

## Biodiversity as a Means of Poverty Alleviation in Sub-Saharan Africa

This paper investigates the relationship between high levels of poverty and biodiversity in sub-Saharan Africa (SSA). Using a collection of secondary research, it was found that the link between these two variables is more than geographic, and that biodiversity conservation is a crucial factor in the alleviation of poverty in SSA. A variety of poverty reducing strategies that incorporate biodiversity conservation have been implemented and succeeded elsewhere, implying that the same is possible for this region. Overall, the paper suggests that the biodiversity of SSA will be particularly important for the economic wellbeing of the poor in a future of climate change.

### 1. Introduction

Sub-Saharan Africa (SSA) is defined as the region of Africa that lies below the Sahara desert (Figure 1). It includes 47 African countries, 800 million people, and covers an area of 23.6 million square kilometers (Africa, 2010; Walker, 2009). Poverty in this region is pervasive, with close to half of the SSA population living in absolute poverty on less than \$1 per day, as defined by the World Bank (Fisher & Christopher, 2007; Lufumpa, 2005). Despite such a simple definition in this case, poverty is a complex, multi-dimensional material

deprivation that involves the lack of access to basic needs such as education, health and nutrition (Roe, 2010). The poverty in SSA will only be amplified by the region's expected drastic increase in population to 1.7 billion people by 2050, and 3 billion

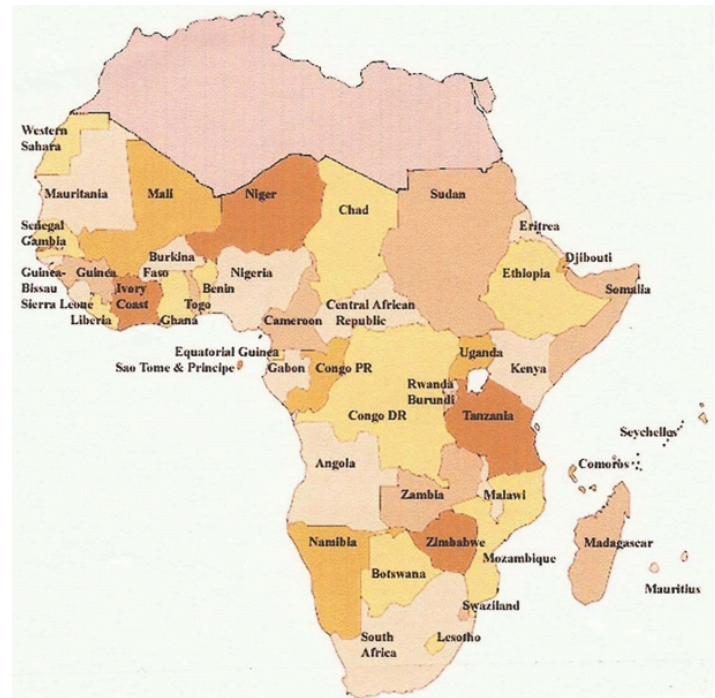


Figure 1: Map of sub-Sahara nations. From Buggey (2007).

by the end of the century (Lufumpa, 2005; Walker, 2009). The majority of this growing population lives in rural areas and depends, as pastoralists and cultivators, on the high levels of biodiversity provided by the broad range of climatic, geological, soil and landscape forms in the region (Darkoh, 2009; Lufumpa, 2005). This biodiversity, defined as species variability, encompasses the variety that occurs within living things, including genetic variation and variations between species (Barrett, Travis, & Dasgupta, 2011). When measured in terms of species richness and endemism, SSA has one of the highest levels of biodiversity globally, making it home to 7.5% of the world's vascular plant species, 5.8% of mammals, 8% of birds, 16% of marine fish, and 5.5% of insects (Roe, 2010; Roe, Walpole, & Elliott, 2010).

## **2. Understanding SSA**

### ***2.1. Environmental Issues***

SSA is a region particularly vulnerable to environmental degradation due to the heavy reliance of its rural populations on the land for their livelihoods (Darkoh, 2009). These environmental concerns, including deforestation, desertification, population growth, pollution and, most relevantly, biodiversity loss, are all expected to be amplified by future changes in climate (Darkoh, 2009). The past decade has been the warmest and driest of the century, and climate change is expected to make the SSA climate more variable, bringing more frequent and severe weather events such as droughts and floods (Darkoh, 2009).

