

# HIV/AIDS and forests in Sub-Saharan Africa: exploring the links between morbidity, mortality, and dependence on biodiversity

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**Abstract.** HIV/AIDS is likely to lead to an intensification of poverty in Sub-Saharan Africa, and poverty can also lead people into conditions that increase their risk of exposure to, and exacerbate the impact of, HIV/AIDS. While the role of forest biodiversity as a safety net for the rural poor during times of crisis has been noted in studies across the developing world, the links between HIV/AIDS, poverty, and forests are not well understood. In particular, scholarly inquiry into the death of a productive household member due to HIV/AIDS, and the environmental ramifications of such an event on household livelihoods, has been lacking. This is an important research gap given the extent of prime-age adult mortality attributable to the HIV/AIDS pandemic, particularly in Sub-Saharan Africa. We conducted a systematic analysis of the published and gray literature in this domain to answer the following questions: (1) How does household dependence on forest biodiversity change from the onset of HIV/AIDS through morbidity and mortality? (2) Is there evidence to suggest that level of dependence varies according to the role of the deceased within the household economy (e.g., wage earner, resource collector)? (3) What do we know about the effects of loss of forest biodiversity on HIV/AIDS-affected households?

Our results indicate that: HIV/AIDS-related morbidity and mortality appears to increase an affected household's dependence on forest biodiversity (although further research is required); the death of a wage earner versus a resource harvester could impoverish a household by making it more reliant on collected natural capital that could previously have been bought; and the loss of forest biodiversity can threaten livelihood sustainability by reducing the availability of important medicinal plants, forcing people to skip meals to compensate for a lack of firewood for cooking, and requiring more physical labour to acquire forest resources such as firewood.

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## BACKGROUND

Throughout Sub-Saharan Africa, the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) pandemic is having devastating and tragic social, economic, and political impacts (Barany *et al.* 2004). HIV/AIDS is both a health issue and a development problem in this region, which has the highest prevalence of HIV in the world, along with 35 of the 45 most highly affected countries (Drimie and Gandure 2005). HIV/AIDS is likely to lead to an intensification of poverty in Sub-Saharan Africa; it “can push some non-poor into poverty and some of the very poor further into destitution” (Drimie 2002, p.6). HIV/AIDS is likely to lead to an intensification of poverty in Sub-Saharan Africa; it “can push some non-poor into poverty and some of the very poor further into destitution” (Drimie 2002, p.6). Poverty can also increase the spread of HIV if, for example, women turn to prostitution in an effort to secure food and money for their families. The disease has complex links to rural livelihoods, human capacity, and conservation (Torell *et al.* 2006; Oglethorpe and Gelman 2007), and is thought to be responsible for undoing decades of economic and social development and causing rural disintegration (Villarreal *et al.* 2006). Losses due to AIDS of the most economically valuable members of communities – prime-aged adults between 18 and 49 years of age – can impede development and affect agricultural activities, natural resource management, and land tenure (Drimie and Gandure 2005; Hunter *et al.* 2008).

The role of forest biodiversity as a safety net for the rural poor during times of crisis has been widely recognized in studies across the developing world. It has been estimated that over two-thirds of Africa's 600 million people rely on forests both for subsistence and to supplement their cash incomes (CIFOR 2005). About 70% of the energy consumed in southern Africa is in the form of fuelwood or charcoal (Syampungani *et al.* 2009). Forest

resources such as fuelwood, wild foods, and medicinal plants, are usually harvested from communal forests and rangelands around rural settlements (Hunter *et al.* 2008), and the importance of natural resources to the health of HIV/AIDS sufferers is evident. Those afflicted with the disease typically require up to 15% more energy and 50% more protein, as well as additional micronutrients as compared to non-sufferers (Kaschula 2008). Wild foods and other natural resources can also play a key role in enabling an afflicted person and their household to control and adapt to HIV/AIDS (Villarreal *et al.* 2006). Fruits, berries, and leaves all produce nutritious foodstuffs that can boost the immune system and help protect against opportunistic disease (Villarreal *et al.* 2006); “wild meats, insects and fruit kernels provide high quality protein and wild leafy vegetables are key sources of micronutrients” (Kaschula 2008, p.163). Some non-timber forest resources have been found to be high in key nutrients required by people living with HIV/AIDS, particularly protein, fat, iron, zinc, and vitamins A and C (Barany *et al.* 2004). Aside from the contributions of forest biodiversity in the form of medicines to treat the side effects of HIV/AIDS (e.g., shingles or diarrhea) and nutritional contributions, timber is also harvested to build more coffins, and Holding-Anyonge *et al.* (2006) found that firewood was required in even greater amounts than usual to prepare food for increasingly frequent funerals. Firewood is also required to prepare staple foods such as maize, sweet potato, and cassava.

