview was managed by two researchers: one would be moderating the focus group, while the other researcher was responsible for audio-recording and writing down notes and observations. Due to local dialects, each focus group was accompanied by two translators. Some of the focus groups were female only, including the moderators and translators, to gather an understanding of gender relations within the household. Most of the focus groups were announced by the local headman or headwoman in charge. Participants were clearly informed that participation was voluntary and that their anonymity would be guaranteed.

¹⁰ Results will be published in the LiveDiverse online DataBase for further research.

3.3. SECONDARY DATA

The secondary data used in this research consists of published peer reviewed scientific articles focusing on vulnerability, agricultural development strategies, capacity assessment, climate smart agriculture, and gender relations. Information regarding the case-study area was obtained from CSIR's database, which contained local scientific publications about the Limpopo Province and the Vhembe District. Besides scientific articles, the South African census of 2001 has been used as well as governmental websites. It should be noted that there is a general lack of recent meteorological data about the case-study area, which made it more difficult to see specific climate changes, such as drought and precipitation over a period of time.

3.4. LIMITATIONS

Three limitations were expected to have a negative impact on the collection of data during fieldwork: time, language and culture. The first limitation is a lack of time: only three weeks of fieldwork were scheduled for collecting data and observation. As the case-study area is located in a remote area with poor infrastructure, time-management was essential to cover all five case-study areas, leaving no option open for flexibility. The entire research was conducted during the morning and afternoon¹¹, which could be the reason why the main respondents were females, as employed men would work during the day. The second limitation is language: each researcher was accompanied by one translator that was trained to perform questionnaires. Some information got lost in translation: we cannot be a 100 percent sure how the respondents interpreted the questions. Also, the interviews were more time-consuming than expected as most answers needed to be translated. Some translators even had problems understanding the respondent due to the diversity of local dialects in the region. The final limitation was that of gender: it should be taken into account that the gender of the interviewer can alter the responses of the respondents. Additional limitations encountered were the responses of some of the survey questions. Respondents were for instance asked to indicate their monthly income from all sources. However, some respondents were not sure how much they receive per month or were not eager to reveal it. We could therefore say that the total income per month should be treated with caution. Income from piece-jobs may, for instance, not have been included¹². The same problem accounts for questions in relation to measurements, most respondents had no idea how large their piece of land was or how much they would grow per season. This made it very difficult to get a representative image of the average size of land and agricultural productivity per village.

¹¹ It was not allowed to enter our accommodation after sunset, which was at 18:00.

¹² Piece-jobs are occasional jobs, for instance cleaning, laundry or selling fruit for someone else.

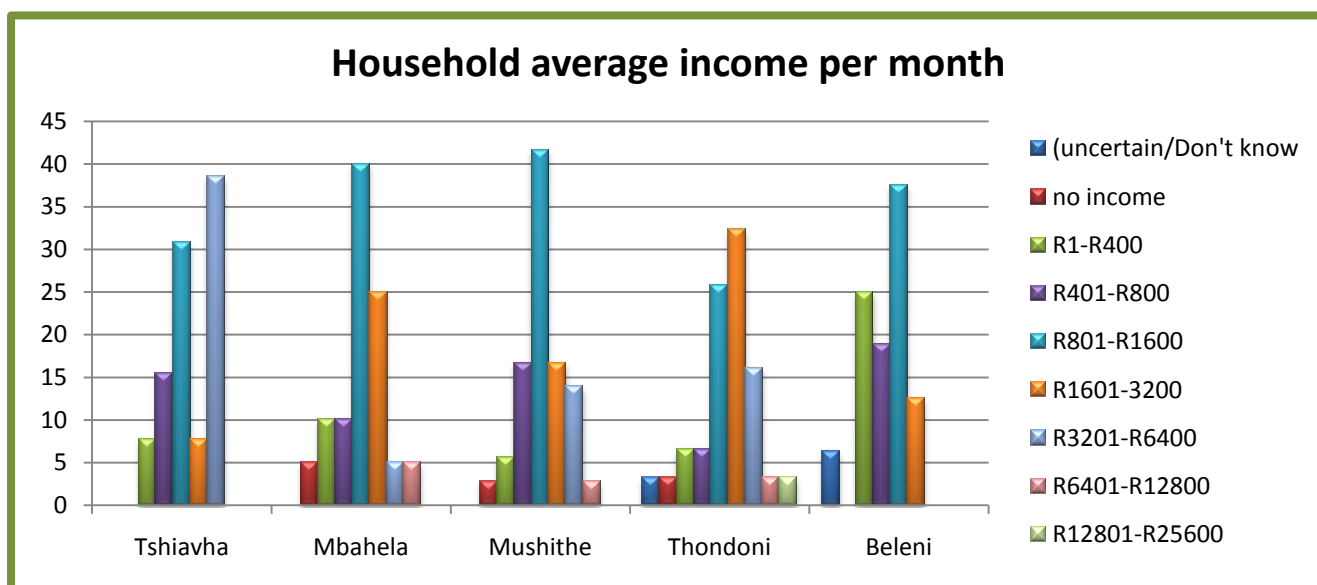
CHAPTER 4. VULNERABILITY TO CLIMATE CHANGE

4.1. INTRODUCTION

Climate change is expected to increase the vulnerability of villages in the Mutale Basin. In order to adapt to the challenges for climate change by investing in climate smart agriculture, it is important to gain a wider understanding of how vulnerable villages in the Mutale Basin are. This chapter will provide a short analysis of the socio-economic situation of the Mutale Basin by looking at: household income, livelihood strategy, food and water security and education level.

4.2. HOUSEHOLD INCOME

The households we interviewed in both up- and downstream villages mostly depend on social grants or livestock for an income. In graph 4.2 we can see that the average income per households, in both up- and downstream villages, is between R801 and R1600 per month. These numbers represent the monthly income per household and not per capita. With an average of five individuals per household, this sums up to an income of R160 to R320 per person per month which is predominantly under the international poverty line of one dollar per day (Bouma and Huitema, 2010). Social grants are considered extremely important for most households as on average it accounts for at least half of their monthly income¹³. However, for some households access to these grants are a problem due to poor infrastructure and red tape. Especially in downstream villages several respondents mentioned that it was (too) difficult for them to access social grants which need to be applied for in Polokwane at the District Welfare Office, which is approximately 271 kilometres away.



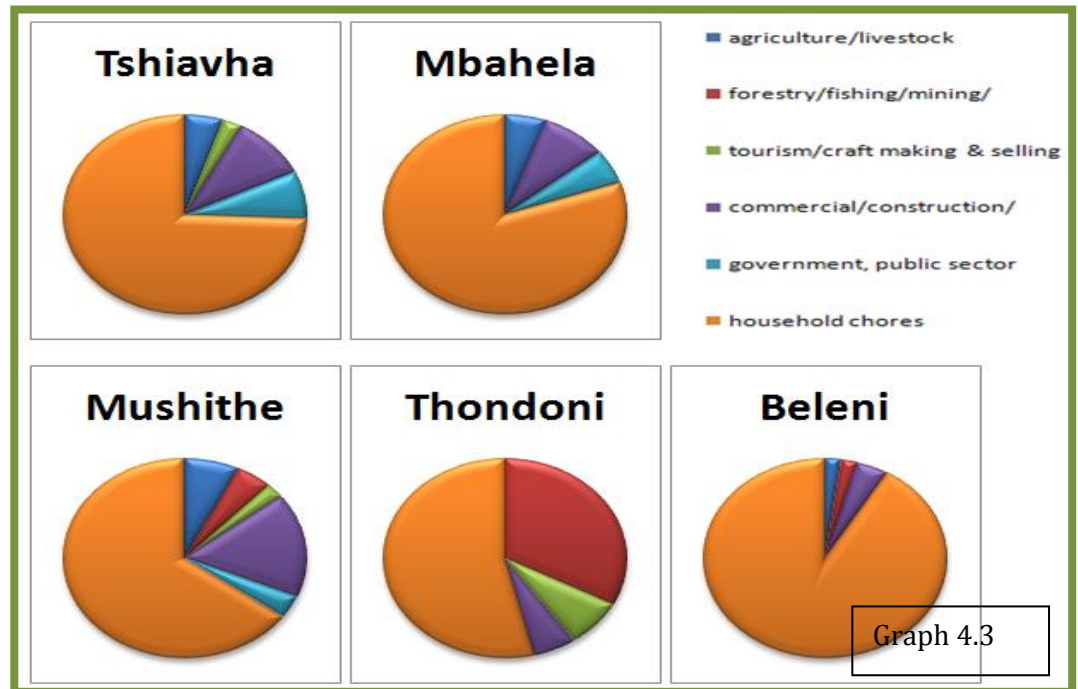
Graph 4.2 Income per household per month

