"AIDS and Kitchen Gardens: Insights from a Village in Western Kenya"

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Abstract

In rural Africa, indigenous farming and natural resource management systems exemplified by kitchen gardens are being reshaped by HIV/AIDS epidemic and its negative impacts (illness, stigma and mortality, and economic costs) and positive opportunities (organizational responses to the epidemic). Subtle changes in crops and farm techniques can be traced to these diverse influences of HIV+ infection, illness, mortality, widowhood, foster child care, and AIDS support groups, as well as the organizations, ideas, and funding flows from outside. These findings draw on original field data: a village census, in-depth interviews with gardeners, and group discussions in a village in Bungoma District (in 2005 and 2007). This part of western Kenya is a typical small-farm zone that has faced a moderate HIV/AIDS epidemic since the 1990s, following decades of demographic, environmental, technological, and institutional changes. Implications of this case study for further research on HIV/AIDS and micro-level population-environment change suggest that households are useful but imperfect analytical units best seen as part of complex social networks, shaping connections to markets. These important "mediating institutions" link AIDS as a demographic and economic force with environmental outcomes in cultivated landscapes.

Keywords

HIV/AIDS, gardens, livelihoods, Africa, community-based, technology

Author's Biosketch

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of the African HIV/AIDS epidemic for rural livelihoods, technologies, and well-being, supported by the John D. and Catherine T. MacArthur Foundation, the National Science Foundation (NSF) and others.

1. Introduction

The HIV/AIDS epidemic touches the lives of millions of households in rural sub-Saharan Africa today through direct infection or indirect impacts of illness, care and mortality (UNAIDS 2007). In doing so, it changes rural farm labor, livelihoods, and resources, although empirical evidence remains slim. The disease is still spreading (despite decades of prevention programs) and still incurable (although increasingly managed as a chronic disease). HIV/AIDS will thus likely have long-term influences on population and environment dynamics from the kitchen garden to the regional landscape. Despite its importance, we still know little about how the disease actually intersects with rural livelihoods and the environment. This article tackles how HIV/AIDS affects intensive home or kitchen garden, an important part of food security for many sub-Saharan African households. First, the article reviews relevant literature and introduces the interdisciplinary research approach, before summarizing evidence from the Kenyan field site around the complex interaction of HIV/AIDS and gardens. It ends with some suggestions for population-environment research in AIDS-affected Africa.

A growing, but still small body of research documents AIDS' impacts on rural livelihoods (FAO 1995; White and Robinson 2000; FAO 2004, FASAZ 2003, Loewinsohn and Gillespie 2004; Murphy et. al 2005; Bryceson and Fonseca 2006; DeSherbinin 2006). From Mozambique to Kenya to Rwanda, AIDS undermines labor productivity (Yamano and Jayne 2004, Mather et al 2005, Fox et al 2004) , land tenure and farm management (i.e., DeWaal and Whiteside 2003; DFID 2003; Drimie 2002; Mather et al 2005). The epidemic seems to threaten traditional resource management systems, through the loss of adult labor and knowledge important for managing intensive gardens and harvesting wild plants (Gari 2004), managing seed systems (Waterhouse 2005), and sustaining fishing practices (Allison and Seely, 2004; Bishop-Sambrook and Tanzern 2004; Gori 2005). Researchers concerned with how AIDS will affect natural resource management systems, biomass, and medicinal plants have encouraged a recent burst of empirical studies, mostly in southern Africa, which inconclusively link AIDS with stresses on natural resources (i.e., Barany et al 2004; Page 2002; Hunter & Twine 2005; Hunter, Twine and Johnson 2005). Conceptually, experts suggest that HIV/AIDS impacts of park guards and professionals might undermine natural area protection systems (Dwasi/ABCG 2002; DAI/USAID 2005; Mauambeta 2003).

Throughout rural Africa, home or kitchen gardens are an integral part of rural livelihoods. These small patches of land dedicated to labor- and land-intensive cultivation of horticulture crops, such as vegetables, leafy greens, medicinal plants, fruits, bananas, and tubers, often combining organic techniques--have been getting more attention, but mostly from development agencies (Action Aid 2005; Nordin 2005; HSRC 2003, Steiner et al 2004). Gardens are seen as plausible strategies to help households who have lost labor, income sources and practical knowledge to better manage their scarce capital to enhance nutrition for HIV infected and to help ensure food and livelihood security for households and

groups. Gardens are usually imagined to be close to the home, thus minimizing transport and inconvenience for the fragmented woman gardener's work day. They can grow staple foods, relish plants for nutrition, surplus crops to sell for income, and medicinal plants (Gari 2004, Nordin 2005). "Community gardens," often based at schools or clinics, or managed by a community group, are suggested as ways to generate food to support the growing numbers of Orphans and Vulnerable Children (OVCs), HIV+ people, and elderly in populations devastated by AIDS (Action Aid 2005, HSRC 2003). From an environmental perspective, small kitchen or communal gardens could increase vegetative cover, protect watersheds, preserve local germplasm, and increase biodiversity in the regional landscape (Gari, 2004; Nordin 2005). Specifically, home gardens are recognized to be repositories of neglected native African varieties of greens, legumes and tubers that have been displaced over the past century by introduced ("exotic"), European vegetables and commercial grain hybrids (Future Harvest, 2005; BOSTID 1996; Maundu 1999).

Despite their apparent potential for improving food security and nutritional status, mitigating AIDS impacts (especially for women), and enhancing local environments (according to development agency reports), no academic research has documented the (changing) composition and function of home gardens in relation to HIV and AIDS. This article addresses that gap in empirical scholarship, recognizing that much more research will be needed in different regions of Africa and in more depth. Furthermore, no research systematically considers these micro-level patterns within the larger domain of population-environment interactions. These relationships might well be beneficial if gardens are made more diverse and permanent with the influence of HIV/AIDS. These impacts could be harmful to natural resources, if AIDS aggravates postulated negative population, poverty, and environment connections (i.e. Cleaver and Schreiber, 1994). Rural households facing poverty and AIDS could be forced to mine soil fertility and biomass and might lack capital to reinvest in natural and human capital.

2. Research Approach and Methods

This article draws from an interdisciplinary case study of technology change in rural Africa. Data are comprised of "quantitative" and "qualitative" data, combining a comprehensive household survey (i.e. census) with in-depth interviews with selected informant for a village in western Kenya (1). The household survey is comprehensive, comprising a village census for a geographic catchment area considered to be fairly typical of the small-farm sector in western Kenya (Table 2). Here, HIV/AIDS is a problem, but not an overwhelming influence as in the Lake Victoria region or parts of southern Africa. This analysis builds on a smaller 2005 study of HIV/AIDS and gardens, and involved tracing 21 HIV/AIDS-affected innovative gardeners to learn more about crops, choices, problems, and changes since 2005. This is part of a larger study of technology changes in rural AIDS-affected Africa; this article

specifically focuses on kitchen gardens which represent "hybrid" technologies integrating local knowledge, plants, livestock, and tools with imported technologies (from new seeds to mobile phones). This article shed lights on gardens in particular, while aiming to contribute to understanding of how to integrate HIV/AIDS into larger population and environmental changes. HIV/AIDS is a complex element of this equation in African societies, where it is both a burdensome epidemic infectious disease and a potent social, political, and economic phenomena. The reorientation of development priorities around HIV/AIDS is helping to reshape local and national institutions (Iliffe, 2006; de Waal, 2006).

