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An ecogeography of poverty? Dependence on biodiversity among communities adjacent to protected areas

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Abstract
Many of the poor people of the world live in biodiverse regions where they disproportionately depend on biodiversity for the sustenance of livelihoods. An estimated 1.6 billion people, mainly located in tropical developing countries, depend on forests and forest products for livelihoods. This colocation of biodiversity and poverty is commonly referred to as the ecogeography of poverty. The study assessed the levels of dependence on biodiversity and evidences of the ecogeography of poverty in two rural communities in the south-east lowveld of Zimbabwe, which is one of the biodiverse regions of the country. A questionnaire was used to gather primary data on the socio-economic status of study respondents and levels of dependence on biodiversity. Key informants, and also secondary data, were further consulted so as to ascertain the status of biodiversity in areas adjacent to the study sites. The information on the socio-economic status of respondents and levels of dependence on biodiversity was crucial in determining the ecogeography of poverty in the study sites. The study revealed a high dependence on biodiversity among very poor households in both study sites, clearly indicating a colocation of biodiversity and poverty. It is recommended that the many protected areas bordering the study sites should be involved in community outreach programmes and activities for improving the livelihoods of adjacent communities. With Zimbabwe currently involved in a land reform exercise, relocating some of the households in the study sites to agro-ecologically more suitable areas would more sustainably enhance their livelihoods, in addition to encouraging those that remain to specialise in cattle ranching. This would help in reducing the clearly evident ecogeography of poverty in the study areas.

Keywords: biodiversity, dependence, ecogeography, livelihoods, poverty, protected area

1. Introduction
The Millennium Ecosystem Assessment (MEA) emphasises the link between biodiversity and livelihoods [1]. MEA views biodiversity as underpinning the delivery of a wide range of ecosystem goods and services on which human well-being depends [2, 3]. It is worth noting that, globally, more than 1.6 billion people depend to varying degrees on forests for their livelihoods [3]. While the rest of humanity depend on biodiversity, poor people, however, appear to be particularly, and disproportionately, more dependent on the natural resource environment for their livelihoods [4, 3, 5].

Many of the studies highlighting dependence on biodiversity use income from biodiversity-based resources calculated as a percentage of total household income as their indicator of the extent of dependency [6], and Table 1 offers a summary of some of these studies. The table shows that there is a significant, albeit varied, dependence on biodiversity-based resources for income in the selected regions. It is important to note that all the regions shown are in the developing world, and therefore are home to many of the poorest people of the world, with a great part of their income generated out of the use of natural resources.

Table 1: Evidence on dependence on biodiversity for income [6]

Source	Region	Evidence	Resource type
Bahuguna (2000)	South Asia	48.7% of household income	Forests: fuel, fodder, employment
Bene *et al* (2009)	West Africa	Varies from 90% (poorest)-29.7% (richest)	Fish
Cavendish (2000)	Southern Africa	35.4% of household income in 1993-94; 36.9% in 1996-97	Wild foods, wood, grasses and other environmental resources
Coomes *et al.* (2004)	Latin America	20% of household income	Fish, palm products, timber, hunting
de Merode *et al* (2004)	West Africa	24% of cash sales	Wild foods
Fisher (2004)	Southern Africa	30% of household income	Forests
Jodha (1990)	South Asia	14-23% of total household income	Common pool resources
Kamanga *et al* (2009)	Southern Africa	15% of total household income	Forests
Levang *et al* (2005)	South-east Asia	30% of total household income	Forests
Mamo *et al* (2007)	East Africa	39% of total household income	Forests
Narain *et al* (2008a)	South Asia	Quartile1: 9%, Quartile2: 7.2%; Quartile 3: 7.9%; Quartile 4: 8% of permanent income	Fuelwood, dung for fuel, manure, fodder, construction wood
Shaanker *et al* (2004)	South Asia	Site 1: 16%, Site 2: 24%, Site 3: 59% of household income	Non-Timber Forest Products (NTFPs)
Viet Quang and Anh (2006)	South-east Asia	For 30% of households, over 50% of total income; further 15%, 25-50% of total income	NTFPs

Other studies have used the proportion of households engaged in particular types of activities as an indicator of the depth of dependence on biodiversity [6], the findings of which are summarised in Table 2. As the table shows, the depth of dependence on various types of biological resources among households in the developing world is quite high, with an indication of higher dependence among poorer households.

