

## Article

# Exploring Long-Term Livelihood and Landscape Change in Two Semi-Arid Sites in Southern Africa: Drivers and Consequences for Social–Ecological Vulnerability

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Received: 22 February 2018; Accepted: 11 April 2018; Published: 16 April 2018



**Abstract:** This paper investigates the drivers and dynamics of livelihood and landscape change over a 30-year period in two sites in the communal drylands of Zimbabwe (Marwendo) and South Africa (Tshivuhulani). Of particular interest to us was how access to social protection and a wider range of options may mitigate increased vulnerability under a changing climate. A mixed methods approach (using household surveys, focus group discussions, life history interviews, transect walks and secondary sources of data) was applied to develop human–environment timelines for each study site. Findings indicate that prolonged periods of droughts, unreliable rainfall, changing socioeconomic policies and development-related projects were among the major drivers of both positive and negative change in both villages. Marwendo, in particular, experienced a suite of negative drivers in the last 10 years that increased vulnerability and forced households to diversify into potentially maladaptive activities. In contrast, the expansion in social grants in Tshivuhulani provided an important safety net that reduced vulnerability, but also led to a decline in farming and a narrowing of livelihood activities for some households. We demonstrate that rural development initiatives such as electrification and road construction can strengthen local people’s capacity to respond to drivers of change, while new methods of farming and diversification of the livelihood portfolio can make them more climate-resilient. However, long-term changes in landscapes and ecosystem services and feedbacks on livelihoods could reverse some of the benefits of development by eroding the natural capital many households still depend on.

**Keywords:** livelihoods; landscape change; drivers; trends; vulnerability

## 1. Introduction

There is a growing sense of urgency to better understand the complex and rapidly changing global realities that the world faces today [1]. Greater risk and uncertainty is fast becoming the norm as our planet undergoes escalating levels of environmental change (e.g., [2]), including climate change, and as globalisation links countries and economic systems in multifarious and often unpredictable ways [3,4]. Ongoing and accelerated change in climate, population and migration, environment, land use, and economies often translate into increased risk and vulnerability at the local level, particularly amongst poor natural resource dependent communities [5–7].

In southern Africa, it is well established that contemporary rural society is facing a growing suite of interacting stressors including HIV / AIDS and other health shocks, poverty, food insecurity, weak governance, climate variability and increased extreme events, and land and resource degradation, to name but some [5,8–16]. These changes and stressors combine to exacerbate livelihood asset erosion,

vulnerability, poverty and food insecurity, and tend to be most amplified in the dryland parts of the region [17–20]. Drylands (arid, semi-arid and dry sub-humid areas) represent highly sensitive systems where precipitation is scarce and typically more or less unpredictable, temperatures are high, humidity is low and soils generally contain small amounts of organic matter [21,22]. These, and other biophysical features, have profound socioeconomic implications, which exacerbate the feedbacks between poverty, environmental decline and long-term vulnerability [15,23]. Such biophysical sensitivity is further affected by a lack of capacity in civil society, the private sector and governments to respond appropriately to emerging threats in these areas [24].

Moreover, several commentators have argued that new and incipient risks and threats in these regions are outpacing and superseding any positive development changes that may have strengthened livelihoods and improved the ability of rural people to respond to the negative impacts of change in the past [15,25]. Indeed, in dryland regions livelihoods are reported to be deteriorating and poverty deepening [15], while there is mounting evidence that people are turning to potentially unsustainable practices, such as higher levels of natural resources harvesting, in order to cope with the increasingly harsh living conditions they are facing [14,26–28]. Overall, people and ecosystems in the region are said to be becoming increasingly vulnerable, especially to climate change [17,29,30]. Given this situation, these local level social–ecological complexities require systematic unpacking in order to identify and promote sustainable pathways and trajectories into the future. In particular, how different economic and policy contexts play out in either blocking or enabling sustainable livelihood responses in these constrained arid and semi-arid environments needs further enquiry, something this paper seeks to do using South African and Zimbabwean case studies.

Many approaches to global environmental change research tend not to include the broader political-economy and development context, nor address historical processes. Vulnerability and adaptation in southern Africa cannot be addressed in isolation of an understanding of broader issues such as historical trends, regional development challenges, drivers of poverty and inequality, problems of political representation, health concerns, land and tenure issues, social welfare systems and people's own concerns and priorities. Current drivers of change are deeply embedded in the past and have profound implications for what is possible in the future [1]. Thus, when facing major environmental change, such as the effects of climate change, developing an in-depth knowledge of past drivers and experiences is of prime importance [31,32]. Furthermore, a holistic picture is needed as poorly coordinated national and regional policies and strategies sometimes reinforce the structural and political factors that contribute to vulnerability and poverty in the first place. To fully understand how different contexts, policies and multiple stressors shape vulnerability and to capture local people's own experiences, local-level, place-based case studies that link social and ecological change and vulnerability are essential [33]. These studies need to include the 'lived experiences' and narratives of the very people affected by climate change and other stressors. The use of inductive qualitative approaches, such as applied in the human–environmental timeline method [31,34] and life histories, together with quantitative data enable us to describe drivers and processes of change that determine livelihood outcomes and vulnerability in particular local circumstances. We argue that only through understanding how society and ecosystems simultaneously interact and respond to new and exacerbated drivers can we start to address vulnerability and promote sustainability in a changing world. Consequently, more place-based studies that facilitate comparison of the livelihood and vulnerability outcomes resulting from different historical and contemporary drivers, from the national to local scale, are needed in order to inform development and adaptation solutions going forward.

In this paper we use the Millennium Ecosystem Assessment (MEA, [23]) definition of a driver as any factor (natural or human-induced) that can cause a change (direct or indirect) in the structure and/or function of a social–ecological system. Drivers that result in negative outcomes are often referred to as stressors [35] and tend to be ongoing, long-term and persistent [36], as in the case of resource declines, seasonality issues, and temperature increases. Shocks, on the other hand, are generally unpredictable, short term events such as human, crop and livestock disease epidemics;

natural events such as droughts, and floods; and economic turns such as currency devaluation [37]. To unravel the impacts of different drivers on livelihood outcomes and vulnerability we applied Dorward and colleagues' livelihoods aspiration framework [38] that identifies three dynamic livelihood strategies or trajectories that emerge from change: "hanging in", "stepping up", and "stepping out". We added another category, "losing out", which refers to a situation of increasing vulnerability. Vulnerability is most commonly understood as consisting of exposure to shocks and stressors, the susceptibility to harm from these (sensitivity), and the capacity (or not) to respond and recuperate from such adverse impacts (adaptive capacity) [13]. Here, we draw on a notion of vulnerability that highlights the importance of incorporating both a risk-hazards perspective (that locates vulnerability within external risk) and an entitlements–livelihoods and political ecology perspective (that traces vulnerability to multiple social, political and economic factors at different scales) [39,40]. Place-based vulnerability is thus a function of the starting context in which people find themselves, including their livelihood options and activities and the assets they have to draw on, all embedded within the local institutional context, wider political economy and agro-ecological system, and influenced by historical processes, such as colonisation, and the risks and threats that households face.

