

Non-Timber Forest Products in the Livelihood and Coping  
Strategies of Households and Communities Afflicted by  
HIV/AIDS

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# Non-Timber Forest Products in the Livelihood and Coping Strategies of Households and Communities Afflicted by HIV/AIDS

Marc Edwin Barany

## **Abstract**

This paper argues that natural resources, specifically non-timber forest products (i.e., medicinal plants, wild foods, artesinal materials, etc.) play an integral part in household and community responses to the biophysical and socio-economic impacts of HIV/AIDS in sub-Saharan Africa. Based on previous analyses of HIV/AIDS in sub-Saharan Africa, and analyses of non-timber forest products in the context of rural livelihoods, a theoretical framework for analysis of non-timber forest products in the context of HIV/AIDS is presented. Potential interactions between household/community responses to HIV/AIDS and natural resources are explored and their implications for multisectoral interventions are discussed.

## Acknowledgements

My mother, for her life-long living lesson of selfless compassion. My brothers, for the early teaching that life is not painless, scaling their own walls and leaving directions. My father, for his success and my education – a gift that only a few in this world are fortunate to have received. My dear friend Florian for his life, a gift beyond words, and his death, an absolute inspiration. Catherine, because with you, it all makes sense.

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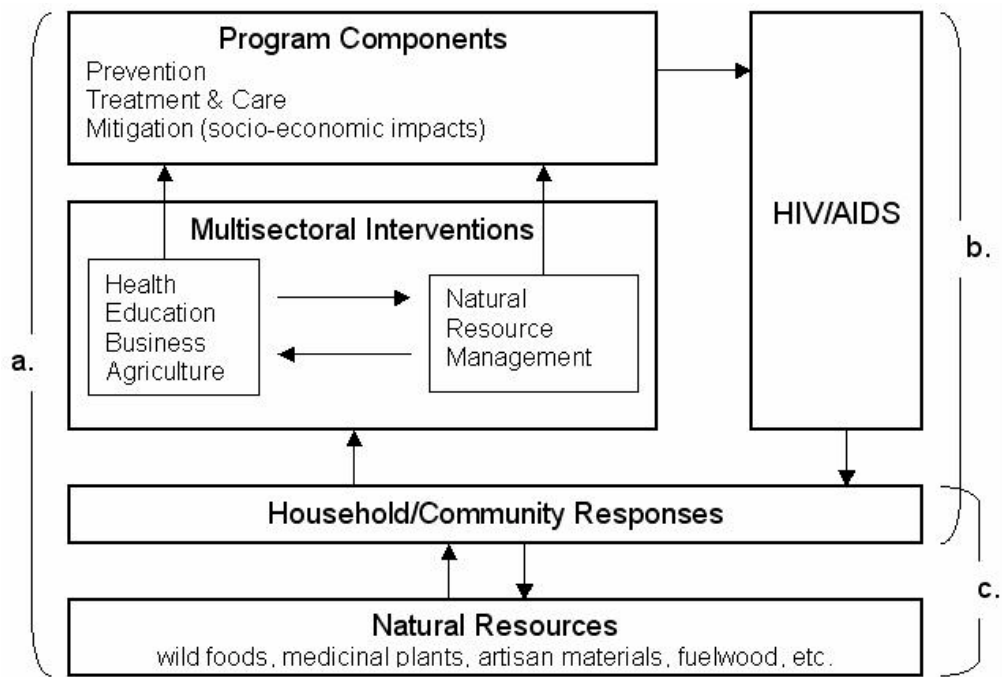
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**Figure 1.** Approach to the Integration of Natural Resources and Natural Resource Management in HIV/AIDS Programs

## Adult Percent Rate of People Living with HIV/AIDS in Africa, end 1999

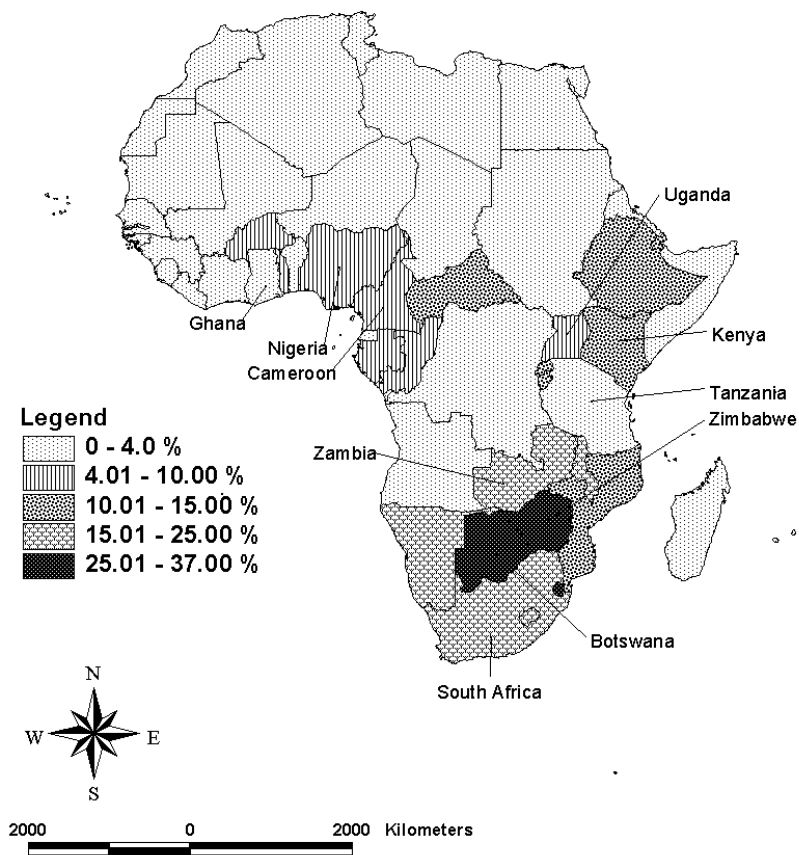


Figure 2a



# Forest Cover in Africa

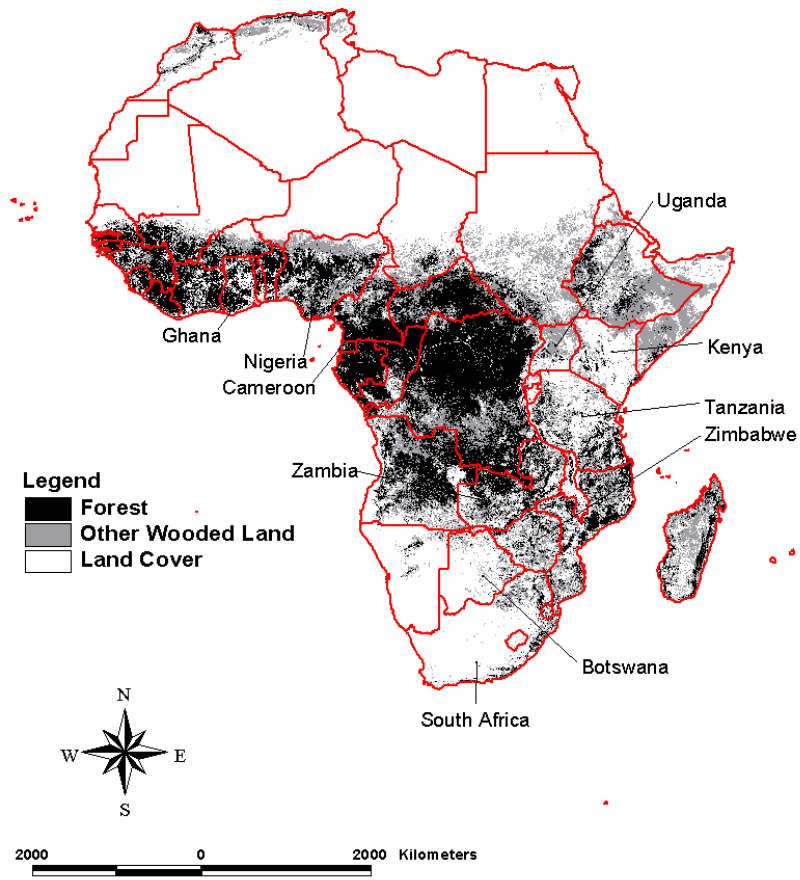
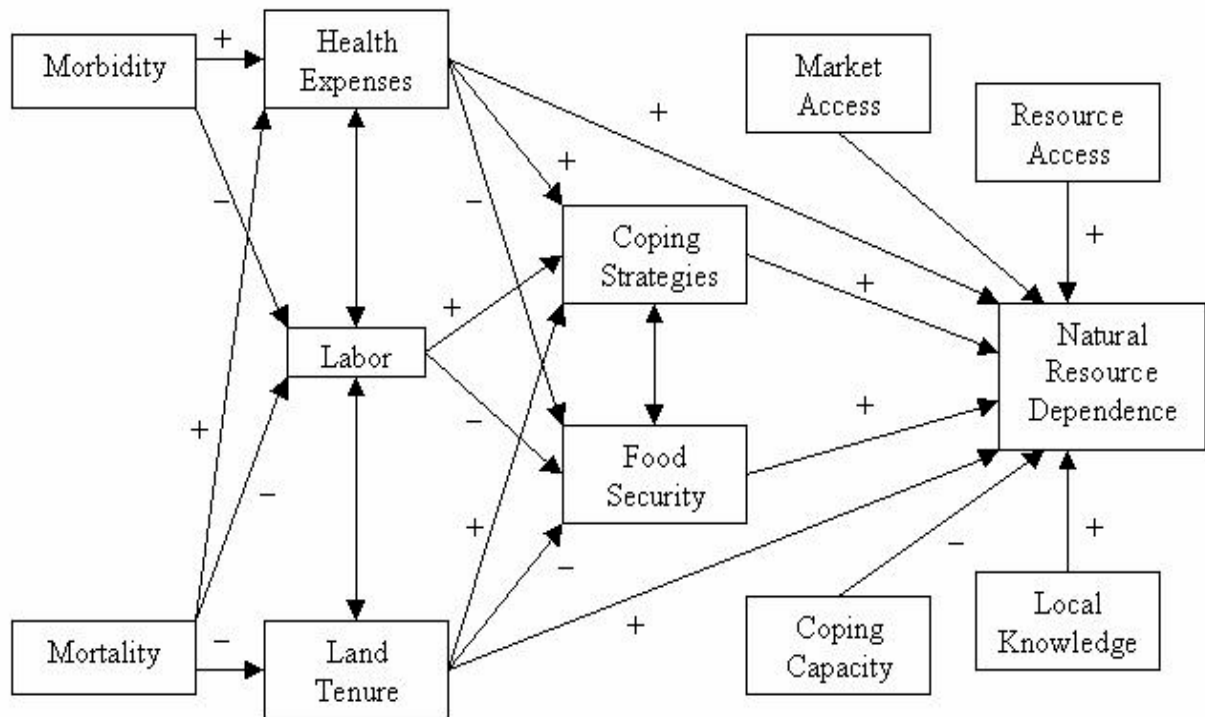


Figure 2b



**Figure 3.** Model of Natural Resource Dependence in HIV/AIDS-Afflicted Household

## CHAPTER 1

### INTRODUCTION

In sub-Saharan Africa, natural resources (i.e., forests, woodland savannas, coastal mangroves, etc.) serve as a safety-net for rural households coping with agricultural shortfalls, consistently provide income and food security for the rural poor, and supply medicinal plants on which traditional healthcare systems depend. Though it is established that HIV/AIDS constrains agricultural productivity, reduces household wealth and food security, and increases demand for healthcare; relationships between these impacts and natural resources have thus far been overlooked in the analysis of HIV/AIDS (FAO, 2003).

To the extent that households and communities afflicted by HIV/AIDS depend on natural resources, failure to understand these relationships limits the development of multisectoral interventions that build-on and support local responses to HIV/AIDS and the ability of the natural resource sector to plan and manage for the sustainability of these responses. The paucity of, and need for empirical evidence regarding the relationships between HIV/AIDS and natural resources has been a common consensus at recent government and non-governmental HIV/AIDS planning meetings (ABCG, 2002; USAID, 2002<sub>a</sub>, 2002<sub>b</sub>)

Addressing this need, the specific aim of this literature review was to design a research methodology to:

1. Determine if natural resource dependence in rural households afflicted by HIV/AIDS is different from that of un-afflicted households.

2. Model the mechanisms through which morbidity and mortality of household prime-age adults affects natural resource dependence.
3. Explore changes in natural resources used in local responses to HIV/AIDS.

The hypotheses underlying these objectives include:

1. Afflicted households depend on natural resources more than un-afflicted households.
2. The extent to which HIV/AIDS influences household dependence on natural resources is a function of HIV/AIDS staging, the concurrent socio-economic impacts of HIV/AIDS, the household's coping capacity (e.g., dependency ratio), access to natural resources, market access, and knowledge of natural resources.
3. Demand for certain medicinal plant species used in treating HIV/AIDS-related illnesses is associated with local species scarcity.

The overall goal of this paper, and the proposed research methodology, is to identify future research priorities and intervention opportunities that build-on and sustain local, natural resource-based responses to HIV/AIDS in sub-Saharan Africa. The theoretical framework guiding this research is represented in Figure 1. Identifying research priorities and opportunities to optimize multisectoral interventions that build-on and sustain local natural resource-based responses to HIV/AIDS (a), first requires an understanding of the relationships between household/community responses to HIV/AIDS and natural resources (b and c).

Chapters 2 – 5 explain and demonstrate the conceptual basis for this framework. In Chapter 2, the interactions between HIV/AIDS, rural livelihoods, and natural resources are summarized with brief discussion given to potential interventions to mitigate the

impacts of HIV/AIDS on rural households, as well as interventions to sustain the beneficial aspects of natural resource-based responses. Chapters 3, 4, and 5 are presented in the chronological order in which they were written and published. Chapter 3 reviews literature regarding the impact of HIV/AIDS on agricultural households and sets forth the rationale of increased dependence on natural resources to cope with HIV/AIDS-related food insecurity and poverty. In Chapter 4, the effect of HIV/AIDS on markets for products from natural resources is explored with an emphasis on opportunities for strengthening linkages between these markets and HIV/AIDS-afflicted households. Chapter 5 explores the potential nutritional contribution of foods originating from natural resources for people living with HIV/AIDS.