¹³ Child-Support:R240//Disability-Grant:R1010//Pension-Grant:R1010 (SASSA, 2009)

4.3. LIVELIHOOD STRATEGY

In both up- and downstream villages there is a lack of job opportunities. Graph 4.3. clearly illustrates that most time and effort goes into household chores¹⁴ and piece jobs, and that agriculture is less common than commercial work or mining. In Tshiavha most households depend on construction work. Due to its location near the sacred Lake Fundudzi, there are some jobs available in the government and public sector, which are involved with current ideas regarding eco-tourism and natural resource management. In Mbahela, households depend on jobs in construction, agriculture or the public

sector. The Mbahela Irrigation Scheme does provide 300 jobs but it remains unclear how many people from Mbahela are working there. Downstream villages are located near the Tshikondeni coal mine and near Makuya Park, which explains the higher percentage of mining, tourism and



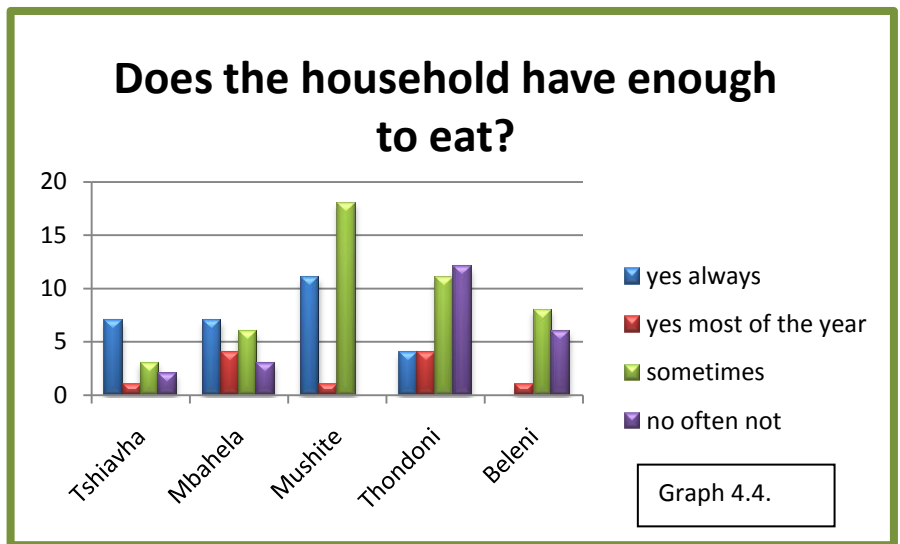
construction workers. Note should be made that the majority of these jobs are temporary and do not guarantee a secure income. Unemployment rates are extremely high in Beleni. One of the reasons is that the village is too isolated. In Mushithe we noticed that many households, including the headwomen's family, are collecting firewood for selling on the market. In Thondoni and Beleni the rules are more strict, as there is a fine on collecting and selling of firewood to prevent deforestation.

4.3. FOOD AND WATER SECURITY

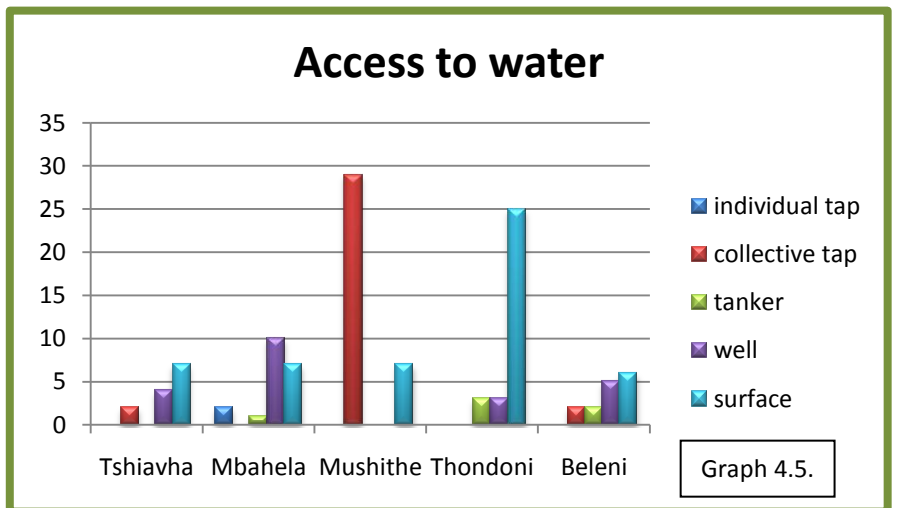
Results above showed that the majority of the households do not depend on subsistence agriculture. A lack of fertile land and access to water increased households dependence on their local ecosystem and markets for their food security. In Graph 4.4. we can see that, especially in downstream villages, most households *often* do not have enough to eat. In Beleni and Thondoni food insecurity is high; more than 50 percent of the households struggle to have enough food to eat. Access to food is extremely important for downstream villages as many people cope with serious health problems, which in most cases is malaria. Malaria transmission mainly occurs from September to May,

¹⁴ As the majority of the respondents were female these figures should be considered with caution as they might be biased.

and the incidence rate of malaria in males is higher than in females, which could be explained by the fact that men move around more frequently than women looking for work (Gerritsen et al., 2008).



Access to water has been mentioned as one of the biggest constraints in both up- and downstream villages (graph 4.5). Most households depend on surface water or a nearby well. Though the majority of the villages do have water infrastructure, most of the time they do not function or the water is really dirty and sandy during the rainy season, causing diarrhoea. Villages that lack water infrastructure, predominantly downstream villages, make use of water tankers. However these do not contribute significantly to the welfare of the community as there are many problems regarding the logistics of new water, maintenance of the tanker and the burning sun on the tanker, almost creating a pool of bacterial infections.



This explains the fact that most households prefer to use wells from the mountains or surface water from the Mutale River for cooking, drinking, washing but also watering their garden and livestock.

4.5. EDUCATION

Results in table 4.5 show that literacy rates in upstream villages are more than 77 percent. Tshiavha has one school near the village and Mbahela has one primary school and a secondary school a two kilometres walk away. According to Chief Netshiavha (Tshiavha), education has improved since 2007, when they received a grant to build a school. According to Chief Mamatsharaga (Mbahela) there is a need for more education in Mbahela. *“Education is necessary to stimulate youngsters”*. He mentioned that there is a need for training farmers, to improve their access to information and to create awareness regarding financial investments. However they have no access and *“know how”* to use the internet which makes it more difficult. During fieldwork we encountered many youngsters working the land of the Mbahela Irrigation Scheme, which holds 300 field workers. They work 10 hours per day on the field, and

get paid R50 per day in return. That means that 300 youngsters in the age from 13 years till somewhere in their twenties do not receive any education, and do not invest in subsistence agriculture but work for a small wage in monoculture farming.

	Upstream		Downstream		
Village	Tshiavha	Mbahela	Mushithe	Thondoni	Beleni
Literacy average %	80,7	77,5	81,1	86,6	75,8

Table 4.5 Literacy Rate

In downstream villages there is a significant difference in literacy rates; Thondoni has one school and a nursery home, Mushithe does not have a school and the closest school is primary level and is a two kilometre walk away, and Beleni has no school nearby at all. This is clearly reflected in the literacy rate, which is highest in Thondoni, followed by Mushithe and Beleni. The lack of schools nearby the village has been mentioned by many respondents in the villages as one of the main problems: *“You think they go to school, but some children don’t want to walk that far distance and are playing somewhere outside, their parents often don’t even know”*.