The numerous environmental issues that exist in SSA are interlinked, all contributing in one way or another to a loss of biodiversity in the region.

Deforestation and desertification cause a loss of 5.3 million hectares of SSA forests

and woodlands annually (Darkoh, 2009). These losses are due to unsustainable land use practices such as overgrazing and excessive fertilization, as well as the use of wood for cooking, heating, and lighting (since only approximately 24% of the SSA population have access to electricity) (Darkoh, 2009; Lufumpa, 2005). This high level of land degradation poses serious threats to the region's biodiversity by destroying ecosystems, natural habitats, and threatening the survival of many plant and animal species (Lufumpa, 2005). Population growth in this region is extreme, putting a strain on environmental resources through a required increase in production and consumption (Darkoh, 2009). As standards of living in the region improve, the currently low levels of air and water pollution will likely be increased due to demands for industrialization (Darkoh, 2009). This increased stress on natural resources will lead to further biodiversity degradation (Darkoh, 2009). Even civil conflicts pose a threat to the region's diversity, as displaced populations are forced to pay little attention to environmental concerns (Darkoh, 2009; Lufumpa, 2005). These threats to biodiversity are a major concern for a region with such initially high levels of diversity and such high economic dependence on the land (Darkoh, 2009). The extinction rate in SSA is already high by global standards, and the region's plant and animal species continue to be threatened daily (Darkoh, 2009; Lufumpa, 2005).

## ***2.2. Poverty***

Poverty in SSA is widespread, particularly in rural regions, with at least 313 million of the region's population living on less than \$1 a day (Munthali, 2007). Although not the poorest region of the world, SSA is the only region in which poverty is anticipated to increase significantly (by 19% by 2015), contrary to the United Nations Millennium development goal to cut the number living in poverty in

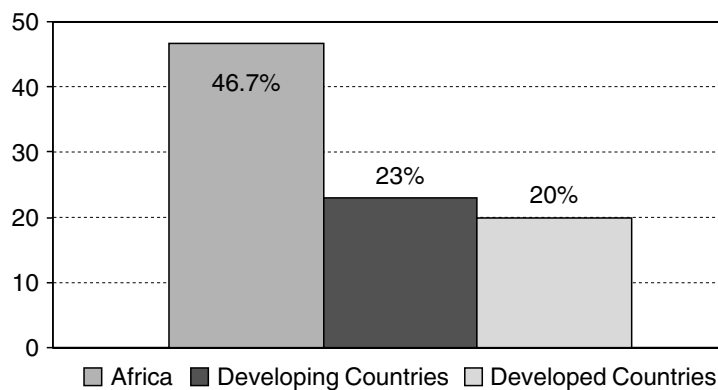


Figure 2: Population living in poverty (percentage below \$1 a day of income). From Lufumpa (2005).

half by 2015 (Lufumpa, 2005; Munthali, 2007). SSA currently accounts for 30% of the developing world's population living in poverty (Figure 2), compared to 16% in the 1980's (Lufumpa, 2005). This pervasive

poverty is closely related to the deterioration of biodiversity in the region, as large rural communities are forced to degrade the environment for survival (Lufumpa, 2005). This interrelation is a major concern for SSA, as these impoverished rural residents have a strong dependence on this degraded land as their main source of livelihood, thereby creating a vicious cycle (Lufumpa, 2005).

### 3. Link Between Biodiversity and Poverty

#### 3.1. Geographical Link

There is a high magnitude of overlap between globally important regions of biodiversity and regions of poverty, and mounting evidence suggests that these two variables do coincide spatially (Figure 3) (Barrett, Travis, & Dasgupta, 2011; Fisher,

