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Chapter

Beitbridge Minority Farmer Communities and Climate Change: Prospects for Sustainability

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Abstract

Indigenous minority farmer communities in Beitbridge district of Zimbabwe are on the cutting edge of climate change and climate vulnerability. This chapter assesses through questionnaires, interviews and focus group discussions how these communities are triangulating their indigenous knowledge systems, government and NGOs initiatives to achieve sustainability. Results reveal that although the farmers are appreciative of external assistance through government and NGOs assistance, such assistance can only be sustainable provided it is built around their indigenous knowledge systems which they hold sacrosanct. The study therefore recommends more use of the abundant natural resources in Beitbridge and The district's competitive advantage is a rich livestock district. The community identifies itself with these resources, so all developmental endeavours should coalesce around these resources for sustained social, economic and environmental growth as a cushion against the climate change phenomenon and associated threats. All such efforts should be community driven rather than being imported from central government or NGO headquarters or country offices. The resilient and hardworking qualities of these communities need not be destroyed by food aid and free farming input hand-outs. Instead, these qualities should be utilised to drive community development initiatives for household livelihood sustainability.

Keywords: climate change, Beitbridge district, indigenous minority farmer communities, Maramani, community sustainability, CAMPFIRE

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1. Background

Climate change through natural and anthropogenic forces has drastically changed the earth's climate over the past century worsening key challenges for global food production [1]. Climate change impacts, which are expected to be mainly negative, are likely to be felt mostly by the already vulnerable communities in economically less-developed countries. Most developing countries in Africa, Asia, the Americas outside the United States of America and Canada are generally poorly equipped both financially and infrastructurally which makes them more vulnerable to climate change impacts [2]. The effects of climate change are alarming enough in themselves, for instance, droughts, burning temperatures, more frequent hurricanes, worse floods and new plagues of diseases.

Climate change defines alterations in the long-term average conditions of the climate, persisting for unusually longer periods, which can be decades or generations [3]. These changes may be due to natural or persistent anthropogenic alterations in the composition of the atmosphere or in land use. Climate variability, on the other hand, refers to unusual changes in the spatial and temporal state of climatic variables. Food is an incessant priority for subsistence for many indigenous minorities who are already vulnerable to changing environmental conditions. Due to a continuous dependence on agriculture for most livelihoods, the effects of climate change on productive croplands are likely to drastically threaten the well-being of the population [4]. The close relationship of minorities with their natural environments makes them mainly sensitive to the effects of climate change. One of the most outrageous examples of minorities' greater exposure to climate change is in India where indigenous minority groups known as Dalits, Adivass and Muslims were economically, physically and socially excluded from the rest of society [4]. As a result, they were worst hit by the abnormally severe monsoon floods in 2007.

Minority people tend to live close to nature, in relatively natural environments, rather than in cities, growing and making much of the food and other products that they need to survive [5]. This gives them an exceptionally intimate knowledge of local weather, plant and animal life. Customary wisdom on issues such as where to hunt for food or when to plant crops has been accrued over many generations, but now that the climate is shifting, some of those understandings are proving to be no longer applicable [6]. Masud et al. [7] also argue that some rainfall patterns have changed in line with what climate change scientists are predicting and, as a result, people's customary knowledge about when to plant crops is no longer consistent. Hence, the capability to accurately recognise the rainy season has suffered leading them to plant crops impulsively.

Coping strategies means actions that reduce the actual and expected effects of climate change making people adapt to prevailing conditions. These coping strategies can actually take place at a local level where people make changes they can, independently of government. Coping strategies can also be introduced by governments and NGOs to indigenous minority people. For example, in the Arctic Sam reindeer, herders transport food to the reindeer in winters when the animals cannot reach the lichen [8]. They also reverse their traditional pattern and take their animals inland during the summer and to the coast in winter, where there is no snow and so grazing is less. However, the author further asserts that their ability to adapt is limited by lack of financial resources and technical expertise. There is so much that they cannot perform without government support, and as a result, this affects the sustainability of their own introduced coping strategies. In Kenya, some pastoralists have adapted to climate change by growing livestock fodder crops in wetter areas near rivers, selling some of their livestock rather than allowing them to die during droughts [8]. But their insufficient representation in national politics has smashed their capacity to cope with the increasingly harsh climate thereby affecting the sustainability of their own coping strategies.

Climate variability has always been experienced in Southern Africa. During the 1991–1992 drought in Zimbabwe, average annual precipitation fluctuated from 335 to 1004 mm and averaged 640 mm [9]. Recurrent droughts and sporadic seasonal floods that have been experienced in the region have resulted in the loss of human life, livestock and property. They have also caused severe localised shortages of the main cereal crops like maize and other food items. Implications of climate change for Zimbabwe are serious. The number of years with below average rainfall is increasing. A survey on farmers' perceptions of climate change in Zimbabwe by Masendeke [10] indicates that farmers have noticed changes in the quantity, quality and efficacy of rainfall. There is a general decline in the amount of rainfall, which is

more pronounced in the semi-arid tropics, the largest part of which is constituted by south-west Zimbabwe, the study area. Zimbabwe has an agricultural economy which is generally rain-fed. It has a rural population of more than 70% which depends on subsistence agriculture for livelihood [11]. This makes most sectors of the national economy sensitive to extreme changes or shifts to weather and climatic patterns.

The lack of research into the ways in which minorities are being affected by climate, how they are coping with effects of climate change and the sustainability of the coping strategies only aggravate their disadvantage and susceptibility. For minorities to get the assistance they need, their circumstances must first be documented and acknowledged by academics, development and environmental NGOs, governments and intergovernmental organisations. Climate change is a serious issue affecting the world, but seldom does its impact on minorities get a mention, even though they are among the worst affected. Despite the high susceptibility of Zimbabwe to climatic fluctuations, very little research has been carried out on climate change, particularly on coping strategies of minority communities, most of whom occupy marginal, remote, hot, dry regions of the country. There is a serious lack of community-specific and household-specific data demonstrating their vulnerability. Communities, however, have been witnessing the gradual changes in climate over the years, and have been attempting to cope, albeit with mixed success. Few studies have tried to highlight and interrogate these coping strategies by communities for possible development and improvement, despite the fact that this is what has made them resilient to this day. This study therefore aims to cover this gap in knowledge.