4.6. CONCLUSION

We can conclude that both up- and downstream villages are extremely vulnerable for internal and external shocks. Results show that there is a general lack, or even absence, of job opportunities in both up-and downstream villages. The majority of the population in the Mutale Basin depend on government grants and do not depend on subsistence farming. They are constraint by a lack of infrastructure and access to education. If climate change models are correct, the Mutale Basin will experience an increase of floods and droughts in the future. This will most likely have a negative impact on their direct ecosystem and will limit communities access to water even further. A decrease of water access will affect their health conditions and constrain livestock keeping. As subsistence farming is not a common practise in the Mutale Basin, investments in climate smart agriculture will not reduce their current vulnerability but could provide an alternative livelihood strategy and increasing their food security . The following chapter will illustrate how important land and livestock actually are for rural households in the Mutale Basin and how investments in climate smart agriculture can contribute to reduce their vulnerability.

CHAPTER 5. CLIMATE SMART INVESTMENTS IN LAND AND LIVESTOCK

5.1. LAND

In up and downstream villages land is still communally owned and land use rights are distributed by the local chief or headman/woman in charge. The most common procedure for households to acquire an additional piece of land for agriculture is first to find a piece of land which is not allocated to another household, and then ask permission for occupation. For widows, divorced or single women access to land is more difficult as, according to custom, their husband should apply for a piece of land. In some villages women said that compared with the past, it is nowadays more easy to get a piece of land, but the fact remains that even where legislation may be in place to strengthen women's property rights, a lack of legal knowledge and weak implementation could limit women's ability to participate in land investments (Quisumbing and Pandolfelli, 2008).

LANDHOLDING

Figures in table 5.1 shows that Tshiavha has by far the highest average of landholding with 6,4 acres, and only 8 percent of the households having no land. In Mbahela households only have access to a small piece of land and there is a high percentage of landless households. This high percentage can be explained by the presence of the local irrigation scheme, see box 5.1.

Mbahela is situated between the irrigation canal and the mountain, and all fertile land near the irrigation side is occupied. A consequence is that new arriving settlers are clearing the forest on the mountainside to create more space. Chief Mamatsharaga of Mbahela emphasized that this

Box 5.1. Mbahela Irrigation Scheme

Mbahela has the lowest average landholding with 0,9 acres and a high percentage of landless households. Most of the respondents in Mbahela claimed that the "white man" took their land. After further investigation, this "white man" appeared to be the manager of the Mbahela Irrigation Scheme, which is a farmer's corporation. This corporation manages a land size of 101 hectares downhill of the village near the Mutale River, growing two types of crops by the year, sweet potato and maize. They use a floppy irrigation system which means that the water supply from the Mutale river and irrigation canals are managed by a computer. Some villagers said they received R4000 from last year's yields and others accused the white farmer of stealing their land, which could explain the low size of average landholding, and the high percentage of landless households.

is becoming a problem as more people are moving into the village because of the Irrigation Scheme.

	Upstream		Downstream		
	Tshiavha	Mbahela	Mushithe	Thondoni	Beleni
Average landholding (acre)	6,4	0,9	4,3	1,8	3
Landless (%)	8	40	39	55	63

Table 5.1. Overview landholding and landless (%) per village.

In downstream communities there is a high percentage of landless households. Interesting to note is that Mushithe has 4.3 acre land on average however most of it is not used for cropping, as there is a lack of water and fertile soil. Some respondents in Beleni claimed that it is difficult to acquire a piece of land due to bureaucracy and to the high costs involved¹⁵. For young couples it becomes even more difficult to acquire a piece of land as there is a custom of “first in, first choice”. In Thondoni the rules remain unclear about access to land. At the time of our visit there was no appointed headman or woman. Respondents mentioned that the absence of good leadership is affecting the atmosphere in the village; people do not trust each other at all.

	<i>Tshiavha</i>	<i>Mbahela</i>	<i>Mushite</i>	<i>Thondoni</i>	<i>Beleni</i>
Type of crops	Maize	Maize	Maize	Maize	Spinach
	Beans	(sweet)potato	Watermelon	Spinach	Tomato
	Fruits	Fruits	Vegetables	Watermelon	Fruit
	Vegetables	Beans	Beans	Vegetables	Maize
		Vegetables			

Table 5.2. Type of crops per village

There are only a few households in both up- and downstream villages that have a plot for subsistence agriculture. These plots are mainly located near the Mutale River or another source of water. A minor number of households produced enough to sell at the local market. Table 5.2. provides an overview of most produced crops per villages. Households which did not produce their own crops acquired their food from the local supermarket, neighbours or their direct natural environment. Specific data about average land productivity is missing in all five villages as most respondents had difficulties estimating their seasonal yields.

5.2. LIVESTOCK

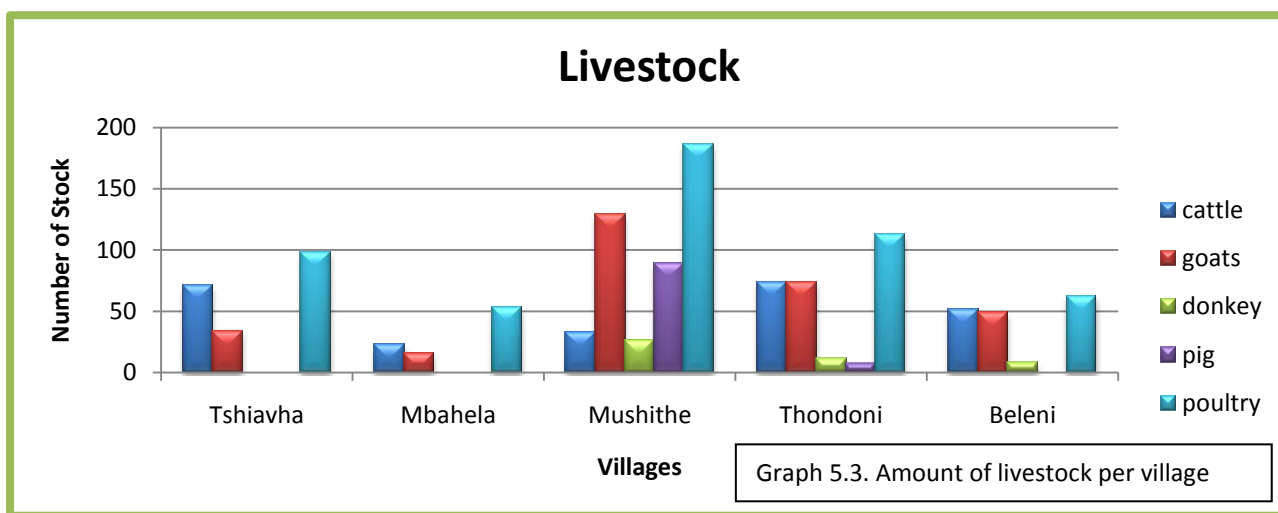
UPSTREAM

Livestock plays a significant role in up- and downstream villages. In Tshiavha and Mbahela there is a high average number of cattle (see graph 5.3.). Based on previous literature (Lahiff, 1997; Macleod, 2008), expectations were that one of the main purposes of cattle would be ploughing, however this was not mentioned in Tshiavha and Mbahela as a purpose during the research. The main purpose mentioned was meat and milk for household consumption and as a financial asset in times of need. In Tshiavha the average price of cattle is R5000 per head, and in Mbahela R4000. According to respondents, prices are set per community. Generally if people own five cattle or more they are perceived as rich, they have a high social status. The price of cattle has increased enormously compared with 2003, when the average price of cattle was R1784 (Randela, 2003). What the cause of this increase is remains unclear. Some respondents claim that it is becoming more expensive and difficult to have cattle, leading to an increase in the price. *“You have to watch them, feed them, pay for dipping tank against diseases, and keeping cattle is a risky*

¹⁵ *“If you want a big piece of land, you have to pay monthly for it, it is not fair”* (HH3 Beleni). New comers to the village have to pay 1005R to the chief.

business". Most common risks mentioned are: stealing of cattle, floods, droughts and diseases. Especially in Mbahela there are many problems with cattle theft, causing a low-trust atmosphere in the village. Besides that, it is expensive to keep cattle. Mbahela is also faced with a decline in grazing fields. Due to an increase in new settlers and the irrigation scheme there is not much space left for livestock to graze. Chief Mamatsharaga even mentioned that livestock is becoming: "less important because plantations need to be secured and animals are not allowed, they destroy crops, it's a big issue...". As livestock is expensive to have and challenging to maintain it is only available for more affluent households.