The research approach falls into the broad, interdisciplinary "political ecology" approach (Blaikie 1987; Stonich 1992). This appreciates the historical, political and cultural context necessary to comprehend contemporary resource use, especially when it seems to lead to undesirable environmental outcomes such as deforestation, land degradation, and loss of biological diversity. Within any village, the epidemic works alongside population growth, economic change, and other factors to reshape farming practices and the livelihood strategies available to rural residents. AIDS influences households, small groups, and in villages in ways that cannot be fully understood with regression models, although such approaches can useful model the extent and scale of influence at the provincial and national level (i.e., Yamano and Jayne, 2004; Donovan and Mather, 2004). Other factors include cultural norms and the historical trajectory of socio-demographic change, a full appreciation of which must challenge our conventional understanding of contemporary environmental change (i.e., the causes of deforestation in West Africa: Fairhead and Leach, 1996). Among the Bantu tribes of Western Kenya, where the study site is situated, "traditional" agricultural practices have been altered since pre-colonial times (Wagner, 1947), new technologies arriving in a globalized economy: maize by the 17th century, kale by the 1920s, and more recently the mobile phone (around 2001) and anti-retroviral therapy (ART) to treat AIDS in 2004. International development projects also influence community institutions, politics and priorities, setting up bureaucracies with a momentum and rationality of their own (Ferguson 1992). National policies influence agriculture: Structural Adjustment Policies (SAPs) in the 1980s led to cutbacks in extension services in much of rural Africa and higher prices for fertilizer and seeds. This gap in technical assistance to the poorest farmers is still filled only partially by governmental and non-governmental organizations (NGOs). HIV/AIDS has entered African societies already undergoing deagrarianization, a process of changing rural livelihoods and economies visible in increasing reliance on wage work, informal economy activities, formal schooling and dispersed households (Francis, 2000; Bryceson 2000), and less on subsistence and commercial agricultural activities managed by an imagined extended, intact traditional rural household.

This study also draws on the livelihoods approach to HIV/AIDS, which recognizes different forms of assets or capital that households manage, and the range of activities they engage in (not just

farming). HIV/AIDS has particular interactions with livelihoods (Barnett and Whiteside 2003; Loewinsohn and Gillespie, 2004; Slater and Wiggins 2004)). The disease affects working age adults in particular, cutting into rural labor supply, parenting, and knowledge. the long incubation period from initial infection with HIV to AIDS-related illness means the disease remains invisible while it spreads The effects of the disease are often concentrated in households, since the virus has often entered through the female or male head and spread to other spouses and partners (and from mothers to children). Increasingly, both worldwide, in Africa (and visible in the study site), AIDS is a female epidemic with more women than men infected and on treatment (UNAIDS 2007). Historically, treatment was not available–this gap is changing rapidly with anti-retroviral therapy (ART), now widely available and virtually free for many rural Africans since around 2004. Still, many lack adequate food and nutrition to stay healthy enough to tolerate often toxic side-effects (Gillespie and Kadiyala 2005). AIDS-related stigma persists (and emerged in discussions with care-givers in the village): it manifests itself as silence around HIV/AIDS, denial and refusal to get tested, harassment and outright discrimination around land and assets, and psychosocial stress and depression, reflecting patterns observed throughout sub-Saharan Africa (Ogden et al 2005). The disease can affect the larger community through increasing the burden of care, numbers of orphans and elderly dependents, and demands on local groups (Ogden, et al. 2006; (Levine, Foster and Williamson 2006): Children affected by AIDS are pulled out of schools, lose their land, and are shifted among foster households, all of which bring economic, psychosocial, and physical consequences for the short and long term. Thus, HIV/AIDS is not like other one-time, neutral external shocks to livelihoods, such as accidental death, malaria, or rising fertilizer prices (Baylies 2002). The epidemic needs to be comprehended in its entirety to appreciate how it might affect gardens, farming, and other aspects of rural resource management.

The study aims to associate changes in gardens to HIV and AIDS broadly, given this framework—i.e., to vulnerability to infection, the impact of illness, the burden of care on a household, and access to HIV/AIDS- targeted resources. While biomarker data (i.e., saliva or blood tests) would empirically verify sero-prevalence, they would not capture larger impacts over time (i.e., previous deaths). Tests would furthermore consume scarce research funds and alienate many participants. Thus, other sources of information on HIV/AIDS were used. First, the household roster identifies “chronic illness” (> month, with associated symptoms of rash, fever, diarrhea and wasting), “prime-age” adult deaths within the past 5 years, and foster children; these are commonly used household-level proxies for AIDS-related illness and adult mortality (Donovan and Mather 2004). Secondly, discussions with local home-based care (HBC) workers enabled a confidential tally of people with HIV , “stable on ceptrin” (i.e., HIV+ but not on ART), “on ART,” “bed-ridden,” and “suffered discrimination.” Some households had a member who “died due to AIDS” or “dissolved” entirely. This information helps appreciate the full

impact of HIV/AIDS and trends and to verify the status of individual gardeners (Table 3). These interviews reinforced the prominent role of AIDS-oriented community groups in providing support, and the significance of changes in the health care situation in the region, such as affordable ART in 2004/5. Focus group discussions with men and women from the village shared their personal and subjective experiences as HIV positive person, AIDS-affected, widowed, and care-giving adults. Interviews with village elders confirmed the impression of the arrival of HIV into the village in the mid-1990s, as well as the common perception (not objectively verified) that errant, misguided youth are selling their ancestral lands for quick profits and easy life in towns, putting them at risk and perpetuating the epidemic.

Analytically and epistemologically, the case study approach calls for iteratively integrating methods and data to address the question: how is HIV/AIDS associated with changes in gardens (and with resource management and landscape change broadly)? Triangulated sources, it is hoped, enable a more nuanced interpretation of how and why changes in the village are happening than would be possible from either statistical analysis of survey data alone, or interpretation of in-depth transcripts alone (but without the village census as a backdrop). The historical context of demographic, HIV/AIDS, and environmental change is established through village elder interviews and historic document review (dating to the 1920s: endnote 4). Simple statistical analysis of the project census of the village (February-March 2007) established the extent of (and the range of differences in) cultivated land, crops, and gardens, tools, assets, housing, and community-group membership. The census helps appreciate the idiosyncratic nature of personal experiences of AIDS-affected gardeners, but also their representativeness as "typical" residents in terms of land, livelihoods, and family size. The personal history of individual HIV/AIDS-affected gardeners were revealed through interrogating the transcripts of their narrative responses to a semi-structured interview. Their gardens as documented in 2005 (in field notes) was compared to their reported situation with 2007 in terms of HIV/AIDS, household situation, land, crops and techniques. For 17 of the 21 in-depth informants, data on the individuals' household, economic situation, and livelihoods were derived from census data (note: several of the 2005 garden informants fall outside the 2007 study catchment area.)

3. The Study Site and Population-Environment Setting

The village study site is located in Marakaru Sub-Location, Bungoma District, Western Province of Kenya (Figure 1). A nearby paved road leads to the district capital, Bungoma (30 km away) and to nearby market centers. Situated on the lower foot hills of Mount Elgon and spanning about 15 square kilometers, the study area spans diverse agroecological zones, access to roads, and infrastructure. Soils vary in composition and origin rock, but are typically low in nitrogen and phosphorus and sandy and light clay in texture, therefore vulnerable to erosion. Water is available in a few seasonal streams, springs and

wells, and 2 boreholes. Severe gullying is visible in stream beds and tracks that cut through the village. Most local tree species have been exploited since the early 19th century for grazing, fuelwood, charcoal and tobacco (Wagner, 1947; interviews with village elders: see Table 1). Marginal, rocky, lands are now being cultivated intensively since land is now relatively scarce.

Figure 1 (Map) here

The area was settled in the early 1800s by semi-autonomous clans (according to village elders) . The area was "mostly forested" (see Table 1) and people lived communally in dispersed forts" (fortified compounds) to protect themselves and large herds of cattle from wild animals and theft by raiding Masai and Sabaot. The Bukusu clans practiced shifting agriculture in clearings, cutting and burning trees and brush. They planted sorghum, millet, beans, sweet potatoes, yams and pumpkin. Women cultivated local leafy greens such as spiderplant, clotalaria, sunhemp, amaranth, cowpeas, in intensive kitchen gardens situated around the fertile cattle *bomas* (enclosures, rich in manure). As well, these early clans harvested seasonal, wild leafy vegetables. Hunting and gathering small animals and fishes filled out the adequate diet (Wagner 1947).