2. The study area

Beitbridge lies in the Limpopo Valley, a paragneiss zone that stretches from the east of Chiredzi to the Border with Botswana. Mean annual rainfall for the district is between 300 and 600 mm [12]. Most of the rainfall is experienced in summer from October to March. Mean annual temperature is between 25 and 27.5°C. Soils in the district are varied, depending on the parent materials and age. On sedimentary formations, soils that occur in younger deposits are deep and often stratified. On levee deposits, soils are relatively light-textured with a high proportion of coarse sand of granitic origin. Basin areas have heavy-textured soils derived from fine materials deposited during floods. Vegetation varies from the savanna on deep fertile soils to shrub savanna on shallower ones. It is of lower stature of 2–6 m high with a sparse grass cover of mainly *Sporobolus* spp (love grass) and *Cynodon dactylon*. Common trees in this region include mopani, which is prevalent on salt-rich soils, baobab, *marula* and various species of combretum and acacia [13]. Apart from the urban setting of Beitbridge as a border town with South Africa, the west of Beitbridge district is semi-arid, remote and marginal. Farmers are generally sedentary pastoralists who practice dry land farming which concentrates on drought-tolerant small grains like sorghum, millet and rapoko. Communities in Beitbridge traditionally keep large heads of the indigenous thuli cattle and other breeds. They also keep large flocks of sheep and goats. The district has some natural salt pans where salt extraction takes place. Beitbridge has a heterogeneous population of marginalised minority farmer communities which include the Venda, Shangani and Suthu. There is no evidence of a concerted study which disaggregates the age-sex classes of each of these minority ethnic communities and this emphasises their social and economic vulnerability. However, Beitbridge district has a population of 80,083 (14) comprised mainly of these three ethnic groups whose combined population, together with other Bantu-speaking minority ethnic communities like the Tonga (Binga district) and Kalanga (Bulilima and Mangwe districts) is slightly over 1% of Zimbabwe's total population

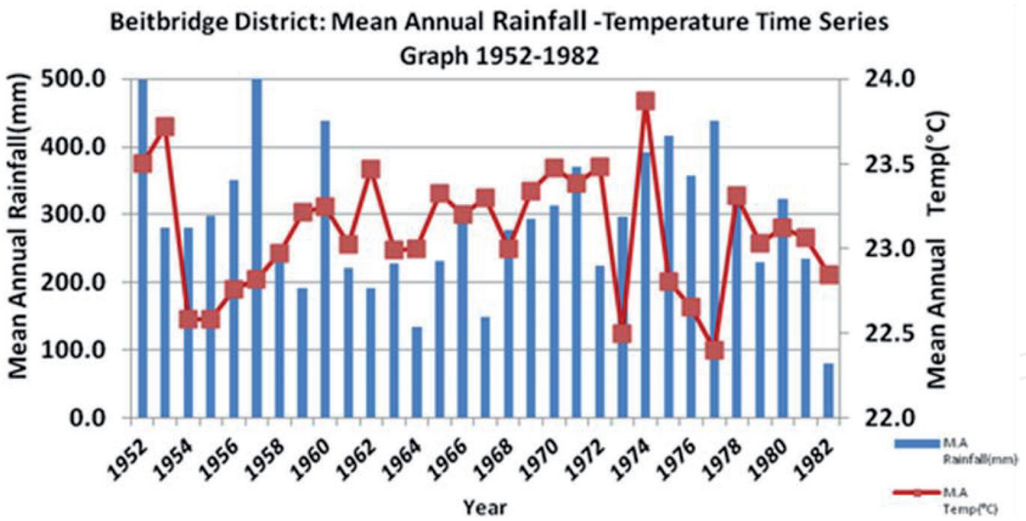


Figure 1.
Mean annual rainfall-temperature graph for Beitbridge district (1952–1982). Data source: Meteorological Department, Harare.

of about 17 million. The population density of Beitbridge district is between 4.42 and 10.61 [14]. The district has 15 wards for administrative and developmental purposes (**Figure 1**).

3. Methodology

The study used qualitative ethnographic research design to investigate coping strategies to climate change and climate variability by specific minority farmer communities. Communities borrow indigenous knowledge from their culture to adapt to their environment. Fraenkel and Wallen [15] submit that ethnography describes social groups or situations; delineating behaviour and shared beliefs of a particular group of people and in the process gaining an understanding of how and why the participants function and behave as they do in the context of their culture. Qualitative ethnographic design enabled the researcher to obtain in-depth data concerning minority farmer communities through interviews, focus group discussions and direct observations. It embraced their experiences, feelings and behaviour as they respond to climate change and climate variability issues.

An analysis of relevant documents in text format was done to gain preliminary knowledge of the minority communities in Beitbridge district. Documents analysed included scientific work published on the district and documents outlining the district's developmental plans. Secondary rainfall and temperature data from the Meteorological Department was also collected for analysis. Document analysis enabled the researcher to examine records and documents and to get an idea of past and present life of these communities in an unobtrusive manner [16]. In this study, interest was on determining coping strategies of minority communities to climate change and variability.

A total of 20 purposively selected farmers were subjected to in-depth interviews focusing on answering the research questions like environmental evidence which point to a changing climate; and community knowledge-based initiatives in place to cope with climate change impacts. The farmers are geographically intermingled, incorporating Venda, Suthu and Shangani communities and thus geographical differentiation was not an important variable in their selection. The snowball technique was used to ethnically but purposively select the 20 farmers (8 Venda, 6 Suthu and 6 Shangani) to give each ethnic group a voice. Chief

Executive Officer for Beitbridge Rural District Council was interviewed to get insight into government's involvement in climate change and climate variability issues in the district. A randomly selected traditional leader (local Chief) from the district was interviewed to get the traditional perception of climate change issues in relation to their respective areas of jurisdiction The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) country representative was also interviewed to find out the activities it is involved in which are aimed at climate change mitigation/adaptation as well as communities' response to their initiatives. ICRISAT is based in Zimbabwe's south-west district of Matobo (Matopos), some 40 km to the south-east of Zimbabwe's second largest city, Bulawayo.

Focus group discussions were used to give independent voice mainly to women, who because of patriarchal domination, do not usually narrate their experiences as they experience them, but instead answer questions as expected of them by society. Discussions on climate change issues and how communities are coping with them were initiated at social gatherings like food for-work programmes, boreholes, school development gatherings and similar gatherings to get communities' views. Focus group discussions, therefore, provided some quality controls on data collection in that participants were able to provide checks and balances on each other. This helped in weeding false or extreme views, and it was fairly easy for the researcher to assess the extent to which there was a relatively consistent or shared view among the participants. Focus groups allowed insight into the values, beliefs, fears and aspirations of the different communities regarding climate change and variability.

Structured observation was used to verify communities coping strategies in situ. It was used to verify findings from interviews, questionnaires, focus group discussions and ethnography. Climate change and coping strategies-related evidence like drying of wetlands, state of pastures, traditionally preserved foods, etc., were observed. The researcher observed events or phenomena in the natural and social spheres without any manipulation, interference or intervention. All relevant observations were noted on a coding sheet or checklist.

The questionnaire method was applied and analysed as a quantitative research method. A questionnaire with closed items which focussed on facts on evidence and impacts of climate change was developed for this study. The questionnaire survey was meant to collect as much data as possible from respondents on their coping strategies to climate change and climate variability. To ensure a 100% response rate and also to save on time, the questionnaire was administered in the form of an interview. Questionnaires were distributed to 10 randomly selected households per each of Beitbridge district's 15 wards to confirm or refute information obtained from in-depth interviews and other methods. This means 150 questionnaires were randomly administered across the district.

To verify whether rainfall and temperature were changing over time in Beitbridge district, secondary data from the Meteorological Department were analysed in Microsoft Excel. Sum monthly rainfall totals from September to August were calculated and averaged. The sums of monthly maximum and minimum temperature were also calculated and averages computed in Microsoft Excel. The district's rainfall and temperature data were divided into three generations for the period 1922–2012.The data were obtained from the Meteorological Services Department in Harare. However, the first generation, 1922–1952, had inadequate data to make meaningful comparisons, so only data from generations 2 and 3 were used. Meteorological data were thus divided into 1952–1982 and 1982–2012 generations and rainfall-temperature compound time-series graphs were computed in order to compare rainfall and temperature variations which impact minority farmer communities' livelihoods in Beitbridge.