Drawing on the above and responding to the research gaps highlighted, in this paper we investigate the drivers and dynamics of livelihood and landscape change over a 30-year period in two rural villages in southern Africa, one in Limpopo Province of South Africa and the other in Manicaland Province of Zimbabwe. The two villages are located in similar semi-arid environments, but vary in terms of socioeconomic policies and conditions. In particular, what stand out are the site differences in relation to access to social protection and welfare, basic service delivery and development opportunities. In South Africa, social grants in the form of old age pensions and child grants are received by large numbers of poor households; these provide a safety net that is not available in Zimbabwe [41]. Furthermore, the post-apartheid period in this country has been characterised by a commitment to improvement in service delivery in many previously neglected areas. Through analysis of how these contextual differences, and the drivers behind them, influence people and landscapes at the local level, we aim to contribute to the growing body of literature on social–ecological change in the region. We are particularly interested in how access to social protection and a wider range of options in South Africa may militate against some of the impacts of new threats and prevent a possible downward spiral of increasing vulnerability or a poverty trap. Such downward trajectories might result from, for example, higher dependency on, and subsequent overuse of, a range of vital ecosystem services that people turn to when livelihood options are limited [14]. The study was thus designed to facilitate examination of the similarities and differences between villages in relation to the national and local socioeconomic and political context, while the construction of coupled human–environmental timelines enabled us to explore the temporal coevolution of drivers, livelihoods and natural resources based on local perspectives and narratives. Specific objectives included to: (1) identify the drivers that have influenced livelihood and landscape change within the two villages; (2) unpack the changes that have taken place; and, lastly (3) interpret what these changes mean for social–ecological vulnerability and future livelihood trajectories in each setting.

## 2. Study Sites, Approach and Methods

### 2.1. Study Sites

The study was conducted in two paired, purposefully selected villages (366 to 645 households), in the drylands of southern Africa, namely Tshivhulani village in Limpopo Province of South Africa (part of the former homeland of Venda; 22°55'46" S; 30°29'40" E) and Marwendo village in the Manicaland Province of Zimbabwe (20°6'28" S; 32°27'3" E).

Both study sites fall within the savanna biome, specifically what is commonly referred to as dry woodlands, and receive an average rainfall of between 334–450 mm per annum, characterised by high variability and mid-season droughts [42,43]. The vegetation in Tshivhulani is classified as

Soutpansberg mountain bushveld [44], and is characteristically heavily impacted by overgrazing, wood-collecting and farming activities. Common trees found include *Vachellia* (previously *Acacia*) *karoo*, *Berchemia zeyheri*, *Combretum molle*, and *Kirkia acuminata* among others. Marwendo lies in agro-ecological Region IV of Zimbabwe [42], a semi-extensive farming region that is characterised by low rainfall and periodical seasonal droughts and severe dry spells. The most extensive vegetation types in the village are open Mopane (*Clophospermum mopane*) woodland and *Acacia-Combretum* woodland. Other common species and genera include the baobab (*Adansonia digitata*) (an important source of fibre and emergency food) and *Terminalia* spp. The grass cover in the village has been heavily affected by overgrazing and bush encroachment [45].

The villages differ in terms of their socioeconomic characteristics (Table 1), especially with respect to proximity to urban areas, government policies, and access to social protection or welfare. Tshivhulani village is located some 10 km from the nearest town (Thohoyandou), whereas Marwendo village is located 40 km from the nearest town (Chipinge). Access to electricity and piped water is more uniform in Tshivhulani than Marwendo. Both sites are characterised by widespread poverty and unemployment [46,47]. In Tshivhulani most households rely on a combination of government social grants (mainly old age pensions and child grants), remittances from migrant workers, home gardening, some livestock production and the collection of firewood and other natural resources (wild fruits, vegetables) for their livelihood [48]. In Marwendo, livelihoods are dominated by cereal production for household consumption, which is the key livelihood activity for the majority of Zimbabwe's rural population [47]. Livestock production, mainly cattle and goats, is also important. The village is located on the edge of the Mutema Highlands [45]. Residents rely heavily on natural resources, such as construction poles, firewood and fencing materials, and food and medicine, obtained from these highlands. Cash and in-kind remittances primarily from South Africa have become an increasingly important source of household income. Due to the significantly high levels of poverty, low levels of economic activity coupled with poor quality of land available, non-farm activities such as seasonal casual work, petty trading and the sale of handicrafts and other local natural resources have become important sources of income.

**Table 1.** General characteristics of the two study villages.

Village Characteristics	Tshivhulani (South Africa)	Marwendo (Zimbabwe)
Number of households	645	366
Dominant ethnic composition	Venda	Ndau
Water source	Piped water	River/boreholes for most of village except township/urban area
Transportation	Gravel road	Gravel road, close to the main highway
Market access	Very easy	Fairly easy
Electricity	Yes	Yes/only few households
Distance to the nearest town	Less than 10 km	40 km
Social grants (monthly)	Yes	No

## 2.2. Approach and Methods

The human–environment timelines presented in this paper were developed by drawing on the findings from a mixed-methods approach that included a household survey, focus group discussions, in-depth life history interviews, transect walks and a review of secondary sources. This approach facilitated the triangulation of findings and provided multiple sources of information to construct comprehensive human–environment timelines that are able to highlight the co-evolution of livelihoods and landscapes over time as influenced by major biophysical, socioeconomic, development and policy drivers of change. Furthermore, the insights gained from these various approaches, in particular the qualitative methods, assisted with interpreting the findings presented in the timelines. The timelines

were constructed to cover the period from 1980 to the present and were divided into three distinct periods: Period 1 (1980s): 1980 to 1989; Period 2 (1990s): 1990 to 1999; and Period 3 (2000s): 2000 to the present. The drivers and changes are described and the outcomes interpreted according to Dorward et al.'s typology in [38].

The bulk of the long-term temporal information was obtained from focus group discussions. One focus group was held in each village with 6–12 participants (based on who arrived on the day) in their 50s and 60s, including both men and women. Members of this age group are viewed as the custodians of considerable knowledge and experience of the past, making it possible to look back at least two generations. The local councillor assisted with finding suitable participants. To determine key chronological events and temporal changes in the village over a 30-year period, participants were asked to recall and generate insights about changes in their villages (both in relation to their livelihoods and the local landscape), the factors behind these changes (drivers) and the outcomes for livelihoods. This was complemented by a ranking exercise that was used to determine the relative importance attached to various livelihood activities and environmental concerns that had been identified by the participants.

Other data used in the human–environmental timeline included findings from the household survey carried out in each village. Some of these results are also tabulated or graphed in this paper to provide additional evidence for the trends indicated in the human–environmental timeline. Structured questionnaires were administered to 80 households in each village. These households were randomly selected using freely downloadable Google Earth software, where random points were generated using the “Cruise tool” [49]. The Cruise functions allow one to enter the number of points required; 80 random points were generated from each map site. These points were then displayed on a Google Earth map, printed out in colour and taken to the field. During fieldwork, the household nearest to the GPS point was selected for the study and, if not available or not willing to take part, the next closest willing household was visited. The questionnaire covered four main themes: (1) household members and structure, income, assets, livestock and farming activities; (2) shocks, long-term stressors and other changes and local responses (including natural resource safety nets); (3) changes in woodland cover and natural resource use and drivers; and (4) future concerns.

Stories obtained from in-depth, life history interviews also provided contextualisation for the timeline. Ten households were selected in each village, targeting the elderly. The interviews were recorded and field notes were taken. The interviews were later transcribed. Respondents were asked to tell their “life stories” in whatever way they felt comfortable and to describe notable events that they believe defined their experiences. To facilitate the storytelling, questions based on the following major themes were used to guide the interview: (1) livelihood changes (general household information, personal narrative of the respondent's life from growing up to present, village's history and any changes that occurred since their arrival, hardships experienced, major causes of hardships); (2) local responses to key changes, shocks and stressors faced (with a particular focus on the role of social protection and use of natural resources); and finally (3) a look into the future (major concerns into the future for the household and the community).

For data on landscape and natural resource change, a transect walk, which involved walking from the village periphery into the surrounding grazing lands, was carried out in each village with 5–10 willing participants (both male and female) recruited from the community. This walk provided an opportunity for direct observation, questioning, discussion and learning about natural resources and biophysical indicators of change and the livelihood impacts of these for villagers. Several aspects related to the use and availability of woodland resources were discussed and recorded. These included the main uses of key woodland products, who uses them (e.g., men, women, children, community outsiders, etc.), any changes in vegetation structure, species, and the relative abundance/scarcity of useful species, changes in the distance and/or time required for collection of woodland products; and changes in land use and cover, including woodland shrinking and/or patchiness and the opening up or abandonment of cultivated areas. Where the transects passed through fields or old fields, various issues relating to arable agriculture were discussed.