Chapters 6 - 8 propose a methodology to test the assumptions and theories set forth in the previous chapters. Chapter 6 describes a methodology to determine if households afflicted by HIV/AIDS rely more heavily on natural resources, and the factors that influence the extent to which morbidity and mortality lead to natural resource dependence. Chapter 7 describes a methodology to determine if demand for medicinal plants used in treating HIV/AIDS-related illnesses is associated with local scarcities, and the implications this has for natural resource management interventions. Chapter 8 presents measures to be taken to protect the human subjects in this research. The social stigma associated with HIV/AIDS in the region makes this component of the methodology particularly important. Finally, Chapter 9 concludes the concepts and methods set forth in the preceding chapters.

## CHAPTER 2

### BACKGROUND AND JUSTIFICATION

#### **2.1 Natural Resources in Rural Household Responses to HIV/AIDS and Implications for Multisectoral HIV/AIDS Interventions**

Several distinct features define natural resources as unique economic resources for rural households (Cavendish, 2000). First, they provide a wide array of products to meet numerous needs. Among these are wild foods for consumption, nonfood direct uses such as medicine, materials for handicrafts (e.g., grasses, reeds, and canes for baskets and mats), wood for energy, construction, and agricultural implements, and other products such as fodder for livestock feed and fertilizer. When originating from forests or other tree-systems (i.e., woodland savannas, agroforests, and even urban forests), these products are referred to as non-timber forest products (NTFPs). Second, these goods are derived from multiple types of ecological zones including areas around homesteads, woodlands, river and stream banks, wetlands, inter-tidal zones, etc. Third, the majority of these resources are characterized as common property tenure systems (i.e., having open access).

The erosion of productive assets and loss of agricultural productivity resulting from HIV/AIDS, suggests that afflicted households in rural sub-Saharan Africa increase their dependence on such natural resources as both a temporary coping strategy, and/or as a more permanent livelihood strategy (Barany et al., 2001). At the household level, HIV/AIDS morbidity and mortality increase the amount of time and money allocated to healthcare while reducing labor and productivity. Household responses to these impacts

include the reduction in the area of land cultivated, the reduction of farm inputs, and the sale of assets such as livestock and land (Baier, 1997; Barnett & Blaikie, 1992; Engh et al., 2000; UNAIDS, 1999). Such responses ultimately lead to food insecurity and deeper poverty (Egal & Valstar, 1999; Topouzis & Hemrich, 1996).

Food insecurity and poverty are both positively correlated with dependence on natural resources. Rural households often turn to natural resources in response to agricultural shortfalls and other contingencies (Campbell et al., 2002; Frankenberger, 1992; Loibooki et al. 2002; Pattanayak & Sills, 2001). For example, in northwest Tanzania, Loibooki et al. (2002) found that households responded to crop failure by hunting bushmeat for consumption and sale. In north central Tanzania, pastoralists responded to their eviction from grazing lands by entering the medicinal plant trade (Brockington 2001). Households fall back on such natural resource-based activities because these activities require minimal capital inputs. For the same reason, natural resource-based activities contribute more consistently to the livelihoods of the rural poor (Arnold, 2001; Cavendish, 2000; Reddy & Chakravarty, 1999; Shackleton et al., 2002). Consequently, women typically make up the majority of those involved in natural resource-based activities (FAO, 1989).

This hypothesized causality between the socio-economic impacts of HIV/AIDS and household dependence on natural resources is loosely supported by anecdotal evidence. For example, Barnett and Haslwimmer (1995) describe the participation of afflicted households in Uganda in reed-mat making and bark-cloth production. Menzel and D'Aluisio (1998) describe the reliance of a suspected AIDS orphan on the collection of woodland caterpillars in an effort to generate cash to care for her siblings. Afflicted

households have been observed substituting purchased food with wild vegetables (Mutangadura et al., 1999), and HIV/AIDS widows in Zimbabwe rely on production of baskets with fibers collected from local woodlands as their main source of income (Clark, 2003).

By determining if dependence on natural resources by households afflicted by HIV/AIDS differs from that of unafflicted households, and identifying the processes and factors through which HIV/AIDS does or does not influence household dependence on natural resources, the proposed research will inform the development of multisectoral HIV/AIDS interventions such as those to improve household nutrition and income.

Nutrition interventions are considered one of the most important components in the treatment and care for people living with HIV/AIDS (Haddad & Gillespie, 2001; USAID, 2001). However, afflicted households in sub-Saharan Africa find it difficult following nutritional guidelines which promote foods that are not available (Nnko et al., 2000). The nutritional contents of various species of wild fruits, vegetables, nuts, insects and animals commonly gathered from natural resources in sub-Saharan Africa compare favorably to those of conventional foods recommended to improve the well-being of people living with HIV/AIDS (PLWHA) and are high in specific nutrients of particular importance to PLWHA (Barany et al., Forthcoming). If HIV/AIDS increases dependence on natural resources for food, then the development of nutritional guidelines for afflicted households in sub-Saharan Africa can benefit by integrated efforts (of the health and natural resource management sectors) to identify locally available and nutritionally valuable foods.



Interventions that improve household economic access to food and healthcare are also important components of HIV/AIDS programs in Africa (USAID, 2002<sub>b</sub>). Interventions including the development of marketing skills, small-scale enterprises, and micro-finance schemes all require linkages to adequate markets. Markets for certain natural resource products that are affordable substitutes for manufactured goods (e.g., medicinal plants) are likely to expand in relation to the epidemic, providing commercial opportunities for those entering into natural resource-based income-generating activities (Barany et al., 2003). Determining if afflicted households increase dependence on natural resources for income is the first step in linking the activities of these households to markets through market-oriented interventions.

## **2.2 HIV/AIDS Treatment and Medicinal Plant Resources**

Sub-Saharan Africa has the fastest rate of deforestation in the world (FAO, 2001). Those natural resources remaining accessible to the public are vulnerable to “the tragedy of the commons” – the degradation of open access natural resources resulting from rates of utilization in excess of the resource’s capacity to regenerate. Additionally, formal and informal natural resource management and conservation institutions are losing staff and finances to HIV/AIDS (Dwasi, 2002). Because the long-term viability of natural resource-based household/community responses to HIV/AIDS ultimately depends on the carrying capacity of the resource base, our effort to identify research priorities and opportunities to optimize multisectoral interventions that build-on and sustain local responses to HIV/AIDS would be incomplete without exploring changes in those resources depended upon to cope with HIV/AIDS.

While the role of natural resources in household responses to HIV/AIDS has yet to be explored, dependence on traditional medicine and medicinal plants is a known natural resource-based community-level response to HIV/AIDS (Good, 1989, 1996). Since the World Health Organization first advocated the inclusion of traditional health systems in the treatment and care of PLWHA in 1990, national ministries of health and non-governmental organizations (NGOs) continue to form collaborative arrangements with traditional health sectors relying on medicinal plants for the treatment of HIV/AIDS-related infections and conditions such as herpes zoster, thrush, diarrhea, and appetite loss (Bodeker et al. 2000; King, 2000). The United Nations Program on HIV/AIDS (UNAIDS) recently designated several of these NGOs, as “Best Practices” - advocating the replication and scaling-up of programs involving medicinal plants in the treatment of PLWHA (UNAIDS 2002).

Reliance on medicinal plants as a response to HIV/AIDS treatment and care is primarily a function of economic and physical accessibility. However, where demand for medicinal plants exceeds local supply, over-harvesting can lead to poorer quality and higher prices for medicinal plants, undermining this accessibility (Mander, 1998). In extreme instances, species scarcity has pushed the price of certain medicinal plants higher than their manufactured substitutes (e.g., *Walburgia salutaris*) (Cunningham, 1997), and substitution with less effective species can occur. Traditional healers at the 13th International AIDS Conference in Durban, South Africa (2000) indicated that the natural stocks of medicinal plants used in their treatment of HIV/AIDS-related illnesses are declining.

Exploratory analysis of the demand for specific medicinal plant species used in treating HIV/AIDS-related illnesses in relation to the natural resources from which these plants are harvested will determine the need for, and types of natural resource management interventions to help ensure the sustainability of local responses to HIV/AIDS. For example, the domestication of wild plant species in farming systems requires substantial investment in research and development (Tchoundjeu et al. 2002). Assuming domestication that maintains a species medical efficacy is possible, the high input costs associated with medicinal plant cultivation has proven uncompetitive when a supply shortfall in one geographic area is compensated by an increase of harvesting in another (Cunningham, 1997). Details regarding change in medicinal plant populations, shifts in harvesting areas, policies governing these areas, and those involved in harvesting will help inform the feasibility of alternative interventions such as better management of wild resources and the improvement of harvesting methods.

## CHAPTER 3

### NON-TIMBER FOREST BENEFITS AND HIV/AIDS

#### IN SUB-SAHARAN AFRICA<sup>1</sup>

### 3.1 Introduction

Non-timber products from forests and other tree systems continue to constitute an important component of household health and nutrition in Africa - a continent with a forest cover of 21 percent (Figure 2) (Hoskins 1990; Sene 2000; FAO 2001b). Though undervalued by planners and policy makers (Katerere 1998), forests and trees provide food, fiber, fodder, fuel, and medicinal products (Nair 1990). Neglecting to adequately recognize these non-timber values of forests, forest policy - or the lack thereof, often denies the socio-economic benefits of forests to those who are dependent upon them (Deweese 2000).

Africa's forests are being converted at a rate of nearly 1 percent annually – the highest of any region in the world (FAO 2001b). According to African forestry specialists, marginalization of forestry within policies external to the sector, such as agriculture, is one of the major constraints to sustainable forest management (FAO 1996; Mlay et al. 2000). Mainstreaming forest policy in socially sustainable national development programming will require further efforts to quantify the non-timber services rendered to society at large, as well as recognition of these values by both foresters and planners outside of the forest sector (such as agriculture and health). This paper examines the current HIV/AIDS pandemic in Sub-Saharan Africa (SSA) and the potential

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<sup>1</sup> Adapted from Barany, M., A.L. Hammett, A. Sene, and B. Amichev. 2001. Non-timber Forest Benefits and HIV/AIDS in Sub-Saharan Africa. *Journal of Forestry* 99(12): 36-41.

nutritional and health values offered to households by forests and trees. Though forestry has been neglected in research concerned with the socio-economic effects of the pandemic, there clearly is a need to examine the disease's implications on forestry, and the potential role of forestry (within the context of a multi-sector strategy) to address the HIV/AIDS crisis in SSA.

### **3.2 HIV/AIDS and Agriculture**

Already plagued by a history of food insecurity, per capita agricultural productivity across SSA is decreasing further with the rise of HIV/AIDS (Eponou 1996; Sayagues 1999; UNAIDS 1999; FAO 2001c). This HIV/AIDS induced reduction of agricultural production could be devastating to SSA. In Zimbabwe, the output of communal agriculture has fallen by 50 percent over the past five years, largely because of AIDS (UNAIDS 1999). Not only does this epidemic threaten rural populations directly dependent on agricultural harvests for survival, but a recent study shows that Kenya's commercial agriculture sector is particularly susceptible to the epidemic, suggesting a severe social and economic crisis (Rugalema 1999). Kenya's commercial agriculture sector accounts for nearly 30 percent of the national GDP (Versi 1995).

A major workforce reduction is at the root of this agricultural demise. By 2020, 17 percent of Kenya's agricultural labor force could be lost due to AIDS (FAO 2001a). Most susceptible to AIDS mortality are adults between the ages of 15 and 50, the age group that typically makes up the bulk of a state's labor force. In Botswana, the estimated adult infection rate is 36 percent (*figure 1*) (UNAIDS 2000). Compounding the epidemic's induced toll on the agricultural workforce is the occurrence of higher

infection rates for women (which account for 70 percent of SSA's agricultural labor force) and their traditional role as caretaker (Davison 1988; Baier 1997). A study in Tanzania shows that a woman with a sick husband spends 60 percent less time on agricultural activities than she normally would (UNAIDS 1999).

### **3.3 HIV/AIDS, Food Insecurity and Forests**

Farming households affected by HIV/AIDS-induced labor shortages have been observed to utilize various coping strategies (Baier 1997; FAO 1998; Engh, Stloukal, and Guerny 2000). Made in desperation, these coping strategies ultimately lead to decreases in crop yields and buying power, exacerbating the effects of poverty (Egal and Valstar 1999). Contributing to this downward spiral of poverty and disease are the increasingly high costs of household health care, which can represent 25 to 50 percent of the net annual income of most small-scale farms (UNAIDS 1999). As drugs remain too costly despite price reductions (Farah 2001), and recent market orientation of health care systems is limiting access to medical treatment (World Bank 1999; Gray and Smit 2000; Loewenson 2000), home-based care of AIDS victims is increasing (Nnko et al. 2000). In the case of home-based care, household food security and nutrition is important (FAO 2001c). Individuals infected by HIV need to consume more food as their bodies require more nutrients. In Uganda, food insecurity and malnutrition are the most critical concerns among female-headed AIDS affected households (Topouzis and Hemrich 1996).

Rural household labor shortages, and the resulting reduction in agricultural production, suggest potential increases in utilization of forests and tree systems as they have traditionally contributed to nutrition and health at relatively low labor inputs.

Historically, there is evidence suggesting that past epidemics have influenced such a shift from agrarian societies to forest dependent societies (Balee 1992). Reversion to wild, uncultivated resources in SSA has been documented more recently by a United Nations AIDS Institution (UNAIDS) study in Zambia that found households to be substituting purchased food with indigenous or wild vegetables (UNAIDS 1999). The following discussion will explain how the non-timber values of forests can address both the socio-economic crisis associated with HIV/AIDS induced reductions in agricultural production, and the more fundamental need for improvements in afflicted household nutrition and health.