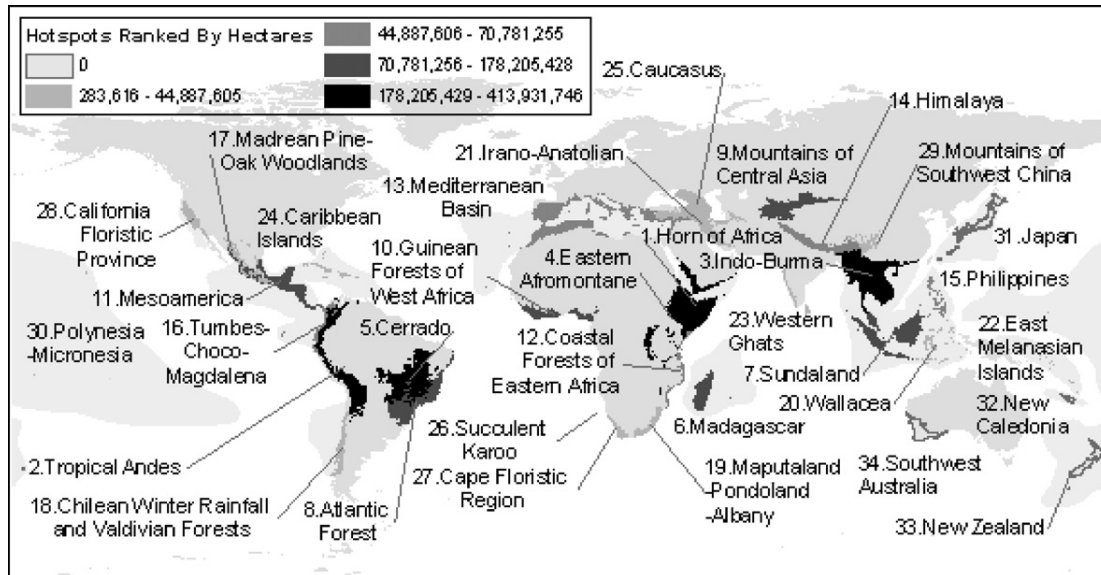


Figure 3: Global biodiversity and poverty overlap (Darker shades show the most impoverished of the world's 34 biodiversity hot spots). From Fisher & Christopher (2007).

& Christopher 2007; Roe, 2010). SSA is a particularly interesting case of this overlap between biodiversity and poverty, as it displays increasing poverty levels along with decreases in biodiversity (Roe, 2010; Roe, Walpole, & Elliott, 2010). This geographical link is important as it is often presented as rationale for pursuing biodiversity conservation and poverty reduction together (Roe, Walpole, & Elliott, 2010).

### 3.2. Misleading Implication

On the surface, this strong overlap between high levels of biodiversity and high levels of poverty may suggest that a healthy economy and diverse environment are mutually exclusive occurrences (Adams et al., 2004). This strong spatial link can lead to dangerous conclusions, as it may suggest a cause-and-effect relationship in which poverty is a constraint on conservation, or conservation is harmful to those in poverty (Adams et al., 2004; Fisher, & Christopher, 2007). The more dangerous of these conclusions is that conservation efforts may be harmful to, and should not

compromise, poverty reduction (Adams et al., 2004; Fisher, & Christopher, 2007). This implies that poverty should not be increased due to conservational efforts, and that the livelihood of the poor should not be undermined in order to conserve biodiversity in the region (Adams et al., 2004). This is a troubling implication, as it suggests that a choice needs to be made between the environmental and social wellbeing of this region.

Further research has shown that this implied causal link may be too simplistic to describe the complex interconnection between these variables (Adams et al., 2004; Fisher, & Christopher, 2007; Roe, 2010). Although the geographical overlap should not be ignored, a more in depth understanding of the link between poverty and biodiversity may suggest a more accurate approach to this complex relationship (Adams et al., 2004; Fisher, & Christopher, 2007; Roe, 2010).

#### **4. Importance of Biodiversity in Alleviating Poverty**

##### ***4.1. Dependence on Biodiversity***

The majority of the poor in SSA live in rural areas with a livelihood critically dependent upon the exploitation of natural resources such as water, arable land, and forest resources (Lufumpa, 2005). This makes the poor in this region disproportionately and directly dependent upon its biodiversity (Reid, & Swiderska, 2008; Roe, Walpole, & Elliott, 2010). The history of civilization in SSA shows a remarkable link with biodiversity, as pre-colonial population centers were built in areas with an average of 444.4 species, as opposed to the 359.6 species average in the rest of the region (Fjeldsa, & Burgwss, 2011). Current population centers and species richness also appear to be strongly correlated (Figure 4), suggesting that the

spatial patterns of population growth have been governed by environmental factors such as biodiversity (Fjeldsa, & Burgwss, 2011; Roe, Walpole, & Elliott, 2010).