Lastly, secondary data sources including government reports, other published historical or anthropological studies in southern Africa, newspaper articles and non-governmental organisation (NGO) reports were reviewed to gather background information on the historical context as well to triangulate the findings.

### 3. Results and Discussion: Coupled Human–Environmental Timelines

#### 3.1. Drivers of Change and Trends

In this section, we highlight the key drivers of change (both positive and negative) identified from the various data sources. For ease of discussion, we classify them into four main categories, namely: (1) climatic drivers and events (perceived changes in rainfall and other weather-related parameters); (2) demographic and socioeconomic drivers and events (changes in socioeconomic and structural policies); (3) local developmental drivers and events (local factors, including NGO projects and provision of new services, that facilitated or detracted from people's ability to make a living); and (4) drivers of natural resource change (changes in land use and cover, natural vegetation and useful species). These various drivers work together to influence ecosystem and human vulnerability and livelihood outcomes. The sections that follow then consider the combined impacts and consequences of these drivers and the subsequent changes in livelihood and landscape vulnerability.

##### 3.1.1. Climate-Related Events and Drivers

Given that both villages are located in dryland areas with highly variable climates, it is not surprising that climate, particularly drought, emerged as an important driver of change (Figure 1a,b). Both villages have experienced prolonged periods of drought, on an almost decadal basis, coupled with increasing temperatures since the 1980s. All of the droughts were considered by participants to be severe. In Marwendo (Figure 1aA), participants spoke about the 1992 drought as being the worst in living memory. This drought was said to have been so severe that it resulted in critically low levels of surface water for both domestic use and livestock, and people had to live from hand to mouth. In Tshivhulani (Figure 1bA), the 1992 drought was regarded by the focus group participants as a natural disaster in economic, social and environmental terms that altered the course of their livelihoods, while the 2002 drought was said to have caused severe hunger and dragged people into deep poverty.

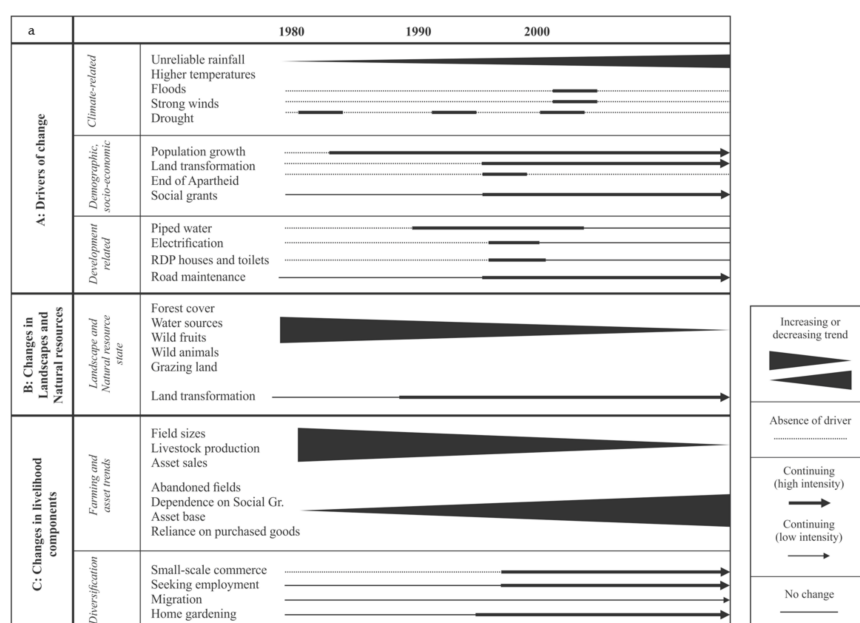
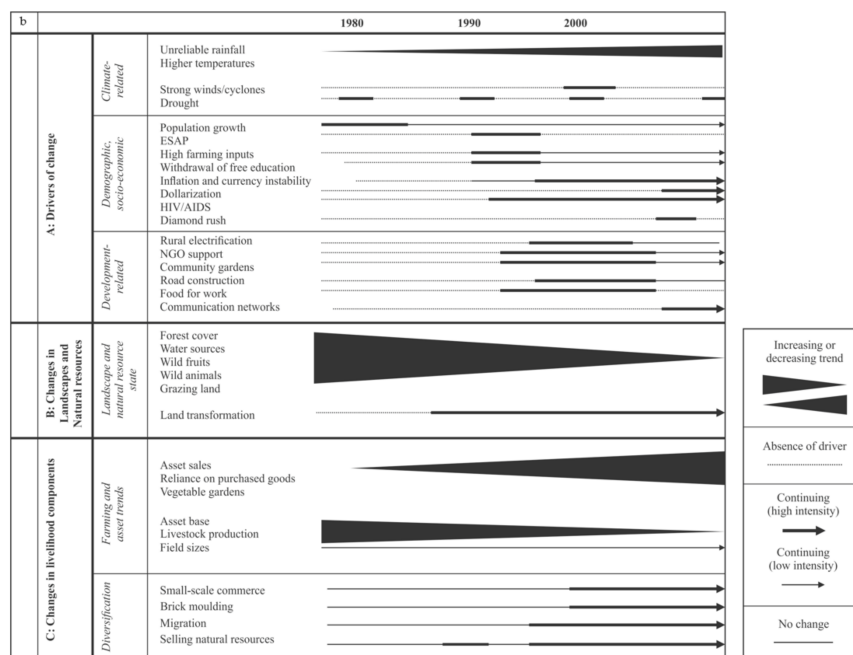


Figure 1. Cont.



Other than droughts and increasing temperature, another climate-related driver mentioned in both villages was greater uncertainty regarding rainfall patterns. The rainy season was described as becoming increasingly unpredictable, and, together with high temperatures, these unfavourable weather conditions were considered to be pushing people into off-farm activities. An increase in strong winds and veld fires, particularly in the early 2000s, were mentioned in Tshivhulani resulting in damage to houses and vegetation. The 2000 flood was also a key event in this village, which resulted in loss of property (collapsed dwellings) and damage to infrastructure such as roads. This was pinpointed to the first two weeks of February 2000, showing that many respondents had clear memories of this event.

### 3.1.2. Demographic, Socioeconomic and Policy-Related Events and Drivers

Events and changes in the demographic, socioeconomic and political spheres also contributed significantly to the changing conditions in the two villages, with the primary drivers being quite different between the two countries.

A key influence on change in both villages in the early 1980s was a peak in the population, and then steady growth following that. In Marwendo, this was said to be the result of an influx of refugees from neighbouring Mozambique. The refugees were fleeing the Matsangaissa anti-communist rebel group, which had sparked war in their country [50]. For some villagers the refugees were welcomed as they provided a relatively cheap source of labour, although after the war many of these Mozambicans returned home. One participant commented:

“I was able to hire one of the refugees (Arushia) . . . I provided him with a place to put his head, food to eat every day . . . in return Arushia (the hired refugee) would help me with herding my cattle and farming. By then I had a large herd of cattle before the 1992 drought wiped out all of them . . . these friends of ours, ‘*maputukezi*’ meaning ‘Portuguese refugees’, were very obedient and trustworthy and this made it easier for us to live with them like

family . . . . After the war in their country, it was sad for me and my family to see him go as he was now part of our family” [Male respondent in Marwendo village].