4. Results

4.1 Socio-demographic characteristics of respondents

In Beitbridge district, a total of 100 respondents successfully answered questionnaires, 50 were males and another 50 females. Respondents' age-groups ranged between 26 and 105 years who had lived within the district for 30 years or more and were believed to have witnessed considerable climatic and environmental changes. Like in other border districts in the south-western part of Zimbabwe, it was, however, easier to find female respondents than male ones. Most males and the youth go to neighbouring South Africa and Botswana to look for better employment and livelihood opportunities [17]. About 68% of the respondents were married, 18% were single and 10% were widowed, while 4% were divorcees. The level of education in the district is generally low, with 30% of the respondents having acquired only primary education, another 30% lower secondary level and 28% basic secondary education. Only 2% had advanced secondary level of education and 10% had tertiary training, 8% of whom being teachers and 2% agricultural extension officers. Average family size in Beitbridge was 6. About 52% of the respondents were unemployed and were typical agro-pastoralists who relied mainly on livestock and subsistence crop farming for their day-to-day household livelihood. About 26% were in part-time employment which mainly involved cross-border trading in household goods between Zimbabwe and South Africa. This group would shuttle weekly or monthly, by hook or by crook, legally or illegally between the two countries for their household livelihood. Only 22% were in formal employment, most of them being teachers or employed in other government departments like agriculture or Beitbridge Rural District Council employees.

4.1.1 Evidence attributable to climate change in south-west Zimbabwe

In Beitbridge district, there is a high realisation that the rainy season is now starting late (100%) and yet ending early (94%) (**Table 1**). This could be linked to the change in wind patterns which 80% of the respondents identified as having changed. Summer season is becoming hotter (80%), while winter is becoming warmer (64%). The apparent rise in temperature could partly be the reason for the drying of perennial

Ward number	Ward name	Ward number	Ward name
1	Chipise	9	Machuchuta
2	Dite 1	10	Dendele
3	Dite 2	11	Siyoka 2
4	Mtetengwe 1	12	Siyoka 1
5	Mtetengwe 2	13	Leasnth
6	Mtetengwe 3	14a	Bishopstone
7	Masera	14b	Bishopstone
8	Maramani	15	Old Tuli

Source: generated by author.
N = 100.

Table 1.
Environmental evidence indicative of climate change in Beitbridge district.

rivers and springs (78%) through increased evapotranspiration. Increased temperature can also help explain diminishing pastures (88%) through depletion in soil moisture.

In an interview, Beitbridge Rural District Council Officer in charge of the central wards of Mtetengwe I, II and III, Mr. Sibanda (65) observed that early summer rains which used to start in September/October are now starting in December. June and July which are supposedly the coldest months of the year are no longer very cold. Instead, February, which is characteristically a very rainy month, is turning out to be very cold. Drought is now more frequent and temperatures are no longer predictable. Mr. Mudawu (70), a Shashe village elder in the western ward of Maramani, added that when the rains come, they are uncharacteristically erratic and cause lots of damages to bridges, schools, homes and even kill people and livestock through very violent and strong winds, flooding, lightning and thunder. Mrs. Simuta (64) of Chaswingo village in Dite I ward concurs that seasons have changed but added that this confuses farmers as to when to plant. Pastures in the eastern wards of Beitbridge comprising Dite I, Dite II and the Shangani-dominated Chipise are now few even if it rains. This has resulted in many livestock deaths in recent years.

In the Suthu-dominated north-western wards of Siyoka I, Siyoka II and Dendele, environmental evidence attributable to climate change include heavy siltation of Umzingwane River which used to be perennial with multiple permanent pools. The river no longer has any pools. According to Mr. Siziba (70) of Vutururа village (Dendele ward), harvests are now very poor yet in yesteryears grain used *ukubola eziphaleni ngobunengi babo* (grain used to rot in granaries because of huge harvests).

Places like Lutumba village in central Beitbridge which used to successfully produce more dry land maize than pearl millet and sorghum no longer produce maize because of unreliable rainfall. Amacimbi (mopane worms) used to be plentiful in the whole district but because of low and variable amounts of rainfall, amacimbi have become fewer, smaller and as a result fetch much less income for the farmers than before. In very dry years, amacimbi die before maturity. Amarula juice, the most common fruit product in Lutumba, has become less common.

Harvests used to take place up to August but now they end in May. Wildlife, which used to be a common sight in the wards, has also disappeared partly because of negative variations in climate change-related environmental modification.

4.1.2 Meteorological evidence of climate change in Beitbridge district

Figures 2 and **3** show some descriptive evidence that Beitbridge is generally a dry district. Only 2 years (1952 and 1957) received annual rainfall above 500 mm in the generation 1952–1982. Comparatively, the third generation (1982–2012) had only 1 year (2000) receiving annual rainfall above 500 mm. The second generation had 19 years which received mean annual rainfall figures of 300 mm and below compared to the third generation's 21 years. The two climate graphs (**Figures 2** and **3**) also show that temperature range for Beitbridge increased from 1.4°C in the second generation (1952–1982) to 3.3°C in the third generation (1982–2012). Beitbridge district has, therefore, become drier and hotter in recent years.

Rainfall is the most important climate variable in south-western Zimbabwe because of minority farmers' reliance on semi-nomadic pastoralism and rain-fed crop farming. Mean annual rainfall coefficient of variation was calculated in SPSS version 20 to determine the percentage variation from one generation to the next.

Beitbridge district's mean annual rainfall coefficient of variation for the second generation (**Figure 3**) varied from as low as 35% in the second generation to 53% in the third generation (**Figure 4**).

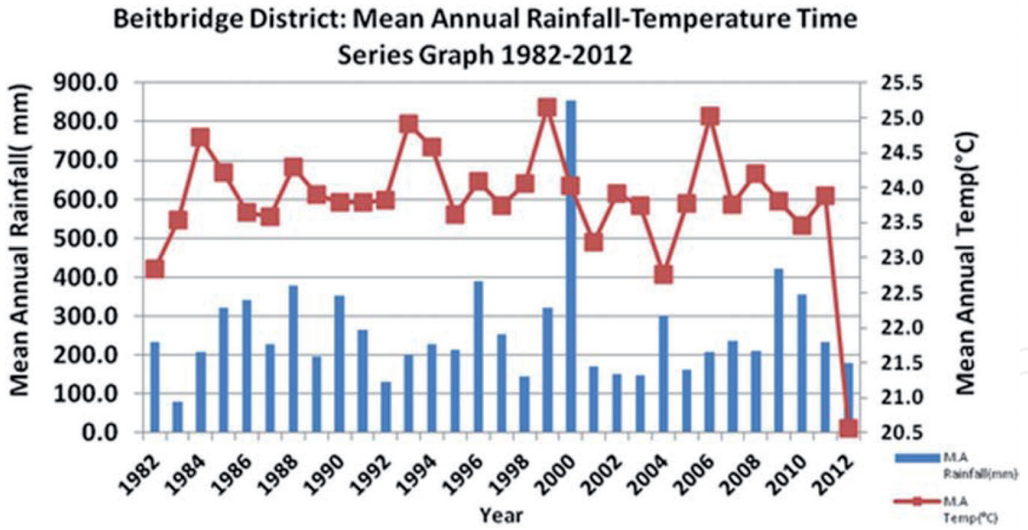


Figure 2.
Mean annual rainfall-temperature graph for Beitbridge district (1982–2012). Data source: Meteorological Department, Harare.