Table 1 here (Population-Environment Context)

By the early 1960s, according to village elders, only 33 homesteads, or about 600-800 people, lived in the village catchment area and "paid tax" in cattle. By the late 1980s, due mostly to natural growth, the population had risen "substantially." The current population of the catchment area is just over 5100 in 878 households, ranging from 1 to 17 members (see Table 2). The current population includes many descendents of the original Bukusu plus new in-migrants from nearby locations (The principal language is Bukusu, a dialect of Luhya spoken throughout Western Province). About 31 percent of households visited in the 2007 project census arrived in the past 10 years. Land sales seem to be accelerating and land size decreasing owing to rising land pressure throughout western Kenya (Conelly and Chaiken 2000; Lado 2004). Most farms are under 3 acres now due to subdivision, inheritance, in-migration, and resale. Education levels are low: 68% of male heads have only "some or complete primary" schooling. Housing is simple mud and thatch for most; tin roofing is increasingly common since the grass used for thatch is scarce. Like most villages, it lacks electricity, paved roads or motorized transport. During the rainy season, parts of the village are inaccessible. It is served by three overflowing primary schools and three small market centers (each with a few primitive shops, a diesel grain "posho" mill).

Table 2 (Characteristics of Site) here

The village still boasts relatively good growing conditions, which seem to attract new migrants. Favorable rains provide two growing seasons, March through May (maize, beans ---the staple foods—plus sunflowers, tomatoes, kales, and onions) and October – December (maize, beans plus tomatoes, sweet potatoes, cassava and local vegetables). Year-round, coffee is grown on many farms; fruits such as papaya, banana, avocado, pineapple and other trees. Botanically, kitchen gardens represent a "hybrid system" of indigenous plants and introduced plants (see Table 3 for a list of crops grown). "Indigenous" plants include leafy greens such as sunhemp, clotalaria, spider plant, amaranth, cowpea (both a legume and leafy green), and pumpkin (a vegetable and leafy green); as well as various fruits and gourds (used as containers, especially to store seeds and milk). Well-established introduced species include maize (which arrived by the 17th Century), "local" sweet potato, and varieties of banana and papaya. More recently, kale (*sukuma wiki*), cabbage, onions, and tomatoes were introduced by British settlers, colonial authorities, and missionaries by the 1920s. More recent "exotics" include soya and eggplant and a Vitamin A-enriched sweet potato variety named "SPK004" bred in Kenya. These arrived in the village around 2000, but have been found throughout Kenya since the 1990s. Some crops are grown principally for sale (cotton, sunflower, tobacco, coffee as well as tomatoes, onions, kale, bananas), while others mainly supply food but are often sold to raise cash (maize, beans, sweet potatoes, indigenous greens.)

Table 3 (List of crops grown in village) here

Common livelihood activities include "own-farm production," plus low-wage work, sale of home-made products such as sisal rope and charcoal, small business (mostly trading in farm produce or running a kiosk), remittances from family members living elsewhere, and exchanges of work, labor or goods with neighbors. The poorest households include the elderly woman living alone in a one-room hut with no tools or the widowed mother of several young children. The wealthier teachers, veterinarians, and accountants own a large house, mobile phones, tools and perhaps a car. Over 20 community organizations exist: savings clubs ("merry-go-rounds"), AIDS support groups, and Orphan and Vulnerable Children (OVC) and widow support groups. No non-governmental organization (NGO) has a physical presence, but ACE-Africa, SACRED-Africa, and World Vision have provided training or child sponsorship.

The official HIV/AIDS rate for Bungoma District is about 7 percent (GOK 2006); a relatively high rate for Kenya but not as worrisome as the Lake Victoria region where official rates surpass 20 percent (personal communication, Homa Bay District HIV/AIDS officials, July 2007). The epidemic in Bungoma arrived with truck drivers and spread through commercial sex work serving them as they passed

through to Uganda. Within the village, polygynous households, extramarital affairs, excessive alcohol consumption, "drunkenness and loose behavior," land-sales (and temporary out-migration to towns) ,and chronic poverty seem to drive the epidemic. Informants tell of women compelled by lack of cash and landlessness (due to HIV/AIDS and its stigma) and the demands of child care to exchange sex for *goro-goro* (2 kilogram) of maize. According to the project census and key informants, HIV/AIDS is estimated to have cumulatively affected through infections, illness, death, and fostering, about 20% of households since the 1990s. New infections are less common according to home-based care workers, health center staff, while "orphan care" is a rising concern, replacing care for bed-ridden adults that was a dominant problem before ART became widely available.

4. Findings on AIDS and Kitchen Gardens

These data present a picture of a typical Kenyan small-farm community experiencing temporary in- and out--migration, population growth and land fragmentation, socio-economic differentiation, and persistent adaptation as external ideas have been brought into traditional Bukusu ways over the decades. This section summarizes fieldwork findings, first summarizing the site selection and methods, then the substantive findings around HIV/AIDS and gardens. Findings from in-depth, personal interviews reveal the diversity of HIV/AIDS impacts as well as a common set of notable changes (new crops and techniques), gendered and lifecycle aspects of garden management, and some environmental impacts (negative and positive). The role of groups reveals the force of rural networks in communicating ideas coming from outside. Some statistics for the population set these in-depth data on AIDS-affected gardeners into the context of the village as a whole.

The site was selected in June 2005 for a study of kitchen gardens, a widespread response to AIDS throughout Sub-Saharan Africa (1, 4). HIV/AIDS-affected gardeners were identified who are using new crops, (organic) techniques, are managing more intensive and diverse gardens, irrigating more permanent gardens, and/or re-establishing "neglected" indigenous plants. The 2005 data collection involved participatory and rapid techniques; village mapping, identification of gardens and HIV/AIDS-affected, and group discussions around benefits of gardens (Murphy et al 2006). From February to April 2007, a local field assistant located each gardener and enquired about specific crops, techniques, motivations, constraints, and HIV/AIDS. Of the original 21 in 2005, 17 could be re-interviewed: four others were lost to migration (1), death (2), or were not locatable (2). Findings from these interviews are integrated with associated household data from the project census and summarized in Table 4. These 21 gardeners are evidently typical of village residents, having from none to 4 acres of land (average: 2 acres). They rely on own-farm production, wage work, crafting and sale of local goods (sisal rope, bricks, millet-yeast, and charcoal); remittances, work exchanges, and occasional charitable donations. The relatively "innovative"

gardens identified in 2005 have thus generally persisted, yet evolved in distinctive ways, reflecting circumstances and the intersection of HIV/AIDS, NGO actions, the household's and individual's lifecycle, rainfall, as well as gender norms and poverty.

Table 4. HIV/AIDS affected gardeners, about here

Gardeners represent a range of HIV status and AIDS impacts. These include HIV+ men and women, as well as infected and uninfected AIDS widows/ers, home-based care workers treating the ill and affected, and leaders of AIDS support groups. They range from apparently no negative impact so far (despite infection) to the cumulatively severe experience (i.e., "CW" in Table 3). By 2007, one study participant had died from AIDS, the husband of another died, while another four had improved their health dramatically by going on anti-retroviral therapy (ART). One participant ("JN") chose to go off ART, because of side effects, but stays healthy through improving nutrition and "reducing stress." Relative to the general population, a disproportionate number relative to the larger population of the village, i.e., 6 of 15 individuals with children, were caring for "OVCs". Indeed, orphans were often cited as creating problems and motivating the cultivation of foods to fed them and to sell for clothing, medical care and school expenses. Sometimes these are their own children with one surviving parent ("CW"), other times they are foster children in unrelated households ("CM", "MB", "GB"). The level of foster care can vary from occasional food and gifts, to temporary housing, to outright (but not legally recognized) adoption, involving long-term emotional and financial support.

Benefits of gardens are not static and universal, but vary over time and by gardener, in relation to his/her experience of HIV/AIDS, the household lifecycle, and in response to erratic rainfall and other outside events. Individuals value different aspects of gardens depending on whether they must care for a sick person or elderly dependents (i.e., they need both palatable staples and traditional greens) or growing young foster children (requiring school expenses and staple foods).