Despite the importance of forests to rural livelihoods, research on the interactions between the dependence on forest biodiversity and contemporary epidemics in general, and on the environmental dimensions of the HIV/AIDS pandemic in particular, remains surprisingly limited (Hunter *et al.* 2008; Holding-Anyonge *et al.* 2006). Specifically, there has been a dearth of research on the links between the livelihoods of HIV/AIDS affected households and forest resources (Torell *et al.* 2006; Barany *et al.* 2005; Holding-Anyonge *et al.* 2006), and on the long-term impacts of people living with HIV/AIDS on the management of forest resources (Dwasi 2002). In particular, scholarly inquiry into the death of a productive household member due to HIV/AIDS, and the environmental ramifications of such an event, has been lacking. AIDS-related morbidity and mortality are believed to increase the amount of time and money allocated to healthcare, while reducing household labour and productive capacity. This is an important research gap given the extent of prime-age adult mortality attributable to the HIV/AIDS pandemic, particularly in Sub-Saharan Africa (Hunter *et al.* 2008). Likewise, there are growing health implications

of environmental degradation (Tabor 2002), and global environmental changes, such as deforestation and forest degradation, can pose various risks to human population health (McMichael 2002). With forest resources buffering the impact of HIV/AIDS and enabling households to both adapt and respond more effectively to the disease, HIV/AIDS makes the better use and management of forests in Sub-Saharan Africa all the more urgent (Topouzis 2007).

The purpose of this paper is to contribute to an understanding of the interactions between HIV/AIDS-related morbidity and mortality, and an affected household's dependence on forest biodiversity. Specifically we aim to collate information which will help answer the following questions: (1) How does household dependence on forest biodiversity change from the onset of HIV/AIDS through morbidity and mortality? (2) Does the level of household dependence on biodiversity vary according to the role of the deceased within the household economy (e.g., wage earner, resource collector)? (3) How does a loss of forest biodiversity impact HIV/AIDS-affected households?

It is important to clarify the meaning of the broad term *dependence* that is used in this paper. Interestingly, we did not come across a specific definition of dependence in our review of the literature. However, it is safe to assume that dependence can refer to both the frequency of collection of particular resources and level of consumption of particular resources. In this paper, we use dependence interchangeably to refer to both interpretations and offer the following as an illustration of the distinction. HIV/AIDS-affected households may change their frequency of collection of certain products in response to the disease. For instance, firewood may be collected with less frequency due to a decrease in the availability of labour because the firewood collector has fallen ill and does not have enough energy to collect the resource. However, there may also be changes in the level of consumption of a resource. For example, medicinal plants are commonly used to treat the symptoms of the disease. While the need for specific medicinal plants may increase, it is difficult to ascertain from the papers used in our analysis the frequency and abundance of collection. Hence, there could be a decrease in the *frequency* of collection and a greater *abundance* collected at any given time. Wherever possible, we attempt to distinguish between these key components of *dependence*. However, where we were unable to disentangle these components to a sufficient degree, we employ the broader term of *dependence*.

## METHODOLOGY

We conducted a systematic analysis of the published and grey literature to answer the above-mentioned research questions. We deliberately cast our net wide in order to include as much literature as possible given the dearth of information in this domain. Key terms used in our search included: "natural resources HIV AIDS", "biodiversity HIV AIDS", "HIV AIDS forest", "deforestation HIV AIDS", "forest dependence HIV AIDS", and "forest dependence mortality". The following databases were searched in English: Web of Science, Pubmed, Social Sciences in Forestry, Agricola, and CIFOR. Web of Science, Pubmed, and Social Sciences in Forestry were searched in French. A university library's QuickSearch tool was also used, and the above-quoted key terms and others were searched in the following categories: General (including the databases JSTOR, Project Muse, Web of Science, Academic Search Complete and Google Scholar), Natural Sciences (including the databases ASFA Aquatic Sciences, BIOSIS Previews, Environmental Sciences, Web of Science and Zoological Record Plus), and Social Sciences (including Anthropology Plus, EconLit, Geobase, PsycINFO, Sociological Abstracts, Web of Science, Worldwide Political Science Abstracts, and Academic Search Complete). These databases were also searched using the key terms in French, however this search yielded no results.