### **3.4 NTFPs, Nutrition and Health**

Wild supplies of food make up much more of subsistence population's dietary value than is often realized (Hoskins 1990). There are approximately 1,500 species of wild plants collected for consumption in Central and West Africa (Chege 1994). In parts of Africa, diets based on staple grains depend largely on tree products to provide essential vitamins. For instance, many trees produce oil seeds, edible leaves, and fruits rich in important vitamins and nutritional elements (Hoskins 1990; Ogden 1990). Other nutrition values are obtained from forest and trees. After the oil palm, the shea-butter tree (*Butyrospermum paradoxm*) is the main source of fat in Africa (FAO 1995). In some areas, wild game from forests provides most of the protein eaten by rural populations (Butynski and Richter 1974; FAO 1995; Bennett and Robinson 2000). In the context of the current epidemic, dietary supplementation with forest and tree products may play an important role in community nutrition considering the growing evidence that malnutrition

(specifically depleted micronutrient status) is a major underlying cause for the rapid progression to AIDS in Africa's HIV infected individuals (Enwonwu and Warren 2001).

Perhaps one of the most important NTFPs necessary to household nutrition and health is fuelwood. In some regions of Africa, fuelwood comprises between 61 to 86% of the primary energy consumption, with 74 to 97% of this consumed by households (Amous 2000). The availability of fuel often determines the nutritional value of meals (Egal et al. 2000). Fuelwood is essential if food supplies are to be converted into adequate diets as it provides most of the energy for cooking, which releases nutrients in grains and fibrous foods. For example, cassava (*Manihot esculenta*), a staple root crop of many people in the developing world, requires processing, often by fire, to remove toxic levels of cyanide in the pre-processed root. It is presumed that access to this NTFP can be directly related to household food cooking time, frequency of parasitic diseases, and the workload of women amongst some communities (Anonymous 1990).

In SSA, health care is largely a forest-based service (Chege 1994). Forests and trees are valued by agrarian communities for their supply of medicinal NTFPs (Hoskins 1990). Plant-based remedies in various SSA countries are more frequently being used for the treatment of HIV/AIDS-related illnesses (Bodeker et al. 2000). In Tanzania, the Tanga AIDS Working Group (TAWG) is treating AIDS patients with herbs prescribed by traditional healers (Hayman 2001). At the Mefopla Centre in Cameroon, efforts to boost the immune system of AIDS patients involve indigenous medicinal plants with enzyme rich food including cultivated tree nuts and wild fruits (Kinyuy 2001). Not only do forest and tree products directly contribute to nutrition and health, but they also contribute to the accessibility of food and health care by increasing household purchasing power.



Non-timber forest products (NTFPs) are commonly offered for sale and provide employment. In Ghana, a study of seven villages found household incomes derived from NTFPs range between 49 and 87 percent; while in Cameroon, extractive activities around one forest contribute to over half of local incomes (Chege 1994). Markets for NTFPs are growing as large urban centers and scarce forest resources create demands for high value NTFPs. In West Africa, the roots of *Swartzia madagascar* are traded distances over 500 Kms (Cunningham 1993). The understory plants belonging to the genus *Gnetum* are exported from Central Africa to Europe (Mialoundama 1993).

Even when the amount of income generated by the sale of fruit, fuelwood, etc, may not be that large, it can play an important role in household expenses (Scherr 1995). Caterpillars that feed on the leaves of the mopane tree (*Colophospermum mopane*) are a cash crop in southern Africa. One report documents the reliance of an AIDS orphan on this economic activity in an effort to care for her siblings (Menzel and D'Aluisio 1998). Over-extraction of the caterpillar is threatening the sustainability of this activity so there are current efforts to establish mopane farming. Both the direct and indirect values of NTFPs to nutrition and health justify their incorporation into cultivation systems. In the following section, agroforestry is discussed as an appropriate means to exploit these values.

### **3.5 Agroforests: Low-Input Production Systems**

Considering the household labor shortages associated with HIV/AIDS and the benefits of NTFPs to rural households, agroforestry appears to be an appropriate, long-term response to the epidemics negative effects on traditional agriculture production and household food security. Trees can support food production by reducing the risk of

annual crop failure, compensating for seasonal scarcities, and by providing emergency food supply during droughts (Hoskins 1990). Tree crops are not costly to establish/manage compared to many high value agricultural crops (Warner 1995), and for the small, non-mechanized farmer, incorporating multi-use trees into their crop field can save time and resources (Hamilton and Bliss 1998).

Where labor is scarce, and a minimum management system is required, tree crops can become the farmer's primary preference (Arnold 1990), as they require less labor to cultivate, allow household labor to engage in other activities (Deweese and Saxena 1995), and provide the opportunity for households to spread harvesting labor more evenly throughout the year (Nair 1990). According to Hoekstra (1987) agroforestry can reduce the costs of labor by:

- maximizing the productivity of biological systems;
- improving the efficiency of labor through positive interaction of trees and the human component (shading);
- allowing for the combination of activities such as grazing and fuelwood collection.

A study in Nigeria shows that when labor is the household's major farm input, returns to labor in agroforestry systems are four to eight times as much as those in monocropped fields (Arnold, 1990). This inverse relationship between labor scarcity and tree systems is supported by the natural regeneration of forest resources where labor is in short supply.

As HIV/AIDS impacted households reduce cultivated land areas, it has been observed that more remote fields tend to be left fallow and revert to bush (Guerny 1999). A study of a heavily HIV/AIDS impacted community in Uganda revealed that, in most

cases, farmers abandoned about one-third of their land to bush (Barnett and Haslwimmer 1995). Another study from Tanzania reported that large farms inherited by young orphans were rapidly degenerating into bush because of the lack of care. Traditionally, the community would manage such farms, but traditional community organizations are breaking down due to the shortage of labor (UNAIDS 1999).

Bush-fallow systems have historically been utilized in parts of SSA to improve soil and produce NTFPs such as poles, firewood, and animal feed. Hence, the current reversion of agricultural land to bush does not represent a complete loss of productivity (as suggested in the literature), yet it is an opportunity for land-use and household productivity diversification. For example, there are thirteen fodder tree species and seven species known to bear wild edible fruits in *Zambian Acacia* fallow (Chidumayo 1988). This increasing occurrence of bush-fallow succession suggests new utility in research concerning the formulation/recovery of fallow strategies that meet the needs of HIV/AIDS affected households. In the next section we will discuss forestry research themes relevant to the new socio-economic conditions (created by the epidemic) that are altering household strategies of resource use.

### **3.6 Forestry Research**

The forestry sector has been almost completely excluded from assessments of HIV/AIDS impacts in SSA despite the aforementioned socio-economic conditions that would suggest the appropriate utility of forests. Though there is scant literature or research concerned with HIV/AIDS and forestry, there are reports that concretely confirm this proposed utility. One example is the AIDS orphan who earns money collecting

mopane caterpillars. Another example was found in a recent report of an AIDS orphan in Zambia who collects fuelwood for a local charcoal industry (Anonymous 2001). On a broader scale of forest utility is the increasing pressure on wild stocks of plants used in traditional medicine (Cunningham 1997; Bodeker 2000), which emphasizes the need to address the sustainability of such forest utility. The lack of, and inconclusiveness of literature and observations supports the need to understand the current and potential role of forestry in mitigating the socioeconomic effects of the epidemic. Information generated from the following research themes is necessary to ensure holistic planning and policy in regards to the multisectoral response to HIV/AIDS.

### *3.6.1 Management of forest resources*

NTFPs predominantly come from existing common property forests and woodlands (FAO 1993). The supply of, and demand upon NTFPs within various forest resources need to be addressed. Where supplies are abundant but markets are strong, over-utilization of resources may be occurring. Currently there is a plant associated with the treatment of HIV/AIDS, which is being harvested rapidly due to its utility to local people and markets in South Africa (Cliff and Dlamini 1999). Another important contributing factor is the declining availability of forest foods as increasing populations, severe forest degradation, and privatization/regulation of formerly common lands reduce the accessibility of remaining forest resources by dependent populations.

### *3.6.2 Agroforestry and the domestication of forest products*

Pressures on indigenous plant resources due to population growth and deforestation has historically led to the domestication of many of these indigenous forest

plants and incorporating them into agricultural systems primarily for the benefit of small scale farmers (Leakey and Izac 1996). Through domestication, many NTFPs can be improved to be more attractive to farmers and more marketable. According to agricultural development theory, farmers adopt new practices when there arise clear economic incentives to do so. Information on the relationship between design and management factors, tree growth, and crop competition, would help farmers improve choices of tree selection of marketable species (Scherr 1995).

### *3.6.3. Marketing of NTFPs*

With the decline in the ability of household labor to generate the necessary yields from agricultural production, there is a need for programs that help improve and diversify the income of affected houses. Urbanizing populations and shrinking resources have lead to a strong trade in NTFPs. In many countries, small-scale forest-based enterprises are among the top employers of rural resource-poor and landless people (Nair 1990). In HIV/AIDS affected households, the loss of the head(s) of the household and their marketing skills has meant that many families have to rely on selling their produce to unscrupulous middlemen. Even for those households able to produce a surplus, marketing remains a major bottleneck especially when a person dies along with the skills of marketing.

### *3.6.4 Women's access to forest resources*

With heavily constrained labor pools, and the bulk of household workloads traditionally being carried out by women, there is a need to alleviate women's work burden. This is especially important in the case of HIV/AIDS where women are much

more likely to become the caretaker of an infected individual (Nnko et al. 2000). Reduction of women's work burden can occur through labor saving efforts such as improving access to fuelwood (UNAIDS 1999). In SSA, access to land by women who have been left widowed can be automatically constrained by traditional tenure arrangements (FAO 2001c; Page 2001). If more time is necessary to collect forest resources (fuelwood) there is less time for food production, childcare, and income generation (Ogden 1990). Understanding how to improve forest resource access for women can make available more labor necessary for the household's survival.

### *3.6.5 Intellectual property rights*

Indigenous knowledge of trees and forests is an important resource, and is being actively investigated for botanical remedies of diseases such as AIDS (Nair 1990; FAO 1993). Recent efforts to bring together indigenous knowledge of medicinal plants with medical research and development institutions have been made. The International Conference on Traditional Medicine on HIV/AIDS and Malaria in Abuja, Nigeria focused on the traditional treatment of HIV/AIDS, providing guidelines for the biochemical evaluation and standardization of traditional medicinal products (Anonymous 2000). The World Bank Indigenous Knowledge for Development Program, US National Institutes of Health, and representatives of African traditional healers have agreed to collaborate on the validation of herbal treatments of HIV/AIDS related opportunistic infections (World Bank 2001). These efforts to promote the traditional medicine practices in SSA suggest an increasing pressure on medicinal resources, creating questions of management and rights to these resources.

### 3.6.6. *Traditional knowledge continuation*

While NTFP importance is likely to increase, the tremendous knowledge base of NTFP use is threatened as HIV/AIDS is creating a large population of children who are growing up without parents. In SSA, there are 12.1 million HIV/AIDS orphans (*table 1*), which is almost 92 percent of the global total (UNAIDS 2000). Traditionally, rural children learn many of their farming skills through working together with their parents (du Guerny 1998), and a study in Kenya shows that only 7 percent of agricultural households headed by orphans had adequate knowledge of agricultural production (FAO 2001a). When traditional information systems break down due to the illness or death of the parent, there does not appear to be replacement mechanisms for the child who remains. It is not only the person that dies, but the knowledge and skills of that individual.

## 3.7 Conclusions

HIV/AIDS differs from epidemics common to Africa such as famine. It produces long-term shockwaves that change the agro-ecological landscape (Rugalema 1999). The socio-economic effects of HIV/AIDS on agrarian households suggest that natural forests and agroforestry systems are, or can play an important role in rural household coping strategies. The effectiveness of household coping strategies depends on wider societal structures such as policy. Though appropriate forest policy requires a comprehensive research foundation, there appears to be little, or no effort made to understand the role of forestry in mitigating the dilemmas of HIV/AIDS affected households to date. This gap in the HIV/AIDS literature neglects the traditionally strong dependence of local peoples on

forest resources for health and nutrition, and the compatibility of agroforestry systems to the productive challenges associated with low household labor supplies.

Acknowledging this potential role for forestry should open the door to rapid assessments of perception, use, and management of NTFPs amongst affected communities. There are documented cases where forestry and tree planting were becoming less desirable in AIDS-affected communities due to the perceived high risk of labor investments in forestry activities that lack short-term benefits. Due to this commonly perceived risk there is a particular need to focus on research implications that can lead to immediate pay-offs such as marketing support, access to forest resources, and tenure systems. However, long term strategies, such as fallow improvement techniques, domestication of medicinal or marketable NTFPs, and appropriate agroforestry system design, are justified by the nature of the HIV/AIDS epidemic, which will have long term impacts on affected communities.

Prioritization of these research themes by governments, nongovernmental organizations, and international forestry institutions is the first step toward a scientific basis for the integration of forest policy with non-forestry sectors such as agriculture, health, and education. Strengthening linkages between these sectors, such as medicinal plant resources and primary health care systems, may stimulate local forest-based economies and minimize the high costs associated with expensive drug treatments. The cost of treatment of AIDS and related infections is expected to exceed 60 percent of government health expenditures in Zimbabwe by 2005 (FAO 2001c). Capacity building for a cost-effective multisectoral strategy will require a new dialogue amongst professionals from multiple disciplines. Reality of such capacity building is slighted by



the magnitude of the epidemic, which has left many development institutions physically unable to achieve their intended outputs.

While the implications of forestry research and planning for HIV/AIDS affected societies can lead to long-term benefits, the time with which appropriate strategies can be developed is severely limited by the epidemics toll on Sub-Saharan Africa's human resources, whose collective knowledge is threatened by the large mortality rates within age brackets traditionally responsible for the continuation of information. Non-traditional mechanisms for information dissemination, such as extension services, are not an exception from the high mortality rates of this epidemic. Clearly, we feel that there is an immediate need for a coordinated effort to understand and include forestry in the response to HIV/AIDS in Sub-Saharan Africa.