Negative impacts of HIV/AIDS

A few hard-hit gardeners reported acute, seasonal shortages of (adult) labor as well as permanent cutbacks in labor productivity and supply. The impacts of illness are mitigated by free ART. Even so, chronic illness and adult deaths pose challenges: For example, "SK" in Table 3 had a thriving garden in 2005 while her husband was alive, but since his death, she has been unable to maintain the bananas, coffee and leafy greens. " JJ" suffered the loss of her husband to AIDS in 2007, even though he had been stable on ART for several years. She relied on extended family and AIDS support group members to pay funeral costs. AIDS-affected gardeners have a range of able-bodied working age adults, from virtually

none (i.e., and elderly woman living alone) to 4. Most (11/17) have only one or two adults. (Table 3: this is the actual number, not ratio, of adults aged 18-64). Compared to the population of the village, the AIDS-affected gardeners are somewhat labor-short on average, but individually their situations vary dramatically. An elderly widow suffers face arthritis and back pain. Some older people have been abandoned by grown children. The burdens of managing a garden are largest for such elderly single women or men and those recently dealing with adult death. They are modest for a younger couple managing to live with AIDS (i.e., on ART) and with children able to work.

Gender

The gendered aspects of gardens and AIDS intersect with changing norms and commercialization. Male and female gardeners alike value kitchen gardens for food security, nutrition and income. While gardens were once solely the domain of women, however (and still perceived by many to be married women's work) they are often now managed by men. This trend parallels men's participation in "women's groups," and reflects men's appreciation of the income potential from small patches. Women in this patrilineal society can be denied access to farmland (getting access through marriage); several cases of discrimination and landlessness related to HIV status were reported. "JN" (Table 3) was forced off her husband's land when she was found to be HIV+, and has had to borrow small parcels. This impermanence keeps her from investing in perennials, composting, and fencing necessary for better garden.

AIDS and resources

As noted in the literature reviewed earlier, AIDS can be expected to have negative impacts through increasing natural resource extraction (soil, biomass) and accelerating the loss of local varieties and resource management systems; while environmentally benign changes might include shifts to labor-saving varieties, reduction in cultivated area, and increasing land in fallow. Evidence from the study site for environmental impacts of AIDS is inconclusive. In 2007, fallow land was often visible on larger parcels (over 10 acres), but fallowing t is not generally due to AIDS-related labor shortages, according to informants (except in one known case of a census respondent who buried her husband in 2006 and lacked cash to pay for ploughing). Instead it is to protect the soil and aid its rejuvenation in the absence of commercial fertilizer. Extraction of wood, fiber and biomass for fuelwood, charcoal, hoe and axe handles, brick-burning, sisal rope are widespread livelihood activities involving extracting local trees and fiber plants, and which earn little income. However, these activities are not linked to HIV/AIDS affectedness (among the 17 gardeners) nor with HIV/AIDS indicators in the census (chronic illness, prime-age death, orphan support). Instead they correlate with "poverty": i.e., poor housing, small land size, not owning

cows, and lacking radio, furniture and other household assets are associated with such unremunerative survival strategies.

In fact, several environmental (as well as social and nutritional) benefits of improved gardens seem to be associated with HIV/AIDS. Kitchen gardens increase the number of plants grown in small patches of land, enhancing biological diversity and helping protect the soil from rains. Indigenous sun hemp, spiderplant, crotalaria, and other seeds were considered scarce in 2005; they are more available in 2007 and on sale in local markets. Informants express interest in "seed-bulking" (growing and storing seeds) to preserve neglected, even threatened local species. While organic techniques—including composting, natural pesticide teas, terracing—are fairly widely known (superficially they are recognized by 60-80% of census informants), composting (for example) is disproportionately visible among the trained HIV/AIDS affected gardeners. Together, crop diversity, irrigation, seed bulking and composting help improve soil fertility. Now "nothing grows without fertilizer" say many.

Networks of Knowledge

Information around gardens and HIV/AIDS has spread through groups, most visible here in the work of AIDS support groups and neighbors, suggesting the importance of networks as channels of diffusion. Six individuals were formally trained in 2004 or 2005 by a local NGO (see endnote 5). They share seeds, techniques and ideas to others in the village. "MJ" (in Table 3) noted that indeed "AIDS is 'changing what people are growing…" as before we "did not know anything about nutritional values of some indigenous crops"; she learned not from the NGO but from a (trained) neighbor. Membership in these HIV/AIDS support groups and widow support groups, channel scarce seeds, information, tools, cash, and moral support through group members, within the village and across village boundaries. So important and visible are their efforts that, in the words of "EN" (30, HIV+) "if they can mobilise the entire community to join the group, then HIV/AIDS can be minimized". Small funds (government and NGO) earmarked for HIV/ AIDS groups bring hoes, uniforms, grain mills, and nutritional supplements to the HIV+ and their care-givers. While these gifts are rare in fact and small in size (based on interviews with NGO and community group representatives in Bungoma), the perception remains that AIDS groups can attract them.

These networks are spreading ideas such as knowledge about crops and their nutritional needs, new varieties (sweet potatoes), new crops (soya), and less visibly, increasing diversity of plants and intensity of cultivation techniques (i.e., hand irrigation). Knowledge of nutritional values is spreading: HIV+ people and trained home-based care workers spontaneously report the vitamin composition of different plants (mentioning "Vitamin A"), their contribution to "positive living," and ability to improve "immune response." This terminology reflects exposure to formal training materials. As well,

agroecological characteristics of particular plants (i.e., the improved Sweet Potato SPK004), such as shorter growing season, lesser labor requirements, tolerance of drought, and ease of storage and processing are mentioned. These benefit any households short of labor and cash (regardless of HIV/AIDS status). The rapid spread of soya and SPK004 from an original single adopter in 2005 to 6 in 2007 is notable, since these crops are less common in the village. A majority of the 17 "HIV/AIDS-affected" had increased the number of "currently grown" crops, which is a rough indicator of increasing intensification, since they were hand-irrigating seedbeds and plants during the dry season rather than simply broadcasting a few leafy greens with the rains.

AIDS Gardens or Kitchen Gardens?

To what extent are these changes in gardens –new crops, techniques, and diffusion channels— unique to the HIV/AIDS-affected? Or do improvements in gardens reflect a more widespread interest in varieties and techniques to overcome widespread soil infertility, population pressure, and rising prices?

Data from the 2007 census on households tell us about land, gardens, techniques, tools and crops, differentiating "currently grown" plants, crops grown "last season" and to be planted "next season." Residents were asked if they "maintain a home garden": 85% of all respondents reported "Yes," but direct observation during fieldwork indicates that many are seasonal and involve only kale (*sukuma wiki),* a crop that is easy to grow, sell and cook. A smaller proportion of the population are currently cultivating any indigenous leafy greens (only 60% of village as a whole vs. 90% of AIDS-affected). Furthermore, new crops such as soya and SPK004, grown by 6 percent and 22 percent in the population are less common than among HIV/AIDS affected, 45 to 50 percent of whom report these new crops. In 2007, the openly HIV/AIDS affected (using proxy measures of census data) were much more likely to recognize AIDS-oriented NGOs, and are more connected to outside training and resources.

These data suggest that it is the specific individuals who have tapped into HIV/AIDS networks who are more likely to have improved gardens: semi-permanent and irrigated by hand to overcome poor rain, with a greater diversity of plants, and with newer varieties that are hard to procure. While they are often directly affected by HIV/AIDS through infection, illness, or death of a spouse, it is evidently, not the presence of the virus nor the burden of disease which enables changes alone; but the training, support, seeds and tools that arrive through groups. These resources make more intensive and productive gardens more feasible despite AIDS-related labor shortages and other costs.

These village census data suggest subtle differences between the HIV/AIDS-affected and the larger population in this homogenous community. While HIV/AIDS is clearly an influence on gardens (positive and negative) it is not a large factor for many who can manage to maintain a simple garden despite lack of training or AIDS support group, and for those who lack cash (regardless of HIV/AIDS

status), poverty is a barrier. Notes one study informant who lacked a kitchen garden and any apparent association with HIV/AIDS: it is not labor shortages or illness, but simply "poverty [that] has made [us] not even to have a sheep or goat …to collect the droppings and make compost beds."