Most other drivers of change in this category emerged in the 1990s and 2000s, especially the last 10 years, and their impacts continue to be felt. During this period, Marwendo faced mostly negative drivers. One of these was the adoption by the government of Zimbabwe of the Economic Structural Adjustment Programme (ESAP) in the 1990s, designed by the International Monetary Fund (IMF) and World Bank. Smallholder farmers in Marwendo explained that the ESAP resulted in economic turmoil, which saw them becoming less well-off due to rising input costs, higher costs of services (e.g., health care, education), lower output prices and reduced remittances from urban areas as people lost their jobs. The far-reaching impacts of the ESAP have also been written about by several other authors [51–54]. The ESAP saw massive retrenchment of the labour force, particularly in industries and civil service [54]. This had serious negative repercussions on the economy of the country and made rural people worse off, as one participant shared:

“I lost my job after the company I was working for had to retrench workers. I was forced to come back to the village where I started to plough the land. From the day I lost my job, things have never been the same, eating from hand to mouth” [Male participant, Marwendo village].

The above sentiment clearly shows that chronic underemployment and increases in unemployment meant that rural communal areas like Marwendo had to endure much of the strain.

It was during the same period that most participants agreed that HIV/AIDS was becoming a serious concern, furthering the downward spiral of poverty in the village. The HIV/AIDS epidemic hit rural populations hard and peaked in the late 1990s, with major effects on household structure, gender relations and labour. According to Freeny [55], Zimbabwe experienced a huge increase in adult mortality from the mid-1980s to the mid-1990s, essentially due to HIV/AIDS. Most affected households were forced to sell their assets in order to cover medical costs. The South African situation mirrors this.

The decline in health and higher mortality rates was further compounded by policy change, which saw the introduction of school fees for secondary schooling. This presented a major challenge to poor people in the village. This rolling back of government services also included withdrawal of free health care, agricultural extension and veterinary services [56]. The removal of subsidies for seeds and fertilisers, coupled with the healthcare burden, seriously affected farming in the village.

Compounding all of this is the issue of inflation, which peaked in the years 2008 and 2009. People felt desperate, as captured in the following quote:

“It is only left for God to decide the fate of peoples’ lives . . . It was very hard for me and my family to even buy a loaf of bread ‘*mari yaisatenga*’ (meaning ‘money could not buy anything’) during these difficult times . . . the prices of goods and services would change more than three times a day” [Female participant, Marwendo village].

The last 10–15 years have therefore seen a loss of income for investment in productive assets such as livestock, household health, education and household food security for most villagers. We discuss this and the longer-term consequences in the next section.

Another important and more positive economic driver that was noted to have occurred in the late 2000s in Marwendo was the introduction of the United States dollar as the official currency of Zimbabwe in April 2009. Most respondents agreed that this stabilised the prices of goods and services and increased the availability of consumer goods that were in short supply between 2000 and 2008. However, the present chronic shortages of currency have all but reversed the benefits that dollarisation brought.

In contrast to Marwendo, the drivers in this category in Tshivhulani had mainly positive outcomes for villagers. The South African democratic transition in 1994 marked the end of discriminatory



apartheid policies, and a commitment to amend the injustices of the past. It was generally agreed amongst participants that this led to improvements in basic infrastructure such as water and sanitation systems, electricity lines, roads, housing and other services provided at municipal level (discussed further below). In addition to this, the democratic transition saw the equalisation and increased value of old age pensions, as well as the introduction of child grants (<http://millionssaved.cgdev.org/case-studies/south-africas-child-support-grant>). Following this, social grants became an increasingly important part of villagers' income profiles with the availability of cash fostering more livelihood options and providing an important safety net.

### 3.1.3. Local Development-Related Events and Drivers

Local development-related drivers mentioned by focus group participants mainly related to the provision of infrastructure and services, although in Marwendo support by non-governmental organisations was also highlighted. This had benefits for both villages.

The provision of piped potable water (clean and easily accessible) around 1985, by the government to the people in Tshivhulani village was noted as a significant driver of change, as it spared villagers from fetching water from unprotected sources and paved the way for small home gardens for improved nutrition as explained by a female participant:

“We used to wake up very early in the morning to go and fetch water . . . but now it is very easy since we have tapped water inside our yard. We even have a small garden where we grow our green vegetables because the water is readily available. Piped water has made our lives easier” [Female participant, Tshivhulani village].

The provision of piped water was also emphasised by participants during the focus group as having relieved drought stress on people, crops in their gardens, and livestock.

Similarly, rural electrification was seen as a significant driver of change in Tshivhulani since 1999 (when the whole village was electrified). Most households were said to now use electricity, as it is faster and cleaner, although the use of firewood is still common. The advent of electricity facilitated the flow of information through radio and television broadcast, and allowed households to diversify their income by engaging in small backyard industries.

More recently the construction of Reconstruction and Development Programme (RDP) houses and toilets has had positive outcomes. Not only did this provide decent accommodation and sanitation for the villagers, but also much-needed employment opportunities as the locals were hired to work as construction workers. Other positive developments included improved road maintenance and thus mobility and access to the nearby town.

Like Tshivhulani, electrification of Marwendo village in 2009 was also a noteworthy positive driver of livelihood change. This came as a result of the government recognising that rural electrification is a major pillar in enhancing socioeconomic development in rural areas. This rural electrification programme mainly targeted growth points; however households close to the gridlines benefited as well. The focus group participants acknowledged an increase in enterprise as a result of electrification, suggesting that such a development can contribute immensely to an increase in rural enterprise opportunities as also shown by Mapoko and Prasad [57] in southwest Zimbabwe in Matebeleland South.

Following the arrival of Non-Governmental Organisation (NGOs) operations during the 2000s, Marwendo witnessed varied development projects and concomitant shifts in local livelihood strategies. Projects included the establishment of a community garden, several nutrition gardens, women's savings clubs and gully reclamation and road construction projects. Thus, external assistance from NGOs acted as a prominent driver of positive change.

The recent advent of mobile network boosters (around 2012) in the village was mentioned to have facilitated communication flow to Marwendo through mobile communication and mobile money transfers, among other services that come with mobile phone networking. Another local

driver of change was the Chiadzwa Diamond Rush (a period when people migrated to the Chiadzwa diamond mines to engage in illegal diamond mining) in the mid to late 2000s (after discovery in 2006). The diamonds were discovered at Chiadzwa, a communal area located in Marange, Zimbabwe [58], less than 150 km from Marwendo village. This new activity injected cash into the village economy and resulted in an increase in small-scale commercial activities.

### 3.1.4. Drivers of Vegetation and Land Cover Change

Land transformation was mentioned as the most significant driver of change in village landscapes and natural resources, manifested through establishment of new settlements, deforestation (driven by clearing and fuelwood consumption and sale), overharvesting of natural resources (wild fruits, wild animals, firewood, thatch grass), and brick moulding (only in Marwendo). The burgeoning of new and unplanned settlements in Tshivhulani was noted as a major driver of landscape change in the village, with 70% of survey respondents attributing the loss of woodland cover in the village to this driver. In contrast, in Marwendo new settlements (3%) were only mentioned by a few households. The unplanned expansion of residential areas in Tshivhulani was also said to have resulted in siltation of the river that feeds the village. One participant said:

“The people in our village just settle wherever they want...our ‘Bafuwi’ (meaning traditional leader) has lost control over the allocation of stands for people to stay. Long time ago it used to be in the hands of the ‘Bafuwi’, which means that it was organised. Today people have settled themselves near water sources, polluting them and cutting down trees. No wonder we do not have enough water to drink. At this rate, I fear that my grandchildren will not live to see the river flow as it used to. When it rains, all the loose soils are dragged into the river, now it hardly flows throughout the year . . . something should be done surely with these new settlements that are erupting all over the village” [72-year-old female respondent in Tshivhulani village].

The increase of brick moulding was said to be having the same impact in Marwendo, while 70% of respondents in the household survey felt that poor waste management and pollution were a major problem in Tshivhulani (Appendix B).