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**CHAPTER 4**

**POTENTIAL INCOME GENERATING OPPORTUNITIES FOR  
SMALLHOLDERS AFFECTED BY HIV/AIDS: LINKING AGRO-  
ECOLOGICAL CHANGE AND NON-TIMBER FOREST PRODUCT MARKETS<sup>2</sup>**

#### **4.1 Introduction**

Because current HIV/AIDS affected household strategies are little more than palliative responses to the larger issues of the declining sustainability of the household's livelihood (Rugalema, 2000), there is a need for mitigation, or, the creation of policies and strategies that build on the capacities of affected households to facilitate a sustained rehabilitation process. Key components of mitigation efforts are policies and strategies that improve and diversify income-generating activities for affected households (Michiels, 2001; Mutangadura et al., 1999). If households cannot meet food needs from their farms, there is a need to develop means through which households can improve their economic access to food. The suitability of income-generating activities to household capacities will depend upon the local social, economic, and agro-ecological context within which affected households struggle to survive.

Rural household labor shortages, and the resulting reduction in agricultural production, suggest potential increases in utilization of forests and trees within agro-ecosystems (Barany et al., 2001). At the same time, in some areas, demand for non-timber forest products (NTFPs) is increasing with the growing HIV/AIDS epidemic

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<sup>2</sup> Adapted from Barany, M.E., A.L. Hammett, R.R.B. Leakey, and K. Moore. 2003. Income generating opportunities for smallholders affected by HIV/AIDS: Linking agro-ecological change and non-timber forest product markets. *Journal of Management Studies* 39(4): 26-39.

(Dwasi, 2002; Mander, 1998). Linking demand for these products to the production capacities of households affected by HIV/AIDS may provide viable new opportunities for income generation and reduce increasing social costs associated with the rising prices for some products. Using NTFP enterprises as an example, this paper illustrates the role of multisectoral interventions in creating policies and strategies in support of alternative income generating activities based on household-level capacities.

## **4.2 Non-Timber Forest Products in the Responses of HIV/AIDS Affected**

### **Smallholders**

In sub-Saharan Africa, the majority of rural households are smallholders (Koopman, 1993). Smallholders are rural cultivators of relatively small permanent farms in areas of dense population, in which the household is the major economic unit, producing much of its own subsistence while also participating in the market (Netting, 1993). Because smallholders do not usually rely on farm income alone, but engage in various subsistence and commercial activities, Smallholders affected by HIV/AIDS have been observed to compensate for the loss of agricultural productivity with non-agricultural activities (Barnett & Haslwimmer, 1995; Muchunguzi, 1999). These activities may include the collection, processing, and trading of NTFPs.

NTFPs include all materials of biological origin other than timber originating from forests. In this context, forests represent “all resources that can produce forest products. These can comprise woodland, scrubland, bush fallow and farm bush, and trees on farm, as well as forests” (Arnold, 1998 as cited in Warner 2001). NTFPs provide energy, construction materials, food, fodder, medicine, and materials for handicrafts.

Though there has been little research explicitly exploring the relationship between the socio-agro-ecological impacts associated with HIV/AIDS and smallholder reliance on NTFPs, there are conceptual linkages in support of such a relationship. First, the HIV/AIDS-associated depletion of household assets and loss of agricultural productivity intensifies poverty. Resource-poor households usually derive greater utility from NTFP activities (Neumann & Hirsch, 2000; Warner, 2000). Second, HIV/AIDS disproportionately reduces access to land and financial resources for women (Chengu, 1999). Often it is poor women who are most reliant on NTFP extraction, sometimes, their only means of income (Falconer, 1992). Third, in HIV/AIDS affected households, both the elderly and young make an increasingly significant contribution to household food security (Guerny, 2002). Reliance on NTFPs varies amongst age groups with both the oldest and youngest generations pre-disposed to greater reliance. For example, many forest foods are considered to be “child’s food” (Moore & Vaughn, 1994). Elders are likely to have more knowledge of natural resources, have less concern for negative stigmas associated with their use, and be more accustomed to using them (FAO, 1995).

At the same time that these factors may be forcing households into increased dependence on NTFPs, there may be a temporary regeneration of this natural capital within agro-ecosystems. HIV/AIDS can lead to increases of fallow farmland (Barnett & Blaikie, 1992; Guerny, 1999). In sub-Saharan Africa, bush-fallow systems have historically been utilized for products such as poles, firewood, and animal feed. For example, thirteen fodder tree species and seven edible fruit species were identified in Zambian *Acacia* fallow (Chidumayo, 1988). Hence, the current reversion of agricultural

land to bush does not represent a complete loss of productivity, but a potential source of diverse NTFPs.

While minimal efforts have been made to explore the role of NTFPs in the responses of smallholders affected by HIV/AIDS, considerable anecdotal evidence is supportive of this relationship. For example, Barnett & Haslwimmer (1995) report that the activities of female-headed households affected by HIV/AIDS in Uganda included mat making and bark cloth production. Another report documents the reliance of an AIDS orphan on the collection of caterpillars that feed on the leaves of the mopane tree (*Colophospermum mopane*) in an effort to generate cash to care for her siblings (Menzel & D'Aluisio, 1998). There is a large market for these caterpillars throughout southern Africa. A smallholder HIV-positive widow writes:

...there were those [foods] that I can get for free of charge in the village even without growing because people are not aware of their nutrition value... avocados are easy to get from neighbors because traditionally adults do not eat avocados. Besides I have a single tree that gives me enough for my family. My children sell these and get some school items... (Katunzi, 1999).

These anecdotes demonstrate the potential roles of NTFP activities in the responses of smallholders affected by HIV/AIDS. To create opportunities for income-generating activities adapted to these strategies, it is necessary to understand which NTFPs have strong markets.

### **4.3 HIV/AIDS and Demand for Non-Timber Forest Products**

Some NTFP income generating activities are likely to have more potential than others. The epidemic may reduce the market for certain products. For example, in Malawi some micro-enterprise sales of fuelwood have decreased because of fewer customers due to the epidemic (ECI & NSO, 2001). HIV/AIDS may also decrease consumer demand as losses in agricultural production lower household purchasing power (Haddad & Gillespie, 2001). On the other hand, the same study from Malawi makes the point that, “while we normally assume that HIV/AIDS would have a negative impact on businesses, it is important to note that it also leads to some new business opportunities or increases in sales by other businesses” (ECI & NSO, 2001). Medicinal plants and nutritional foods are two types of NTFPs for which there may be new business opportunities.

While urbanization and international demand are often cited as the reason for growing NTFP markets, HIV/AIDS and associated illnesses appear to be increasing demand for these products. It is widely accepted that about 80% of people in Africa rely on traditional medicine for many of their health care needs (King, 2000). Because traditional medicine is often based on the use of indigenous plants, plant-based remedies are more frequently being used for the treatment of HIV/AIDS-related illnesses (Bodeker et al., 2000). In Tanzania, the Tanga AIDS Working Group (TAWG) is treating AIDS patients with herbs prescribed by traditional healers (Hayman, 2001). At the Mefopla Centre in Cameroon, efforts to boost the immune system of AIDS patients involve indigenous medicinal plants with enzyme rich food including cultivated tree nuts and wild fruits (Kinyuy, 2001). As modern pharmaceutical drugs remain too costly for the majority of people in under-developed countries and access to healthcare remains limited,

AIDS patients are often cared for at home (Nnko et al., 2000). Local medicines provide a basic ingredient in home-based care (King, 2000).

In the case of home-based care, nutrition is important for resistance to opportunistic infections associated with AIDS (FAO, 2001a). For example, vitamin A is critical in immunological functions (Beisel, 2002), and may reduce risk of HIV transmission from mother to child. However, vitamin A deficiency is one of the most common micronutrient deficiencies in sub-Saharan Africa and occurs in many HIV patients (Ogle et al 2000). As a result of such deficiencies (including, but not limited to vitamin A), improving nutrition is a component of both prevention and mitigation efforts. Calls for interventions include nutrition education and counseling to change dietary habits and to increase consumption of key foods and nutrients (Haddad and Gillespie 2001).

Though often not dietary staples, NTFPs can play an important supplementary role to household nutrition. For example, a single mango can provide the daily recommendation of vitamin A (Ogle et al., 2000). In Tanzania, Fleuret (1979) found high intakes of vitamin A from consumption of wild fruits and plants. While Barnett & Haslwimmer (1995) concluded that tree crops such as mangoes and avocados “receive little care from households” because it was not part of the normal diet, prejudices towards such foods as being “child’s food” or “backwards” may be changing in some areas. A market survey in some South African townships showed that the demand for traditional wild foods was very substantial and some considered such traditional foods to be superior stating that western foods make them weak (Taylor, 1996).

#### 4.4 Supporting Affected Smallholder - NTFP Market Linkages

Before the production capacities of smallholders affected by HIV/AIDS can be sustainably linked to these demands for medicinal and nutritional NTFPs, there are a number of issues that need to be addressed. First, products offering opportunities for income-generating activities need developed markets. Despite the fact that governments are looking to their traditional health systems and medicinal plants for treatment and therapy of AIDS victims (Bodeker, 1999), markets for medicinal plants remain underdeveloped. For example, Mander (1998) found that the medicinal market in KwaZulu-Natal was poorly developed because:

- most policy is designed to limit the marketing of indigenous medicinal plants;
- insignificant investment in education, training, research and extension regarding medicinal plant markets;
- inefficiency with markets due to underdeveloped market information systems
- inefficient coordination of trade activities; and
- limited sharing of knowledge between market players.

Even when markets are developed, consumer demand may not necessarily equate to income generating opportunities for the poor, as they are likely to find it more difficult to benefit from opportunities related to the increasing commercialization of forest products (Warner, 2001). De Jong et al. (2001) clearly summarizes the main reasons limiting the ability to sustain benefits from NTFP income generating activities:

1. resources are over-harvested;
2. benefits of commercialization are appropriated by more powerful stakeholders;

3. domestication and production may occur away from original collectors;
4. products may go out of fashion; and
5. the product can be manufactured.

The last two factors are considered to be less significant constraints to resource-poor smallholders, than the issues of resource sustainability, access, and ownership.

Urban consumers in South Africa indicated that they anticipated their consumption of indigenous medicine would either remain at current levels or increase as indigenous medicine is not an inferior good, and culturally it is preferred (Mander, 1998). More challenging to the development of sustainable NTFP income-generating activities for smallholders affected by HIV/AIDS are the issues of resource sustainability, access, and ownership. As we will see in the next section, these challenges are compounded by the impacts of HIV/AIDS.

#### **4.5 HIV/AIDS Challenges to the Development of Sustainable NTFP Income Generating Activities**

##### *4.5.1 Market development*

The epidemic's severe reduction of the middle-aged population is having a heavy impact on social institutions. Trader-farmer networks are one of the forms of social capital that HIV/AIDS undermines (Haddad & Gillespie, 2001). At the household level, marketing becomes a problem when a person dies along with the skills of marketing and social networks (Barnett & Haslwimmer, 1995). Personal relationships guaranteeing trust for commercial exchanges are lost. The new entrepreneurs consisting of young and



elderly people often lack information and marketing skills (Chengu, 1999). Information losses are especially limiting with the death of traders, considering the role they play in connecting the gap between farm and market. Information exchange between the trader and farmer is crucial to market development as it ensures the farmer that there will be a market and the trader knows that there is a stable supply of a quality product (Leakey & Izac, 1996).

#### *4.5.2 Natural resource management*

Social institutions, both formal and informal, are also crucial in the management of natural resources. Dwasi (2002) found that HIV/AIDS toll is depleting professionals and community leaders responsible for natural resource management. An agricultural extension office in one district in Uganda has experienced a 20-50% loss of work time due to HIV/AIDS related issues (Barnett & Haslwimmer, 1995). At the same time, incentives to manage communal resources are diminished as the future is highly discounted. Barnett & Haslwimmer (1995) note that the practice of planting *Ficus* sp. trees by HIV/AIDS affected households ceased due to their heavily discounted future associated with certain premature death. It is more likely that people will intensify their use of already existing forest and trees rather than invest in planting trees, which do not produce benefits in the short term. The breaking down of such institutions may disable the community to avoid over-harvesting of NTFPs and scenarios such as the appropriation of commercial benefits.

#### *4.5.3 Women's access to capital*

Understanding how to improve access to the benefits of commercial opportunities for women is especially important in the case of HIV/AIDS. Access to land by women who have been left widowed can be constrained by traditional land inheritance customs (FAO, 2001a). Reduction in the cultivation of land may not mean that the land is left fallow, instead it may be sold, or in some areas passed to the husband's brother (Muchunguzi, 1999). Haddad & Gillespie (2001) explain that, "if property rights and user rights for a whole range of assets are not clearly and equitably defined or are not enforced, women are likely to become less able to shape their own destiny." Women's access to credit and markets is also of concern. Chengu (1999) recommends institutions review and redefine the criteria for land allocation/settlement and ownership, to formulate appropriate land reform policies in response to the negative impact of HIV on land ownership, especially for women.

#### *4.5.4 Knowledge*

The commercial value of the knowledge base of NTFP is illustrated by recent efforts to bring together indigenous knowledge of medicinal plants with medical research and development institutions (World Bank, 2001). Traditionally, rural children learn many of their farming skills through working together with their parents (Guerny, 1998). A study in Kenya shows that only 7 percent of agricultural households headed by AIDS orphans had adequate knowledge of agricultural production (FAO, 2001b). Transfer of cultural norms and practices may also be affected. This is made clear in Barnett & Haslwimmers' (1995) description of a local NTFP industry where bark cloth making has become strictly the domain of older men. The authors cite two reasons why the industry

is shrinking despite growing prices for the bark cloth. First, young men are unwilling to plant Ficus trees, fearing that they might die before the trees mature, and youths prefer trading to bark cloth making. Their conclusion is that bark cloth making may be disappearing in the absence of a link between the older and younger generation.