5. From Kitchen Gardens to Rural Landscapes: Population-Environment Research

The prior section established the subtle role of HIV/AIDS and kitchen gardens, both as epidemic disease bringing cash and labor shortages (for some), and as a broader social phenomena shaping ideas, funding streams, and organizational priorities. For this catchment area, HIV/AIDS has yet no distinct, visible negative impacts (yet) on land, soil, and resource use. In fact, land sales, fragmentation, poor soils and poverty seem to help drive the epidemic, rather than the converse. As social phenomena, however, AIDS has had a modest positive influence on several individual gardens over recent years. This section builds on this case study findings to address larger issues: How should we think about how HIV/AIDS will affect farming systems and the rural environment in sub-Saharan Africa? In so doing, it challenges some assumptions about how HIV/AIDS can be expected to affect rural localities. The case study also has implications for how to approach research on AIDS, population, and environment --at least the rural landscape.

Because AIDS affects adults in their prime, it is logically suggested that the epidemic will undermine knowledge of traditional farming, seed preservation, and other natural resource management systems (Mutangadura et al 1999; Domingues, Jones and Waterhouse 2004; Gari 2004). Fortunately, so far, there is little evidence of loss of farming and gardening knowledge due to AIDS in this village. Rather, the apparent neglect of traditional crops (leafy greens, millet and sorghum) arose before HIV/AIDS arrived. Modern crops were promoted from the 1920s. Demand for cash for taxes, schooling, clothing, and transport increased the mobility of the rural workforce. Tastes and cooking techniques are changing with the greater convenience of maize and kale. Decades of formal schooling led to disinterest among youth in gardens and agriculture generally: "Young girls don't dig gardens" observes one Kenyan expert (personal communication with Anton Okutu, ACE-Africa, Feb. 2007). Weeding is punishment for wayward pupils; agriculture was dropped from the Kenyan curriculum. Furthermore, small-farmers were deprived of relevant agricultural assistance from the late 1980s (under "demand-driven" extension policies) (Ellis and Freeman, 2004). In the village site, no one could remember the last time a ministry extension worker visited, fertilizer prices-- Ksh 2000 per bag, about ten days rural wages—are beyond most small farmers' means. Useful but neglected indigenous crops have received attention from international agencies since the 1990s (BOSTID 1996), but resources are now reaching the site, and possibly other villages too, principally through HIV/AIDS-targeted rather than standard agricultural technical assistance. Throughout sub-Saharan Africa, the impacts of HIV/AIDS on rural farms and

landscapes will be hard to tease apart from these longer-run demographic, cultural and policy changes affecting rural livelihoods and knowledge systems.

Furthermore, this case study suggests that methodological richness is needed to elucidate and understand small-scale micro-level trends, such as these subtle patterns visible on the family farm and garden. AIDS is neither a straight Malthusian check on over-large rural populations, nor a necessarily negative impact on traditional land management systems; but should be appreciated as a complex demographic, social and political phenomena. It necessitates more complex measurement of households, families, and social groups as they manage livelihoods and deal with HIV/AIDS among other challenges and opportunities.

The "household" (as farm manager, unit of livelihood) is important and convenient levels of analysis and has become the convention in rural research around the world. In population-environment literature, meanwhile, the "household" (i.e., its numbers, rates of growth, and consumption levels) is increasingly recognized as a better predictor of aggregate impact (i.e., greenhouse gases, ecological footprint, biodiversity loss) than 'population' per se, since households are the relevant unit of resource use and impact (Liu, et al 2003). Evidently, however, while households are real and meaningful as consumer units and decision-makers, in rural Africa as in urban America; they are still not sufficient to appreciate how HIV/AIDS intersects with rural lives. Households in this case study are bound in space, but are part of extended families who combine land- and urban- activities to produce a living. These activities are fluid across space and changing over time—possibly even more so with HIV/AIDS. Households cultivate dispersed parcels across agro-ecological zones, possess multiple residences, juggle different sources of income and goods, and rely on group support. Adults move due to divorce, employment, health, and AIDS-related discrimination. Children move due to orphanhood, eviction, to assist a lonely grandparent, or attend school—movements which put them at risk of HIV (directly, through incest and rape: in group discussions) as well as helping to mitigate the burden of AIDS. Capturing just "households" would miss these profound interconnections among individuals of different ages and roles and with different (variable) residences (in this case: the village, Nairobi, Kisumu, Kitale, Mombasa and more). These interconnections are also evident in the reliance on community-based social networks which sustain gardeners through hard times--whether due to AIDS, malaria or other drought. Though subtle, these small changes and flows might well transform the broader rural landscape over the longer run.

These forces should be captured in population-environment studies of rural Africa in the age of AIDS: this entails multi-method approaches which uphold the convention of "household" level (for convenience and comparability) but capture larger connections, too. Approaches could vary usefully from in-depth, geographically focused case studies (such as the approach pursued here) to more rigorous modeling of formal social networks across large geographic regions (i.e., Entwistle et al 2000).

A second implication for population-environment research arises from appreciating the importance of interconnections, between individuals, groups, and markets, as "mediating factors" that are changing with HIV/AIDS. Rural households are one such mediating factor that throughout sub-Saharan Africa have been linked together (for labor, ploughing, and local produce), with regional urban markets (for income, selling their labor, charcoal, fuelwood, bricks, and crops), and with the global economy (selling or abandoning cotton, tobacco and sugar with their boom-bust cycles) (Bryceson, 2000; Frances, 2004). This level of inter-connection with the wider world has been part of the problem for rural Africa, i.e., the original source of HIV infection, as "rural" men and women moved away for work, returning with the virus, creating the generalized rural epidemic (Barnett and Whiteside, 2003; Iliffe 2006). At the same time, these interconnections can become part of the solution to problems (poverty, population pressure, lack of formal technical assistance) aggravated by AIDS. Study site residents regularly sell their produce in tiny volumes for tea, medicines, bus fares, uniforms; they lack adequate economies of scale, information and geographic access to negotiate markets, thus keeping their incomes low. This poor "market access" obviously inhibits household well-being and access to resources.

Poorly functioning markets and others networks of flows can also undermine the long-run prospects for sustainable agricultural intensification. Long-term research in Machakos, Kenya (Tiffen et al 1994) revealed that population growth is not necessarily a negative force driving environmental destruction, but can be consistent with increased food production and recovery of the landscape (from the 1930s to around 1990). This long-term 'Machakos Miracle' required functioning markets and steady flows of remittances (from laborers in Nairobi) to reinvest in terraces and gardens; as well as access to relevant and affordable agricultural technologies. For the contemporary situation, HIV/AIDS must be now part of this 'population-development-environment' equation, but not simplistically as a force shaping the demographic structure. It is a more complex force reshaping several mediating factors: households, extended families, support groups and their social networks, and access to markets. These will mediate how rapid population growth affects agricultural intensification, of which kitchen gardens are an element. The cumulative burden of AIDS in the village is an additional stressor in this resource-strapped rural setting, to be counterbalanced conceptually and analytically with the potential for positive influences of AIDS on these mediating institutions and long-run environmental outcomes.

6. Conclusions

Drawing on original field data from western Kenya, this article examines recent, subtle transformations in kitchen gardens and draws out their associations with HIV/AIDS, appreciating the social and historical setting for such changes. AIDS in Africa is not just a potent demographic and epidemiological force, but a social phenomena affecting individuals, households and their cultivated

landscape, as well as the invisible "landscape" of community groups and international development aid. This process leads to some surprising positive outcomes.

HIV/AIDS is a chronic disease, a factor in NGO and government responses, and works alongside other long-terms trends such as cash cropping, wage work, and urbanization to reshape rural lives. Gardens have been a neglected but important component of these rural ways. The specific ways that HIV/AIDS reshapes village livelihoods is in part a consequence of modernization, mobility, and the projects of contemporary development institutions. Over the long run, dramatic landscape level effects such as increased vegetative cover and soil fertility might be visible, but for now only micro-level effects can be seen in individual gardens, such as re-established indigenous greens, composting, new hybrid varieties of sweet potato and soya, and greater independence from purchased farm inputs. These actions are modest but might overcome decades of declining soil fertility, scarcity of vegetable biomass and cattle manure, and scarcity of local seeds.