4.2 Indigenous household strategies for coping with climate change

In Beitbridge district, common indigenous coping strategies for coping with food insecurity associated with climate change include planting drought-resistant crops (94%) like sorghum and millet which are quite popular (**Table 2**). Rapoko is grown by few farmers. The semi-arid conditions of the district and the unpredictable and variable nature of the rainfall pattern forces farmers to practise probability planting which farmers gave a 72% frequency rating. Traditional adaptation mechanisms like collecting and drying wild fruits for future use, drying some crops for future use and eating wild fruits as household meals all have suppressed frequency ratings of 56 and 52%, respectively. This could be because crops like sweet reeds, groundnuts and watermelon which used to be dried for future use are no longer productively grown in the district because of inadequately distributed

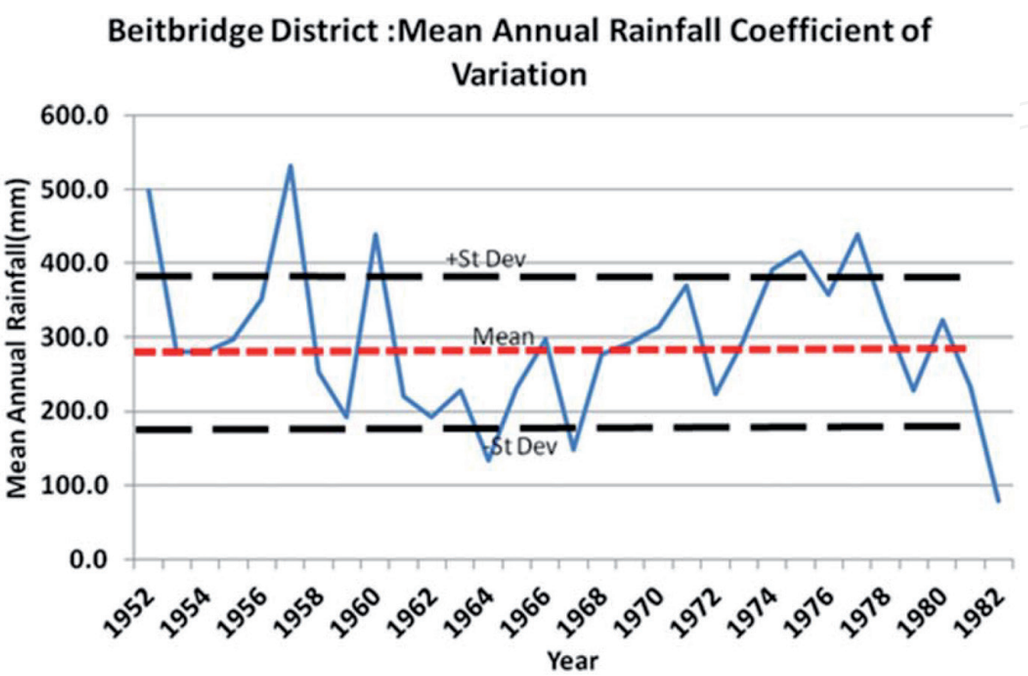


Figure 3.
Mean annual coefficient of variation for Beitbridge district (1952–1982).

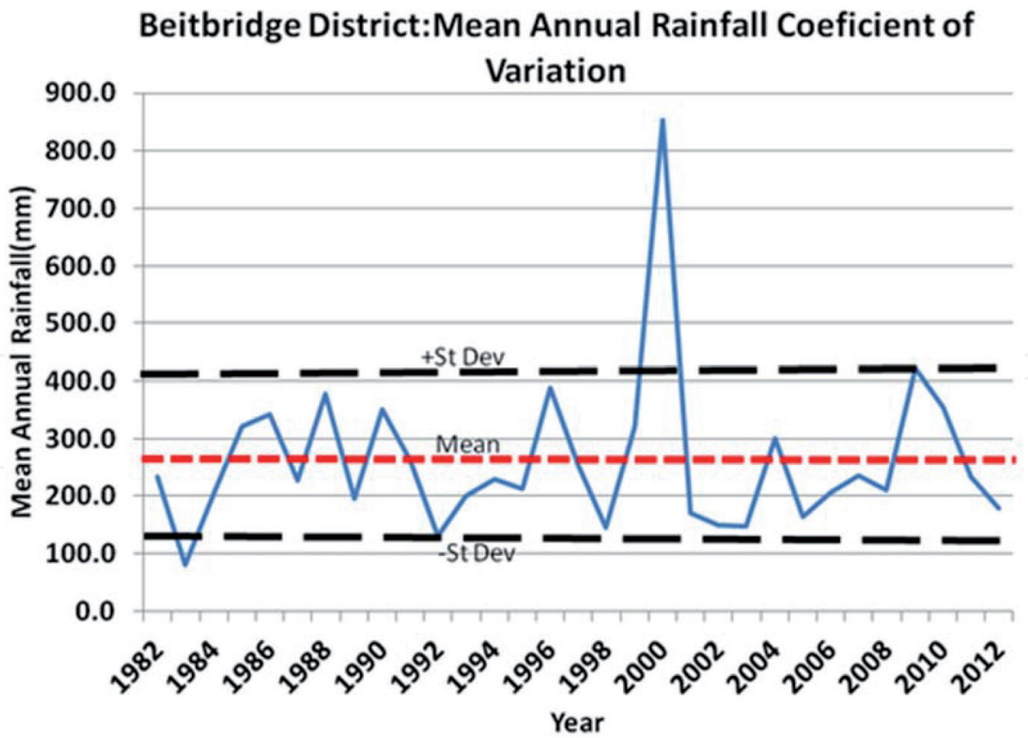


Figure 4.
Mean annual coefficient of variation for Beitbridge district (1982–2012).

soil moisture levels. Traditional fruit trees like *umkhomo, uxakuxaku, umgano* are now very few in Beitbridge because the trees no longer observe their normal reproductive cycle because of rainfall, temperature and soil moisture variability related to climate change. About 68% of the farmers, however, believe planting early maturing varieties of the national staple maize is still helpful in the district. This could be because in climatically favourable years, some farmers get decent maize yields.

The Venda, Shangani and Suthu also cope with climate change through diversification of economic activities. This mixed economy strategy involves pastoralism, cultivation, hunting, fishing, barter trading, cross-border trading, formal and informal employment and remittances from siblings in the regional Diaspora, mainly South Africa and Botswana. These diverse sources of livelihood help communities remain hopeful even when the climatic regime becomes bleak.

Environmental evidence	**Frequency**			
	Evident	**%**	**Not evident**	**%**
Drying of perennial rivers and springs	78	78	22	22
Late onset of the rains	100	100	0	0
Early cessation of the rains	94	94	6	6
Change in wind patterns	80	80	20	20
Diminishing pastures	88	88	12	12
Cold season warmer	64	64	36	36
Hot season hotter	80	80	20	20

N = 100.

Table 2.
Indigenous household strategies for coping with climate change.