Table 2: Evidence on depth of dependence on biodiversity [6]

Source	Region	Evidence	Resource type
Coomes *et al (*2004)	Latin America	66% of households depend on resource extraction	Fish, palm products, timber, hunting
Dovie *et al (*2007)	Southern Africa	98% of households use NTFPs	Non-Timber Forest Products (NTFPs)
Dovie *et al (*2007)	Southern Africa	91% of households use wild herbs	Wild herbs
Glaser (2003)	Latin America	68% of households depend on mangroves	Mangrove resources, especially crabs and fish
Jha (2009)	South Asia	70% of households depend on beedi making or firewood	Forests
Jodha (1990)	South Asia	84-100% of poor depend on CPRs	Common pool resources
Jodha (1990)	South Asia	10-19% of rich depend on CPRs	Common pool resources
Levang et al (2005)	South-east Asia	72% of households depend on forest products	Forests
Mamo *et al (*2007)	East Africa	42% of households depend on forest for grazing	Forests
Narain *et al (*2008a)	South Asia	Quartile1: 77.5%, Quartile 2: 81.5%; Quartile 3: 72.8%; Quartile 4: 61.4% of households collect NTFPs	Fuel wood, dung for fuel, manure, fodder, construction wood
Shackleton and Shackleton (2006)	Southern Africa	96-100% of households purchase NTFPs	NTFPs
Shackleton and Shackleton (2006)	Southern Africa	8% (rich), 15% (middle), 36% (poor) households sell NTFPs	NTFPs
Sharma *et al (*2009)	South Asia	75% of household fuel and fodder needs from forests	Forests

Evidence on the relative dependence of richer and poorer people on biodiversity-based resources has, however, been the subject of considerable interest and is somewhat mixed [6]. Earlier studies suggested unanimously that the poor were disproportionately dependent on biodiversity, and this became accepted wisdom [7, 8, 3]. More recent studies, however, now question such a stance. For example, some complementarity has been documented between asset ownership and the use of certain types of biological resources [9, 10, 11, 6], with asset rich households found to be depending more on certain natural resources. If this difference in asset ownership is further reflected in greater political power at the local level, rich households are also able to use their dominance to secure access to resources and to exclude the relatively poor [6]. While a biodiversity-based resource remains relatively low-value, rich users tend not to feel the need to restrict access, but are more likely to exclude the poor from access when returns from certain resources increase [6]. Under such circumstances, the poor appear to be linked with low-value resource use, which may serve to perpetuate poverty [12, 6]. Biodiversity resource dependence in this case will now be a symptom of poverty and the poor can only escape the poverty trap by looking for alternative livelihood sources other than biodiversity [13, 14, 6]. The poor therefore tend to depend more on biological resources compared to the richer, while the richer tend to depend more on fewer but higher-value natural resources.

The dependence of the poor on biodiversity is further highlighted through the geographical overlap between biodiversity and poverty (the ecogeography of poverty). Claims are commonly made that the poor are distributed in areas of high biodiversity [15, 16, 17, 3, 18, 19]. The claim is made in a variety of ways, including the coincidence of poor countries and the majority of the world's biodiversity in the Southern hemisphere [20, 15, 18, 5, 21]. Such a claim of a spatial link between biodiversity and poverty is often presented as a basic rationale why biodiversity conservation and poverty reduction should be pursued jointly [20, 22, 19]. While it may probably be too simplistic to claim that the majority of the world's biodiversity is in the Southern hemisphere, which is also where the poorer countries of the world are, there is mounting evidence to suggest that, at a variety of scales and in many different ways, biodiversity and poverty do coincide [1].