Most households own small livestock. In Tshivha there are more goats than in Mbahela which are overall used for household consumption or as a financial asset. As goats graze freely they have been mentioned as a "nuisance" by respondents in Mbahela because they destroy crops. This causes the need to build fences around their plots to prevent livestock from entering. Chickens are very common in upstream villages. According to several respondents, the main purpose of chickens is the meat in times of need and not the eggs, "you don't want to eat your new chicken" was their response. Chickens are easy and cheap to keep as their main feed consists of crop residue.



DOWNSTREAM

In downstream villages cattle numbers are also quite high.¹⁶ Their main purpose is milk and meat. Herders even claimed that there are now more cattle than in the past as there have not been severe droughts or floods recently. Keeping cattle is even more expensive for downstream villages as the region is characterized by very dry and scrubby land which requires the need to buy additional fodder. In downstream villages donkeys are more common than in upstream villages. Their main purpose is transport. One respondent in Beleni owns six donkeys, which he mostly rents out for transporting firewood. Many households have small livestock; goats, pigs and chickens. Small livestock is predominantly used for household consumption, and is a very important financial resource in downstream villages. It is also less expensive to maintain small livestock as they feed on crop residue and household waste. Respondents in Mushithe mentioned that there has been a village agriculture poultry/pigs project initiated in the

¹⁶ Note should be taken that some respondents did not own the cattle but only looked after the cattle for friends or relatives which could be biased information.

past. However the project failed as the “money keeper” took off with all the money, increasing the distrustful atmosphere in the village.

5.3. CLIMATE SMART INVESTMENTS

INTRODUCTION

The previous paragraph illustrated that the availability of land and conditions for livestock differ between up- and downstream villages. Upstream villages have better conditions for crop production but lack grazing land while downstream villages are faced with extreme droughts and depend more on livestock keeping. Based on these conditions there are two different climate smart agriculture strategies suitable for the region; *food production system elements* and *livestock production efficiency and resilience*.

UPSTREAM

In upstream villages households do practise agriculture on a small scale, near their house or on an additional plot, however they are constrained by a lack of water and access and ownership of land. The Chief of Tshiavha mentioned that there is a need for investment in irrigation as it would contribute to increasing agricultural production. Yet investments in irrigation require access to water, infrastructure, large sums of money, land and education, besides which irrigation is not always considered sustainable (Smith, 2004; Odhiambo, 2006). In Mbahela it is a different story, due to the local irrigation scheme. This irrigation scheme aims at commercializing agriculture in the area for local development, however the benefits for the majority of local households are not really clear. Which could explain why in the past vandalism has been mentioned as a big problem as most irrigation canals were destroyed (Stevens, 2007). Now the irrigation scheme uses a floppy irrigated system. The most important environmental disadvantages of floppy irrigation is compaction of the soils which could lead to a decline in yields in the future, and therefore an increased need for fertilizers leading to higher costs. As the irrigation scheme takes up most of the land available, some households grow vegetables and fruits next to their house to secure their nutrition intake, where they lack access to water. During interviews with respondents another constraint mentioned was the disinterest in agriculture by the younger generation. According to the elderly in the village this was because of a change of religion and modernization. Youngsters we interviewed on the Irrigation Scheme confirmed this, as they preferred to work under temporary contract or to move to the city if they had the chance.

Food production system elements suggest six key improvements which could contribute to a transition towards climate smart agriculture. The two most import strategies for upstream villages available are; soil and nutrient management and water harvesting and use. As floods in the past have decreased the quality of the soil, efficient use of livestock manure and crop residues could contribute to improve and enhance the quality. Manure could replace expensive fertilizers and even become a new product for selling at the market. However the use of manure does come with some constraints as it can be difficult and expensive to transport and to store. Results published by

Odhiambo (2006) illustrate that there are several lessons to be learned to improve farmers efforts towards combating soil degradation (Table 5.4.). Investments in education and training are therefore essential, but more importantly it can contribute to stimulate youngsters interest for agriculture¹⁷.

Main constraints for farmers to combat soil degradation	
Knowledge of Soil fertility management and conservation practices	Insufficient information on appropriate practices for soil fertility management and conservation. This is further compounded by the fact that majority of the farmers have education level ranging from no formal education to grade 7.
Fertilizer use	Although most farmers apply fertilizer to their crops, the quantity of fertilizers applied is below optimum crop requirements. The main reason was identified as insufficient funds to purchase fertilizers.
Soil sampling:	Majority of farmers do not know how to collect soil samples for analysis.
Soil acidity	A significant proportion of the cropland area is moderately to severely acidic. This severely limits crop yield unless remedial measures are undertaken to correct the acidity. This can be successfully achieved with the application of the right type and quantity of liming material.
Salinity	Salinity in irrigated areas is a major problem. Up to 26% of soil in all irrigation areas have become waterlogged and salt-affected.

Table 5.4. Source: Odhiambo, J.J.O. 2006 LDA report Soils

A major constraint mentioned by most respondents is the lack of water. Most households depend on the Mutale River for water, which stands dry for at least half of the year. Water harvesting and preservation could benefit downstream villages in addressing the predicted irregularity of rainfall patterns due to climate change. The preservation of water can be achieved by creating pools, dams, pits, retaining ridges or even sandbanks. These techniques do not require a lot of money and expertise but do require man power and the commitment of the community to collaborate. Investments in irrigation systems have been mentioned by the FAO (2010) as key for improving yield production, but do require more financial capital, expertise and infrastructure. Most rural households would not profit from irrigation systems as they lack the money to pay for the use of irrigation. It could even make the situation worse as irrigation will increase pressure on the already limited water resources. Building dams for irrigation could increase soil salinity and compaction, but even more important, wildlife in adjacent Makuya and Kruger National Park will be cut off from their access to water.

DOWNSTREAM

In downstream villages livestock plays a more important role than crop production due to poor soil quality and a lack of water. The majority of the villages depend on the local (super) market or their ecosystem for food. Investments in subsistence agriculture do not seem like a realistic opportunity as the environment is too degraded and challenged by extreme droughts. In downstream villages most households do own livestock, which play an important multifunctional role providing food, income, transport and social status. The majority of the households in

¹⁷ Interesting detail is that the Limpopo Department of Agriculture at this current moment is offering agricultural training in China.

downstream villages own goats and poultry. Fascinating is that Mushithe is the only village which has a lot of pigs, which are used for household consumption as pigs are no valuable financial asset. According to Lahiff (2000) there is a strong cultural antipathy to pigs in Venda, which could be explained by its Semitic origin in which it is forbidden to eat pork (Roux, 1999). Even more interesting to know is that in contrast to cattle, goats and donkeys, pigs are the property of women who are solely responsible for their care (Nelson, 2008), and that Mushithe is the only village with a female headwoman.

Investments in *livestock production efficiency and resilience* with a focus on small livestock could reduce the vulnerability of rural households, as it can increase their income and nutrition security, while safeguarding the natural environment. Investments in small livestock require less money than in large livestock and therefore carry less risk. More important is that small livestock tends to live closer to the household. This makes it easier and safer for women to manage them as they lack the time to manage livestock over a long distance. Pigs, goats and chicken feed on household waste or food scraps and do not require a lot of land and water. Large livestock on the other hand, do require a lot of water, fodder and grazing land. They are expensive to keep, therefore more risky, and contribute more to environmental degradation by overgrazing and land degradation. Though the number of cattle in the area is not a current major threat for the natural environment, investments in large livestock will increase the pressure on the availability of land and water. In Thondoni small livestock projects have been initiated in the past. These however failed to succeed due to a lack of leadership and trust. Investments in small livestock projects should be introduced community wide and require good communication towards the participants of the project.