No restrictions were placed on the year of publication in order to ensure that the largest selection of literature was included in this analysis. Although we were primarily interested in the literature on forest resources and HIV/AIDS, our literature search revealed several papers that incorporated

forest resources more broadly under natural resources or biodiversity (e.g., Freeman 2002; Twine and Hunter 2008). We deliberately included papers in our literature database that we knew fit our search criteria, but which for some reason were not captured in our search methods. While we did not deliberately limit our search to Sub-Saharan Africa, all of the literature that emerged was restricted to this region, possibly an indication of the already crucial role of forests in the daily lives of rural people and the prevalence of the disease across the region.

After compiling our database of articles in a Microsoft Excel spreadsheet, the methodology of each paper was reviewed. Those not based on empirical findings emerging from a quantitative or qualitative study (e.g., review articles, opinion pieces, or reports providing policy recommendations) were eliminated. Subsequent to detailed review, four more articles were removed from the analysis as they were deemed to be only very tangentially related to the topic. Thus, from an initial database of 67 papers, 39 papers were included in our final analysis.

The goal of our review is to indicate trends rather than to produce a statistically defensible meta-analysis, therefore we have elected to include several articles where the same authors carried out different analyses on what appear to be the same data sets (see, for example, Hunter *et al.* 2007, Hunter *et al.* 2008). We have, however, taken care not to include statistics from one author that have been attributed to another author also used in this analysis; that is, wherever possible we have gone to the source of the statistics in question.

## RESULTS

### Changes in household dependence on forest biodiversity from the onset of HIV/AIDS through morbidity and mortality

While our analysis does reveal a link between HIV/AIDS-morbidity and mortality and increased household dependence on forest biodiversity, the evidence is not quite as convincing as much of the anecdotal information available in this domain purports. We caution that further research on this topic is warranted.

Approximately half of the articles included in our analysis reiterated the commonly-held belief that HIV/AIDS-related morbidity results in a greater household dependence on forest biodiversity, yet only nine articles offered data to support this assertion. Of these, there appears to be more evidence to suggest that HIV/AIDS-morbidity does in fact result in an increased dependence on forest biodiversity. For instance, in their study on the impacts of HIV/AIDS on rural children in South Africa, McGarry and Shackleton (2009) found that highly vulnerable children (having, for example, a chronically ill caregiver in the home or the mortality of a family member within the past two years) hunted and consumed far more wild meat than the least vulnerable children. Kaschula (2008) found that HIV-affected households had significantly higher mean proportions of wild food(s) in their detailed household dietary recalls than did unaffected households. The authors cite several hypotheses as to why this might be the case. These include the hypothesis that HIV-affected households: are more resilient households; have a tendency to employ other coping strategies more readily which might further buffer household income; are more entrepreneurial and thus more likely to engage in other forms of self-providing activities as part of their livelihood strategies; and might be more likely to generate income from trade in natural resources. Challe and Price (2009) found that ninety-seven percent of HIV/AIDS affected households in their study relied on orchid gathering as their primary economic activity, compared to non-HIV/AIDS affected households at 9.7 percent. The authors surmise that the collection of edible orchid tubers appears to be an important activity for AIDS orphans and HIV/AIDS affected adults. However, one study reported a decreased dependence on forest resources with adult illness. Barany *et al.* (2005) found that 54% of households in their sample reduced the frequency of forest product collection due to sickness, and/or an increase in time spent caring for the sick. However, it is unclear whether or not the abundance of forest product collection decreased as well.

As with morbidity, there appears to be an increased dependence on forest resources after mortality, but again the results are inconclusive. Barany *et al.* (2005) found that 23% of the households affected by prime-aged adult mortality reported an increased importance in forest product collection following the death. These households reportedly had become more dependent on income from the sale of forest products (e.g., firewood, thatch grass, fruits, mushrooms, mats, baskets) and activities requiring firewood as an input (e.g., brewing, food vending). Holding-Anyonge *et al.* (2006) reported that higher adult mortality rates had increased the demand for fuelwood, in part to prepare food for increasingly frequent funerals. Hunter *et al.* (2008) found that recent adult mortality was associated with an increased likelihood that a household would use wood, while Twine and Hunter (2008) reported that mortality-affected households were more likely to turn to natural resources as cost-saving substitutes, such as using insects, fruit, and fuelwood specifically because they are less expensive than alternatives. Hunter *et al.* (2007) noted that such dependence continues even several years after the death, suggesting that increased dependence on the woodlands is not only a short-term coping strategy.