At regional and national scales, it is clear that many countries and regions with high biodiversity also have high levels of poverty [23], and this is particularly true of sub-Saharan Africa and Asia which have the greatest proportion and number of poor people respectively [1]. One researcher has noted that "…most areas considered to be high priority biodiversity hotspots are also social and political hotbeds" featuring high levels of poverty, insecure land tenure, landlessness and undemocratic political systems [23]. There is therefore a real danger that nature protection interventions could exacerbate the social conditions of the resource-dependent poor communities [24, 23]. At finer scales, whilst many people live in urban areas, poverty remains generally higher in rural areas, with the most acute poverty often being found in remote or inaccessible areas of low population densities where biodiversity is most intact [25, 26, 17, 27, 1]. Whichever way poverty and biodiversity are measured, it is clear that those practising biodiversity conservation and poverty alleviation will often find themselves side by side in the same places [1].

It is also important to note that some of the world's poorest countries now have a significant proportion of their territories designated as protected areas [28, 29, 30]. As international concern over poverty continues to grow, such protected areas certainly need to play an important role towards poverty reduction.

Zimbabwe is situated in southern Africa between latitudes 15°30′ and 22°30′ south of the equator and between longitudes 25° and 33°10′ east of the Greenwich Meridian [31]. It is a landlocked country covering a total land area of 390 757 km^2. Zimbabwe is endowed with a rich diversity of life forms [32]. The country's varied climatic, adaphic, and topographic

conditions support a wide range of fauna and flora that play a critical role in the socio-economic well-being of the country [33]. For example, agriculture, forestry and fisheries contributed 18% to the country's GDP in 1996 in comparison to manufacturing, 17%; mining, 5%; and tourism 18% [34, 35]. The forestry industry employed more than 13 800 people and generated over US$ 30 million in 2007 through the export of various timber products [32].

Zimbabwe's biodiversity is particularly important to the poor. Forests produce various non-timber forest products (NTFPs) including, *inter alia*, traditional medicines, edible insects, thatch grass, honey, fruits and vegetables, bark fibre, firewood, and 'wild' meat [34, 32, 35, 36, 37]. NTFPs are particularly important in rural areas where the majority of the people depend on them for their livelihoods and income generation [32, 36, 37]. NTFPs contributed over 35% of the average rural incomes in some parts of Zimbabwe in 2000 [38]. Although agriculture plays a vital role in rural households, the contribution of activities based on environmental resources has increasingly been recognised particularly among the poorer households [39].

The advent of colonialism in the last decade of the 19th century in Zimbabwe led to the emergence of a racist landholding structure, whereby indigenous Africans were resettled in marginal areas in agro-ecological regions IV and V suitable only for wildlife, while white settlers were allocated land in the prime agricultural areas in agro-ecological regions I, II and III [34]. Eventually, many indigenous populations found themselves living adjacent to national parks and other protected areas, with use of resources in protected areas strictly prohibited. This forced them to irk a living out of peasant farming characterised by low yields and abject poverty, and a high dependency on natural resources, a situation still evident in most of the communal areas of Zimbabwe. This reflects the ecogeography of poverty propounded in international conservation literature.

This paper comparatively assesses the dependence on biodiversity in two rural communities adjacent to protected areas, namely: the Mahenye communal area bordering Gonarezhou National Park; and the Chizvirizvi resettlement area, also bordering Gonarezhou, and adjacent to Malilangwe Wildlife Reserve. The aim of the study is to ascertain the level or depth of dependence on biodiversity in these two communities, and look for any signs of the juxtaposition of biodiversity and poverty, that is the ecogeography of poverty, in the study areas.

2. Methodology

2.1 Study Sites

The Mahenye communal area is located in Chipinge District, Manicaland Province, in south-eastern Zimbabwe (Figure 1). It covers an area approximately 210 km^2 between the Save River in the west and the Rupembi River in the East. Mahenye receives a low annual rainfall of between 450-500 mm, accompanied by high summer temperatures and frequent mid-season dry spells, making the area unsuitable for crop production except on a purely subsistence basis. The dominant vegetation in Mahenye is mixed mopane and combretum woodland, with some dense riverine forest occurring along the Save River [40].