5.4. CONCLUSION

So far this research shows that climate smart investments are really context specific. Upstream villages have better climatic conditions and more fertile soil for agriculture and investment in livestock is not really considered an option as it will increase the current competition over land use and water. Soil and nutrient management and water harvesting can increase agricultural production in a climate smart manner, but does come with a list of requirements. Key requirements to take into account are access and ownership of land, the availability of water, access to finance, infrastructure and information. In downstream villages livestock plays a more important role than subsistence agriculture, as a lack of fertile land and water make it extremely difficult to grow crops. Most households do own livestock, especially small livestock. Climate smart investments in small livestock can reduce the socio-economic vulnerability in ways of income and nutrition security. As small livestock is easier to keep than large livestock and does not require a lot of land, investments in small livestock have a lower risk than investments in large livestock. However gender relations play a crucial role in access and ownership of livestock. The following chapter will illustrate why these need to be recognized and addressed before investments are made.

CHAPTER 6. GENDER

6.1. INTRODUCTION

According to Quisumbing and Pandolfelli (2006) inequality in the distribution of resources between men and women are linked with production inefficiency. A common constraint encountered in agricultural development strategies is that women often lack access and ownership of land, water and livestock. The absence of recognized ownership to land and livestock limits the women's ability to obtain credit and to undertake investments in agriculture. A consequence could be that women might withdraw their time and effort in response due to a lack of incentives, when customary rights are not recognized. Climate smart investments in agricultural land will only prove to be a success if among others the issue of land ownership will be addressed.

6.2. GENDER ROLES IN THE MUTALE BASIN

In table 6.1. we can see that the majority of the residents are female except for Tshiavha. The reason why Tshiavha stands out has not become clear during the course of the research. A possible explanation could be that Tshiavha has better socio-economic conditions in comparison with the other villages, therefore depending less on migration. Most of the respondents we have spoken during our field visit were women, as the male head of the household was not present. The main reason for this according to female respondents was that the men were out for work, looking after cattle, gone fishing, or drinking beer at the local shabeen¹⁸. Drinking traditional beer is a common male activity which seems to be "accepted" by most women, as they have no right in deciding what the men can spend their money on¹⁹. Meanwhile women are held responsible for daily tasks like: collecting water, firewood, vegetables or fruits. If they were not out for collecting basic necessities to survive they would be preparing food, washing clothes, watering the garden or taking care of the children, sick or elderly. Not one woman was encountered doing absolutely nothing during three weeks of fieldwork.

	Upstream		Downstream		
Village	Tshiavha	Mbahela	Mushithe	Thondoni	Beleni
Average no. of HH members	4,8	4,7	4,9	4,9	4,6
Average females per hh. %	49	61	53	51	53

Table 6.1. Gender in percentages.

For downstream villages it is very important how gender relations can affect investments in livestock management. In the past, and according to custom, keeping cattle is a man's job. The men are held responsible for watching the

¹⁸ Shabeen is a place (household) where locals, mostly men, get together to drink traditional home-brewed beer.

¹⁹ Some female respondents mentioned that alcohol was a big problem, but they cannot stop them from drinking. Among the more well off households, were the shabeens.

livestock, building the kraal, and feeding and watering them in times of drought. They had to pay fees for dipping the cattle against diseases and veterinary services. The men would take their sons and teach them how to manage livestock, but times are changing. A decline of subsistence agriculture and a lack of local economic opportunities has led to increased migration, leaving the women behind. Most children can go to school nowadays and have less time to help within the household. Some youngsters also mentioned that they were not interested in agriculture and livestock keeping, which village elderly affirmed more than once.²⁰ The women who are left behind are responsible for managing the household, relatives and if present, livestock. One widow had to manage five cattle, which were not her property but her former husband's brothers. She had to bear the workload and the costs, but had no ownership. Important to keep in mind is that even though livestock-related activities can reduce the households socio-economic vulnerability by income and nutrition, households may not always be interested in investing extra time and energy in enhancing livestock related activities. Besides time and energy, women often feel unsafe managing livestock in isolated areas as rape is not an exception.

6.3. CONCLUSION

It is extremely important to address gender relations as they will determine the success of a project on the local scale. Men and women have different roles, resources and power. Due to these differences, climate change will have a different impact on both men and women, but overall women become more vulnerable. Women are held responsible for staying home and taking care of the household while men can migrate and access new economic opportunities. Due to an increase of workload women are constraint to diversify their livelihood strategy by a lack of time and labor. Even if they have the time, they are faced with a lack of land and livestock ownership, and access to information and finance. Without ownership of land and livestock, women's ability to manage risks by, for example, investing in soil and nutrient management or small livestock keeping or, are limited. Access to information and finances are as well crucial for women but not always available. This is, among others, caused by women's lack of mobility but also because most information gathering or extension officers involved with agricultural projects are male, and do not provide enough opportunities for women to participate. This is a loss for both parties as women often have traditional knowledge that can inform and improve agricultural investment efforts. Mainstreaming gender relations in project designs are a step forward but understanding local gender relations requires more in depth research and should be used for project design. Not only is understanding gender relations important for the project design it remains important during the project execution and evaluation.

²⁰ *"In the old days a lot of people had a piece of land to plough, nowadays the youngsters are not really interested to have an own piece of land. It is too expensive for them to invest in this." "There is new generation: Christianity, and older people are too old to work the land, and the youngsters don't work the land. They contribute but they prefer a wage.."*

CHAPTER 7. CAPACITY FOR CLIMATE SMART AGRICULTURE

7.1. CAPACITY ASSESSMENT

We illustrated the vulnerability for climate change in the Mutale Basin and highlighted two climate smart agricultural strategies available for their local context. However the most important question remains; does the Mutale Basin have the capacity for investments in; *food production system elements* and *livestock production efficiency and resilience*. Making use of the indicators provided by the coalition Farming First the analyses below will show if climate smart agriculture can indeed reduce the vulnerability of up- and downstream villages for the impacts of climate change.

SECURE ACCESS TO LAND AND WATER

For agricultural investment secure access to land and water is essential, especially for women. These two resources are the most challenging ones, especially in South Africa, as land governance is a serious point of debate due to the legacy of Apartheid. Though the government has introduced Land Reform Programs, progress is slow due to traditional rules and bureaucracy. In upstream villages there is no secure access to land, which is clearly illustrated by the irrigation scheme. People lost their piece of land, due to a decision made by the Chief to invest in a local development program²¹. Though water infrastructure is available in upstream villages, most people depend on surface water as water pumps are often not working. As women are held responsible for the collection of water they are more vulnerable, due to long distance walks multiple times a day.

In downstream villages there is no secure access to land either, as the land is communally owned. New arriving settlers even have to pay land rent to the Tribal Authorities. It is not clear what the fees for the land will be spent on, most likely they do not go back into the community. Though women can acquire a piece of land, they have no ownership. In downstream villages water is a major constraint for local development. Similar to upstream villages water infrastructure is available, but most of the time not working or very sandy and salty. During the dry season the Mutale River stands dry, and respondents mentioned they have to dig holes in the riverbed to acquire water. This is extremely heavy and time-consuming work, mostly done by women who are responsible for collecting water from the river. Climate change will only increase pressure on water access, which could be addressed by water harvesting.

In both up- and downstream villages, lack of secure access to land and water is a serious barrier for investing in climate smart agriculture. The lack of secure tenure and associated costs, refrains or even constrains, the majority of the households to invest in agriculture as they face the risk of losing out on their land, their investments. Though

²¹ The Irrigation Scheme in Mbahela is a good example of how things can go wrong, as a lack of communication and information has caused disagreement regarding the benefits of the project. Some women blamed the “white man” for stealing their land while it is supposed to stimulate local development.

secure access to water could be addressed by water harvesting, this comes with a severe trade off for downstream villages and adjacent National Parks, which will face severe water shortage. The welfare of a rural community will most likely not be in favor if the Provincial Government has to decide to invest in water security for the community or the wildlife, as National Parks are a major contributor to South Africa's GDP.

ACCESS TO FINANCE

In all villages there is a lack of opportunities for financing. Most of the female respondents are members of a women's group, also known as *stokvel*. Members of these groups set aside an amount every month for a special purpose. At the end of the year, or in times of need they will use this money for groceries, funerals or weddings. Some of these women's groups also provide the opportunity to loan money; the interest rate varies between 20% - 30% per month. For many women these groups represent their savings account in times of need. If members fail to contribute or pay their interest and debt they are expelled from the group. In Mbahela some people have a bank account, which is a new development initiated by the local Chief in cooperation with the local irrigation scheme. In order to open a bank account residents need to acquire papers from the Chief. Though this opportunity exists most respondents did not mention anything about a bank account.