#### **Relationship between the level of dependence on forest biodiversity and the role of the deceased within the household economy**

From our analysis of the literature, there appears to be a dearth of evidence on the relationship between household dependence on forest biodiversity and the role of the deceased within the household economy. Only two articles directly addressed this topic. Using data collected from the MRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt) in rural South Africa, Hunter *et al.* (2007) and Hunter *et al.* (2008) examined the use of local environmental resources as related to prime-age adult mortality in the study site. Hunter *et al.* (2007) found that households experiencing a male death were more likely to supplement their food intake from the natural environment than were those experiencing a female death. Furthermore, if the deceased was a resource collector/harvester and had not engaged in income-generating work outside the household, his or her collection duties were typically taken on by other household members, whereas if the deceased had contributed wages, household members were forced to harvest wood and water on their own instead of purchasing them (Hunter *et al.* 2008). Though further evidence on this question is required, these results indicate that the death of a wage earner versus a resource harvester could impoverish a household by making it more reliant on collected natural capital which could have been previously purchased.

Two other studies indirectly or anecdotally addressed this question. Kaschula (2008) found that households fostering paternal orphans had significantly lower numbers of adult males, and tended to harvest more wild foods. The author postulated that it was possibly due to a relatively higher availability of adult female and child labour. Thangata *et al.* (2007) utilised a dynamic (10 year) ethnographic linear programme and found that the death of a male head of household resulted in a reduced availability of field labour and therefore less food and cash crops produced, subsequently creating a more food-insecure household. However, the authors found that the effect was not as great on male labour when a woman got sick and later died.

#### **The effects of loss of forest biodiversity on HIV/AIDS-affected households**

From our review, it appears that there is a knowledge gap regarding how the loss of forest biodiversity impacts HIV/AIDS-affected households. Notably however, many authors have reported on the inverse of this relationship, that is, how HIV/AIDS-affected households (negatively) impact the natural environment (see, for example, Holding-Anyonge *et al.* 2006; Barany *et al.* 2005; Hunter *et al.* 2008; Shackleton *et al.* 2006; Topouzis 2007; Torell *et al.* 2006).

Only a few authors in our review provided evidence about the effects of biodiversity loss on HIV/AIDS-affected households. Barany *et al.* (2005) found that the quality of woodland resources appeared to be negatively associated with HIV prevalence, with respondents in two study villages indicating that

the vast majority of the households had to travel further to collect firewood. Respondents also indicated that, compared to the years before HIV and AIDS, they could not find the required medicinal trees and shrubs within reasonable walking distance, and that their ability to cope was undermined by the loss of woodland resources (Holding-Anyonge *et al.* 2006). Kayambazinthu *et al.* (2005) noted that six percent of households in their survey skipped a meal due to the lack of firewood. Barany *et al.* (2005) found that 32 medicinal plant species, including species used in the treatment of HIV/AIDS-related illnesses, were increasingly difficult to source. However, how the loss of these important medicinal plants actually manifests itself in terms of health impacts, such as increased exhaustion resulting from more labour expended collecting scarce resources, was not examined. And Freeman (2002) observed that livelihood sustainability in the study area was being weakened by increased pressures on the village's wooded commons, affecting the ability of households to weather droughts, economic misfortunes, and poverty. Again, to what extent and what this would look like in reality were not assessed.

Within our review, a number of authors did imply how the loss of biodiversity and degradation of the natural environment could impact negatively on HIV/AIDS-affected households. Among the natural capital that can be affected are water, medicinal plants, wild foods, and firewood. DeMotts (2008) described the strain that HIV/AIDS can place on natural capital due to an increased need for water and nutrition by sufferers of the disease. Barany *et al.* (2005) and Kayambazinthu *et al.* (2005) noted that woodland degradation had potentially negative implications for (HIV) affected households including: loss of income generating options; increase in labour spent collecting forest products; reduction in use of firewood and; an inability to cook certain foods (possibly leading to reduced nutrition and sanitation).

## **DISCUSSION**

The purpose of this paper is to contribute to a better understanding of the complex interactions between HIV/AIDS-related morbidity and mortality, and an affected household's dependence on forest biodiversity. Although there is a general dearth of evidence in this domain, that which does exist points to an increased dependence on forest biodiversity by households affected by HIV/AIDS in Sub-Saharan Africa. Our results also indicate that the death of a wage earner versus a resource harvester could impoverish a household by making it more reliant on collected natural capital that could previously have been bought. Though further evidence on these questions is required, these are important findings given the extent of prime-age adult mortality attributable to HIV/AIDS in Sub-Saharan Africa and other developing countries that rely on forest biodiversity for both subsistence and small-scale income-generation.