This case study furthermore reveals the need to better appreciate the role and limits of the household as a unit. The interconnected, networked and dynamic roles of the individuals shape garden activities across the village. Secondly, real market access is an important mediating factor linking local growers and livelihoods with larger urban and regional networks. Cash income from gardens, fields, and resource extraction is critical to household security and well-being, especially where AIDS and poverty intersect. In locations where the epidemic is severe, these group and market exchanges will likely be more significant to sustain simple livelihoods, not to mention long-term intensification along the lines of the 20th Century "Machakos Miracle." Research into population-environment dynamics in rural Africa in the 21st century can benefit from multi-method case study approaches which can capture these forces and historical trends, rather than relying on either contemporary intensive, in-depth methods alone, or conventional population-level quantitative studies alone.

HIV/AIDS is now possibly a manageable chronic illness (with ART) and the rate of new infections is declining throughout East Africa. Even so, HIV/AIDS will quietly, persistently influence livelihoods and kitchen gardens. Doing so, it will change the lives of HIV/AIDS-affected and their neighbors and friends in modest but locally significant ways. In the long run, the cultivated landscape might evolve in as yet unpredictable ways that can be fruitfully researched as part of a new agenda for population-environment research.

Endnotes

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2. The Census: The village level is the lowest official administrative unit in Kenyan society. This comprehensive coverage offers a useful point of comparison with historical data, compatibility with official census data, and a baseline for long term research. A simple household level questionnaire was developed, translated into Bukusu and administered to male or female heads, from February 3 through March 10, 2007 (dry season) by trained, Bukusu-speaking field enumerators. They interviewed a responsible adult for every grouping that 'eats from the same pot' within the village catchment area. These numbered 878 households (29 cases of non-response due to the family being away, incapacitated, or refusing to participate). The 84 multiple wives associated with 34 polygynous relationships have their own household. A household roster gathered standard data on age, sex, education, religion, work activities, chronic illness, and symptoms for the current members and for "previous members" (who moved away or died within the past five years). The questionnaire asked about land area (owned, rented, fallow), crops (now, last season, next season), tools, techniques, housing, cattle, and other assets owned by the household. The census included a separate questionnaire and group discussions and in-depth interviews to investigate mobile phone ownership and use in the village, a primary topic of the 2007 study, but those details and results are beyond the scope of this article.

3. HIV/AIDS data include: (1) Project census: proxy indicators of "chronic illness", prime-age or adult mortality, and orphans or fostered children gathered through the household roster (see note 2); (2) Key Informant Interviews: Lay home based care (HBC) or community health workers (CHW) who

4. Gardens and Landscape data: The 2005 study documented innovative individual gardens, village infrastructure, and a support group (i.e., community) garden through participatory and group discussions. A particularly innovative and enthusiastic gardener was identified for in-depth interview around her motivations, techniques and problems (one listed in Table 3). The short time frame and structure of the original study entailed a rapid appraisal and did not allow careful study of the larger population nor a strict control group, i.e., non-AIDS affected. The individual gardeners identified were followed up one-on-one in 2007, using a semi-structured questionnaire to inquire about the garden, changes, and perceptions around crops. Interviews were generally conducted in Bukusu and translated into English by local, specially trained field assistant. Also in 2007, in-depth interviews with eight village elders explored changes in gardens, forest cover, cash and food crops, land, and HIV/AIDS, highlighting the extent of deforestation caused by the uptake of commercial commodities like tobacco. Additional historical context is provided from inspection of colonial era (1920s- 1960s) archives at the library of Rhodes House, Oxford University. Relevant documents reviewed included North Kavirondo and Elgon-Nyanza District officer papers, memoranda, and letters on land, health, education, and population. Visual inspection of 1949 aerial photos of the village catchment area revealed the presence of the (current) road (then dirt), scattered large compounds, several patches of cultivated land, widespread pasture, and few large trees. The level of land conversion by that early age is evidently due to cattle grazing and shifting cultivation, later complemented by charcoal production, tobacco-curing, and fuelwood and poles (for building).

5. ACE-Africa (www.ace-africa.org) is based in Bungoma, operating throughout the District, reaching AIDS-affected with information, training, demonstration gardens, orphan support, and income

generation. They have sponsored workshop in agricultural techniques and nutrition and distributed new seeds and techniques (ACE-Africa 2004). This training specifically targeted the HIV+ people, widows, and those providing support for HIV+ people and OVCs throughout the district. The 5 day curriculum (shared with the Ministry of Health and other NGOs) encompassed classroom lectures and field practice. Trainee learned how to cultivate indigenous/local crops (millet, sorghum, various leafy greens) and several new plants (soya, eggplant). Messages emphasized the nutritional value of plants, the need to boost the "immune response" with a varied, adequate diet, reducing use of chemicals in planting and of fats in cooking, and saving money through using home-grown rather than purchased inputs and ingredients. Demonstrations at field sites illustrated new techniques, such as green manure, ground cover, and vegetable-based composting (both pit- and pile-type). These techniques were encouraged for individual and community gardens. This is the formal training which over 2004-5 reached 6 individuals who reside in the study site, and dozens of others throughout the district.

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Figure 1. Location of Village Study Site in Bungoma District, Western Kenya

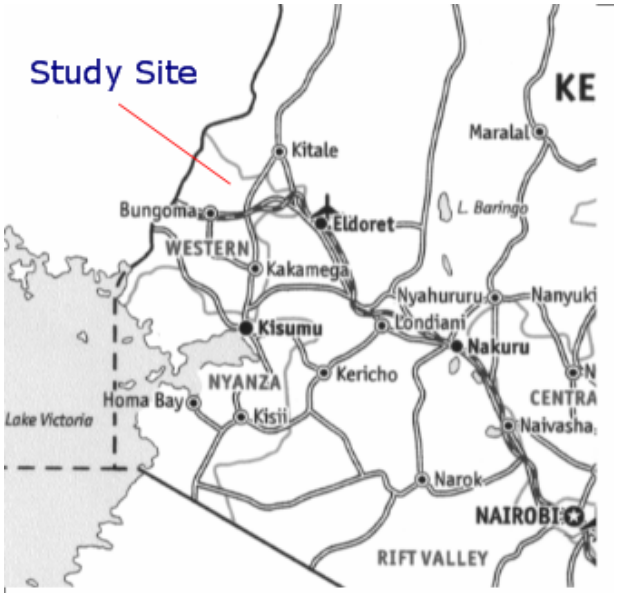


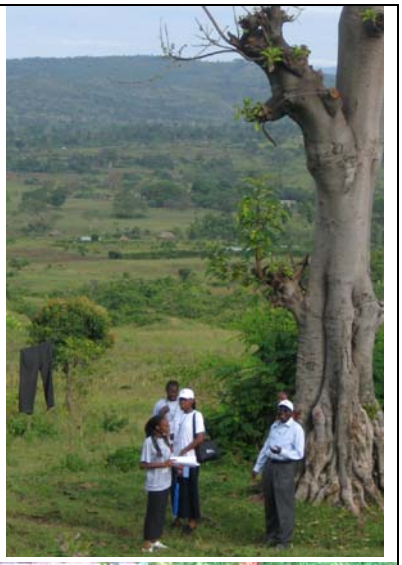
Table 1. The Population-Environment Context of the Marakaru Sub-Location Study Site