In downstream villages there are also women's groups which provide micro-credit with an interest of 30% per month. Besides the women's groups the Tshikondeni Mine offers micro-credit for a monthly interest rate of 25%. Some respondents mentioned that there are also local lenders, which offer micro-credit but ask 50% interest per month. The interest rates are overall high which comes with high risk investments. Due to the location of all villages it is extremely difficult to reach a bank.

Investing in climate smart agriculture comes at a cost, as soil and nutrient management or livestock keeping requires agricultural inputs, labor and time. Fertilizers, seeds, tools but also livestock itself or wires for fencing are not the main investment priorities for poor hungry households. Due to a lack of access to finance with low interest rates, households are constrained to invest as they face a high investment risk. For instance if harvests will fail or livestock gets stolen, they have no income, are left behind with huge debts and might be expelled from their *stokvel*, losing not only their money but also their social status.

AVAILABILITY OF INFRASTRUCTURE

The availability of infrastructure is crucial as it can constrain access to markets, services, information and finance. Crop production for sale only makes sense if you are able to transport your crops to a market. Besides the transport of products to sell, infrastructure is necessary to gain access to inputs, services, information and finance. Tshiavha lacks proper road infrastructure and is located on a mountain. During heavy rain it is impossible to leave or get into the village due to mud slides, which is a huge constraint for the transport of goods and the commuting of people. Mbahela is located nearby a tarred road, expectations are that in July 2011 the tarred road will be extended to the village, however at this current moment no construction is taking place.

In downstream villages there is a complete lack of infrastructure. Especially in Mushithe and Beleni there are no tarred roads nearby and the gravel road is full with pot holes. Some respondents in Mushithe and Beleni wait for days to get a lift if they need to go to town or another place. Investments in infrastructure can contribute to a migration of products and stimulate local employment. Severe weather conditions expected due to climate change will only increase the isolation of the villages if the lack of infrastructure is not addressed.

The lack of infrastructure in both up- and downstream villages constrains rural households access to markets, products, services, information and finance. If households decide to invest in climate smart agriculture it is important they can access necessary resources but even more important to export their surplus. Due to the lack of infrastructure all communities are too isolated which comes at a high cost in terms of money, time and for women their safety.

ACCESS TO INFORMATION, COMMUNICATION

Overall access to education has improved over the last year in the Mutale Basin. But most of the education provided is till the age of twelve. If youngsters want to continue studying they have to migrate and be able to pay school fees. For the majority of the youngsters this is not an option due to a lack of money. There are no communal centre’s available where people can get informed about events or news. Information sharing mostly occurs via social gatherings like: women’s clubs, shabeen, church or ceremonies or notifications by the headman or woman in charge. Both villages have access to mobile networks which can make the introduction of mobile banking more accessible.

In downstream villages there is a complete lack of communication and information. Especially in Thondoni there was in June 2010 no appointed headman or woman in charge which caused misunderstanding regarding the local rules, especially in relation to access to land. In Thondoni the office of the Tribal Authority is sometimes used to inform people. However interviews revealed that most people do not trust the Tribal Authorities as they do not involve the villagers during decision making. Education is less available downstream than upstream, as the schools are too far away. Information sharing mostly occurs via social gatherings like: women’s clubs, shabeen, church or ceremonies. Thondoni and Mushithe have in some places access to mobile networks. Beleni has no electricity nor mobile reception.

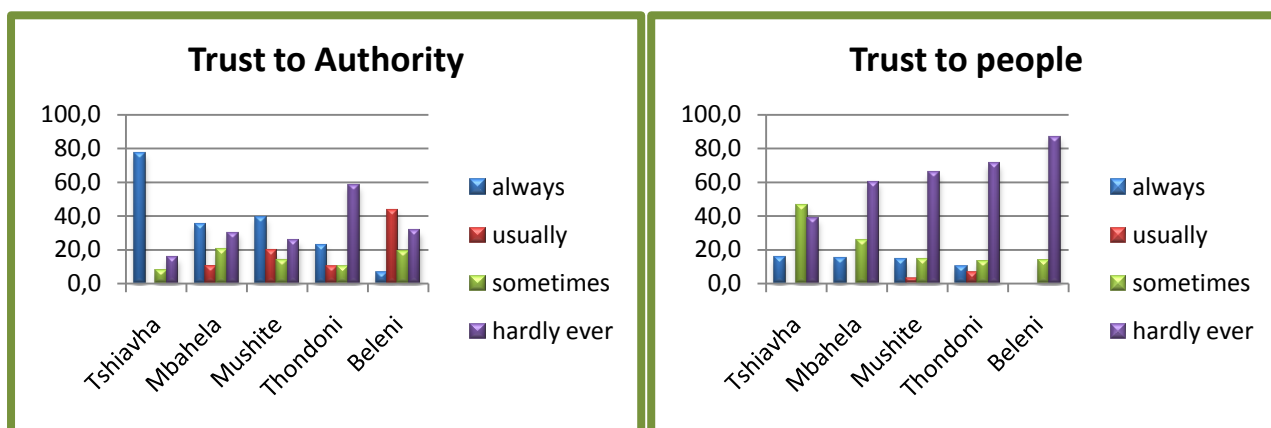


Table 7.1. Level of trust per village

Information, education and communication are extremely important for local development plans. A lack of information for, and between, local households often leads to misunderstanding thereby increasing a distrustful atmosphere. This lack of trust, especially in downstream villages (see table 7.1.), will make it very difficult to invest in climate smart agriculture. If people do not trust each other, they will not act together. To stimulate information and communication, good leadership is a prerequisite so households become more aware and involved within community decision making. If they feel accepted and part of the community they are more likely to make investments. This community feeling will stimulate communication between households and thereby improve sharing of local knowledge.

ACCESS TO AGRICULTURAL INPUTS AND SERVICES

In downstream villages most subsistence farmers use manure in combination with bought fertilizers. They say that it increases their yields. For some people buying fertilizers is not an option and they only use manure. Most local shops do sell seeds, but the majority of the people collect their own seeds or share them with each other. There is no irrigation available for local households. Due to the irrigation scheme in Mbahela there are agricultural inputs available as they have opened a supply shop nearby. There are tractors in the area but these are only used for the irrigation scheme.

In downstream villages there are no agricultural inputs and services available. In Thondoni there is a dipping tank for livestock which needs to be used once every two weeks if you have cattle. Most people use manure as fertilizer in combination with fertilizers acquired from a market or shop elsewhere. Most households lack the income to buy agricultural inputs or are too far isolated from shops. The closest agricultural service department is located in Makwarela near Thohoyandou, which is at least one hour and a half hours by car.

The lack of agricultural inputs and services makes it more difficult for households to invest in soil and nutrient management systems and livestock keeping. Agricultural supplies and services should be made locally available at a low price so it becomes, especially for women, more easy to access.

7.2. SUMMARY

Both up-and downstream villages lack the majority of the fundamental necessary resources to implement investments in climate smart agriculture (see table 7.2). A lack of secure access to land and water are the biggest constraints as these resources are the most difficult to gain because traditional and institutional rules are difficult to change. Investments in water harvesting could reduce water insecurity for downstream villages but comes with a high trade-off as the building of dams will limit wildlife's access to water in adjacent National Parks. Though all villages have access to finance, this comes at a high price. Official micro-credit schemes are absent, households mostly depend on informal loan schemes with a high interest. Though Mbahela does offer opportunities to open a bank account, respondents spoken to were not aware of this possibility. Access to other forms of finance is difficult, amongst other things, due to a lack of infrastructure and transport. Infrastructure is a requirement for the

movement of goods or people. For some households this has an additional negative impact on their income, especially the sick and elderly, as they are not able to travel to social service offices to apply for grants.