When in season, minority women, girls and small boys gather fruits like umviyo, umqokolo, mtshwankela, amaganu, umkhomo, umkhemeswane and umhali as household food supplements. Wild vegetables like imbuya, idelele and ulude are important relish during the wet season. These, together with bean leaves, pumpkin leaves and garden vegetables are dried and preserved for use during drought or famine periods.

Locusts, inyeza (cicadas), inhlwa and mopane worms (amacimbi) are important among the Venda, Suthu and Shangani communities. Although mopane worms can be eaten while fresh, for future use, they are usually dried and roasted. Mopane worms are a regional delicacy in south-western Zimbabwe; hence, they are an important source of income. The income is used to purchase other important food items like mealie-meal and grain.

The Venda also gather roots like mutobhi, mukwikwi and mudzamoyo and add to their diet in drought periods. These onion-like roots are found in wet areas which because of climate change are now under severe threat of extinction.

4.3 Coping strategies for livestock sustenance under climate change

Indigenous minority communities in Beitbridge are sedentary pastoralists who depend heavily on livestock for their sustenance (**Table 3**). Their various types of livestock which include goats, sheep, donkeys and cattle are vulnerable to both climate change and environmental change.

In Beitbridge, with livestock being their major fallback cushion against poverty, communities have adopted means of sustaining their animals albeit with limited success. In the Shangani-dominated eastern wards of Dite I, Dite II and Chipise, farmers collect both wet and dry mopane, *mutsingidzi* and *murabva* leaves which they sprinkle with salt solution and give to cattle. Others mix dry leaves with molasses which they buy from Lutumba and feed their cattle.

In the Venda-dominated central wards of Mtetengwe I, Mtetengwe II and Mtetengwe III where pastures are now a problem, natural cattle husbandry is no longer practised because of heavily depleted pastures partly due to climate change. Farmers characteristically stock pile crop stover to feed cattle during drought periods. Such practice is new in a district known to be a natural pastoral region. Some farmers now sell part of their herd to raise money to buy stock feed for their cattle so that they survive the more frequent drought periods. Beitbridge experienced drought periods in the seasons 1982/1983, 1987/1988, 1991/1992, 1992/1993, 1996/1997, 1997/1998, 2001/2002, 2002/2003, 2004/2006, 2005/2006, 2011/2012 [17].

Strategy	Frequency			
	Helpful	%	Not helpful	%
Planting early maturing varieties of staple maize	68	68	32	32
Planting drought-resistant crops	94	94	6	6
Collecting and drying wild fruits for future use	56	56	44	44
Drying crops for future use	62	62	38	38
Probability planting	72	72	28	28
Eating wild fruits as household meals	52	52	48	48

N = 100.

Table 3.
Indigenous strategies for livestock sustenance under climate change.

Mr. Sibanda highlighted that in western wards (Machuchuta, Masera and Maramani) and north-western wards (Dendele, Siyoka I and Siyoka II), cattle deaths during drought periods are relatively lower. During the fast-track land reform programme communities generally agreed to repossess land from former white commercial farmers. However, they chose not to go and settle in most of those farms but reserved them as grazing areas (miraga) for their cattle during drought periods. Communities of Machuchuta, Masera and Maramani, for example, send their cattle to Shobi Block farm during dire periods. This explains why central and eastern wards which chose to go and settle in newly acquired farms record high figures of cattle losses to drought. These areas no longer have typical *miraga* (reserved natural pastures).

4.4 Constraints encountered by indigenous minority farmers in coping with climate change and variability

Attempts by farmers to cope with climate change in Beitbridge district are being hindered by a number of constraints. Both planting time (94%) and harvesting time (92%) are no longer predictable (**Table 4**). This is mainly because of the unpredictability and unreliability of seasonal rainfall patterns. A large section of the district, including places like Lutumba and Chaswingo, are generally dry with few rivers. This is the reason why 70% of the respondents describe water sources as being few and far from their homesteads. The national radio and television broadcaster, The Zimbabwe Broadcasting Corporation, covers only a small section of the district, in and around Beitbridge town. The larger area of the district, for example, Shashe, Chaswingo, Masera and Maramani either do not have this service or the signal is erratic and unreliable. This explains why 74% of the respondents do not have access to weather forecasts. Of the 26% who receive the signal, 24% of them describe weather forecasts provided as unreliable. This could be because the meteorological department itself is also experiencing challenges with changes in climatic phenomena.

Mr. Siziba of Vuturura village argued that although monthly council-administered cattle sales are a good idea which is supposed to help farmers creep out of poverty, the fact that council insist on farmers having temporary trading licences to conduct business at such sales renders the endeavour futile. Farmers do not raise much from the sales because their livestock will generally be in bad shape and yet goods sold by other traders are expensive. In the eastern wards (Dite I, Dite II and Chipise), for example, a mature cow or bull (or ox) could fetch as little as US$90 according to Mrs. Simuta of Chaswingo village in Dite I ward. In group discussions, farmers from Chaswingo village thanked one white who they said 'helped' them by buying their very thin cattle which he would feed first before transporting them to his Matengeni farm in Mwenezi district.

Strategy	Frequency			
	Helpful	%	Not helpful	%
Sending cattle to far-off places for better pastures	96	96	4	4
Preserving crop residue after harvest	58	58	42	42
Sourcing tree leaves/twigs/fruits for livestock	80	80	20	20
Reducing the size of livestock herds during drought periods	80	80	20	20

N = 100.

Table 4.
Constraints in coping with climate change.

In the western wards, farmers at Shashe and Toporo complained that although they sell cattle and goats every month, private buyers cheat them by buying their livestock at less than a dollar per kilogramme which is unsustainable. They appealed to government to re-introduce the Cold Storage Company which pays more sustainable prices. Even weavers at Maramani Craft Centre complained of unfair markets for their products. Despite all the time and effort invested, one broom would cost 2 South African rands and yet the buyer would sell the same broom at 20 rands. Buyers take advantage of the remote location of these wards in relation to Beitbridge town centre. Roads in rural Beitbridge are barely navigable. Feeding cattle with tree leaves requires considerable amount of labour which is in short supply in the district given that most young people migrate to South Africa. It also requires scotch-carts to transport leaves home. Families who do not have scotch-carts usually suffer heavier losses of livestock during drought periods. It is important to note that feeding livestock with leaves is only a stop gap measure to reduce livestock mortality. It does not prepare them for the market, neither is it sustainable if drought periods persist beyond a year.

All areas of the district bemoaned the prevalence of cattle rustlers who steal cattle, goats and sheep at night. They target mainly female-headed households where they know women would not go out for fear of possible harm or even death.

Although *miraga* (extensive natural rangelands) reduce cattle mortalities, farmers complained that they are expensive. Where these *miraga* are owned by private farmers, community farmers have to pay a single herd of cattle per every 10 herd of cattle. This is despite the fact that during severe drought years, cattle die even there and yet miraga owners will insist on their charge. Mrs. Muleya of Chaswingo, for example, lost 50 herds of cattle at the *muraga yakholomo* (cattle-dominated resettlement areas) during the severe 2012 drought. She only received cattle bells as evidence of cattle deaths. Cattle usually go to *miraga* in June/July when pastures have completely depleted and watering points have dried up.