#### **4.6 Conclusion**

The impacts of HIV/AIDS have serious implications for rural livelihood strategies. For smallholders, this often means the loss of agricultural productivity, which ultimately leads to food insecurity. Food security is a basic human right and without it, the biological and social conditions that facilitate the spread of the disease will persist. Economic access to food is possible through alternative income generating activities - a component of current government and non-government mitigation interventions. Appropriate income generating activities imply that business opportunities are suited to household production capacities. Understanding these capacities requires an understanding of current household responses. Understanding business opportunities requires an understanding of current markets. Depending on the ecological context, theory and anecdotal evidence suggest that responses of smallholders affected by HIV/AIDS may be relying upon forests and tree products. At the same time, HIV/AIDS is leading to increased demand for traditional medicine and associated forest and tree products. If, and where this is the case, there are a number of pre-requisites for sustainable forest and tree product enterprises.

As HIV/AIDS limits the social capacity of communities, achievement of these pre-requisites is severely challenged. These limits provide the objectives for strategies

and policies that facilitate household capacities to move from a situation of survival towards a rehabilitation process. In the case of NTFPs, intervention objectives might include support for:

- smallholder-trader networks;
- ecologically sustainable products that minimize the need for resource management;
- access to credit and resources particularly for women and orphans; and
- the transfer of, and rights to local knowledge.

These interventions coincide with the current strategies in:

- health - to engage traditional medicine;
- business - to develop micro-enterprises and lending schemes;
- agriculture – to increase access to land and credit; and

However, there remains little response from the natural resource management sector, a result of inadequate understanding of its role in household responses.

Recommended interventions to support income generating activities involving NTFPs fall under the current emphases of the international multisectoral response.

Considering this, implementation of the recommended interventions does not require a new framework. Given the limited funds, and the magnitude of the epidemic, efficiency is a primary concern of responses. Another concern is effectiveness. An effective and sustainable mitigation effort will require support for bottom-up processes. In the case of NTFPs, there remains a need for better understanding of these bottom-up responses.

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**CHAPTER 5**

**NON-TIMBER FOREST PRODUCTS IN THE FOOD SECURITY AND  
NUTRITION OF SMALLHOLDERS AFFLICTED BY HIV/AIDS IN SUB-  
SAHARAN AFRICA<sup>3</sup>**

**5.1 Introduction**

For people living with HIV/AIDS (PLWHA), adequate nutrition is necessary to: maintain body weight and energy, replenish depleted micronutrients, enhance the immune system, slow the progression of HIV infection to the development of AIDS, improve the effectiveness of antiretroviral therapy, and reduce vertical transmission of HIV (Baum & Shor-Posner, 1998; Beisel, 2002; Enwonwu & Warren, 2001; FAO, 2002). Thus, in sub-Saharan Africa, where nutrient deficiencies are common and access to healthcare is limited, early and adequate nutrition interventions (e.g., education, counseling, etc.) are considered one of the most important interventions for PLWHA (Haddad & Gillespie, 2001). However, patients and caregivers find it difficult promoting, providing, and obtaining foods that are not readily available for many HIV/AIDS-afflicted households (Nnko et al., 2000).

The socio-economic impacts of HIV/AIDS often lead to household food insecurity (Egal & Valstar, 1999). Morbidity and mortality increase the amount of time and money allocated to healthcare while reducing household labor and productive capacity (UNAIDS, 1999). Rural households afflicted by HIV/AIDS cope with these

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<sup>3</sup> Adapted from Barany, M.E., A.L. Hammett and K. Stadler. (Forthcoming). Non-timber forest products in the food security and nutrition of smallholder households afflicted by HIV/AIDS in sub-Saharan Africa. *Forests, Trees and Livelihoods*.

socio-economic impacts by reducing the area of land they cultivate, reducing farm inputs, and selling assets such as livestock and land (Baier, 1997; Engh et al., 2000). Illustrating the affects of such responses, a study in Uganda found that food insecurity and malnutrition, not access to healthcare, are the most critical concerns among female-headed households afflicted by HIV/AIDS (Topouzis & Hemrich, 1996).

Given the adverse impacts of HIV/AIDS on household food security, effective nutrition interventions need to account for the adaptation of household food strategies (Chengu, 1999). Edible non-timber forest products (NTFPs) gathered from forests, woodland savannas, trees within agricultural systems, and other common pool resources may play a significant role in such strategies. In a study of 150 rural households in Northern Province and KwaZulu-Natal, South Africa, Shackleton et al. (2002) reported the following types of food and proportions of households consuming them: wild herbs (97.3%), wild fruits (82.7%), insects (67.8%), mushrooms (40.8%), wild animals (28.5%), and bird eggs (13.3%). Such foods may be consumed frequently and in significant quantities. In a village in central Côte d'Ivoire Herzog et al. (1994) reported that gathered fruits account for about half of the fruits eaten over the whole year. In the southern provinces of Boulgou and Nahouri, Burkina Faso, wild plants comprise 21% of the total diet (Smith, Clegg, Keen, & Grivetti, 1996).

The erosion of assets and agricultural productivity resulting from HIV/AIDS suggests that afflicted households increase their dependence on NTFPs as both a temporary coping strategy, and/or as a more permanent livelihood strategy (Barany et al., 2001). Rural households often turn to natural resources in response to agricultural shortfalls and other contingencies (Campbell et al., 2002; Pattanayak & Sills, 2001).

Natural resource-based activities also tend to contribute more consistently to the livelihoods of the rural poor because these activities require minimal capital inputs and households can enter and exit such activities at little cost (Arnold, 2001; Cavendish, 2000; Reddy & Chakravarty, 1999).

Though empirical investigation has yet to yield conclusive evidence, anecdotal evidence supports the hypothesis that the socio-economic impacts of HIV/AIDS leads to greater household dependence on natural resources for food security. For example, afflicted households have been observed substituting purchased food with wild vegetables (Mutangadura et al., 1999). Where rural households afflicted by HIV/AIDS respond to the disease's socio-economic impacts by relying upon edible NTFPs, to what extent can such food strategies realistically contribute to the nutritional needs of PLWHA? What multisectoral efforts can be taken towards the development of nutrition interventions appropriately adapted to these strategies?

## **5.2 Methods**

The first step in answering these questions was the identification of micronutrients whose deficiencies are associated with HIV/AIDS and/or which play an important role in immune system functioning. These include vitamins A, C, E, certain B group vitamins, selenium, zinc, and iron (Baum & Shor-Posner, 1998; FAO, 2002). Important in meeting the immune system's energy requirements, the macronutrients protein and fat were also included in this analysis. Carbohydrates were excluded because most African diets are carbohydrate-based (i.e., maize, cassava, rice and other cereals).

Second, a review of references regarding the nutritional composition of NTFPs and other wild foods commonly consumed in various regions of sub-Saharan Africa was conducted. Those foods having significant amounts of the nutrients important in the nutrition of PLWHA were short-listed and their nutritional content was compared to the nutritional content of conventional foods, and where possible, expressed as a percentage of recommended daily nutrient intake (RNI) levels established by the Food and Agriculture Organization of the United Nations (FAO/WHO, 2002). Standard RNI levels were used because there is little documentation that supplementation beyond what is recommended has had any impact on clinical outcome (Nerad et al., 2003). The nutritional values are expressed as per 100g edible portion.

This analysis did not exclusively involve NTFPs but includes foods gathered from both woodland and arable environments that typically occur spontaneously but may be managed and/or cultivated to some extent. For example, some of the leafy vegetables are available on disturbed sites around homes, and in some instances may be cultivated, particularly green leafy vegetables. It was important to include these early succession species because HIV/AIDS-afflicted households often reduce their area of land under cultivation, which subsequently returns to bush (Tony Barnett & Blaikie, 1992; Guerny, 1999), and these foods are some of the most commonly consumed wild/semi-wild foods in the region.

### **5.3 Results**

Certain NTFPs and other wild foods compare favorably to conventional foods in their nutrient content, and are high in some of the key nutrients required by PLWHA,

particularly protein, fat, vitamins A and C, iron and zinc (Figure 4). In terms of nutritional value, this comparative analysis suggests that NTFPs and other wild foods can serve as equivalent, if not superior substitutes for conventional foods that may not be accessible or available to smallholder households afflicted by HIV/AIDS in sub-Saharan Africa.

### 5.3.1 *Macronutrients*

Elevated intakes of protein, fat, and carbohydrates are recommended because HIV/AIDS decreases food intake and absorption while increasing energy requirements (FAO, 2002). Recommended sources of protein for PLWHA include animal products such as beef, chicken, eggs, fish, and beans. The amount of crude protein in select foods harvested from natural resources (particularly insects, mushrooms, nuts, and animals) compare favorably to the commonly recommended conventional foods. For example, the mopane worm (*Gonimbrasia belina*) has more than double the amount of crude protein than beef. Crude protein content in the *Psathyrella atroumbonata* mushroom was 76.8% higher than beef. The tree seeds of *Parkia sp.*, *Adansonia digitata*, *Sclerocarya caffra*, and *Ricinodendron rautanenii*; and the iguana, *Varanu niloticus*, all have higher crude protein contents than beef. Though there are relatively fewer leaf and fruit sources of protein, the fruits of *Annona senegalensis* and *Syzigium guineense*, and the leaves of *Adansonia digitata* are also relatively high in protein.

Small amounts of fat can provide significant amounts of energy. Foods with high fat contents recommended by the FAO include peanuts and avocados. The fruit of *Dacryodes edulis* contains 66% more fat than peanuts, and more than triple that found in avocados. The seeds of *Irvingea gabonensis*, *Ricinodendron rautanenii*, and *Sclerocarya*



*caffra* have higher fat contents than that of peanuts. Other NTFPS with relatively high fat contents include the seeds of *Parkia biglobosa*, *Adansonia digitata*, *Butyrospermum parkii*, *Sclerocarya birrea*; and the fruit of *Strychnos spinosa*.

### 5.3.2 Micronutrients

Specific micronutrients associated with HIV/AIDS are critical in the nutrition of PLWHA. Because they are needed only in small amounts, consumption of non-staple NTFPs may be able to provide adequate amounts of micronutrients.

Vitamin A<sup>4</sup> is perhaps the most important micronutrient in terms of nutritional interventions because of its widespread deficiency in sub-Saharan Africa and the roles it plays in resistance to pathogenic organisms, production of protective secretions and cells, prevention of rashes and sores, and potential reduction of vertical HIV transmission (FAO, 2002; FAO/WHO, 2002). Recommended conventional sources of vitamin A for PLWHA include carrots, spinach, and mangoes. Again certain wild foods compare favorably, with leafy vegetables and fruits (i.e., tree, bush, and liana) making up the most common types of vitamin A-rich foods. The leaves of *Heliotropium somalense* contain 284% of the daily recommended nutrient intake. The leaves of *Commelina spp.*, *Cucumis dipsacens*, and the fruit of *Annona senegalensis* contain 184%, 111%, and 103% of the RNI respectively. *Landolphia hirsute* berries, the tree pods of *Parkia biglobosa*, and the fruit of *Sarcocephalus latifolius* compare similarly to that of the mango.

Vitamin C helps protect against infection and plays an important role in iron absorption (FAO, 2002). Addition of certain vegetables or fruits containing ascorbic acid to meals can triple dietary absorption of iron (FAO/WHO, 2002). Recommended

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<sup>4</sup> Includes preformed vitamin A/pro-vitamin A carotenoids

conventional sources of Vitamin C for PLWHA include spinach, oranges, and mangoes. The leaves of *Gynandropsis gynandra*, the fruit of *Adansonia digitata*, and the leaves of *Solanum nigrum* contain 189%, 179%, and 131% of the RNI for vitamin C, respectively. The leaves of *Gnetum ofericinum*, and the fruits of *Carissa macrocarpa*, *Bauhinia thonningii*, *Sclerocarya caffra*, and *Landolphia capensis* contain over half of the RNI. Other NTFPs with significant vitamin C contents include *Diospyros monobuttensis*, *Annona senegalensis*, *Ximenia caffra*, and *Dacryodes edulis*.

Iron is important in the body's defense against infections and its deficiency reduces appetite (FAO/WHO, 2002). Conventional foods recommended as sources of iron for PLWHA include millet, cow-pea, sorghum, spinach, and beef. The leaves of *Tamarindus indica*, *Zantedeschia sp.*, *Corchorus spp.*, *Adansonia digitata*, *Pterocarpus mildbraedii*; the insect *Gonimbrasia belina*; and the fermented seed of *Parkia biglobosa* all contain more than 100% of the RNI. These, in addition to the leaves of *Annesorhiza flagella-folia* and *Cucumis dipsacens*, contain more iron than the recommended conventional foods.

Zinc plays a central role in the immune system, reducing opportunistic infections and preventing disease progression. HIV infected individuals are particularly susceptible to zinc deficiency (Baum, Shor-Posner, & Campa, 2000). The fermented seeds of *Parkia biglobosa* contain 42% of the RNI, and provide more iron than the recommended conventional sources of beef, peanuts, cow peas, maize, and chicken. Relative to these conventional foods, the seeds of *Sclerocarya birrea*, and the leaves of *Tamarindus indica*, *Adansonia digitata*, and *Corchorus spp.* provide roughly equivalent amounts of zinc.