Fundamental Resources	Upstream	Downstream
Secure access to land and water resources.	There is no secure access to land in upstream villages. Water infrastructure is available, but most of the time not working or of bad quality. Most households depend on surface water.	There is no secure access to land. Most households depend on surface water. There is a lack of water especially during the dry season.
Access to micro-finance services.	Micro-credit is available via the women club with 30% interest per month in both villages. In Mbahela there is an opportunity to open a bank account	The Tshikondeni Mine offers micro-credit for a monthly rent of 25%. Some local lenders offer micro-credit but they ask 50% interest per month. Women groups something provide micro-credit with an interest of 30% per month.
Availability of infrastructure.	Tshivaha lacks proper road infrastructure, the village is not accessible during times of heavy rain. Mbahela is located nearby a tarred road, expectations are that in July 2011 the tarred road will be extended to the village.	Complete lack of infrastructure in all three villages of which Mushithe and Beleni are completely isolated.
Access to information, communication for sharing knowledge/ education.	Both villages have schools nearby. Mbahela has a small post office. Information sharing mostly occurs via social gatherings like: women clubs, shabeen, church or ceremonies. Both villages have access to mobile network.	There is a lack of communication in all three villages. There is a general lack of education. Information sharing mostly occurs via social gatherings like: women clubs, shabeen, church or ceremonies. Thondoni and Mushithe some access to mobile network, Beleni has no access.
Access to agricultural inputs and services.	Seeds are available in the local bazaar and manure is being used as fertilizer. There is no irrigation available. Mbahela is located near a agricultural supply shop, with all necessary products available. There are tractors in the area but these are only used for the irrigation scheme.	There are no agricultural inputs and services available. In Thondoni there is a dipping tank for livestock. Most people use manure as fertilizer in combination with fertilizers acquired from a market or shop elsewhere.

Table 7.2. Summary of fundamental resources for climate smart agriculture in up- and downstream villages in the Mutale Basin

A lack of information in the majority of the villages is mostly due to absence of good leadership, communication and education. Though communication does happen through social gatherings, the majority of the respondents hardly ever trust people surrounding them. Poor governance and weak leadership increases this feeling of mistrust and is a serious barrier for local development plans. Investments and effort should go to local governance, social gatherings and active participation of all villagers. A community centre could contribute to create awareness of local activities and opportunities. Mobile communication would also be an innovative way of spreading information. For climate smart investments agricultural inputs are necessary. Near most villages agricultural inputs like fertilizers and seeds are available, but they are not affordable for the majority of the households. Not only are agricultural inputs expensive, they are also difficult to transport due to a lack of infrastructure.

CONCLUSION AND RECOMMENDATIONS

During the writing of this thesis, new reports and events about climate smart agriculture have been published every week. Climate smart agriculture will play a key role during the climate negotiations at the end of this year in Durban. The main reason for this is that the world population is growing and everyone needs to eat, thereby increasing pressure on the natural environment. Climate smart agriculture offers the opportunity to increase food security in a sustainable manner. But it also is gaining much attention, and popularity, as it is considered a new climate change adaptation development strategy for poor subsistence farmers in developing countries and therefore a perfect candidate for climate finance.

The Mutale Basin is scarred in different ways by the Apartheid regime and is extremely vulnerable to climate change. The majority of the households are living on small pieces of marginal land, lacking basic necessities like proper water provision, tenure rights, education, credit facilities and infrastructure. Households mostly depend on social grants and their direct natural environment for survival. The region is faced with soil degradation and a lack of water. If climate change models are correct, the Mutale Basin will experience an increase of floods and droughts in the future increasing food insecurity and vulnerability. The purpose of this research was to analyze if climate smart investments in land and livestock are a feasible solution for diversifying their livelihood strategy, increasing food security and reducing the vulnerability of poor households in the Mutale Basin. Results showed however that the Mutale Basin does not have the capacity for climate smart investments in land and livestock at this moment. Both up- and downstream villages lack the necessary resources for climate smart investments as they have no secure access to land, water, infrastructure, information, finance nor agricultural inputs. Though infrastructure, information, finances and agricultural inputs can be addressed by investments, access to land and water touch upon local governance and traditions which are not so easy to address. The predominant feeling of mistrust in all villages is another important barrier for local development plans. People do not trust each other, sometimes not even their own families. In downstream villages weak leadership is even blamed for a lack of resources and job opportunities. Local development plans will only work if poor governance will be addressed and people are willing and able to work together striving towards a participatory bottom up “farmer first” approach instead of a “top down” approach. Future development plans should therefore focus on investments in good governance, information and communication to stimulate awareness but also trust.

As men and women have different roles, resources and power it is extremely important for future policy makers to address gender relations as they will have an enormous influence on the success of a project on the local scale. Overall women are held responsible for managing the household while most of the time they lack access and ownership of the necessary resources especially when it comes to land rights and livestock ownership. The absence of recognized ownership to land and livestock limits women’s ability to undertake investments in agriculture. Though mainstreaming gender relations in project designs is a step forward, understanding local gender relations requires more in depth research on the local scale.

Investments in climate smart agriculture can diversify the household income, reducing food insecurity and vulnerability, but does come with a list of requirements. Therefore further research is necessary to investigate how to address the lack of and access to land, water and finance in order for climate smart agriculture to succeed as an adaptation strategy in the Mutale Basin.

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APPENDIX A

FINAL VERSION LIVEDIVERSE HOUSEHOLD SURVEY 2010 (APRIL 9)

Village/hamlet (name)	
Household number and respondent name	
Time and date of the interview	

Hello, my name is and I am carrying out interviews with randomly selected local residents on behalf of(mention case study partner or IVM) and the EU funded LiveDiverse project. Do you have 30 minutes time to answer some questions? The questionnaire is meant to collect information about how people make a living and depend on nature to do so, so that we can better understand what could be done to improve people's livelihoods and protect nature at the same time. For this purpose we would like to ask you some questions about your land use and your access to water and other natural resources (such as wood, animals, plants), your main sources of income and the management of resources in your village. Also, we have a couple of questions about how you see the management of the nearby protected area (NAME), your relationship with the authorities and if you feel you are able to influence the decisions made. Your answers will be treated as completely confidential; we will not tell anyone what answers you gave. The findings from this study will be used to inform policy-makers. Your effort in answering the questions would be highly appreciated. Thank you very much.

Household = All persons in the household who eat from the same cooking pot/kitchen and who are normally resident at least 15 days per month

1. Please list the household members with their age, sex, literacy and occupation (Please don't read all categories aloud, but ask the respondent about the different household members with their age, sex, literacy and occupation, and mark the answers below)

Household member No.	Age	Sex M=1 F=2	Literate Yes=1 no=0	Current occup.	Sector	Current occupation codes
						00= child below 6 years
						01= child (>6) not going to school
						02= school/education
						03= self-employed
						04= temporary labour
Respondent						05= permanent
02						06= non-employed
03						07=household tasks
04						08= retired
05						09= other (specify)
07						Sector codes (link to occupation)
08						01=agriculture/livestock

09						02=forestry/fishing/mining/ etc.
10						03= tourism/craft making & selling
11						04=commercial/construction/
12						05= government, public sector
13						06= other (specify) ²²

2. Does the household receive any remittances (money sent home) from outside family members, and how important are these remittances for the household's income?

01= yes, very important	02= yes, important	03= yes, not so important	04= no	00= don't know	99=refuse to answer
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3. Has the household been in the village for the last 20 years, and if not where is it from?

01= yes	02= no, displaced (protected area)	03= no, displaced (dam)	04= no, in-migrant regional/national	05= no, in-migrant international
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4. Does the household have any agricultural (farm) land?

If no, continue to question 6

Yes=1, no=0	
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5. Could you tell me the total size of your landholding and how much of it has access to irrigation (water for crops)? And do you own this land, do you rent it or is it communal land? Finally, what are the main crops you grow on your land, and what do you on average produce (kg/acre) (or plot)?

Size (acres)	With irrigation (acres)	Ownership	Crop	Kg/acre	Ownership codes	Crop codes (multiple answers possible)
					01=private ownership	01= mais
					02=communal land	02=potatoes
					03= rented land	03=tomatoes
					04= no entitlement	04=sweet potato
					05= other (specify)	05= mango
						06=avocado
						07=orange

6. Could you tell me how many (read out the relevant type of livestock) you own and for what purpose they are used (for example own consumption or production for the market or own ploughing or to rent out)? Also, could you tell me how you feed your livestock (free grazing, own pasture, crop residue)?