In Beitbridge, minority farmer communities still have considerable faith in their traditional staples like sorghum and millet (**Figure 5**). A frequency of 50 for sorghum and 36 for millet show that the household granary provides most of the seeds grown, which are traditionally treated and carefully stored for replanting. Maize, the national staple crop, generally does not do well in Beitbridge district because of erratic and unreliable rainfall. Maize requires mean annual rainfall of between 600 and 800 mm which the district rarely gets. Farmers, however, insist on planting maize despite low yields because of its palatability which is more than that

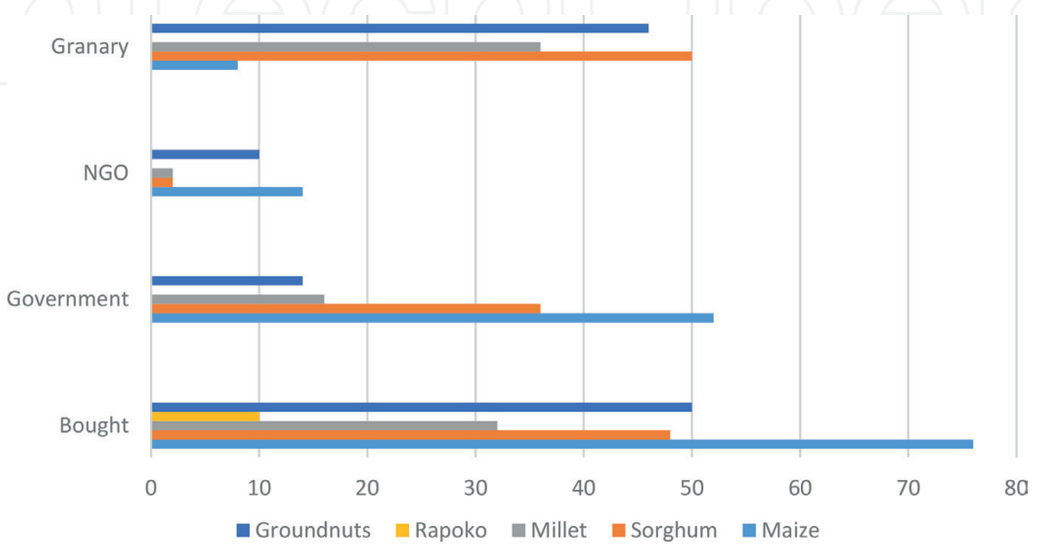


Figure 5.
Frequency of household sources of seed in Beitbridge district (%).

of sorghum and millet. Most of the maize seed (frequency of 76%) is either bought or supplied by government through its grain loan scheme where farmers are given seeds and are expected to repay with maize grain after harvesting. The loans are rarely repaid because of persistent poor harvests.

Maize is not a traditional Venda, Suthu or Shangani crop and hence these communities do not have traditionally time-tested ways of maize seed preservation as with sorghum and millet. This explains the granary's contribution to maize seed in the district. Though groundnuts require significant rainfall amounts for favourable harvests, households in Beitbridge grow them because of their multiple uses as relish, as relish enhancers or as body lotion. Farmers prefer traditionally prepared and preserved seed from the granary but if this is not available or is not enough, they buy from seed houses or from other households.

4.5 Government initiatives to help farmers cope with the effects of climate change

In Beitbridge district, questionnaire results show that government has not done much to help Venda, Suthu and Shangani farmers cope with climate change. Government initiatives cited include borehole drilling in wards 2, 3, 5 and 9. This stretched from the 1980 decade to the 1990s. In 2012, the severe drought which hit the district forced government to initiate a supplementary feeding scheme for cattle. This, however, came after many households had lost large herds of cattle.

Through the Livestock Development Programme (LDP), government advises farmers to sell some of their cattle to serve others. Government provides inputs like maize, sorghum and pearl millet seeds and fertilisers which farmers claim are common during election campaign periods at political rallies. The authorities also give drought relief at subsidised prices to farmers. Through AGRITEX, government educates farmers on helpful techniques to cope with climate change. For example, they are encouraged to practise dry planting to make maximum use of the early rains. During the 2012 drought, government availed supplementary feeding at subsidised prices where a 50 kg bag of 'beef survival' feed was sold at US$6.50 instead of US$14 from National Foods Limited. This assistance, however, was not very helpful since most farmers could still not afford.

Farmers around Zhove Dam thanked government for the dam from which they get an alternative source of livelihood through fish projects. They sell fish to clients from as far afield as Gwanda, Bulawayo and to middlemen who sell along highways and in villages.

Beitbridge has abundant wildlife which most rural farmer communities manage under Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) projects which can be very useful in helping communities cope with climate change and climate variability through giving hunting quotas to professional hunters. CAMPFIRE is a government-initiated strategy designed to help rural communities manage their resources for the development of their localities. It was initiated in 1986. CAMPFIRE programmes are run by local authorities (rural district councils) and are therefore an arm of central government.

Assistant to Chief Executive Officer (Administration) Ms. Ponela revealed that all CAMPFIRE projects in the district face the danger of being rendered unviable by climate change. The signs are already showing in that the district is always hit by all forms of drought, that is, meteorological, agricultural, hydrological and socio-economic droughts. When there is no surface water in rivers and pools, wildlife migrate to South Africa or Mozambique. This results in reduced safari hunting and consequently reduced dividends to communities.

4.6 Initiatives by NGOs to help farmers cope with the impacts of climate change

In Beitbridge district, initiatives by NGOs to help communities cope with climate change and variability were non-existent between 1980 and 1999. The 2000–2009 decade, however, saw NGOs like Lutheran Development Society (LDS) and CARE International building earth dams to harness rain water for communities. They also introduced community gardens to help reduce malnutrition and food insecurity in general. LDS, CEZVI, Red Cross and World Vision sunk boreholes in various wards across the district and this improved water access for both domestic use and livestock watering. In an attempt to reduce deaths of livestock due to drought and improve the value of cattle for subsistence farmers, LDS introduced cattle fattening. The programme only became successful during the inception period but farmers could not sustain it once the NGO had left due to high running costs.

Community gardens and earth dam construction by CARE and LDS continued into the 2010–2013 period. During the same period, CARE, Southern Alliance for Indigenous Resources (SAFIRE), EU and LED collaboration with government initiated community orchards at Shashe Irrigation Scheme. These are expected to provide economic relief to the Shashe community once the trees start to bear fruits.

Lutheran Development Services (LDS) has rehabilitated boreholes in north-western wards of Dendele, Siyoka I and Siyoka II. World Vision and LDS drilled boreholes at primary schools which include Dendele, Madali and Vuturura. LDS also helped villagers initiate Phondongoma community garden in Vuturura village and Malusungane garden in Dendele ward. Villagers grow different types of vegetables and fruits like oranges, mangoes, peaches and guavas in an attempt to circumvent the effects of climate change and variability. LDS pays school fees for orphans from primary school up to Advanced Level as a way to increase their chances of creeping out of poverty.

In the central wards of Mtetengwe I, II and III, CARE International is the most active. It has helped villagers start community gardens and small irrigation schemes by providing fence, poles and seed packs. The gardening is mainly done by women who are organised in groups of 10. The NGO advise farmers on what to grow taking into account ambient climatic variability. Farmers in these wards, however, complained that although the NGO helps them cope with climate change, it is not a permanent solution because it only stays in an area for two or three seasons and leaves at critical times when they are mastering the new technologies introduced. During the time of the study, CARE had shifted to Masvingo Province and its projects in Beitbridge were already showing signs of collapse.