### 5.3.3 *Study Limitations*

The set of species in this analysis is not exhaustive, excluding other locally available foods that may also be good sources of nutrients for PLWHA. Vitamins E, B6, B12 and selenium were predominantly absent from the nutritional data. This absence likely reflects the paucity of nutritional analyses including NTFPs of animal origin, and the exclusion of nutrients in previous analyses. While nutritional values convey the potential value of these foods, it is also important to note that various factors contribute to, or reduce the presence of nutrients (e.g., seasonality, soils, maturity of plant at harvest, quantity consumed, storage practices, nutrient bioavailability, nutrient loss through boiling, etc.) (Babu, 2000; Glew et al., 1997; Johnson & Grivetti, 2002; Nordiede et al., Ogle, 2001). This analysis did not consider the potential value of medicinal NTFPs to the nutrition of PLWHA in sub-Saharan Africa. Medicinal plants used by indigenous medicinal practitioners can play a significant role in the physiological availability of nutrients by increasing food intake (e.g., appetite stimulation and treatment of oral thrush) and absorption (e.g., reduction of diarrhea and intestinal worms) (UNAIDS/WHO, 2002; Wolday et al., 2002).

## **5.4 Discussions and Recommendations**

Government agencies are advocating a multisectoral approach to the nutritional care of PLWHA in sub-Saharan Africa, linking health workers promoting nutrition with agricultural extension services (AED, 2001). Similar partnerships between the health and natural resource sectors could be implemented.

#### 5.4.1. Promotion of locally available NTFPs and other wild foods for PLWHA

Where HIV/AIDS-afflicted households rely on woodlands and other natural resources for food, nutrition interventions targeting PLWHA and their caregivers should include information regarding the existence, recognition, and utilization of NTFPs. An HIV-positive widow from Tanzania who received nutritional counseling writes, "...there were those [foods] that I can get for free of charge in the village even without growing because people are not aware of their nutrition value..." (Katunzi, 1999). Barnett and Haslwimmer (1995) concluded that tree crops such as mangoes "receive little care from [HIV/AIDS-afflicted] households" and suggested that this was because the nutritional benefits of these products were not understood. Utilization of NTFPs as a source of nutrition may also be limited because of attitudes and cultural beliefs. NTFPs are often considered to be inferior foods (Asfaw & Tadesse, 2001; McGregor, 1995). Moore and Vaughan (1994) found that some women would not collect bush products because they were from a 'modern' family.

Maintaining and communicating information regarding the nutritive value, how to recognize and utilize wild edible species is necessary to allow households to use them under adversity (Babu, 2000; Grivetti & Ogle, 2000). This transfer of information should include storage and processing information. Recent studies have indicated that there is a considerable lack of storage and processing knowledge and skills available for smallholder farmers (Lapido, 1998; Schreckenberget al., 2002). Storage and processing are key determinants of extended shelf life (FAO, 1997) and also help to improve the nutritional value of raw foods by rendering most of the anti-nutritional factors, metabolic enzymes and microbes inactive. For example, farmers process the kernels of *Irvingia spp.*

into a paste. However, in the case of *Dacryodes edulis* more than 50% of farmer's total production is lost due to poor shelf life (2-3 days only) while for *R. heudelotii*, poor, inappropriate, and time-consuming extracting and drying methods are currently being practiced by farmers.

#### *5.4.2 Participatory appraisal of woodland use by HIV/AIDS-afflicted populations*

Advocating the consumption of NTFPs to meet specific nutritional needs, such as vitamin A, would require the identification of vitamin A-rich NTFPs locally available and accessible. In 1979 Fleuret proclaimed that the importance of commonly consumed fruits such as mangoes and papayas as sources of vitamin A is well established, and less is known of local wild foods (Fleuret, 1979). While the links between food security, nutrition and forestry have been promoted in forest management and planning programs organized by the FAO since 1984, the nutritional benefits of local wild foods are still overlooked (Antonsson-Ogle et al., 2000). Participatory techniques to determine woodland use by HIV/AIDS-afflicted households (i.e., type of NTFPs consumed, quantity, and frequency) combined with information regarding the nutritional content of specific NTFPs, can be valuable inputs for those in the health sector developing community-based nutrition interventions for HIV/AIDS-afflicted smallholders.

#### *5.4.3 HIV/AIDS, natural resource management and conservation*

Interventions within the natural resource sector that 1) improve resource accessibility in the short-term, and 2) sustain resource availability over the long-run; can help mitigate the impact of HIV/AIDS on smallholder food security and should be considered components of the multisectoral response to HIV/AIDS. Examples of short-

term interventions include the establishment of woodland reserves for edible NTFP production as proposed by Chidumayo and Mbata (2002), and the decentralization of resource rights and management to local plant collectors in Mzimkulu District, South Africa (Diederichs, Geldenhuys, & Mitchell, 2002). Long-term interventions include the domestication of indigenous food species which can improve nutritive value, reduce intra-specie nutritional variation, and increase yields (Leakey, 1999; Leakey et al., 2002; Leakey & Simons, 1998).

By increasing household dependence on natural resources and creating socio-economic conditions which favor consumption of NTFPs (Barany et al., 2003); HIV/AIDS will likely increase pressure on natural resources. At the same time, management and conservation institutions are losing highly trained personnel to AIDS, experiencing reductions in productivity due to employee illness, and spending more on employee healthcare and insurance (Dwasi 2002). In addition, the financial requirements necessary to combat HIV/AIDS are reducing public sector investment in natural resource management (FAO, 2003). Appropriate multisectoral interventions for the treatment, care, and mitigation of HIV/AIDS in sub-Saharan Africa will require greater political and financial commitment to natural resource management and conservation.

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## CHAPTER 6

### CROSS-SECTIONAL ANALYSIS OF HOUSEHOLD DEPENDENCE ON NATURAL RESOURCES

#### 6.1 Rationale

The theoretical model guiding the design of the proposed analysis (Figure 2) is a probabilistic recursive model in which relations represented with a one-way arrow are linear, additive, and causal; and relations with two-way arrows represent non-recursive relationships excluded from analysis (e.g., the relationship between coping strategies and food security). In this model, mortality and morbidity of household prime-age adults leads to natural resource dependence through a number of mechanisms involving five intervening variables. First, mortality and morbidity increase health expenses, reduce household labor stock, and in the case of female widows, may reduce land tenure. In turn, these three variables decrease household food security, and influence adoption of coping strategies (e.g., reduction in the area of land cultivated, sale of livestock, etc). Food insecurity and coping strategies force households to increase dependence on natural resources. An increase in health expenses may also directly increase dependence on natural resources for medicinal plants. Likewise, loss of land tenure may also have a direct effect by forcing households to rely on common property lands. The control variables include household coping capacity (e.g., household assets, dependency ratio, etc.), knowledge of local natural resources, access to markets, and access to the natural resource base.

Household dependence on natural resources is defined as the extent to which households use natural resources for income, food, and subsistence goods (e.g. fuel, construction materials, implements, etc). To qualify as a natural resource use, the products must be collected from natural resources without having required previous investment of production labor. In the natural resource/rural sociology sciences, there is no consensus on a standardized method for measurement of household natural resource use or dependence and the literature reveals a substantial variation in the methods. For example, Pattanayak and Sills (2001) used the number of forest collection events as a single indicator of household forest dependence in the Amazon. In Zimbabwe, Cavendish (2000) assigned monetary values to all natural resource products used by households and calculated a sum monetary value. Other studies have investigated household dependence on natural resources using only a single indicator (e.g., dietary frequency of wild foods) (Fleuret, 1979; Herzog et al., 1994; Loibooki et al., 2002; McGregor, 1995; Ogle, 2001).

Because using a single indicator of natural resource dependence, or investigating a single dimension potentially compromises content validity, and assigning market values to non-marketed goods raises reliability issues (Wollenberg, 2000); we propose operationalizing natural resource dependence as a multidimensional index combining attitudinal measurements (i.e., perception of natural resources as coping strategy and general livelihood strategy) with the behavioral measurements of direct food consumption, sales of products from natural resources, and labor allocation. This method accounts for the complexity of household dependence on natural resources, will generate data to help guide interventions (e.g., species for nutritional analysis, products for market development), and through triangulation, helps minimize measurement error.

## 6.2 Procedures

A survey will be conducted of rural HIV/AIDS-afflicted and unafflicted households. The HIV/AIDS group will include households in which a member is currently ill from HIV/AIDS and/or having experienced a death from HIV/AIDS in the three years prior to the study. The control group, households unafflicted by HIV/AIDS, will be represented with a proxy – households in which prime-age adults (15 - 49) are not chronically ill or deceased. The lower rate of HIV prevalence in rural Tanga Region, relative to other areas in sub-Saharan Africa, increases the probability that the prime-age adults in such households are HIV-negative.

To overcome the limitations of the underdeveloped healthcare infrastructure and the social/cultural barriers inherent in surveying HIV/AIDS populations in sub-Saharan Africa (Martha Ainsworth & Dayton, 2003; Stokes, 2003), the sample of afflicted households for the proposed study will be drawn from rural households currently and recently enlisted in TAWG's program. The sampling frame will consist of all rural households currently enlisted in TAWG's program and those discontinuing their service within the prior three years due to death. All households within the sampling frame will be invited to participate in the survey ( $n \approx 125$ ) with a minimal target sample size of 100 households.

While this sampling method introduces bias, obtaining a complete sampling frame of afflicted households within the geographic bounds of the study is impossible. An estimated four out of five AIDS cases in the Tanga Region are undiagnosed (UNAIDS, 2002). This method also offers two distinct advantages over the alternative of working

with district-level health centers. First, sampling from TAWG's patients ensures necessary levels of trust and avoids creating expectations that may jeopardize the validity of the responses. In such surveys, households may deliberately distort their response in order to gain development assistance (Frankenberger, 1992). Second, it maximizes logistical efficiencies – households can be surveyed on routine visits. This method of recruitment from HIV/AIDS organizations has been recommended for studies of HIV/AIDS-afflicted households in Africa (Booyesen et al, 2002).

In the villages where the HIV/AIDS group elements are located, the sampling frame for the control group will include all other households in which prime-age adults are not chronically ill or deceased will make up. In proportion to the total number of HIV/AIDS group elements in the village, households in which prime-age adults are not chronically ill or deceased will be systematically sampled using a list of households obtained from the village leader. Screening questions will be used to determine that prime-aged adults are not chronically ill or deceased (see indicators of household morbidity and mortality in the following “Questionnaire” section). As chronic illness and death in a household can be used as proxy indicators of HIV/AIDS afflicted households (Martha Ainsworth & Dayton, 2003; Mastaglio, 2002; Stokes, 2003), we will use these indicators inversely as proxies for unaffected households. Our sampling design may be adjusted to capture anomalies in the spatial distribution of natural resources and HIV/AIDS prevalence.

Before administering the survey, focus group discussions and pre-testing of the questionnaire will be carried out to increase the reliability and validity of the questionnaire items. Focus group discussions will verify if the survey's concepts are

meaningful in the local context and ensure that the syntax through which these concepts are communicated is appropriate. In addition, these discussions will provide necessary inputs into the natural resource dependence measure (e.g., localizing items, appropriate recall periods, etc.).

Focus group discussions will be carried out in each of the three districts of the study area. Each group will consist of about 7 participants. Efforts will be made to ensure as much homogeneity in the groups as possible so that differences in sex, age, and socio-economic background do not inhibit the participation of certain members (Lettenmaier et al., 1994) Using our baseline questionnaire, key concepts (e.g., coping strategies, natural resources, etc.) will be translated into a Swahili discussion guide to be used by a focus group moderator. The moderators will also serve as the questionnaire enumerators. The discussion will be recorded with both audio recorder and paper (i.e., maps and diagrams). Using the focus group outputs, the questionnaire will be adjusted so that the concepts and language are locally understandable. The questionnaire will then be back-translated to verify that the questions measure the intended concepts. This method was used successfully by Fuller et al. (1993) to test the validity of a household crowding questionnaire in Bangkok, Thailand.

The questionnaire will be pre-tested to improve validity. The pre-test will be carried out in a village outside the sampling frame and will include both households in which prime-age adults are healthy and those households in which the prime-age adults are not (n=25). The village leader and local health practitioners will be asked to identify households in which prime-age adults are ill or have recently died. Enumerators will be trained in administering the questionnaire and ensuring the confidentiality and privacy of



the respondent. At each administration of the questionnaire the enumerator will debrief the respondent regarding problems or portions that may be unclear or offensive. In some cases the principal investigator will accompany the enumerator, and enumerators themselves will be debriefed. Using SPSS, scales will be tested for unidimensionality and reliability. Items with item-to-scale coefficient less than 0.3 will be dropped. Items will also be dropped/added to retain Cronbach's alpha values greater than 0.7. Confirmatory factor analysis will be run on the natural resource dependence index.

After questionnaire revision/modification, questionnaires will be administered through two waves of face-to-face, structured interviews. The second wave of the survey is necessary to account for seasonal variation in natural resource dependence. One wave of the survey will be carried out towards the end of the dry season (June-September), and another toward the end of the rainy season (March-May). To increase accuracy, different household members may be asked to answer different parts of the questionnaire. For example, information on morbidity will be collected from each prime-age member having been ill in the four weeks prior to the interview. Sections of the questionnaire regarding household characteristics, coping strategies, coping capacity, and mortality will be administered to the household head. The household member most knowledgeable about natural resources and household food security will be chosen to complete these sections. The same household members will be interviewed in the second wave. To minimize the length of the questionnaire, unstructured key informant interviews with local officials will be carried out simultaneously regarding village-level variables (e.g. indicators of market access - cost of transport to Tanga town).

Respondents will be compensated for their time with household items (e.g., soap, cooking oil). During data collection, random supervision of enumerators will be conducted and all enumerators will be debriefed weekly. The data will be entered during the survey so that questionnaires can be re-administered pending enumerator errors. After the survey, we will hold meetings to address any questions/concerns of the village members. Steps will be taken to maintain participant confidentiality (see “Protection of Human Subjects”).

### **6.3 Questionnaire**

The following provides a brief description of the questionnaire items, grouped according to the constructs they will measure. Some of the items have been developed specifically for this proposed project; where possible, others have been drawn or adapted from standard surveys. For those that we have developed, local officials in Tanzania will be asked about standardized alternatives. It is important to note that the details of the baseline questionnaire (e.g., recall periods) will ultimately be decided after the focus group discussions and pre-testing of the questionnaire.