Given the centrality of forest resources to rural livelihoods, as sources of nutrition, medicines, and firewood, among others, further study in this domain is warranted. As already mentioned, the bulk of the available literature focuses on the (generally negative) impacts that HIV/AIDS-affected households have on the natural environment. While more research on this front is imperative, so too is investigation into the sustainability with which forest biodiversity is utilized. This is critical as the negative health impacts of an impaired environment for HIV/AIDS-affected households could be catastrophic. For instance, if, as Barany *et al.* (2005) found, important medicinal plant species become scarce, the result for an ill individual could be a loss of stamina and a compromised immune system. If this individual were a wage earner, other members of the household could be expected to collect forest resources that were previously purchased (Hunter *et al.* 2007; Hunter *et al.* 2008). As local forest resources become degraded and biodiversity is lost, more time and effort (and hence, labour) would be required to obtain these products. One of the coping mechanisms that could be employed to deal with this would be to skip meals, as found by Kayambazinthu *et al.* (2005). The repercussions of this cycle then could be decreased stamina, increased vulnerability to further infections and other diseases, and less livelihood and food security. It is not difficult to imagine such scenarios whereby the complex and reinforcing impacts of HIV/AIDS-related illnesses and the slow decay of the forest environment could be debilitating for rural households.

Fortunately, policy makers in government forestry departments can assist rural HIV/AIDS-affected households to access important forest biodiversity in a number of ways. First, short-term assistance can be provided through the provisioning of forest resources (such as fuelwood) directly to villagers, and establishing village woodlots for more intensive forest management and cultivation of medicinal plants (Barany *et al.* 2004; Holding-Anyonge *et al.* 2006). Over the longer term, a decrease in demand could be engendered through the use of more efficient wood stoves or a switch to other fuel types, and alternative income-generating activities that are not woodland based (Holding-Anyonge *et al.* 2006). Forestry departments could also work on tenure reform over the long-term to secure local access, and work with other organizations (such as the World Agroforestry Centre) to domesticate and improve indigenous species. Finally, forestry departments could also work to mainstream HIV/AIDS into their programming, such as with the *Forestry HIV and AIDS Strategy 2007-2011* in Malawi (Malawi Government 2007), and by working with other government departments from the health, nutrition, and socio-economic development branches.

We acknowledge that our review has several limitations. First, some level of precision has likely been lost as the component studies making up our review have not used identical measures of 'dependence'. As mentioned previously, we have combined both frequency of collection and level of consumption into the broad theme of dependence. Further study on this topic would ideally disentangle these two, and contribute to a clearer definition of dependence. More attention also needs to be paid to the level of dependence on forest resources in each of the four distinguishable waves of impact from HIV/AIDS: individual HIV infections; opportunistic diseases; AIDS-related illness and death; and the impact on households, communities and nations (Barnett and Whiteside 2002; Ternström 2005).

Common to several of the studies included in our review, and one of our limitations, is an inability to demonstrate that HIV/AIDS was the unique shock with regard to its impact on household dependence on forest biodiversity (*sensu* Twine and Hunter 2008). That is, in households already characterized by severe livelihood insecurities, it is difficult to disentangle the impacts of AIDS on forest dependence from other factors. In regard to the role of wild forest resources, dependence is partly a function of gender, household composition, socio-economic status, social networks, etc. (Kayambazinthu *et al.* 2005; DeMotts 2008; Kaschula 2008).

This strongly suggests that policies and interventions should target vulnerable households more broadly (Twine and Hunter 2008), and supports the need for further research in this domain (Holding-Anyonge *et al.* 2006). To this end, we have identified a number of key research questions that can contribute knowledge in the forest and HIV/AIDS domain:

How do various human diseases, in general, and HIV/AIDS more specifically, affect dependence on forest biodiversity? Beyond an analysis of 'morbidity' and 'mortality', how does household dependence on forest biodiversity change across the four distinguishable waves of impact from HIV/AIDS: individual HIV infections; opportunistic diseases; AIDS-related illness and death; and the impact on households, communities and nations? In each of these, how does dependence on different resources (water versus medicinal plants versus firewood) change?

- What are the impacts of anthropogenic changes to environmental resources, such as deforestation, on human health, particularly in regions where HIV/AIDS is prevalent?
- What are the environmental implications, both positive and negative, of HIV/AIDS?
- What nutritional contributions can forest resources and other natural capital make to people suffering from HIV/AIDS?
- What other forest species can be utilized to meet the nutritional, health, or livelihood needs of people affected by HIV/AIDS?
- What local forest innovations (new or adapted technologies, changes in

gender roles, etc.) have emerged in regions affected by HIV/AIDS?

- What are the impacts of industrial forestry both in terms of the transmission of HIV, and with regards to the removal of forest biodiversity important to those living with HIV/AIDS?

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