This implies that biodiversity is intrinsic to the indigenous agro-pastoral systems of the region, emphasizing their dependence upon it (Fjeldsa, & Burgwss, 2011; Roe, Walpole, & Elliott, 2010).

Biodiversity is important in this region as a means of direct income, as well as insurance, since the prevalent biodiversity acts as a buffer against risks and shocks that the region may face (Roe, 2010). The direct economic benefit of biodiversity comes from the biodiversity-based resources used for household income, production, and consumption (Roe, 2010). Wild animals and plants play an enormous role as resources for the poor in this region, and the genetic diversity in these plant and animal resources is therefore vital for the livelihood of these communities (Roe, 2010). Table 1 shows the dependence of different areas of SSA on certain biodiversity resources, and Table 2 shows how this dependence decreases for those relieved of poverty (The variability in biodiversity resources used as a source of livelihood in these tables reflects the availability and access to the resource each area) (Roe, 2010). The biodiversity in SSA is also indirectly relied

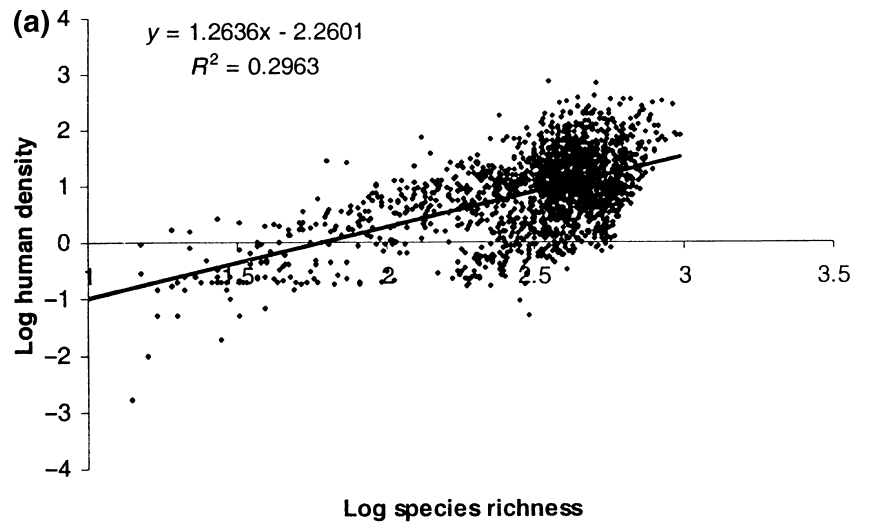


Figure 4: Scatter plot showing species richness and endemism against human population density in SSA. From Fjeldsa & Burgwss (2008).

upon, as it improves the resilience of the regions ecosystems and agricultural land (Roe, 2010). Resilience in this case refers to the ability of the system to absorb shocks or disturbances, and return to a reference state after perturbation (Roe, 2010). Strong and consistent findings show that by improving the resilience of a system, biodiversity has a positive effect on mean crop yields and a negative effect on the variability of crop yields (Roe, 2010). This provides strong insurance against food security risks (Roe, 2010). High levels of biodiversity in SSA farms not only decrease the risk of crop failure, but also increase soil fertility, improve water supplies, and provide natural pest control that allows for an increase in productivity and a direct economic benefit (Roe, 2010; Roe, Walpole, & Elliott, 2010).

Table 1: Collected evidence on the dependence of different regions of SSA on biodiversity for income. From Roe (2010).

<b>Source</b>	<b>Region</b>	<b>Evidence</b>	<b>Resource type</b>
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
de Merode et al. 2004	West Africa	24% of cash sales	Wild foods
Fisher 2004	Southern Africa	30% of household income	Forests
Kamanga et al. 2009	Southern Africa	15% of total household income	Forests
Mamo et al. 2007	East Africa	39% of total household income	Forests



Table 2: Collected evidence on the relative dependence of the poor in different regions of SSA on biodiversity resources (NTFP means non-timber forest products). From Roe (2010).