Period	Population Context	Environmental Context	Garden Characteristics
"Old-Days" 1800s - pre WWII, colonial and pre-colonial era	Low population density: A few homesteads, a few hundred persons in 13 sq. km area Clans lived in several fortified compounds, cultivated communally Modern Village (Catchment Area) boundaries established around1938	Forests, wildlife plentiful Fertile soil, abundant land, shifting cultivation; Harvest wild plants, bushmeat Large herds (>30) of local cattle, plentiful dung	"Birundu" (intensive Bukusu kitchen gardens) were universal. Production for subsistence. Spiderplant, amaranth, millet, sorghum, yams widespread, Cultivated and wild varieties. Local seed production widespread (sorghum, millet, greens). Use short blacksmith-made hoes
1950s – 1990s Modernization, Development Pre-HIV/AIDS	50s: Rapidly rising regional population (3.8% annually); Bungoma town established around sugar industry 50s-60s: Modern primary schooling becomes widespread 60s: 33 homesteads in the Greater Village. 80s: Structural adjustment policies left few agricultural extension services	Deforestation with grazing of cattle, fuelwood, charcoal to sell to Bungoma, tobacco Land fragmentation accelerating; Land passed on through inheritance (Male lineage + large families) Cattle herd size decreasing	Maize and beans dominant field crops, tobacco, cotton and sugar are cash crops Exotic kale, tomatoes, onions replace traditional greens in less diverse gardens. Old women keep up Birundu (gardens) Long-bladed imported hoes displace traditional angled blacksmith hoes Production for cash to pay school fees; non-farm wage work common for males
1990s- today Era of HIV/AIDS	Rising population due to in-migration and natural growth. >600 homesteads, >880 households by 2007. Bungoma District: ~ 1 million people. HIV arrived early 1990s to Village; testing (VCT) nearby in 2004, ART arrived 2004 (free by 2006)	Land parcel size diminishing with subdivion, sales Cattle herds <3 Deforestation of village nearly complete Soil fertility declining, esp. with Striga (witchweed) Scarcity of biomass, fertilizer/cow dung, fuelwood	Maize remains dominant food crop; Tobacco, cotton abandoned by many (non-payment, soil exhaustion) Kitchen gardens start to blend new hybrid varieties (SPK004) and new exotics (eggplant) for nutrition Traditional Birundu-type garden scarce NGOs and Ministries promote indigenous plants; Local seed production insufficient for demand

Source: Project field data, including key informant interviews will elders (2007), group discussion with elders (2007), group discussion with gardeners (2005), In-depth individual interviews with gardeners (2007), Census of Greater Village (Feb-March 2007), archival document review (aerial photos).

Table 2. Demographic and Socio-Economic Characteristics of Village Study Site *(Source: Project census Feb/March 2007*)

Demographic and Health Indicators



Current Population: (est) 5235 individuals in 878 households
Household size: 1 to 17 (mean: 6 persons)
Education: 68% of heads "some" or "complete primary"
In-migration: 31% established farms in past 10 years
Common health concerns: Malaria, typhoid, "stomach", chest problem
"HIV/AIDS affected" households: ~ 20%
Self-reported HIV infected, chronically ill person, AIDS-related death: 3%
Census report of "Chronic adult illness" : 111 households (13%)
(Key informants) Adults on ART: >=8
(Key informants) Bedridden due to AIDS: >=3
AIDS-related Adult mortality within the past 5 years: 33 (4% of households)
Currently hosting orphans: 79 households (9%)
Current Number of OVCs in Greater Village: 233 children
Have suspected HIV/AIDS case: 42 households (5%)

Livelihoods and Assets

Thatch roof: 46% Mean number of rooms = 2.5
Mobile phones: owned by 15% of households
Cattle: 38% have none; 30% have 1-2 cows: 32%; >=3 cows.
Livelihood Activities:
Own-farm production: 95% (89%: "important" or "very important)
Sale of own-farm production 61% ("important")
Trade of others' farm produce : 23%
Casual labor: 29%
Produce / Sale charcoal, bricks, sisal rope: 37%
Small business (kiosk, bicycle taxi, carpenter): 36%
Remittances: 20% Rental of land: 18%
Exchange of goods: 48% Exchange of labor: 46%
Donations (relief, charity): 8%

Resources/Environmental Conditions

Water: adequate, good rains, but seasonal scarcity.
Land: small (decreasing) farm size: 60% have < 3 acres, Gully erosion in streams and slopes. Declining soil fertility, lack of seeds, lack of cow manure or fertilizer common complaints. Intensive terracing on some farms to stem soil erosion. Sisal now scarce.
Forest cover: 3 acres of natural forest in 13 square km, large trees scarce.
Fauna: small wildlife (birds, rock hyrax).

Source: Comprehensive survey (census) of all households in the village catchment area for the study site catchment area, February – March 2007 tallied 5061 individuals in respondent households plus 29 non-response households with averaged 6 persons/household. Environmental data come from field observation and village elder interviews (see endnotes for details).

Captions: Top: Typical treeless landscape; Middle: gardener plucking pumpkin leaves; Bottom: rocky outcrops where new farms are located

Table 3. List of Crops found in Kitchen Gardens in Village Study Site

ENGLISH NAME	BOTANICAL NAME	BUKUSU & OTHER NAMES	USES
Herbs, Tubers, Legumes			
African arrow root	*Tecca leonto petaloides*	Kimitolotolo, nduma	starch
African Eggplant	*Solanum aetniopian*	Rbiling'anya, Ebiling'anya biringanya	vegetables
Aloe plant	*Aloe vera*	kutiokotokio	Medicinal: treat malaria, skin
Amaranth	*Amarantus spp. hybridus*	Litoto	leafy green
Beans (French)	*Phaseolus vulgaris*	Chipisi, chipinji	proteins
Black jack	*Bidens filosa*	makoe	vegetables
Black night shade	*Solanum Americanum*	Namasaka/Esufwa	leafy green
Broad bean	*Vicia faba*	lwakhakha	proteins
Carrot	*Dauca's carota*	Ekaroti, karot	Calcium source & vegetable
cassava	*Manihot esculenta*	Kumwoko/mihogo	Starch, Vitamin A.
Chick pea	*Cicer arictinum*	chimbande	proteins
Chickpea	*Cices ailetnum*	chimbande	Source fats, proteins
Chili pepper	*Capsicum annum*	Epilili,pilili hoho	Vegetable appetizer
Common bean	*Phaseolus species*	kamakanda	protein
Common bean	*Phaleolus spp*	kamakanda	proteins
Cow pea	*Vigna unguiculata*	sikhubi	leafy green, protein
Crotalania	*Crotalania anthyloris*	kimiroo	Vegetable, calcium &vitamins
False cardamom	*Afromomum melegueta*	chingayo	Food
French bean	*Phaseolus vulgaries*	chipisi	Protein source
Garlic	*Allium sativum*	--------	Seasoning, medicinal (immune system)
Gourd	*Legenaria (diff varieties)*	Emuka, kibuyu	vegetable, container
Gourd tomato	*Lycopersican esculentum*	chinyanya	vitamins
Green peas	*Pisum sativum*	Sikhuvi,kunde	vegetable
Ground nuts	*Arachis hypogaea*	chimaito	Fats, starch & proteins
Ground nuts	*Arachis hypoyoea*	Chimaito,njugu	Food/fats, oil seed
Irish potato	*Solanum tuberosum*	Bilasi, viazi waru	starch
Kale	*Brassica carinata*	sukuma	leafy green, cash crop
Locust bean	*Parkia clappertonia*	Raskoko/ nakholo	proteins
Long bean	*Vigna radiata*	tanganyika	proteins
Maize	*Zea mays*	kamaindi	Staple food
Marigold	*Calendula officinalis*	lufuta	Fodder, forage for rabbits, fuelwood
Mushroom		Bubwoba/bumekele	Vegetable, rich in proteins
Neem	*Azadiratu indica*	Mwarubaine	Medicinal, locally used to treats >40 diseases
Onion	*Aljam cepa, Alium fistulosum*	Bitungulu, Situngulu/ kitunguu	vegetables, cash crop, boost immune system
Oyster nut	*Telfairia pedata*	murekura	Fats, oil seed
pea	*Pisum sativum*	chibalayo	proteins
Pigeon pea	*Cajanus cajan*	chibalayo	proteins, leafy green
pineapple	*Ananas comosus*	Kumnanasi, nanasi	vitamins, cash crop
Poorman's spinach	*Amaranthus thunbergii*	Emboka	Seeds are edible, vegetables
Pumpkin	*Cucubita spicies*	kamasiebebe	starch, fats & iron
Pumpkin leaves	*Cucurbita spp.*	Liondo, malenge	iron, vitamin A
Runner bean	*phaseolus*	kamakanda	Plant proteins
Sesame	*Sesamum indilum*	chikhanu	Oil, fats
Sesame leaves	*Sesamum indicum*	Chikhanu, simisim	vegetables
Soya beans	*Glycine max*	chisoya	proteins, added to nutritional supplements