A defining feature of Mahenye is its geographic and ethnic isolation. While the eastern boundary of Mahenye marks the beginning of a different country, Mozambique, its western neighbours are also administratively in a different district, Chiredzi District, in yet a different province, Masvingo Province [40]. In addition, the Mahenye community is also ethnically distinct within Chipinge District. While all the other wards in the district are made up of Shona-speaking Ndau peoples, Mahenye comprises Shangaan-speaking peoples [40]. The isolation of Mahenye has in various ways contributed negatively to its socio-economic development [41, 40].

Chizvirizvi is a resettlement area also situated in south-eastern Zimbabwe, but in a different District and Province. It is located in Chiredzi District of Masvingo Province (Figure 1). The resettlement area was established soon after independence in 1980 as a strategy to decongest overcrowded communal areas created during the colonial period. The landholdings in the resettlement area were further enlarged in 1994 into more economic and self-contained units averaging 85 hectares, with each farmer now able to grow crops and raise livestock on their own piece of land. While the area has rich soils, aridity is the major challenge to agricultural production.

The south-east lowveld into which the study areas are located is considered to be one of the ecological hotspots of the country. Both Mahenye and Chizvirizvi are adjacent to Gonarezhou National Park (GNP), the second largest protected area in Zimbabwe. In addition, the area is home to numerous private protected areas, including Malilangwe Wildlife Reserve (MWR), which is one of the largest private protected areas in the country, and also bordering Chizvirizvi.

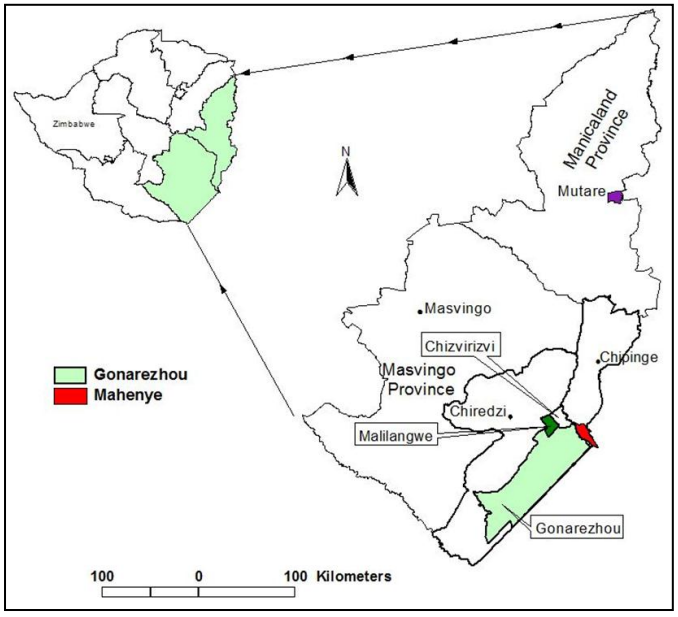

Fig 1: Location of Mahenye and Chizvirizvi [42]

2.2 Data Collection

Questionnaire surveys were undertaken in Mahenye and Chizvirizvi so as to gather primary data on the levels of dependency on biodiversity and socio-economic status of respondents in the study areas. A total of 150 households were selected for questionnaire interviews in each of the two study areas using simple random sampling. The sampling frame for

Mahenye were the 707 households in the area while that for Chizvirizvi comprised the 294 plot holders in the resettlement area. Such huge sample sizes of 21% for Mahenye and 51% for Chizvirizvi ensured a high validity of the results.