Reference	Region	Resource	Relative Dependence
Babulo et al. 2008	East Africa	Forests	Decreases with wealth
Bene et al. 2009	West Africa	Fish	Decreases with wealth
Cavendish 2000	Southern Africa	Multiple	Decreases with wealth
de Merode et al. 2004	West Africa	Wild plants	Consumption/sale decreases with wealth
Fisher 2004	Southern Africa	Low return forest activities	Decreases with wealth
Kamanga et al. 2007	Southern Africa	Forests	Decreases with wealth
Mamo et al. 2007	East Africa	Forests	Decreases with wealth
Paumgarten and Shackleton 2009	Southern Africa	NTFP	Sale decreases with wealth
Shackleton and Shackleton 2006	Southern Africa	NTFP	Sale decreases with wealth
Shackleton and Shackleton 2006	Southern Africa	Fuelwood	Consumption decreases with wealth
Shackleton and Shackleton 2006	Southern Africa	Edible herbs	Consumption decreases with wealth

#### ***4.2. Biodiversity Conservation as a Means of Poverty Reduction***

The conservation of biodiversity is a unique way to provide direct and indirect services that sustain the economy in SSA (Turner et al., 2012). The labour of the poor results in economic returns that are directly dependent upon the quality and quantity of the natural resources available, and these resources are, in turn, dependent upon the biodiversity of the region (Barrett, Travis, & Dasgupta, 2011). The high dependency of the SSA economy on its biodiversity suggests that, at a

minimum, this biodiversity acts as a safety net to maintain the region's current economy (Turner et al., 2012; Roe, Walpole, & Elliott, 2010). It also suggests that biodiversity is a crucial factor in any hope for poverty alleviation in the region (Turner et al., 2012; Roe, Walpole, & Elliott, 2010). Although ecosystem services (sometimes looked at as natural capital), defined as the value of services generated by a habitat, are often taken for granted, underpriced, and overexploited, these services are extremely valuable and essential in the SSA economy (Turner et al., 2012; Roe, 2010). If current payments for these ecosystem services made it directly to the poor, there would be an increase in economic value of 49.7%, suggesting that management of this natural capital could result in poverty alleviation in the region (Turner et al., 2012). An example of the ability of biodiversity conservation to alleviate poverty comes from the comparison of two similar districts in both Costa Rica and Thailand, one with biodiversity conservation and one without (Turner et al., 2012). The protected areas experienced 10% less poverty in Costa Rica, and 30% less poverty in Thailand, providing discrete examples of how this relationship could provide possible benefits to the SSA economy as well (Turner et al., 2012). A variety of similar success stories are available, emphasizing the promising capability of biodiversity conservation as a means of poverty reduction (Fisher, & Christopher, 2007; Munthali, 2007; Roe, 2010).

#### ***4.3. Implementation of Findings***

The complex relationship between poverty and biodiversity in SSA provides compelling reasons for its communities to engage in conservation, as it can be economically, environmentally, politically, socially, and culturally beneficial (Roe,

Walpole, & Elliott, 2010). Community appropriate strategies and policies for incorporating biodiversity conservation and poverty reduction must be designed in order to take advantage of these compelling benefits (Roe, Walpole, & Elliott, 2010).

There are a variety of possibilities and previously implemented strategies that take advantage of the relationship between these two variables, providing “win-win” solutions (Munthali, 2007; Roe, 2010). Community based natural resource management programs are key, as they recognize the importance of the participation of those who live near and are interconnected with the resources at hand (Munthali, 2007). A complex example of such an ecosystem management initiative is Transfrontier Conservation Areas (TFCAs), which recognize that political borders between countries are not necessarily ecological borders (Munthali, 2007). This strategy aims to ensure that key ecological processes continue to function where borders have divided an ecosystem, while also encouraging cooperation between different governments and communities in the region (Munthali, 2007).