Type of livestock	Number	Purpose	Feed	Main purpose codes	Feed codes (multiple answers possible)
Cattle-plough				01=household consumption	01= free grazing

²² Household tasks and small piece jobs in other sectors than 1-5 belong under code: 06.

Cattle-dairy				02= selling to market	02= own pasture
Cattle-meat				03= market+ consumption	03= crop residue
Goat				04= manure	04= community pasture
Sheep				05= transport	05= buy feed
Pig				06= asset/savings	06= household waste
Horse/donkey				07=ploughing	07= other (specify)
Fish (ponds)				08= rent to others	00= not applicable
Chicken/duck				09=other (specify)	

7. What products does the household collect directly from nature (ie the forest/wetland/bush)? (more choices possible) like for example meat, fish, medicinal plants, flowers, fruit, nuts, vegetables, timber, fuel, fodder, material for the house etc? (Please probe a bit and ask whether the household collects merely for its own use or broader and mark the answers below)

None	01
Meat for consumption	02
Meat for the market (selling)	03
(Shell) fish for consumption	04
(Shell)fish for the market (selling)	05
Fruits, berries, nuts etc. for consumption	06
Fruits, berries, nuts etc. for market (selling)	07
Mushrooms, vegetables etc for consumption	08
Mushrooms, vegetables etc for market (selling)	09
Medicinal plants, dye etc for own use	10
Medicinal plants, dye etc for market (selling)	11
Construction material, timber etc. own use	12
Construction material, timber etc. for market (selling)	13
Fuel, fodder etc. for own use	14
Fuel, fodder etc. for market (selling)	15
Flowers, plants for ceremonial purposes	16
Other (specify)	17
(Refused to answer)	99
(Don't know)	00

8. Are any of these products collected in a protected area (NAME)?

Yes=1, no=0	
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9. How important is the collection of these products for the household's livelihood?

01=very important	02= important	03=not so important	04= not important	00= don't know
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10. What is the household's average income per month? Please include the income received from wages, selling products, remittances (money sent home), pensions, grants etc. FROM ALL HOUSEHOLD MEMBERS, excluding taxes. (If the respondent mentions an exact amount, please note this done. Otherwise, ask the household whether they earn somewhere between (higher category) and (lower category) and mark below. Please probe a bit when the amount seems very low or high)

	Household
No income	01
R 1 - R 400	02
R 401 - R 800	03
R 801 - R 1 600	04
R 1 601 - R 3 200	05
R 3 201 - R 6 400	06
R 6 401 - R 12 800	07
R 12 801 - R 25 600	08
R 25 600 and above	09
(Uncertain/Don't know)	00
Refuse to answer	99

11. What is the household's main source of drinking water?

	Rainy season	Dry season
Individual tap	01	01
Collective tap	02	02
Water carrier/tanker	03	03
Borehole/well	04	04
Surface water	05	05

12. Does the household have access to electricity?

Yes=1, no=0	
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13. What is the household's main source of fuel for cooking, and does the household buy or collect?

Charcoal/firewood, self-produced	01
Charcoal/firewood, bought	02
Electricity	03
Cow dung/crop residue	04
Kerosene/coal/natural gas	05
Other (specify)	06

Are members of the household participating in any of the following voluntary organisations?

	Type of voluntary organisation	Active member	Inactive member	Don't belong	Not applicable
14.	Church or religious organization	03	02	01	00
15.	Micro-credit group	03	02	01	00
16.	Producer group	03	02	01	00
17.	Labour union	03	02	01	00
18.	Water user/forest/NRM group	03	02	01	00
19.	Women's group	03	02	01	00
20.	Other (specify)	03	02	01	00

21. Do you feel you have any influence on how decisions are made at the village level?

01=yes, always	02= yes, in most cases	03=sometimes, depends on the issue	04= no, except in some cases	05= no, never	99=refuse to answer
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22. Do you feel that your village is able to influence the developments that affect how local people make a living?

01=yes, always	02= yes, in most cases	03=sometimes, depends on the issue	04= no, except in some cases	05= no, never	99=refuse to answer
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23. When your crop fails, or you lose your main income source, how do you cope? (more choices possible) (Please don't read out all categories, but ask the question and mark the answers below)

01= we eat less, more poor	02=we sell land, livestock, assets	03= we depend on family	04=we depend on the community	05= we depend on the government	99=refuse to answer
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24. Does your household usually have enough to eat?

01=yes, always	02= yes, most of the year	03=no, we sometimes don't have sufficient to eat	04= no, we often don't have sufficient to eat	99= refuse to answer
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Now, we would like to ask you a couple of more personal questions

25. What is your ethnicity or caste?

01= Afrikaans	02=English	03= Thshivenda	04= Ndebele	05=Shangan	06=
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26. Are you of the same ethnicity/caste as the rest of the household?

If yes, continue to question 28

Yes=1, no=0	
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27. If not, what is the ethnicity/caste of the rest of the household members? (relevant codes)

01= Afrikaans	02=English	03= Thsivenda	04= Nbebele	05=Shangan	06=
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28. What is your religion

01= Christian Church	02=	03=	04=	05=	06=
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29. Are you of the same religion as the rest of the household?

If yes, continue to question 31

Yes=1, no=0	
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30. If not, what is the religion of the rest of the household members?

01=	02=	03=	04=	05=	06=
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31. Where does your main source knowledge come from?

01= village elders/traditions	02= education/school	03= family & ancestors	04= government	05= God/higher power	00=don't know	99=refuse to answer
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32. Generally speaking, would you say that people can be trusted?

People can almost always be trusted	01
People can usually be trusted	02
People can only sometimes be trusted	03
People can hardly ever be trusted	04
Don't know	00
Refuse to answer	99

33. Now, turning to the local authorities, would you say they can be trusted?

01 =trust completely	02 =trust somewhat	03=do not trust very much	04 =do not trust at all	00= don't know	99=refuse to answer
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34. Do you feel you have control over your life?

01=yes, always	02= yes, in most cases	03=sometimes, depends on the issue	04= no, except in some cases	05= no, never	00= don't know	99=refuse to answer
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Finally, we have a couple of questions about the management of the protected area/park (NAME) and your beliefs with regard to nature

35. Has the household been affected by the establishment of a protected area/park? (NAME)

If no, continue to question 37

Yes=1, no=0	
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36. Would you say that the effect has been mostly positive, or negative, or neither?

01=mostly positive	02= more positive than negative	03=neutral	04=more negative than positive	05= mostly negative	00=don't know	99=no effect
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37. Do you feel that the rules and regulations with regard to the use of the protected area (NAME) are effectively enforced?

01 =rules are well-enforced	02 =rules are somewhat enforced	03=rules are hardly enforced	04 =not at all	00= don't know	99=refuse to answer
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38. Do you know of households that are breaking the rules in using natural resources in the protected area/park (NAME) (poaching, timber felling, fishing, grazing etc)

01=yes, many households	02= yes, few households	03=yes, but mostly outsiders	04= no	00= don't know	99= refuse to answer
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39. Now, if some organization would try to improve park management and the protection of nature, would you be willing to cooperate and report households that are breaking the rules (poaching, timber felling, fishing, grazing etc)?

01=yes, always	02= yes, in some cases	03= no, except in case of outsiders	04= no	00= don't know	99= refuse to answer
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40. Do you feel you can influence the use and management of the protected area/park (NAME) ?

01=yes, always	02= yes, in some cases	03= sometimes, depends on the issue	04= no	00= don't know	99= refuse to answer
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Please ask the respondent to respond to the following statements:

41. The balance of nature is so delicate that it is easily upset by human activities

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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42. The earth has only limited space and resources such as water, plants and animals

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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43. Humans may use water, plants and animals as they please

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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44. Only rarely does modifying nature and the world around us for human use cause serious problems

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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45. There are no limits to economic development for your country

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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46. Humans are dependent on natural resources such as water, plants and animals for their livelihood

01=strongly agree	02=agree	03=neutral	04= disagree	05= strongly disagree	99= refuse answer
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Thank you very much for you cooperation and we'll be back to present the results!