Multiple-item questions regarding general household characteristics include those to measure adult equivalence units (e.g., number of household members including their age, sex, and proportion of year resident at home; number of children living outside of home); household assets (e.g., dwelling material, hectares of land owned by household, number of livestock owned, estimated value of household’s durable goods); and gross household income over the prior six months - disaggregated to increase respondent’s

ability to recall income from various sources (i.e., agricultural, wage labor, petty-trade, transfers, remittances).

For the dependent variable, household natural resource dependence, the following attitudinal and behavioral dimensions will be measured:

- Perception of natural resources as a buffer against contingencies; and as a component of overall livelihood strategy
- Type and frequency of natural resource product collection
- Consumption of foods from natural resources
- Income (%) derived from the sale of natural resource products
- Labor allocated to natural resource product collection

To measure the perception of natural resources as a buffer against contingencies a Likert scale will be created. Respondents will be asked the extent to which they agree/disagree that natural resources are important sources of food/income: during times of drought, during the “hungry season”, after a bad harvest, when cash is needed for health expenses, and after the death or during the prolonged illness of a prime-aged household member.

To measure perception of natural resource as a regular component of the household livelihood strategy, respondents will be asked the extent to which they agree/disagree that natural sources are important in the following categories: income, food, and medicine. For these same categories, respondents will be asked to agree/disagree if natural resources are more important to the household now than in the past. They will also be asked to rank the importance of natural resources for income against agriculture, wage

labor, petty-trade, transfers, remittances, etc. This latter measure was used by Campbell et al. (Campbell et al., 2002).

To determine the type and frequency of natural resource use, respondents will be presented with a list of all categories of products from natural resources (e.g., fuelwood/charcoal, fodder, medicine, foods, building materials, agricultural tools, crafts). For each category respondents will be asked to select frequency of collection - continuous, frequent, occasional, infrequent, never – for each type of use (consumption, sale). This method was used by (Murniati, Garrity, & Gintings, 2001).

A multi-item question will be used to measure consumption of foods from natural resources. Respondents collecting foods will be asked to list the different types of food from natural resources that are consumed by the household. Categories will be provided to facilitate recall (i.e., fruits, vegetables, nuts, insects, animals). For each species respondents will be asked to select whether they consume them daily, weekly or monthly. A similar method of measuring the frequency of wild food consumption was used by (Shackleton et al., 1998). This is opposed to using the 24-hour dietary recall method, which may underestimate frequency of more dispersed consumption events (Herzog et al., 1994),.

Income (%) from sale of natural resource products will be measured with a multi-item question in which respondents collecting products from natural resources for sale will estimate the volume sold during the month prior and price for each product. Volume will be estimated in local units and then local units will be measured in terms of standard units (e.g., kilograms). This method is commonly used to estimate income from natural resource products (Campbell et al., 2002; Cavendish, 2000).

Labor allocated to collection will be measured by asking the respondent if she/he made special collection trips in the month prior, and if so how many. This method was used by (Pattanayak & Sills, 2001).

The key independent variables in this study include mortality and morbidity of household prime-age adults. Household mortality will be measured as the number of prime-age adult deaths occurring in the prior three years. The reference period of three years is used because we are interested in both short-term natural resource dependence (as an immediate coping strategy), and natural resource dependence as a more consistent livelihood. Stokes (2003) recommends using this reference period for the impacts of HIV/AIDS on food-security and rural livelihoods. Other mortality-related information that will be collected includes: relation of the deceased to household head; age and education level at death; sex; major work activity; duration of illness before death; funeral expenses; and time elapsed since death. Because these questions are the most sensitive, they will be asked at the end of the questionnaire after rapport has been established.

Household morbidity will be measured using the Medical Outcomes Study questionnaire (SF-36) (Ware et al., 1993). Berry et al. (1994) used a slightly modified format of the MOS SF-36 and found it appropriate for surveying men and women with advanced HIV disease. We will not use HIV-specific quality of life instruments because the proposed survey will include households unafflicted by HIV/AIDS. Instead, our questionnaire will draw questions from the Kiswahili version of the MOS SF-36 which has been modified specifically for use in Tanzania. Cronbach's alpha values for scales tested in Tanzania are the following: physical functioning (.92), role-physical (.91),

bodily pain (.84), general health (.70), vitality (.77), social functioning (.70), role-emotional (.89), and mental health (.78) (Wagner et al., 1999). These questions will be administered to all prime-age adults having been ill in the prior four weeks. In the case that another prime-age adult in the household is chronically ill but not present, the available respondent will serve as a proxy.

Three variables will be used to measure the direct socio-economic impacts of HIV/AIDS morbidity and mortality. Household health expenses will be determined by summing several disaggregated items (e.g., costs of hospitalizations, costs of visits to health centers/practitioners including travel, and cost of medications). Effects of morbidity on household labor will be measured as the number of days in the month prior that an ill prime-age adult was unable to perform their usual activities, and the number of days that a prime-age adult was nursing another prime-age adult (Ainsworth et al., 1992; Tibaijuka, 1997). Change in land tenure will be measured by asking the respondent if, and how, household land tenure has changed in the three years prior.

The employment of coping strategies in response to these socio-economic impacts will be measured using a multi-item scale. Respondents will be asked to give an affirmative or negative response to whether, within the recall period, they have engaged in the following activities:

High Reversibility

- Seeking wage labor or migrating to find work
- Agricultural adjustments
  - o Switching to producing low

Low Reversibility

- Sale of productive assets (land, cattle, farm implements)
- Reducing area of land cultivated

- maintenance subsistence crops
- Reduced fertilizer inputs
- Delayed tillage, planting,  
weeding
- Disposal of liquid assets (selling small  
livestock (chickens, goats), jewelry,  
personal possessions, etc.)
- Reducing children in school

These items have been selected based on the body of work regarding coping strategies in response to HIV/AIDS impacts as summarized in Mutangadura et al. (1999) and Stokes (2003). According to frameworks for analyzing household coping strategies (Frankenberger, 1992), we have grouped these indicators into two categories, high-reversibility and low-reversibility. Items categorized in the low reversibility group represent later stages of loss management, and affirmative responses to these items will be weighted more heavily.

The two key indicators of household food security we will measure include the perception of food security, and food intake (Frankenberger, 1992). Questions measuring these dimensions have been selected from the USDA Core Module (Bickel et al., 2000) and will be modified according to the context in Tanga. This module has previously been used to study relationships between health status and food security (Pheley et al., 2002). Respondents will be asked to provide an affirmative or negative response if, within the recall period, the following occurred because there wasn't enough food:

Reduced Food Intake

- Adults not eat for whole day
- Cut the size of children's meals
- Children ever skip meals
- Children not eat for whole day

Perception of Inadequate Food Intake

- Worry food would run out
- Food didn't last
- Relied on low cost foods

Potential additional items include the number of meals served per day, the number of meals that include meat or fish, and the number of times per day gruel was the main meal (Frankenberger, 1992).

Finally, questions will be asked to measure control variables. A multi-item question will be asked regarding resource access. Respondents will be presented with a list of major natural resource types in Tanga (e.g., bush/woodland, scattered forests, coastal mangroves, etc.) and asked to indicate which are within walking distance, to estimate the distance to each type of natural resource, and whether they fear arrest if using these resources. To measure local knowledge respondents will be asked to list all species used for each category of natural resource use. This method was used by Luoga et al. (2000) in central-eastern Tanzania. While variables to measure coping capacity will come from questions regarding household characteristics, respondents will also be asked if they have received loans prior to the survey – an indicator for access to credit. Village level variables measuring market access will be determined from discussions with key informants (e.g., village leaders).



#### 6.4 Analysis Plan

Before analysis, computation of numerous variables will be required, including those measuring household characteristics (i.e., *estimated value of durable goods*, *aggregate household income*) natural resource dependence (i.e., *frequency wild food consumption, income (%)*), aggregate household health expenses, natural resource access (*household average distance to natural resources, village average number of reported species*), and coping capacity (i.e., *dependency ratio*). Computation of several indexes will also be required. For example, the variable *adult equivalence units* is an index calculated from the number of household members adjusted for their age, sex, and proportion of time spent in the home, and is necessary to convert households of different size and composition to a common scale (Deaton & Paxson, 1998). This variable will then be used in the computation of *income (%) from natural resources*. We will also compute an index to measure *local knowledge* (i.e. per category use  $\sum$  [household # species] \* [household # species/ village # species]). Other indexes include *household assets, resource access, coping capacity* and *natural resource dependence*.

Final construction of the indexes will be achieved with confirmatory factor analysis to test for unidimensionality and to assign weights. Using LISREL8, confirmatory factor analysis will be run to assess the degree to which the sample data are consistent with our posited index of natural resource dependence. Reliability tests will be run on scales and items will then be dropped/added to retain Cronbach's alpha values greater than 0.70.

After data preparation, descriptive statistics will be carried out to determine means and standard deviations, and the data graphed to assess quality and relationships

(boxplots, normality plots and scatterplots). To test the hypothesis in Specific Aim 1 that households afflicted by HIV/AIDS depend on natural resources more than unafflicted households, we will use hypothesis testing methods based on analysis of variance and t-tests. Dummy-variable regression analysis will be used to explore relationships between natural resource use and group factors. If subgroups of households emerge from the descriptive statistical analyses (e.g., female vs. male headed households, death within year prior vs. death in 1-3 years prior, wealthy vs. poor, orphan-headed vs. in-tact) and have sufficient sample sizes, multiple dummy variables will be used. Additional models will be run controlling for resource access, coping capacity, market access, and local knowledge.

Specific Aim 2 will be achieved using path analysis (see Figure 2). The variables will be standardized and path coefficients ( $p_{XY}$ ) estimated for the following structural equations:

$$E = p_{EM}M + p_{ED}D$$

where E = health expenses, M = morbidity, D = mortality

$$L = p_{LM}M + p_{LD}D$$

where L = labor

$$T = p_{TD}D$$

where T = land tenure

$$C = p_{CE}E + p_{CL}L + p_{CT}T$$

where C = coping strategies

$$F = p_{FE}E + p_{FL}L + p_{FT}T$$

where F = food security

$$N = p_{NE}E + p_{CN}C + p_{FN}F + p_{TN}T + p_{IN}I + p_{AN}A + p_{KN}K + p_{YN}Y$$

where N = natural resource dependence, I = market access, A = resource access, K = local knowledge, Y = coping capacity

Decomposition of the correlation coefficients will be used to determine that the path coefficients account for the correlations between paired variables. Our hypothesized model will be revised accordingly. Since path analysis is based on correlations, we will use graphical methods to check that the relationships are linear and correlations adequately describe the relationships. Transformations and nonlinear methods will be used to make adjustments where needed.

## 6.5 Limitations

The potential limitations of the proposed procedures are associated with response error (i.e., respondent fatigue, sensitive questions/cultural barriers, distortion of answers, and recall periods), and sampling bias. Measuring numerous constructs, each with several indicators, we recognize the risk of respondent fatigue. To avoid this, focus groups and the pre-test will determine minimum necessary items for scales and indexes. The USDA Core Model and the MOS SF-36 are designed to be completed in less than five and 10 minutes respectively (Bickel et al., 2000; McDowell & Newell, 1996).

Conducting a survey designed by foreigners in Tanzania inherently runs the risk of cultural and political insensitivity. The focus groups are designed to adapt the key concepts and terms to the local context. To avoid difficulty in gaining entry due to socio-cultural differences, the survey will be sub-contracted to a local NGO, directed by

Scheinman. The enumerator teams will be hired from within the Tanga Region and will consist of one female, and one male to match the gender of the enumerator with that of the respondent. Enumerators will be trained in the ethics of confidentiality and privacy, the purpose of the survey will be explained, and all respondents will be informed that their participation is voluntary. Additional emphasis will be placed on respondent confidentiality, to avoid respondent manipulation of answers to get development aid.

As memory failures play a critical role in the validity of AIDS research (Croyle & Loftus, 1993), pre-testing will be used to determine appropriate recall periods. Because shorter recall periods are more reliable (White, 1984), most recall periods will be a month or less. Campbell et al. (2002) used weekly recall periods for woodland harvests, and Sullivan (2002) used monthly earnings for forest product harvests. The recall period in USDA Core Module for food security is one year but can be changed to 30 days (Bickel et al., 2000). To facilitate recall, checklists of forest products will be provided.

Sampling bias associated with sampling households serviced by TAWG may result from measuring the use of natural resources (including medicinal plants) by households receiving them from TAWG, by measuring households which are receiving institutional support, and differences in factors that led to the ability of these households to access TAWG. Fortunately these biases mean that the measure of household natural resource dependence will be conservative - those HIV/AIDS-afflicted households not receiving TAWGs support are likely to be more exploitative with respect to natural resources. An alternative is to gain access to HIV/AIDS-afflicted households not serviced by TAWG through dispensaries and health centers/clinics, survey them, and then

compare characteristics (e.g., age, gender, location of residence, etc.) and use a mean difference hypothesis test to determine the areas and degree of bias.

## CHAPTER 7

### MEDICINAL PLANT MARKETING CHANNEL ANALYSIS

#### 7.1 Rationale

The purpose of Specific Aim 3 is to explore changes in medicinal plant resources used in treating HIV/AIDS-related illnesses and to test the hypothesis that demand for certain species is associated with local scarcities. Methods for measuring changes in medicinal plant populations include inventory measures such as longitudinal studies of vegetation plot measurements. However, because there is no prior empirical data on medicinal plant populations in the study area and initiating a longitudinal ecological study would require a significant amount of time, a more rapid alternative is to collect data on indicators of species demand and scarcity through interviews with traditional healers and others involved in the sale, collection, and therapeutic administration of medicinal plants.

Species scarcity will be measured using several indicators including collection labor per unit of plant material, distance to collection site, out-sourcing of collection labor, and species substitution. The rationale in selecting these indicators to measure species scarcity is derived from both central place and optimal foraging theories, and previous ethnobotanical studies of medicinal plant markets (Agbovie et al., 2002; A. B. Cunningham, 1988; Hersch-Martinez, 1995; Mander, 1998). If species population declines (localized species supply shortages occur), collectors have to allocate more labor to collection in these areas. According to optimal foraging theory, when the marginal cost of the collectors labor exceeds returns, the collector will find a new area to harvest.