In both villages, deforestation was indicated as another major contributor to land transformation (60% of respondents in Marwendo and 56% in Tshivhulani) (Appendix B) and was associated with decreased availability of woodland goods and the erosion of the ecosystems’ capacity to provide ecosystem services, e.g., control of local micro-climate and soil conservation. Transect walks in both villages, revealed that the distance for collection of firewood had increased. In Marwendo, one participant commented:

“We wake up very early before sunrise in search of firewood and only come back in the afternoon. This leaves little time to do other household chores and at the same time is affecting our health” [Female respondent in Marwendo village].

### 3.1.5. Linking Drivers and Local Concerns

Most of the drivers mentioned above relate directly to the areas of concern expressed by villagers. In Marwendo, the major concerns mentioned by survey respondents were persistent unemployment, droughts, hunger, poverty and economic hardships. Respondents in the life history interviews (see Appendix A, Table A1) and the focus groups emphasised economic trends such as inflation and dollarisation, which affected the price of goods and services and the cost of living. Respondents in Marwendo also felt that the current trends in increasing temperature and decreasing precipitation would continue or even increase in the future. Intensified weather extremes, more frequent droughts and dry spells, and more crop failures were anticipated. Consistent with previous results, respondents regularly spoke of the deteriorating natural resource base as a further concern in the village, especially

as this was linked to current livelihood practices, such as brick moulding, which are undertaken out of desperation given few other choices.

In Tshivhulani, there has been a shift in the main concerns in villagers' lives over the past 30 years. According to focus group discussions and life history interviews, previously food scarcity and poverty were major concerns, whereas now social grants have helped to address these, coupled with the end of the apartheid era. The ability to access a good education and the future of children were now ranked as the major concern for most villagers. A better life with better opportunities was generally hoped for by most of the families, but unemployment was a major concern, as well as truancy and crime (see narratives in Appendix A, Table A2).

### 3.2. *Changes in Landscapes and Natural Resources*

Several changes in landscapes, the natural resource base and the way in which people utilise ecosystem services were mentioned in the focus group discussions and household survey, primarily as a result of the land transformation drivers mentioned above. These changes are illustrated in section B of the human–environment timelines (Figure 1a,b). In both villages there was a general consensus by focus group participants that natural resources and woodland products were in a state of decline. In addition, the majority of household survey respondents in both villages also felt that woodland cover, availability of water from natural water sources, species diversity, wild fruits, wild animals and grass cover had decreased (see Appendix B). Increasing soil erosion and loss of soil fertility were also mentioned. Regarding wildlife, elderly participants in the focus group discussions in Marwendo recalled times when there used to be an abundance of small antelope and other small mammals such as scrub hares in the natural woodland close to the village. According to their narrative, all that remains are baboons and monkeys, which are, because of the growing wild food scarcity, increasingly encroaching onto crop fields and the main road that passes through the village. Traditional wild fruits, which used to be abundant, were mentioned to now be scarce and many species that provide fruits were said to have disappeared from local agro-ecological systems. Despite electrification, fuelwood harvesting is still seen as an important livelihood activity and source of energy. Many of these landscape changes impact on livelihoods and even result in livelihood changes, as highlighted below.

### 3.3. *Livelihood Changes and Trends*

Similar to landscapes, our understanding on how livelihoods are changing as a consequence of the drivers identified was drawn mainly from the focus groups discussions as well as the household survey. From this information we were able to construct the livelihood change portion (C) of each human–environmental timeline (Figure 1a,b). The household survey was particularly useful in relation to trends in livelihoods activities, household physical assets and overall standard of living in the last 5–10 years. Here we consider how drivers work in synchrony to influence what we see in livelihoods today.

#### 3.3.1. *Changes in Livelihood Strategies and Activities*

The highly negative economic and policy drivers in Zimbabwe since 2000 combined with the two recent droughts were viewed to have pushed many villagers in Marwendo to diversify into a range of 'self-reliant' income earning activities. These included the commercialisation of garden produce (tomatoes, vegetables and onions) and woodland products (firewood, wild fruits, baobab fibre goods, and thatch grass), brick moulding, casual labour, and migration in search of employment. Some of these 'new' activities were supported by NGOs and were focused on improving rural livelihoods and adapting to changing climatic conditions. Participants in this village also mentioned they had adopted strategies and practices such as conservation farming, use of small grains and drip-system irrigation in order to continue farming. These technologies have been useful in negotiating livelihoods through the changing climatic conditions and deteriorating crop yields, due primarily to heat and water stress, that participants mentioned. In 2002, an NGO introduced community nutrition gardens and fruit

tree plantation projects, mainly for women, which led to improved nutrition and substantial income increases through the sale of produce. However, when we visited during the middle of the drought in 2015 little cultivation at all was happening. In addition, development projects also presented opportunities for local residents to be provided with “food-for-work” employment opportunities through road maintenance and gully reclamation projects. Road maintenance and construction was said to have increased accessibility in the village, supporting easier movement of garden produce and facilitating commercial activities in the village.

While, the above adaptations could be considered a positive response to dealing with negative drivers, some of the self-driven diversification activities such as brick moulding have potentially negative feedbacks on key ecosystem services (i.e., water as river banks are mined for clay) increasing both human and ecosystem vulnerability in the long term. The use of baobab fibre for weaving is another example. This activity could affect the health of baobab trees, undermining access to an important emergency food resource (baobab fruit is used for making a maize or small grain porridge substitute during drought). The reversal in free schooling also caused difficulties for many participants in the focus groups who mentioned struggling to pay the fees. This has resulted in withdrawal of children from school, which again has significant long-term consequences for vulnerability and adaptive capacity.

Like the opportunity created by the nearby diamond discovery mentioned above, electrification also opened the door for small enterprises such as welding and retail in both villages:

“It is better in our village with electricity. I started my welding business in the village repairing and making a wide array of things. Since I am no longer much into farming, my welding business has helped me and my family to survive . . . My eldest son helps with welding and marketing our products. Since there are not many people involved in this kind of work, everyone in the village comes to us . . . For now I continue with welding” [Male participant, Tshivhulani village].

In the above case, diversification of this family’s livelihood activities is a strategy that can be considered as both opportunistic and reactive. The respondent’s choice to diversify is an example of a coping strategy for dealing with fewer options, especially with the increased risk associated with farming, as well as a response to the opportunities created from having access to electricity. New livelihood strategies and activities are often the product of the interaction between choice and constraint [59] but may emerge through the interaction of different drivers. Despite the positive livelihood outcomes of such commercial activities, some participants mentioned they also brought moral and cultural problems. They mentioned increases in crime, school dropouts and teenage pregnancies. The diamond mine close to Marwendo was said to be particularly problematic in this respect even though it facilitated small enterprise development. In terms of electricity the benefits were also not necessarily forthcoming for all. The majority of participants emphasised problems of high costs, slow progress and selective reach to households, and power cuts as some of the negatives associated with the electrification programme.

Migration into neighbouring South Africa in search of jobs was also noted as an important livelihood change in Marwendo and was said to have increased around 2008/9, as at this stage it was mentioned as the most effective way for young men to earn the money needed to get married (i.e., to pay the *lobola* or bride price).

While there was some livelihood diversification in Tshivhulani, the main changes related to a decline in field-based arable agriculture and to a lesser extent livestock production, and greater reliance on social grants as well as an expansion of vegetable gardens. The abandonment of field cultivation is not an unusual finding in the communal areas of South Africa and has been written about in other parts of the country, especially the Eastern Cape (see [16,60–63]). While multiple drivers have been ascribed to this decline, having access to social grants to purchase food means it is no longer essential to farm fields for staple food substances under what is seen as increasingly risky climatic conditions [63–66].