A variety of other conservation mechanisms provide strong evidence of contributions to reductions in poverty by conserving biodiversity (Roe, 2010). Examples include non-timber forest products (NTFPs) in which products such as honey, bamboo and mushrooms can be cultivated and generate profit for the region, as well as timber itself, when forests are owned by communities and harvested sustainably by small-scale wood processing to provide the community with wealth that has historically gone to national elites (Roe, 2010). The use of these strategies

in example cases such as Mexico, Bolivia, and Vietnam has been successful in reducing poverty (Roe, 2010).

An initiative called payments for environmental services (PES), which involves the selling of well-defined environmental services (such as watershed protection or carbon sequestration) so that landowners are compensated for providing environmentally sustainable ecosystem services, has been successfully implemented in Costa Rica for forest protection, and in Ecuador for watershed protection (Fisher, & Christopher, 2007; Roe, 2010). These cases of PES provide considerable evidence of the ability of this strategy to reduce poverty, as it now supplies more than 30% of the household income for the poor in both of these regions (Fisher, & Christopher, 2007; Roe, 2010).

Nature-based tourism is another possible option for SSA, as international attractions such as eco-lodges and safari operations provide direct and indirect benefits to the region in which they are implemented (Roe, 2010). Direct benefits include the creation of jobs in the tourism sector (Roe, 2010). Indirect benefits are the infrastructure and development that come along with tourism, as research has shown that each dollar spent by a tourist leads to a \$2-3 national economic benefit (Roe, 2010).

Fish spillover is another strategy that has been proven to reduce poverty in the locations it is implemented (Roe, 2010). The protection of a key area of marine habitat allows for the fish stocks to replenish and overspill into adjacent areas where they can be caught and benefitted from by the poor (Roe, 2010). The protected areas provide marine biodiversity conservation, while the spillover areas

generate income to reduce poverty in the region (Roe, 2010). This strategy has led to a doubling of local incomes within five years of its establishment in two different Fijian communities (Roe, 2010).

It is a combination of these various strategies and policies that will be necessary to establish any significant poverty alleviation in a region as large and diverse as SSA. Research and experience have shown that these strategies can contribute measurably to both the conservation of biodiversity and alleviation of poverty if executed properly (Munthali, 2007; Roe, 2010). It is important that the strategies implemented incorporate sufficient understanding of the complex relationship between poverty and the environment in SSA, in order to ensure an overall sustainable outcome (Lufumpa, 2005). Challenges faced by such policy implementation include political instability in the region, poor government implementation and a disconnection between government policy and the scholarly research behind the issues (Munthali, 2007). A main challenge for the region is ensuring that it is the poor who benefit from these policy implementations, as opposed to the elite capturing the benefits (Roe, 2010).

## **5. Conclusions**

Biodiversity loss and poverty reduction are global challenges, agreed to be of first order importance in the Convention on Biological Diversity and in the Millennium Development Goals (Barrett, Travis, & Dasgupta, 2011). The connection between these two variables therefore holds profound possibilities for SSA and, if understood fully, could provide promising mechanisms to combat poverty and the loss of biodiversity together (Lufumpa, 2005; Roe, 2010). The close interrelation between

these two variables suggests that if not arrested, biodiversity degradation will affect the regions economic growth, further worsening the situation of those in poverty (Lufumpa, 2005). The importance of this complex relationship must be taken into account, and biodiversity conservation should be a priority in international efforts to address poverty reduction in SSA (Adams et al., 2004; Roe, 2010). The services provided by diverse ecosystems and the habitats providing them are vanishing at alarming rates, and are undervalued in markets, businesses, and government decisions (Turner et al., 2012). This is particularly true when looking into a future of climate change, where this biodiversity will be especially crucial (Turner et al., 2012; Roe, 2010). Although SSA emits one of the lowest levels of green house gases globally, research has shown that this drought-prone region is most at risk of climate change hazards (Reid, & Swiderska, 2008). Biodiversity in SSA can act as a buffer, ensuring protection and resilience against the adverse weather associated with climate change (Roe, 2010). Those in poverty have the lowest capacity to deal with climate change-related shocks, and the resilience provided by conserving the region's biodiversity will be increasingly important for the economic wellbeing of SSA communities in a future of climate change (Reid, & Swiderska, 2008; Roe, 2010).

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