According to central place theory, resources closest to an area of demand will be utilized first; so new sites will require further travelling distance. Because of the increase in labor the costs associated with such a transition, the original collector may out-source collection. In this scenario, species may also be substituted (Mander 1998).

In many parts of sub-Saharan Africa, traditional healers that are herbalists often collect and sell medicinal plants (A. B. Cunningham, 1997). This is predominantly the case in Tanga, thus the survey's target population is traditional healers in Tanga District. However, because scarcity and demand may influence healers to sub-contract collection for certain species (our preliminary informal interviews found this occurring with medicinal plants use in the treatment of HIV/AIDS in Tanga), obtaining data on the indicators related to plant collection may require that the sub-contractors are also interviewed. For this reason, the most appropriate method for this Aim is a marketing channel analysis - the method by which information is gathered from various actors about various stages of a marketing channel (Magrath, 1992). Thus, in addition to each species being investigated, the units of analyses include the marketing channel - both the healer and collectors.

## **7.2 Procedures**

The most popular and ecologically vulnerable medicinal plant species used in treating HIV/AIDS-related illnesses will be selected for this analysis ( $n \approx 3$ ). A small sample of traditional healers will be recruited by key informants and interviewed ( $n \approx 10$ ). Purposive sampling is necessary to involve only those traditional healers with established credibility among the local population. Each respondent will be presented with a list of

opportunistic infections associated with HIV/AIDS (e.g., herpes zoster, oral thrush, diarrhea, tuberculosis), and STIs associated with HIV transmission (i.e., syphilis, chancroid, genital herpes, trichomoniasis, and gonorrhea), which are recognized and commonly treated by traditional healers in Tanga (Good, 1998). The respondent will be asked to indicate which illnesses they treat with medicinal plants, and the medicinal plant species used in each treatment.

For each species listed, the following indicators will measure species popularity and vulnerability. A popularity index will be determined measuring the number of illnesses for which the plant is used (weighted by ranking of illnesses from most - least common), and whether the plant is traded in town markets. Indicators for a vulnerability index include: part of the plant used (i.e., bark, roots, bulbs, leaves, or fruits), the growth rate of the species (i.e., rapid, fairly rapid, or slow), the number of the species' non-medicinal uses, and whether the species has ever been cultivated. Plants in which the curative parts are bark, bulbs or roots are more susceptible to scarcity than those utilized for their leaves or fruit (Peters 1994) and will be assigned heavier weights. Each species will be scored using an index constructed from these indicators. The top three species with the highest mean score will be selected. Before grouping responses of all interviews to determine mean score, vernacular names of the plants will be translated to scientific names. If necessary, voucher specimens will be taken to the Amani Botanical Research Institution.

The sample population of traditional healers will include all traditional healers in the Tanga Association of Traditional Healers (n≈300). The Association will be asked to help facilitate and collaborate in the survey and all healers will be invited to a meeting in



Tanga Town. Travel expenses will be re-reimbursed. Those attending the meeting will form the sampling frame ( $n \approx 100$ ). At the meeting the healers will be assigned a number and provided with several screening questions (e.g., whether they use the selected medicinal plants, frequency of use and sale, etc.). Healers frequently using the shortlisted medicinal plants will be systematically sampled. The target sample size is 45.

Appointments will be made to interview the healers at their practices or at a TAWG office. A similar sampling design was successfully used by Good (1998). If a traditional healer is found to hire others to collect his or her plants, or buys the plants, additional samples will be necessary. In this case, snowball sampling will be used to identify the collectors/traders who will provide answers for questions regarding collection. Details of this methodology, including culturally appropriate strategies, will be worked out with the leadership of the healer's association and trusted community leaders in Tanga District.

### **7.3 Questionnaire**

A brief questionnaire measuring indicators of species scarcity and demand will be administered. As in the cross-sectional analysis, the construction of this survey instrument will include a focus group discussion and a pre-test. The focus group discussion will be carried out with non-sampled attendants at the preliminary meeting, and the pre-tests will be conducted with non-sampled meeting participants. The following describes questions to be included in our baseline questionnaire.

Single-item questions will be asked regarding the background characteristics of traditional healers (i.e., location of practice, distance to Tanga Town, years in the practice, average number of patients they see in a week, and number of sources of

income). Several questions will be asked to measure change in natural stock. Compared to 5 years ago, respondents will be asked to reply (i.e., same, more, or less) to the following items: availability of plants, difficulty locating plants, and distance to collection site. Respondents indicating change will be asked to select the main cause of change. Response options will be grouped into those related to alpha diversity (e.g., population of plants at collection site unable to meet growing demand, collection site depleted of plants, too many people collecting plants), and beta diversity (e.g., source converted to other land use (agriculture/housing), collection prohibited by law). Those in alpha diversity are related to demand for the species, while change in beta diversity is related to other factors.

Indicators of species scarcity include: collection labor per unit of plant material, travel distance to source, out-sourcing of collection labor, and species substitution. To measure substitution respondents will be asked if, because of short supply, they have ever substituted the species with another. To determine if respondents are out-sourcing collection they will be asked whether they now purchase species that they previously collected. The length of time they have been buying plants will be used to weight affirmative responses, with weights increasing relative to time. Labor allocated to collection will be measured by asking the respondent the average volume of plant material collected on a typical collection event, and the estimated amount of time spent at the collection site to harvest this volume. Distance to collection site will be measured with an estimate of the hours or kilometers to the collection site.

To determine volume traded for each species, respondents will be asked several questions to generate an estimate of the volume of plants sold. Respondents will be asked

about the types of their clients (i.e., patient, wholesaler, retailer), the estimated average amount of plant material sold to each type of client (expressed in local units, which will be weighed (dry) and converted to standard units), and the frequency of sale to clients over the recall period (to be determined in focus groups/pre-tests).

#### 7.4 Analysis Plan

Units of analysis include both medicinal plant species and marketing channels. Each marketing channel will be represented by a healer (i.e., the final point of sale). The marketing channel may consist of a single healer, or a combination of a healer and a collector. In the latter case, the healer would provide data on the volume sold, and the collector - data on scarcity indicators. Before data is aggregated into marketing channels, we will compute variables (e.g., volume plant material sold, time spent collecting per unit plant material), and indexes (i.e., scarcity). Confirmatory factor analysis will be used to test the correlations between the posited factors in our scarcity model.

To explore changes in natural resources used in local responses to HIV/AIDS descriptive statistical analysis will be carried out to determine central tendencies and variations. Multiple linear regression analysis will be carried out to test the hypothesis that demand for certain medicinal plants used in treating HIV/AIDS-related illnesses is associated with local scarcities. The following regression model will be run:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_2 + \beta_3 X_3 + e_i$$

$$Y_i = \text{scarcity of species } i$$

$X_{1i}$  = volume traded of species  $i$

$X_2$  = change in beta diversity

$X_3$  = distance to Tanga Town

Change in beta diversity of natural stock is included to determine the effect of factors other than demand (e.g., habitat loss, access restriction, etc.). Distance to Tanga Town will be included to control for variation in scarcity indicators due to population density/urban development.

## **7.5 Limitations**

Information about medicinal plant use and collection is sensitive. Information about uses may create fear that intellectual property rights will be compromised. Information about the harvesting of plants may create a sense of fear as collection is prohibited from certain natural resources in the region. For these reasons, the participation of the healers and the accuracy of their responses requires preliminary establishment of research credibility, trust in the researchers, and a sense of ownership by the healers (A. Cunningham, 2001; Mander, 1998; Williams, Balkwill, & Witkowski, 2000).

The credibility of, and trust in the proposed research are strengthened by our institutional arrangement with TAWG, and the previous work and research experience of Scheinman and Good with the Traditional Healers Association of Tanga. Additional steps will be taken to maintain this credibility and trust, and develop a sense of ownership. An effort will be made to gain the support of association leaders. The objectives, methods,

and foreseeable implications and consequences of the research will be explained at the meeting in Tanga Town, with an emphasis on confidentiality. We will also emphasize the benefits of the research to the healers (e.g., sustainability of their business). Our participatory approach, in which the medicinal plants to be analyzed will be selected by the healers, is intended to develop a feeling of ownership by the healers. It may also be necessary to provide the association with additional incentives, such as simple herb-processing machines.

Because healers tend to be protective of their knowledge, and secrecy amongst them is common, the shortlisting of medicinal plants used in treating HIV/AIDS-related illnesses and subsequent selection of medicinal plants will not be carried out in focus groups, but in individual interviews so that their knowledge remains confidential. Information regarding which medicinal plant species are used for which illness will not be stored. Interviews will be conducted by an enumerator whom is trusted (e.g., TAWG staff). The objective of this phase of the research will also be explained, with emphasis on their confidentiality and protection of their knowledge.

## CHAPTER 8

### PROTECTION OF HUMAN SUBJECTS

Human subjects will be involved in both the cross-sectional analysis and the marketing channel analysis. Face-to-face interviews will be administered to household members, traditional healers, and collectors of medicinal plants. In the cross-sectional analysis, approximately 200-250 households will be surveyed, with the potential for multiple respondents per household. Respondent age is expected to be within the range of 15-49 years, with the exception of orphan-headed or elderly-headed households. The sample will include households in which a prime-age adult is in the symptomatic stage of HIV/AIDS and/or in which an HIV/AIDS patient has recently died. The marketing channel analysis will involve approximately 75 healers. The average age of the traditional healer in Tanga is 52 years, most are Muslim and have been practicing for an average of 19 years (Good 1998). About 10% of the traditional healers in Tanga are women. This survey may also include medicinal plant collectors - men and women of various ages.

The purpose of the study will be explained to all participants. Subjects will be reminded that their participation is voluntary, they are not obligated to answer any questions, and that they may terminate the interview at any time. Informed consent forms will be used with literate respondents. Consent of illiterate respondents will be assumed by their decision to continue with the interview after the purpose of the survey has been explained. Because of possible AIDS-related dementia it is recommended that next of kin are consulted regarding informed consent of HIV-positive respondents (Stevenson, de Moya, & Boruch, 1993).

To assure confidentiality during data collection all enumerators will be made aware of their ethical responsibilities in regard to the confidentiality of data. To assure confidentiality after data collection, questionnaires will include a cover sheet with the name(s) of the respondent(s) and a number identifier. Subsequent pages of the questionnaire will be coded with the number identifier. After completion of the questionnaire the cover page will be separated and securely stored. Furthermore, efforts will be made to confidentialize data in report publication (e.g., collapsing categories of variables that are highly specific).

Potential risks to the subjects of the cross sectional survey include anxiety produced from recalling distressing memories (e.g., the death of a family member), and interview fatigue. Respondents will be informed that they are not obligated to answer any questions and can stop the interview at any point. The households afflicted by HIV/AIDS will be interviewed by TAWG staff as part of their routine home visits. Trained as care-providers and sensitive to the needs of their patients and the issue of HIV/AIDS, they can provide additional support if needed and will be viewed as trustworthy by the respondents. This will also help assure the privacy and confidentiality of the afflicted households.

Risks to subjects in the marketing channel analysis include the transfer of knowledge regarding medicinal plant uses, medicinal plant collection sites, and the potential to generate anxiety associated with fear of self incrimination (i.e., collection of plants illegally). To avoid the latter risk, the purpose of the survey will be explained to healers and collectors, and they will be informed that their participation is voluntary. To avoid compromising traditional healer knowledge of medicinal plant use, species-specific

uses will only be recorded temporarily during the medicinal plant shortlisting process. After the three species have been selected, the species-specific treatment data will be securely filed, and collapsed into a general “HIV/AIDS treatment” category. If this data is made publicly available, information that may help with respondent or collection site identification (i.e., locality) will be removed.

The potential benefits of the proposed study to participating households include the improvement of nutrition interventions and the development of income-generating activities. Determining the types and frequency of wild foods consumed by households will allow for further efforts to ensure that the households are receiving necessary nutrition. This includes the provision of nutritional education and guidelines regarding these foods. The household survey will also provide an impetus for further market research regarding commercial goods that the households are selling. As previously mentioned, the USAID-funded RAISE program is interested in potential micro-enterprise programs for remunerative activities.

Benefits of the medicinal plant marketing channel analysis include the identification of potential interventions to ensure that medicinal plants used in treating HIV/AIDS-related illnesses remain available. This is beneficial to the healers from a business standpoint, and to the general public from the standpoint of healthcare accessibility in Tanga, Tanzania. Interventions may include the domestication of scarce species, improved management of natural stocks, and extension programs for new collectors in regards to sustainable harvesting methods.



## CHAPTER 9

### CONCLUSION

The HIV/AIDS epidemic is not expected to peak in sub-Saharan Africa until the end of this decade, and its socio-economic impacts will continue long into the future. Thus, it is not too late for developing multisectoral programs that mitigate the impacts of HIV/AIDS on afflicted households. With the inadequacy of current levels of public investment in HIV/AIDS programs, and the expected shift in international finance to HIV/AIDS programs in south-east Asia, development of multisectoral programs need to be based on local capacities and responses. As HIV/AIDS reduces household human, social, financial and physical capital, natural capital (i.e., natural resources) offers afflicted households a resource for meeting their needs.

While the role of natural resources in rural livelihoods, and as a rural safety-net is well established, there has been a general lack of integrated HIV/AIDS-natural resource interventions. Interventions involving natural resources can improve the nutrition of PLWHA, create income-generating opportunities, and sustain traditional healthcare resources. The long-term provision of these benefits to the HIV/AIDS crisis in sub-Saharan Africa will in turn depend on natural resource interventions to ensure that these resources remain accessible and available. Integrating the benefits households and communities derive from natural resources into multisectoral programs to alleviate the crisis will require a process such as that illustrated in the framework presented earlier.

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