The cost of investment as local conditions change and as labour needs increase (due to a decline in free labour and work parties) is also seen to not necessarily be worth the returns [66]. The greater number of vegetable gardens in Tshivhulani reflects a shift from fields to manageable homestead gardens partly due to the availability of piped water. Survey results revealed that a large percentage of respondents (46%) have been leaving cultivated land to fallow (Table 2). Focus group discussions reflected similar findings; participants mentioned that although they are still holding on to their fields they are not actively involved in cropping them year in and year out. This was also evident from the transect walks where large areas of unused arable fields were a common feature, especially areas more distant from the village. One participant in the focus group explained:

“We still hold on to my field . . . this is our family inheritance . we take pride in the fact that we have a piece of land to our name although we do not crop in it year in and year out . . . it still remains our asset . . . we have a small garden in our yard where we mainly grow vegetables mainly for consumption. The home gardens are very much easier to maintain as compared to distant fields . . . we can easily water and weed them with very little labour required” [Male respondent in Tshivhulani village].

By contrast, most villagers in Marwendo had little choice but to continue with agriculture, and to adapt this by bringing in more small grains (sorghum, pearl millet, finger millet) to minimise the risk of crop loss from drier and hotter conditions and more frequent droughts. The addition of conservation farming and micro-irrigation approaches has also assisted in making cultivation more resilient. It is of note, however, that fewer households in Marwendo (66%) had access to land than in Tshivhulani (97%), despite being more dependent on cropping for food security (Table 2). Regarding livestock the results show the reverse; 86% of respondents in Marwendo owned livestock compared to 31% in Tshivhulani; this is even in the context of the majority of the respondents in Marwendo believing livestock numbers had declined (Table 2). One respondent explained how he ended up losing most of his livestock:

“As the head of the family and in line with our culture, it’s every man’s ambition to accumulate wealth through acquiring livestock, especially cattle . . . By the late 1980s I had a herd of 19 cattle, but 12 perished during the infamous 1992 drought . . . I started again to rebuild my stock using money from my piece jobs. By 2000, I had significantly recovered . . . but again the 2002 drought struck and coupled with Foot and Mouth disease my herd was severely affected . . . Now I remain with five cattle” [Male respondent in Marwendo village].

The perceived decrease in livestock numbers can be partly explained by the significantly high proportion of survey respondents in Marwendo who confirmed that they had sold livestock in the last five years. The major reasons mentioned included the need for cash income to buy food and pay school fees, and to recover from a shock such as death of a family member, and expensive events, among others. This suggests that in Marwendo, villagers are compelled to sell livestock for cash since it is one of the few options available to them. The quote above illustrates how many villagers are also unable to restock following livestock loss or sale.

As mentioned, in contrast to field cropping, small-scale, intensive vegetable gardening has continued to be important in both sites (some 65% of households have vegetable gardens) with homesteads being the primary location for these in Tshivhulani, while in Marwendo this includes NGO supported community gardens. However, some barriers to continued growth in gardens were identified. In the focus group discussions and interviews in Marwendo, respondents raised the issue of a recent ban by the Environmental Management Agency (EMA) on cultivating vegetable gardens along natural water sources (i.e., the Tanganda River that flows through the village). This has resulted in abandonment of gardens.

In both villages, there is a sense of an increasing level of vulnerability within farming systems and concerns that in the near future it is likely that further adverse climatic events may lead to further declines in crop and livestock production, ultimately impacting food security. Already in the year of



the study (which was a drought), people in Marwendo mentioned greater utilisation of wild foods such as baobab fruits to meet local needs. Without improved local natural resource management even these food sources may become increasingly vulnerable through overutilisation and climate impacts in the future.

**Table 2.** Land use and livestock ownership in the two villages.

Variable	Tshivhulani (South Africa)	Marwendo (Zimbabwe)
Households having gardens (%)	66	64
Mean number of gardens/hh	0.66 ± 0.053	0.78 ± 0.087
Households owning fields (%)	97	69
Mean number of fields/hh	0.98 ± 0.018	0.74 ± 0.066
Fallow land left (%)	46	28
Livestock ownership (%)	31	86
Mean number of livestock/hh	2.78 ± 0.594	9.95 ± 1.054
Changes in livestock numbers—yes (%)	26	85
Decreasing numbers—yes (%)	15	72
Livestock sales—yes (%)	19	60
Increasing livestock sales (%)	5	22

### 3.3.2. Changes in Livelihood Assets, Local Self-Sufficiency and Quality of Life

Household physical asset accumulation and erosion can be a good indicator of livelihood vulnerability and adaptive capacity, as assets are often sold in response to shocks and on-going stressors, while assets purchases are often the result of more disposable household income. Household physical assets can include productive assets such as solar panels, wheelbarrows, farming implements, tools and domestic goods such as televisions, radios, paraffin stoves and furniture. From the survey, we found that the 46% of households in Tshivhulani indicated that their physical asset base has been increasing over the past 30 years (Table 3). In contrast, almost half of households in Marwendo noted a decrease in their total asset base, due to a combination of factors such as being forced to sell livestock and various goods due to economic hardships, food insecurity, and the need for cash. With respect to the last 5–10 years, which has been a period of greater hardship in Marwendo in particular, we found that 40% of households in Marwendo mentioned selling physical assets, whereas the corresponding number in Tshivhulani was only 8%. Overall, Marwendo has seen a significant erosion of household and farming assets.

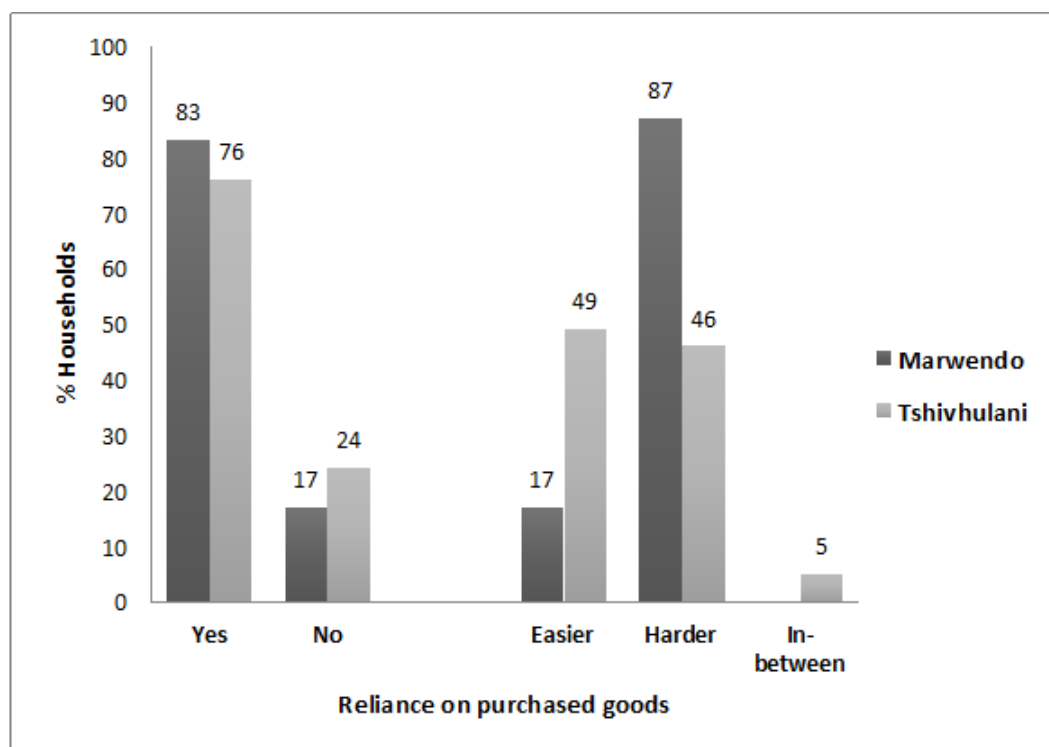
**Table 3.** Ownership, sale and trends in households' physical assets across the two villages.