In the western wards of Machuchuta, Masera and Maramani, CARE International, ICRISAT and ORAP established sale pens for livestock. This has helped farmers realise fairly reasonable prices from their livestock before they become very thin from lack of pasture, browse and water. During severe years, CARE International and World Food Programme provide food packs like cooking oil, soya beans, maize and samp to alleviate starvation. The most notable contribution to these western wards is Shashe Irrigation Scheme where government partnered SAFIRE and CEZVI to initiate the growing of citrus which when complete will cover 140 hectares. About 80 hectares are currently under irrigation. Farmers also grow wheat to cover for their family needs as well as for sale. World Vision built three small earth dams in ward 9 which helped farmers initiate community gardens. The dams also provide water for livestock.

In the eastern wards, CARE International supplied cooking oil and a bag of maize per household per month for 7 months from September 2012 to March 2013, while World Vision provided supplementary feeding for cattle, donkeys and goats. LDS, World Vision, Red Cross and CEZVI drilled boreholes.

4.7 Perspectives by communities in Beitbridge on sustainability of interventions

Minority farmer communities in Beitbridge district comprising the Venda, Suthu and Shangani generally believe their indigenous knowledge is least sustainable at 28% (**Figure 6**). Only 52% of the respondents believe indigenous knowledge is between sustainable to very sustainable. This could be because of environmental change resulting from climate change and variability. NGOs are the best rated in providing interventions against climate change and variability. Respondents gave NGOs a combined rating of 78% between sustainable and very sustainable against a government rating of 56%. This could mainly be because NGOs come to communities' rescue during the hyperinflationary period of the 2000–2009 decade which, combined with famine from recurrent droughts and floods during that period, threatened to wipe out these communities.

4.8 Discussion

In Beitbridge district, climate change is causing failed agricultural produce and reduced yields. These result from climate extremes like droughts, strong winds and floods which also destroy infrastructure like homes, bridges and schools. They also kill people and livestock. Many irrigation schemes in the district are not functional because of the 2000 and 2003 destruction by cyclones Eline and Japhet, respectively. This has negatively impacted households' livelihoods. Climate-dependent environmental endowments like the mopane worm (amacimbi), a southern district delicacy harvested from mopane trees, has become vulnerable because of climate variability. Mopane worms are an important source of livelihood in Beitbridge district. They are eaten in the household as relish or as a stand-alone meal in difficult times. They are also brisk business when sold in villages, along roadsides, at rural service centres or in towns as communities' source income to cushion themselves against poverty. Another traditionally important household cushion against hunger and starvation, amarula juice, is now only episodically produced as the fruit is also succumbing to climate change. Youths in Beitbridge no longer place their hope on their environment but on neighbouring South Africa. With their drift to South Africa, the youths miss out on cultural initiation which would otherwise equip them with their indigenous knowledge. This points to an imminent erosion of rich cultural values of the Venda, Suthu and Shangani communities.

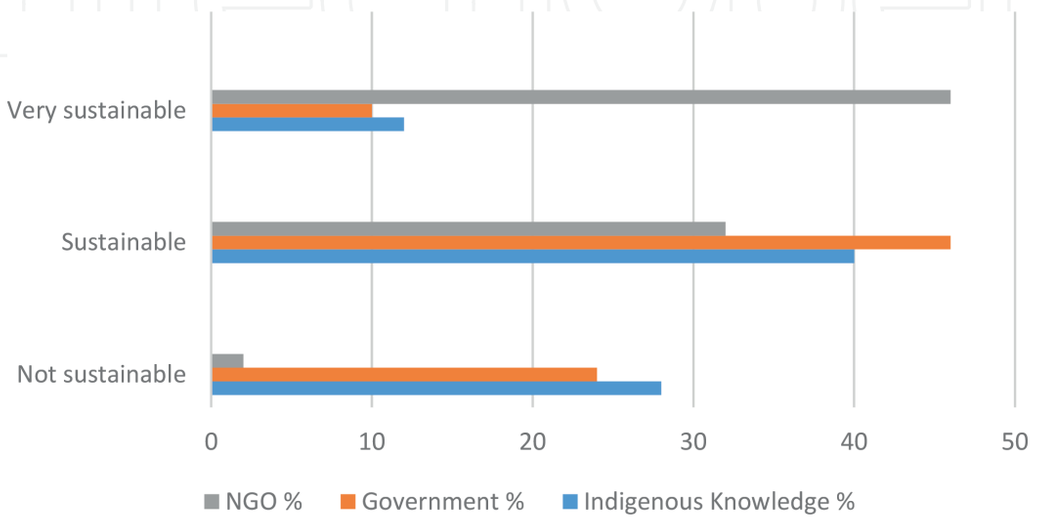


Figure 6.
Interventions sustainability rating.

Climate change is forcing communities to gradually lose confidence and trust in their generations-old indigenous knowledge systems of farming because of erratic rains which lead to reduced agro-ecological yields. Community trust and confidence on indigenous knowledge systems to support food security has now been eroded. Traditional food preparation and preservation are no longer systematic. This leads to loss of these skills by the new generation who traditionally would carry such indigenous knowledge to posterity. Some farmers have since abandoned dry land farming because of persistent droughts. Others have resorted to NGO-sponsored community gardening projects, for example, in Lutumba and Maramani wards. Given the uncertainty of such gardening projects, which usually collapse at the departure of benefactor NGOs, reliance solely on gardens drive households into deeper poverty.

Beitbridge is a livestock district and for most households, livestock is a store of wealth. Climate change induced extreme weather like droughts and floods which kill many animals [17]. Farmers then sell their livestock for very little to people from districts with better pastures. Most of the money that communities get from their livestock is used to buy items and goods from cross-border traders and traders from other districts. This means that even with the large herds of livestock, which can turn them into viable commercial livestock producers, minority community farmers remain poor subsistence livestock herders.

A viable indigenous coping strategy to climate change is, however, manifest in Maramani ward between Shashe and Limpopo Rivers. Both men and women hand-make hats, mats, brooms at Maramani ilala Project Craft Centre using the locally available *ilala* plant which they harvest from wetlands and river banks. They sell their products locally, in towns and even across the border in South Africa. The remote location of both the ward and craft centre, however, negatively affects this local initiative. Clients from outside the ward are few and those who endure the rough drive to the craft centre negotiate for very uneconomical bargains to the weavers. Maramani Ilala project is, however, an example of how communities can use their indigenous knowledge, raw materials from their immediate environment and their skills to cushion themselves against climate change impacts. Largely because of the Maramani Ilala project, climate change effects in Maramani ward are not very dire.

Western wards of Masera, Machuchuta and Maramani, which are rich in wildlife also, have the potential to counter detrimental climate change impacts through CAMPFIRE projects. Wildfire is a promising resource which, if well exploited, can boost tourism in a revamped CAMPFIRE programme. CAMPFIRE proceeds are meant to benefit these wards in infrastructural developments like roads, schools, clinics and bridges are currently inadequate. Communities no longer see any value in conserving wildlife. Some have resorted to poaching in wildlife conservation areas.