Spiderplant, Cats whiskers,	*Cleome gynandia*	-----	vegetable
Spinach	*Basella alba, Spinacia oleracea*	Spinach	Leafy green, cash
sunflower	*Helianthus annus*	Kamaua,maua	fats/oils, cash crop
sunhemp		murere	Leafy green, iron, vitamins
Sweet potato	*Ipomoea batatas*	Kamapwoni, ngwashe	starch
Sweet Potato (improved)	*Ipomoea batatas*	SPK004	Starch, vitamin A
Sweet potato (local)	*Pomea batatas*	kamapwoni	starch, cash crop
Tomato	*Lycopersicon esculentum*	Enyanya, nyanya	Vitamin, vegetable, cash crop
Yam		Nduma	Starch, cash crop
Fruit and nut trees			
Avocado	*Persed amusican*	Kamavacado, avacado	Vit. & fats
Banana	*Musa acuminata*	Litore, ndizi	Starch & vitamins
Blackberry	*Rubus species*	Chifini, zambarau	vitamins
coffee	*Coffee arabica*	Ekawa, kahawa	Beverage, cash crop,
Fig common	*Ficus carica*	kumukhuyu	vitamins
Fig sycamore	*Ficus cycamorus*	kamakhuyu	vitamins
Guava	*Psidium quajava*	kumpera	Food, vitamins source
lemon	*Citrus limon*	Endimu, ndimu	appetizer
Mango	*Mangitera indila*	Kumuemba, muembe	Vitamin C, A
Money quava	*Diospyros mespilitorrmis*	kumera	vitamins
orange	*Citrus sinensis*	Kumchunwa, mchungwa	vitamins
Passion fruit	*Passiflora edulis*	Kamatunda kamalama	vitamins, cash crop
pawpaw	*Carica papaya*	Kumpapai, papai	vitamins
Sour orange	*Citrus auriatum*	Kamasalila, kamakhomako	vitamins
Soursop apple	*Annona muricata*	chikhomeli	vitamins
Watermelon	*Citrullus lanatus*	melon	Seed: vitamins, boosts immune system, zinc
Grains/ cereals & fodder grasses			
Finger millet	*Eleusine coracana*	Bulo, mtama	starch, used in beer brewing
Guinea grass	*Panicum maximum*	Bunyasi, lukhafwa	Grazing
Maize (several varieties)	*Zea mays*	kamaindi	Staple food, starch
Millet	*Panicum miliaceum*	Bulo, mtama	starch & protein
Napier grass		Kimilele	Fodder
Seteria grass	*Setaria anceps*	Lulumbuku/ lungelele	Thatching
sisal	*agave*		Border, fence, fiber
Sorghum (local and hybrid)	*Sorghum bicolor*	Kamaemba, mawele, mtama	Staple, starch, used in beer brewing
sugarcane	*Sacccharium spontaneom*	Kimiba, miwa	Food, sugar and carbohydrates
sunflower	*Helianthus annul*	Kamauwa, mauwa	fats, cash crop

"Kitchen garden" crops refers to any plants grown by respondents in the small area dedicated to kitchen gardens. These include some crops usually grown as field crops (i.e. maize). This list excludes field crops grown exclusively in extensive areas for cash: i.e., tobacco, cotton and other trees (for fuelwood, charcoal, poles) which are still being compiled.

Table 4. Description of Individual Kitchen Gardens of HIV/AIDS network (met in 2005)

Gardener, Household, and Farm	# Adults	# School-age	Livelihoods ("Important" activities)	Crops & Techniques	Assessment: HIV/AIDS & Gardens
CW, 43, Widow, HIV+, ART .75 acre (ac), one hoe	0:1	3	Farm produce, work exchange, donations	7 crops planted Knows 10, uses 3 new techniques. Knows 3 Dev Agencies	Struggling gardener: Heavily Affected (PLWHA, Widow, OVC dependents, discrimination). Ag/N training 2004, Widow and PLWHA support group, OVC group. Labor- and cash-short
WK, F, 43, Married, 4 acres	1:1	8	Farm production, wage work, exchange goods	16 crops (SPK004) Knows 9, uses 6 new techniques, knows 5 agencies	Managing: Undisclosed HIV/AIDS status. Crotalaria and sun hemp new in 2005, still growing them 2007.
SK, 61, F, Widow, OVC household	0:1	3	Farm, sell gourds, exchanges, donations	Diverse, with 23 plants, inc SPK004, soya. Uses 8 new techniques. Labor, moles, a problem. 5 agencies	Struggling: Received A/N training, receives assistance for OVCs; but lost husband's labor and she has "grown weak from disease"; garden is less green and diverse than in 2005.
TW, M, 39, 4 ac, 1 fallow	0.5:1	8	Farm, sell home-made goods. Head works off-farm	13 plants; uses 5 new techniques, array of tools. No agencies known.	Managing: Undisclosed HIV/AIDS status. Learned techniques from neighbors. Lack of cash for seeds, fertilizer
PL, M, 62, 4 acres, 1 fallow	1:1	4	Farm, wage work, selling things, goods and work exchange, rent land	10 plants (SPK004), 9 new techniques. Knows 3 agencies	Thriving: Undisclosed HIV/AIDS status. Member of local Widow and Orphan support group, lends building space. Poor, sandy soil and lack of cash for seeds, fertilizer.
JN, F, 43, on ART. Small plot loaned to her	0:1	4	Farm production	9 vegetable crops planted; changes parcel so can't do perennials	Struggling: AIDS-affected, forced from household, divorced husband, no secure land; entered HIV/AIDS support group, received AG/N training, aware of nutrition needs on ART.
GB, 42, M, married, 3 ac	1:1	10	Farm production, work exchanges, rent land, sell beer/busaa	20 crops (SPK004, soya) knows and uses 10 techniques	Thriving: Supports OVC group, trained CH worker, received Agriculture and nutrition for HIV/AIDS in 2004, est garden 2004
MB, M, 33, Married, 3.5 ac.	1:1	9 w/ foster OVCs	Farm, shop, trade, work exchange, rent land	21 crops (SPK004, Soya). 8 new techniques. Knows 15 and uses 8 new techniques	Thriving: Trained in HBC, extensive outreach in the community to all PLWHA; 2004 and prior training in Ag/Nutrition for HIV/AIDS, organic agric. Cares for OVCs.
RW, F, 55, Widow, well-equipped 2.75 ac.	1:1	3	Remittances, Exchanges, farm	17 plants (SPK004, soya), uses 9 new techniques on	Managing: Registered with AIDS-oriented widow support group. PLHWA, but not openly. Garden since 2005. Older children help.
SN, 75, lives alone, ½ ac loaned	0:0	0	Farm, sells millet-yeast for beer brewing, donations	5 crops, few tools, knows 5 agencies	Struggling. Labor short, elderly, insecure land tenure
JJ, widowed (Husband died 4/01/2007); 3.5 ac	1:1	5	Farm production, wage work, rent land	15 crops (Incl. soya) on ½ acre, rent 2, knows 5 techniques, 4 agencies	Managing so far: on ART, ceptrin; received training, garden expanded since 2005. Future uncertain
EF, 60, Widow, 3 acres	0:1	4	Work exchange, farm production, wage work, beer-brewing	20 plants, 7 new techniques, adequate tools, knows 1 agency	Managing: Possible PLWHA but not disclosed publicly. Started KG 2005. Shifted from tobacco. Access support through Widow group.
CM, F, 65, Widow, well-equipped 4.5 ac.	0:1	2 foster OVCs	Farm production	25 plants (SPK004, soya) and 7 new techniques, knows 8 agencies	Managing: Joined Widow & Orphan group, trained in HBC, Ag and Nutrition. No on-site adult male labor, labor and water short