Interviews with key informants in Mahenye and Chizvirizvi and the adjacent protected areas were also conducted, mainly for gathering information on the richness of the areas in terms of biodiversity. The interviewees were selected through judgemental sampling. Secondary data were also crucial in revealing the richness in biodiversity of study areas and nearby protected areas. The information collected was then corroborated with that on the socio-economic status of questionnaire respondents so as to establish the extent of the juxtaposition of biodiversity and poverty in the study areas, that is, the ecogeography of poverty.

Questionnaire responses were calculated into percentage frequencies and presented in tables. On the other hand, qualitative data obtained through interviews was analysed narratively and corroborated with the quantitative data.

3. Results and Discussion

3.1 Dependence on Biodiversity

When asked to rate their reliance on natural resources for livelihoods (Table 3), 48% of the respondents in Mahenye said they had a very strong reliance on natural resources, 36.7% rated their reliance as strong while 15.3% said they moderately relied on natural resources for livelihood. In Chizvirizvi, 36.7%, 60.7% and 2.7% of the respondents rated their reliance on natural resources as very strong, strong and moderate respectively.

Table 3: Respondents' reliance on natural resources for livelihood (in %)

Respondents' reliance on natural resources	Mahenye (n=150)	Chizvirizvi (n=150)	Total (n=300)
Very strong	48.0	36.7	42.3
Strong	36.7	60.7	48.7
Moderate	15.3	2.7	9.0
Total	100	100	100

With 84.7% and 97.4% of questionnaire respondents in Mahenye and Chizvirizvi respectively rating their reliance on natural resources between very strong and strong, the results indicate that the majority of households in the study sites heavily relied on natural resources for livelihoods. This shows that natural resources play a significant role in the livelihoods of the households in the study areas.

Respondents were further asked to identify the various natural resources they frequently collected from the natural environment around them (Table 4). The information presented in Table 4 is in agreement with the above evidence indicating a strong reliance on natural resources by the majority of the respondents in the study sites.

Table 4: Resources frequently collected by respondents from the natural environment (in %): multiple responses

Resources frequently collected from environment	Mahenye (n=150)	Chizvirizvi (n=150)	Total (n=300)
Meat	86.0	3.3	44.7
Fish	90.7	17.3	54.0
Edible insects	93.3	100	96.7
Fruits	90.7	96.7	93.7
Vegetables	94.7	99.3	97.0
Mushrooms	98.7	100	99.3
Medicines	88.7	99.3	94.0
Dyes (from plants)	16.7	2.0	9.3
Timber	98.0	100	99.0
Thatching grass	98.0	98.0	98.0
Firewood	100	100	100
Flowers	21.3	-	10.7

The results depicted in Tables 3 and 4 are in tandem with previous researchers [7, 38] who indicated that the forests of Zimbabwe provide various timber and non-timber products such as food, medicine, energy, building and craft materials to people in the rural areas where the majority of them depend on these and other natural products for their livelihoods and income generation. While it has been estimated that NTFPs contributed over 35% of rural incomes in some parts of the country in 2000 [38], the role of natural resources towards household income generation has increased markedly since then due to deteriorating socio-economic conditions in the country. With the country's unemployment rate currently pegged at over 80%, most rural households which had relied on remittances from urban areas found themselves increasingly relying on nature to sustain their livelihoods. Studies in other parts of the world [43, 44, 45, 21] have also documented the significance of forest products to livelihoods and well-being among rural households. It should however be noted that "systemic institutional failure to collect forest-related income data across the developing world has led to a significant underestimation of the forest sector's importance to rural livelihoods and economic development" [43]. In addition, biodiversity provides important ecosystem services such as maintenance of soil fertility, regulation of climate and as a natural control for outbreaks of pests and diseases [46, 2, 47]. Such services are crucial to poor rural farmers lacking resources with which to procure fertilisers, pesticides and other modern agricultural chemicals. Interviews with key informants indicated that many households in both study sites collected rotten leaves from forests to substitute inorganic fertilisers which are beyond the reach on most of them.