Variable	Tshivhulani	Marwendo
Average number of assets per household	5 ± 0.23	5 ± 0.42
Asset purchases in last 5–10 years (%)		
Yes	60	47
No	40	53
Asset sales in last 5–10 years (%)		
Yes	8	40
No	92	60
Reasons for asset sales (%)		
Food	100	38
Fees	0	25
Death/other shocks	0	16
Expensive events	0	21
Change in assets from childhood (%)		
Increasing	46	16
Stay much the same	46	35
Decreasing	8	49

Given the changes in livelihoods observed, we were interested in whether households are shifting from being largely self-reliant, especially for food, to being more cash dependent and what this means for vulnerability and adaptive capacity. Results from the survey indicate that, in terms of reliance on purchased goods (over the past 10 years), most respondents in both villages agreed that they now rely

more on purchased goods than crops from their garden/fields for food (Figure 2). This livelihood trend was seen as creating increased hardship in the lives of a majority of households in Marwendo (Figure 2), primarily as a result of scarcity of income and the need for cash leading to asset erosion. One respondent was quoted as saying: “*kana usina mari hauna upenyu*”, which means “if you do not have money you do not have a life”. However, mixed responses were observed in Tshivhulani, with 49% of households agreeing that their lives were made a little easier by relying more on purchased goods due to availability of cash from social grants. Social grants provide a regular source of income pooled within the household and are important to food security as illustrated by the narrative below:

“The whole family survives on a state old age grant from our grandmother whom we stay with ... no-one in the family is employed formally ... the other three grandchildren in the family also receive child support grants ... We normally use this money to buy food and clothes ... If our grandmother were to pass on it will be very difficult for the family to survive because next year one of the grandchildren will be too old to be eligible for the child support grant” [Female respondent in Tshivhulani village].



**Figure 2.** Proportion of households relying more on purchased goods rather than on harvested natural resources/crops from gardens/fields in Marwendo and Tshivhulani village and perceptions of the impact of this change on household livelihoods.

As part of the survey, we asked respondents to reflect on changes in their overall quality of life and how, based on this, they conceived the future. Most respondents in Marwendo (72%) agreed that their lives were better 30 years ago or during their childhood compared to over the last five years with 86% saying their lives have worsened due to the multiple negative drivers of change in the past 30 years coupled with the continuous erosion of livelihood assets and the inability to rebuild these. In contrast, in Tshivhulani, 60% of the respondents said that their lives have become better in the last 5–10 years. This coincides with the increase in social grants, which are described by Shackleton and Luckert [16] as creating a window of opportunity, as well as various developments in the village. Social grants were said to be crucial in contributing to food security and children’s education. In addition,

the infrastructure improvements in the village (electricity, piped water, rural development houses, and road construction) have facilitated access to the town, markets and information, thereby increasing the range of available livelihood options. Studies from elsewhere in the world have also documented how basic rural development can help improve the overall standard of people lives [31,67–69].

Respondents' perspectives on the future were linked to their concerns and their quality of life assessments. Just over half of respondents in Tshivuhlani village (55%) were optimistic regarding their future (Figure 3) reflecting the improved living standards for most people in this village. However, 44% of households had mixed optimism about their future (unknown—26%; bleak—18%). In contrast, 43% of respondents in Marwendo were very pessimistic about their future and another 34% of households were unsure of how their future will turn out. Only a few households (14%) in Marwendo village were positive about their future. Households with a more positive outlook are likely those that have managed to diversify their income sources to include off-farm activities, or those who were receiving remittances from their children or relatives.

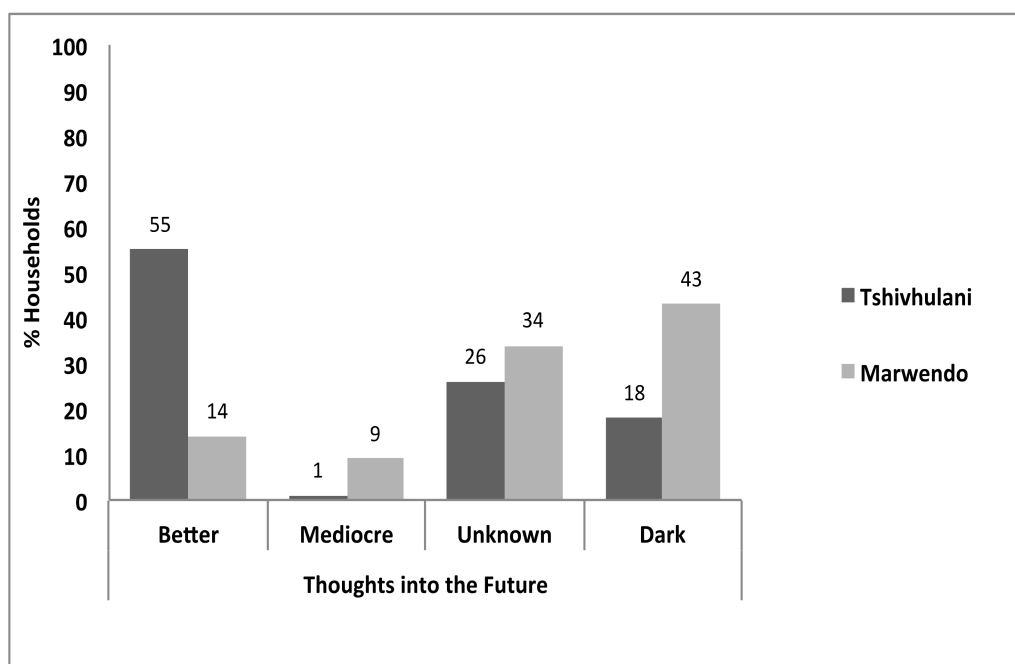


Figure 3. Respondents' perceptions of the future in the two villages.

### 3.3.3. Outcomes for Livelihood and Social–Ecological Vulnerability

The human–environmental timelines constructed for this paper show that considerable changes in livelihoods and landscapes have taken place in Marwendo and Tshivuhlani over the last 30 years, amidst continuity in certain ways of life. These changes are linked to and influenced by the wider political and economic context within which particular drivers operate. The situation is complex, as multiple drivers and changes interact to both create and constrain livelihood options and subsequent ability to respond to changes such as more climate extremes.

Rural development initiatives such as electrification, piped water and road construction, which can be thought as supporting so-called generic adaptation [70], have opened up opportunities as well as countered some of the negative effects of ecosystem service degradation in both villages. Key responses have been new commercial activities and more vegetable gardening. However, the ability to exploit these opportunities is not even, and requires access to cash or credit. Households in Tshivuhlani with access to social grants are much more able to establish alternative livelihood activities when opportunities arise than those in Marwendo.

In both villages, farming has been affected by climate drivers with responses again differing. In Tshivuhlani, cash from social grants that allow the purchasing of staples has meant that extensive field farming is not essential nor necessarily worth the investment and so it has declined, as is the case for other parts of South Africa [16,62,63]. By contrast, in Marwendo, villagers have had to adopt more climate-resilient approaches to farming as they have few other choices available to meet their basic food needs. The social welfare system in South Africa has thus provided a safety net for people both for their daily living and when faced with shocks, whilst in Marwendo villagers are often faced with no option but to continue to engage in risky farming activities or in potentially maladaptive practices (e.g., woodland product commercialisation, brick moulding or asset sales) to get through difficult times. Thus, in this village, climate-related shocks and socioeconomic hardships have combined to erode the household and community asset base impacting on household adaptive capacity. In the long term this could contribute to spiralling vulnerability as described in Shackleton and Shackleton [14]. That said, one could argue that the development interventions and social protection (food for work) brought by NGOs have helped to counter some of the impacts of negative drivers, although the solutions would need to be scaled up to make a difference in the long term.