These wards are comparatively wetter and sustain more herds of livestock. The tragedy, however, is that they are isolated and have badly damaged roads. This results in poor markets for livestock. Although Beitbridge Rural District Council conducts cattle sales at selected 'central' points within the district, these points are in reality not central for most of the minority farmers in remote parts of the district. The selling points are located close to highways to attract buyers from towns and cities. Besides council-conducted cattle sales being a noble idea, council insists on farmers to have temporary cattle trading licences to conduct business. Most farmers cannot afford the money. Moreover, most of their cattle will be in bad shape and cannot give high returns. To raise the money for a council licence and for household needs, farmers are forced to sell many herd of cattle and at very low prices. In the eastern wards of Dite 1, Dite 2 and Chipise, for example, a mature cow or bull can sell for only US$90. In drought years, government, through the Livestock Development Programme (LDP), advises farmers to sell their livestock and not

risk all of them being wiped out by the drought. Minority communities, therefore, have two hard choices for their livestock in drought years; either they sell them very cheaply to people from other districts for fattening and profit-making, or they watch them die miserably.

Even for these comparatively better environmentally endowed western wards, opportunities offered by government in the face of climate change are no longer enough to retain youths. This is because of the strong South African rand pull factor in the more affluent South African cities and farms. The sustainability of indigenous knowledge and local resources as cushions against climate change therefore remain threatened.

Pastures are generally a big problem in Beitbridge district, more so in the Venda-dominated central wards of Mtetengwe1–3 and Eastern Shangani-dominated wards. Although these wards benefitted from the fast track land reform and resettlement programme, beneficiaries preferred to go and settle in the newly acquired areas. This led to quick environmental depletion due to large herds of livestock, clearing of large areas for settlement both of which were not complemented by climate variables, especially rainfall. Some of the resettled areas had over the years been used as *miraga* (winter grazing areas) by these minority farmers. The permanent occupation of such areas, therefore, deprived farmers of fallback options for their livestock in times of drought. Consequently, eastern and central wards lose high numbers of livestock to climate-change-related factors.

By comparison, Suthu-dominated north-western wards of Dendele, Siyoka 1 and 2 and western wards of Machuchuta, Masera and Maramani, livestock deaths are not as devastating. In these areas, instead of occupying the farms they got from the fast track land reform and resettlement programme, communities were prudent enough to reserve most of the farms as *miraga* for their cattle. For example, Maramani, Masera and Machuchuta communities send their cattle to Shobi Block farm which is their winter grazing area.

While *miragas* are generally a viable solution to reduce cattle deaths, they come at a cost to farmers. For every 10 herd of cattle, farmers are obliged to part with one beast as payment to the custodians of respective grazing areas. Besides, at these grazing areas, cattle are not always safe. Cattle rustlers are a problem in the district, with some families losing as many as 50 head of cattle to them at *miraga yakholomo* (winter cattle grazing areas) in one season alone.

Minority Venda, Suthu and Shangani communities in Beitbridge rely on their traditional sorghum and millet varieties as their staple crops. They prepare and treat these seeds and store them in their traditional granaries for replanting. Instead of helping communities improve these local grain varieties through research, government seems determined to change these communities' traditional tastes by introducing maize as an alternative to these small grains. Government provides maize seed loans which farmers rarely pay back because of poor harvests caused mainly by reduced soil moisture content resulting from the changing climate. Government is, therefore, defeating the intentions of the developmental state theory which seeks to promote indigenous initiatives to development.

NGOs are popular in Beitbridge. This is because they attend to the immediate and most pressing needs of the household through, for example, providing food, initiating and funding community gardens, paying fees for school children, fattening cattle during drought periods. NGOs, however, usually do not stay in any ward or district for long. They usually leave after the supposed summer harvest (even if some households do not harvest anything). NGOs usually leave before communities have mastered the art of self-sufficiency in the efficient management of projects. As a result of this pseudo-empowerment, communities fail to sustain themselves.

4.9 Conclusion

All three minority communities (Venda, Suthu and Shangani) that populate Beitbridge are at the mercy of climate change and climate variability. Although they receive some assistance from government and non-governmental organisations, they all have considerable faith in their own indigenous coping strategies to fight the climate change scourge. There is need to recognise, respect and improve their indigenous knowledge systems. A deliberate effort must also be made to integrate this local traditional knowledge with modern technologies to build even stronger resilience and sustainability options.

The case of Beitbridge's minority farmer communities suffering from climate change and climate variability is one of lack of financial and technical resources and to some extent human resources because of an acute outmigration by the youth. Beitbridge is not a poor district from a natural resources' point of view. The district is a livestock region and all minority farmer communities generally have livestock like cattle, goats and sheep. The management of these in the face of climate change is, however, a serious issue as most of them, especially cattle, succumb in large numbers to climate-change-induced droughts and associated hazards like diseases and surface water shortages.

The study acknowledges efforts being initiated by both government and NGOs to reduce effects of climate change in Beitbridge. However, given the rich soils in parts of the district, the palatable pastures and browse, the diverse livestock varieties and abundant surface water potential for both damming and extraction through piping, the minority farmer communities of the district can significantly be better empowered for sustainability. Farmers should not be basket cases but should be helped to develop sustainable strategies and techniques to help them build resilience regardless of climatic hazards.

The interplay of government and NGO assistance on the communities in Beitbridge District risk disorienting the minds of these communities from their traditional cultural beliefs as their political orientation may be influenced by those who feed them. Apart from simply being natural hazardous phenomena, climate change and climate variability may end up being tools of political and economic manipulation of such minority farmer communities by both the rich and humanitarian service providers like NGOs and government through food politics where assistance may only be given to those who comply with the status quo.

4.10 Recommendations

- Relevant government ministries and development partners should conduct workshops to conscientise the community in all 15 wards about climate change and its devastating impact on the environment and their livelihoods in general. This will enable council and the community to work together in coming up with mutually acceptable solutions to problems.

- Beitbridge's comparative advantage in livestock production should be exploited by government through availing tax incentives for livestock-related industries in order to ameliorate climate change impact through employment creation for the locals. This would likely reduce the number of youths who migrate to South Africa. The young minds would thus be taped for the development of the district.

- Beitbridge has/is in the vicinity of perennial rivers like Limpopo, Shashe, Bubi and Runde Rivers which can be dammed to produce large water bodies which

can turn the whole district into a green belt. Government and other development partners should work towards the possible realisation of this possible dream.

- Only 20% of the irrigation schemes in Beitbridge district are functional despite the fact that it falls in agro-ecological region 5 with an average rainfall of 300 mm [17]. Lack of fully functional and efficient irrigation schemes has negative implications on food security within the district especially among minority farmer communities who are on the fringes of development. Beitbridge Rural District Council should partner other arms of government like the irrigation department and AGRITEX to resuscitate and improve capacity utilisation of irrigation schemes in the district.

- Emphasis of the district's irrigation schemes is on subsistence farming rather than on commercialisation. Average irrigation plot sizes range between 0.1 and 0.3 hectares which is relatively small [17]. Though this approach used to be sustainable several decades ago, and had stuck in the mindset of communal minority farmers, the advent of climate change and its destructive effects has rendered subsistence farming unsustainable. Government and NGO initiatives have not helped much with their food handouts which are only temporary and do not guarantee food security. Better coordination of the farmers by AGRITEX, NGOs and even among themselves is required to make irrigation schemes commercially successful.

Acknowledgements

The authors would like to thank all research participants for their generous contributions and also for allowing us to use their names in this chapter.

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