Results on household energy use (Table 5) indicated a dominance of wood for cooking, heating and even lighting in the two study sites. For lighting, all the respondents in Mahenye indicated that they used wood, 15.3% used paraffin, 3.3% used solar while 7.3% used candles. In Chizvirizvi, 78%, 30.7%, 5.3% and 10.7% of the respondents said they

used wood, paraffin, solar and candles, respectively, for lighting. There were slightly more households using paraffin, solar and candles for lighting in Chizvirizvi than in Mahenye. With respect to cooking, all the respondents in the two study sites used wood, while 5.3% in Mahenye and 4.7% in Chizvirizvi were additionally using shelled maize cobs. All the respondents in Mahenye cited wood as the sole energy source for heating. While all the respondents in Chizvirizvi also used wood for heating, an additional 2.7% indicated that they used shelled maize cobs for heating. None of the households in the study sites used electricity (either from the public supply or from generators), gas or coal as energy sources.

Table 5: Sources of energy used for lighting, cooking and heating (in %): multiple responses

Energy sources	Mahenye (n=150)	Chizvirizvi (n=150)	Total (n=300)
Sources of energy used for lighting			
Paraffin	15.3	30.7	23.0
Solar	3.3	5.3	4.3
Fuel wood	100.0	78.0	89.0
Candles	7.3	10.7	9.0
Sources of energy used for cooking			
Fuel wood	100	100	100
Shelled maize cobs	5.3	4.7	4.0
Sources of energy used for heating			
Fuel wood	100	100	100
Shelled maize cobs	-	2.7	1.3

Wood is the most commonly used energy source for over 90% of households in the rural areas in Zimbabwe [48, 34]. This reflects the energy-use situation at the global level where forest biomass is an important source of energy for rural livelihoods particularly in developing countries and "ranks fourth as an energy source worldwide, and provides about 14% of the world's energy needs" [45]. However, with the downturn in the country's economy since 2000, more households in cities also now rely on wood for cooking and heating due to persistent power cuts, resulting in a substantial increase in the movement of wood into urban areas from surrounding rural areas [32]. The selling of wood in urban areas or along major roads by poor people from the rural areas has become a major livelihood activity. The selling of fuel wood was identified as one of the sources of income for many households in both Mahenye and Chizvirizvi, with clients mostly found in schools, clinics, shopping centres and also along nearby highways. The high and increasing use of biomass fuel, particularly wood, has raised serious concerns about deforestation and environmental degradation in the country [35, 33]. Studies in sub-Saharan Africa [44] and also in south Asia [45] have linked biomass energy consumption to environmental strain in these regions. In addition, the use of biomass as the main source of energy by households in Zimbabwe exposes many people to indoor air pollution as most of these households use an open fire or stove without a chimney [49, 50, 51]. Indoor smoke from solid fuels is estimated to be the fourth leading cause of death behind malnutrition, unsafe sex and lack of water and sanitation in developing countries [52]. The health impacts of indoor air pollution have been found to be closely linked with gender and poverty, with women (and babies often carried on their backs) disproportionately bearing the burden of the impacts of pollution due to their greater exposure to smoke while cooking [53, 54]. Considering the high percentage of the population using biofuels, the issue of indoor air pollution is certainly a priority issue for policy-makers. Over-reliance on biomass energy may also mean that residents are spending a lot of their time collecting fuelwood. This translates into opportunity costs in terms of foregone time for other more productive livelihoods activities such as farming.

However, in spite of the above-highlighted centrality of biodiversity to human survival in the rural areas of Zimbabwe, the biodiversity of the country continues to decline due to various drivers [55, 34, 33]. It is important to note that over-reliance on natural resources by rural households has been cited as one of the major drivers of biodiversity decline in the rural areas of Zimbabwe [33], hence the need to find alternative livelihood sources for the majority of rural residents disproportionately dependent on biodiversity for survival.