If we refer to the well-known typology of livelihood trajectories [38], we could argue that in Tshivuhlani most households are on a “stepping out” (diversification) trajectory, although there is also the danger of becoming too reliant on social grants that may not always be available to households as pensioners pass on and children grow up [16]. In contrast, Marwendo households are either “hanging in” (coping) or potentially entering what we have termed a “losing out” (erosion) trajectory, although small-scale development support by NGOs has helped to offset this to some extent. More social protection, like the food for work opportunities provided by NGOs or state social welfare or drought relief systems, may be needed in Marwendo in the long term to prevent a downward spiral into a poverty trap. Only a minority of households in each site could be viewed as “stepping up” (accumulation), and these are likely to be households that have locally secure employment, and have managed to diversify their income sources to include off-farm activities or are receiving remittances (also see [54]).

Based on some of the current livelihood activities—for example, the commercialisation of natural resources in Marwendo and the over-reliance on social grants in Tshivuhlani [71]—we argue that the vulnerability of villagers in both study areas may increase in the future (with Marwendo being worse off). This will result from the impacts on local natural capital in the first case, and a narrowing of livelihood options, flexibility and self-reliance in the latter. The decline in local arable production has possible future consequences as food prices increase with climate change impacts on agriculture globally [16]. This will be further exacerbated by the likely increase in exposure to shocks and stressors of both people and ecosystems, and the current susceptibility of presently pursued livelihoods to both climate extremes and slow onset changes, especially in Marwendo where livelihoods are primarily based on natural resources.

#### 4. Conclusions and Future Trajectories

Given that the findings of this study suggest more fragile and vulnerable livelihoods and less healthy ecosystems in the two study sites, and a further lowering of adaptive capacity, especially in Zimbabwe, it is necessary to ask: what is required to move rural communities in these semi-arid regions onto a more sustainable trajectory? The results suggest that this requires attention to both generic and specific adaptive capacity [70] since adaptation to future climate change is highly influenced by the local and national development context, but also by new climate threats and risks. The observed synergies between the coping or adaptive responses to drivers of change, and what can be considered basic development, corroborate the need for ‘mainstreaming’ adaptation within development planning [31].

Basic service delivery and improved transport, communication and energy infrastructure were found to have positive impacts on livelihoods, for at least some households, in both sites by opening the door for small-scale enterprise development. In Zimbabwe, new climate smart approaches to

agriculture were proving successful in supporting arable production for some farmers through unfavourable weather periods, while private and communal, mainly irrigated, food gardens were playing a role in enhancing food diversity, nutrition and security in both sites, with this also being an income generating opportunity. These, and other areas of development such as providing access to start-up funding and other forms of credit and developing skills in conservation agriculture and micro-irrigation, could help to broaden local options, support diversification and local self-sufficiency and open-up multiple pathways to sustainability that can cater for the interests and priorities of different types of rural households [72]. Such developments and adaptation strategies need to take into account local contexts, be structured to target poorer households and support economic returns without introducing potential negative ecological consequences [31]. At a policy level, in both sites the issue of education as the entry point to new opportunities, including migration, emerged as an area of concern; in Zimbabwe this was primarily related to the reversal of free education and subsequent costs, while in South Africa it was to the poor state of rural education. Both need to be addressed at a policy level. The findings also suggest that various forms of social protection are of crucial importance in the semi-arid conditions that characterise the villages in this study to prevent increasing vulnerability, especially amongst households that are primarily dependent on natural resources. Such social protection could include free schooling, favourable access to credit, agricultural subsidies, public works programmes, or monetary or in-kind relief to facilitate recovery from drought, amongst others [73]. Certainly, there is some evidence from the South African site that access to social welfare reduced engagement in potentially destructive livelihood activities such as sand mining and brick moulding. The continuing concern regarding the natural resource base and the degradation of ecosystem services such as water provision pointed to the need for improved systems for the management of local landscapes and natural resources to prevent feedbacks on livelihood vulnerability in the future. Apparently, already the traditional leadership is reinstituting controls over baobab harvesting in Marwendo, given the importance of this species in food security. Any natural resource/agro-ecological management approach would also need to consider alternative livelihood options for villagers, as resource exploitation tends to be an option of last resort for many.

**Acknowledgments:** We acknowledge the South African National Research Foundation (NRF) for an Incentive Funding Grant to S.S. that covered the field costs for this research and a writing retreat to work on the manuscript. C.M. was generously supported through a Master’s scholarship awarded by the Beit Trust. We are also grateful to the leaders and residents of Marwendo and Tshivhulani for welcoming C.M. and for supporting the research. We thank the two anonymous reviewers and the special issue editing team for constructive feedback that improved the paper.

**Author Contributions:** S.E.S. and C.M. conceived and designed the study; C.M. undertook the field work and data analysis under the guidance of S.E.S. as his MSc supervisor; C.M. wrote the paper with support from S.E.S.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Narratives from life histories indicating the general concerns of people in Marwendo village.

Narratives from Life Histories
“The lack of employment opportunities in our village is a major concern especially for our children who are in school”
“I am worried that my children will not be able to see the <i>Mukamba</i> tree ( <i>Azelia quanzensis</i> ) as this has been seriously overharvested in the village”
“The forests are now very far away from the village. This forces us to wake up very early in the morning to go looking for firewood. The scarcity of firewood is a major concern in the village now as very few houses have electricity”
“We foresee an increased change in the weather patterns, especially with rainfall and temperature. Our river is never full throughout the year. Most of us fear that it may dry up in the near future . . . my greatest concern is food security for my family”
“I foresee more frequent droughts hitting our village, worse than the 1992 one. We are most likely to continue to struggle to feed ourselves”



**Table A2.** Narratives from life histories indicating the general concerns of people in Tshivhulani village.

Narratives from Life Histories
“If my children do well in their education, I foresee a better future, as they will be able to take care of me when I am old, as well as their own children”
“I am looking forward to a better future for my children and grandchildren”
“My main concern is a better life for my children . . . I wish my children could live a better life than the one I lived”
“I am unemployed . . . I don’t want my children to live the way I have lived . . . I am concerned about the future of my children . . . they should live a life that is better than mine”

## Appendix B

**Table A3.** Perceived drivers of landscape change in Marwendo and Tshivhulani villages (% of respondents agreeing with each driver).

Natural Resource	Drivers of Change	Marwendo % (Zimbabwe)	Tshivhulani % (South Africa)
Forest Cover	New settlements/stands	3	78
	Deforestation	60	22
	Brick moulding	4	-
	Hardships/survival	3	-
	Rainfall variability	15	-
	Droughts	15	-
Soil erosion	New settlements/stands	1	70
	Deforestation	34	-
	Cultivation	11	30
	Brick moulding	8	-
	Droughts	3	-
	Rainfall variability	4	-
Water Sources	Floods	39	-
	Rubbish disposal/pollution	3	70
	Deforestation	3	-
	Siltation	10	-
	Droughts	14	-
	Rainfall variability	44	-
Forest Diversity	Cultivation	26	30
	New settlements/stands	15	23
	Deforestation	41	67
	Fires	3	-
	Overharvesting	2	10
	Brick moulding	4	-
Wild Fruits	Droughts	30	-
	Rainfall variability	5	-
	New settlements/stands	3	11
	Deforestation	18	56
	Overharvesting	31	33
	Brick moulding	11	-
Wild Animals	Hardships/survival	4	-
	Droughts	30	-
	Rainfall variability	3	-
	New settlements/stands	-	15
	Deforestation	5	20
	Overharvesting	62	65
Grass Cover	Fires	3	-
	Droughts	10	-
	Deforestation	8	11
	Fires	37	70
	Overharvesting	5	4
	Droughts	27	-
	Rainfall variability	23	-
	New settlements/stands	-	15

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