3.2 Evidences of the ecogeography of poverty in study areas

The study also sought to establish any evidences of the ecogeography of poverty, that is, the juxtaposition or coexistence of biodiversity and poverty. All study respondents in both Mahenye and Chizvirizvi identified subsistence crop and livestock farming as the main livelihood activity. Farming activities in both study sites were characterised by acute undercapitalisation and hence unavailability of modern inputs; lack of agricultural knowledge and skills; absence of extension and support services; aridity; and, additionally for Mahenye, uneconomical landholdings. This has translated into unsustainably low agricultural outputs, with hardly any surplus for sale. When asked to rate the poverty levels of their households, 77.4% and 71.4% of the study respondents in Mahenye and Chizvirizvi respectively rated themselves between high and very high poverty. In addition, the majority of the study respondents in Mahenye (67.3%) and Chizvirizvi (62.7%) had monthly household incomes of less than US$50. With huge average household sizes of 7.9 in Mahenye and 7.5 in Chizvirizvi, it is apparently clear that the majority of households in the study sites are living well below the poverty datum line.

As indicated earlier, the south-east lowveld of Zimbabwe is one of the biodiversity hotspots of the country which is centred on GNP, the second largest national park in the country after Hwange National Park. GNP covers a total area of 5 053km^2, and as at 2011, had a huge and fast growing herd of 11000 elephants, with a growth rate of between 5 and 6% [56]. Buffalo, giraffe impala, nyala and suni are also part of the thriving mammalian fauna of GNP, with lion, leopard, wild dogs and hyena being major predators. Over 50 fish species have been recorded in GNP, including lungfish, killifish, Zambezi shark and small-tooth sawfish. The park herpetofauna includes around 6% of the Southern African endemics and 14 species of special conservation interest. Over 492 species of birds have been recorded from the park, of which 11 are rare or of limited distribution and, therefore, of conservation interest. The varied adaphic and topographic characteristics of GNP have also given rise to a wide variety

of vegetation, amounting to over 50 vegetation types [56].

Besides GNP, the south-east lowveld also features some of the largest private protected areas in the country. Persistent droughts in the 1980s forced many farmers to switch from cattle ranching to wildlife conservancies. Notable among these private parks include Malilangwe Wildlife Reserve, Save Valley Conservancy, Hippo Valley Game Reserve and the Chiredzi River Conservancy.

From the foregoing, it can be seen that an ecogeography of poverty is clearly evident in the study sites, with private and state protected areas teeming with wildlife, juxtaposed with poor rural communities. This is because most of the south-east lowveld is in agro-ecological regions IV and V suitable only for wildlife and not crop production. These communities therefore are irking a living out of farming which, however, is a mismatched livelihood activity, as the ecological conditions cannot sustainably support crop production. This has forced many people to depend on biodiversity as a source of livelihood.

4. Conclusion and Implications

The study has shown that the south-east lowveld, in which the study sites are situated, is one of the biodiverse regions of the country. The study also revealed that a large majority of the residents of Mahenye and Chizvirizvi are poor, and heavily reliant on biodiversity and the natural resource environment for livelihood sustenance in terms of, among others, food, medicine, building materials, manure and income from the selling of varied NTFPs. This is because the region is arid and conducive for wildlife, and unsuitable for crop production except on a purely subsistence basis. Under such conditions, an ecogeography of poverty is clearly evident, whereby areas of rich biodiversity coincide with poor local communities.

The study recommends that both the statal, and private, protected areas in the study sites should be involved in community outreach activities so as to contribute positively to the wellbeing of the poverty-stricken communities adjacent to them. A constant and clarion call in the international biodiversity conservation literature is increasingly for conservation areas to be integrated with local livelihoods enhancement, especially where they are bordered by poor communities as is the case in most developing countries [57].

With aridity identified as a major impediment to agriculture in both study areas, and with the country currently undertaking a land reform exercise, land suitable for agriculture elsewhere should be identified for resettling the people. This will enhance the livelihoods of the people while at the same time freeing more land for wildlife management activities suited to these arid areas, with remaining households encouraged to specialise in cattle ranching, which can also do well in arid areas. This will help in eradicating the ecogeography of poverty clearly evident in the study areas.

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