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Institutional factors affecting wild edible plant (WEP) harvest and consumption in semi-arid Kenya

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ABSTRACT

Pervasive food insecurity and poverty in much of the world drives vulnerable populations to harvest natural resources as a means of generating income and meeting other household needs. Wild edible plants (WEPs) are a particularly common and effective coping strategy used to increase socio-ecological resilience in Sub-Saharan Africa where agricultural systems are often sensitive to environmental perturbations and instability. WEPs are collected across the landscape, from agricultural areas to government-managed hilltops with varying degrees of success and legality. This multiple case study research, conducted in Eastern Province, Kenya, investigates the formal forest regulations and land tenure rights, as well as local enforcement and understanding of those rules, in order to understand their impact on the ability of vulnerable populations to use WEPs as a coping strategy. The results suggest that widespread confusion, trust issues and a strong focus on the commercialization of wild foods are limiting the possible contribution of WEPs to food security and increased socio-ecological resilience. We identify a number of policy changes and extension programs that could better support local communities relying on WEPs for subsistence purposes to improve their adaptive capacity.

Introduction

Ensuring adequate human nutrition is a significant challenge facing governments internationally, despite global efforts to increase agriculture production, improve food distribution and identify appropriate policy interventions (FAO, 2012). This challenge is highly complex, requiring consideration of "food availability, food accessibility and food choice, which in turn may be influenced by geography, demography, disposable income, socioeconomic status, urbanization, globalization, marketing, religion, culture and consumer attitudes" (Kearney, 2010:2802). While in the past, increased global food demand could be addressed by agricultural extensification, this has become less of an option over the past 50 years—a result of population growth, urban sprawl and demand for the production of other natural resources (Smith et al., 2010). Also of concern are the environmental consequences of intensifying and increasing the land occupied by traditional agricultural production such as loss of habitat for biodiversity conservation, nutrient runoff, sedimentation of waterways, pesticide poisoning of humans and non-target species (Zhang et al., 2007) and increased carbon emissions (Godfray et al., 2010). The Millennium Ecosystem Assessment (UN, 2005) found similar trends, concluding that gains in provisioning services, such as food and timber production, are generally associated with environmental degradation and loss of other ecosystem services, such as erosion and water quality controls.

These and other studies have encouraged scientists to call for resilient food production systems that can produce a variety of ecosystem services (Bennett and Balvanera, 2007; Franks, 1999), combining reduced vulnerability to perturbations, both environmental and otherwise, and the capacity to respond to broader changes with renewal and reorganization (Folke et al., 2002). Foley et al. (2005) suggest a compromise between natural areas

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and intensive agricultural regimes could improve social–ecological resilience, while farmers have been identified as the group with the responsibility (and the opportunity) to successfully implement resilient systems (Tilman et al., 2002). These 'middle-ground' biomes, often called agro-ecological systems, must also consider community development objectives by including locals in decision-making processes, sharing knowledge and building relationships (King, 2008).

While non-timber forest products (NTFPs) have been promoted as one way to balance production and provisioning ecosystem services (Neumann, 2000), recent meta-analysis suggests that this may be more complicated than originally expected. Kusters et al. (2006) compiled 55 cases and found that positive livelihood changes, such as increased income and household nutritional status, were associated with lower environmental outcomes such as lower species diversity and abundance or increased soil erosion. This finding has been repeated in other studies, (e.g., Ros-Tonen and Wiersum, 2005), but should be interpreted with caution. While commercial applications and export-level extraction of NTFPs may not be a viable method of integrating conservation and development objectives, the possibility of balancing ecosystem services while supporting food production and community needs remains an important area for development interventions. Less-intensive combined systems have been shown to have a positive impact on the socio-economic conditions of local populations, while avoiding serious negative impacts on biodiversity conservation objectives (Belcher et al., 2005). Subsistence-level NTFP harvest is the predominate condition worldwide, yet has often been excluded from ecosystem service assessments and economic valuation of forests (Delang, 2006a,b). Of the NTFPs used at the household level, wild edible plants (WEPs)[1] are some of the most frequently gathered (Tewari, 2000), representing a major provisioning service of the local agro-ecological system that does not critically undermine other supporting and regulating services since collection is often low volume and intended for use directly by the household (Van Jaarsveld et al., 2005).

Wild edible plants increase resilience when properly managed

Wild edible plants (WEPs) play an important role in food production and maintaining ecosystem services, especially in Sub-Saharan Africa (Grivetti and Ogle, 2000; Bharucha and Pretty, 2010). These wild food resources supplement energy and micronutrients, improve the taste of staple foods and diversify food sources (Arnold and Perez, 2001). This is especially true in poorer households and in rural areas where they can help to reduce spending of limited cash resources on energy, shelter, food and medical needs (Shackleton and Shackleton, 2004). Many WEPs can be gathered without monetary cost and do not require expensive inputs, machinery or processing, meaning initial investment in production is not a barrier to successful outcomes (Jama et al., 2008). In addition to the baseline contribution of WEPs to household food security, they are also an important coping mechanism during periods of food insecurity brought on by drought, political unrest and unstable commodity markets, due to the availability of different species over the calendar year (Fentahun and Hager, 2009) and relatively high tolerance to water stress (Addis et al., 2005).

There are, however, barriers to successfully combining environmental protection and WEPs, particularly when regulating harvest sustainability. Poor policy design, lack of enforcement and community misunderstandings can result in harvest declines and ecosystem degradation (Falconer, 1990; Brooks and Tshering, 2010). While there are many examples where inappropriate formal policy interventions have resulted in negative social–ecological outcomes (see, for example, Stewart, 2003), there are also examples of success (see Robinson and Lokina, 2011). Informal policy also affects the collection and use of WEPs, and can be important in ensuring successful regulation (see, for example, Wynberg and Laird, 2007). Although WEPs are an important dietary resource in rural areas, their contribution to food security is often under-appreciated by policy-makers, leading to formal policies on access, extraction and sale that can lack understanding of local conditions (Shackleton and Shackleton, 2004).

The importance of resilience-focused policy and institutions

Institutions are central to balancing social and ecological issues and resources if food security in the face of global environmental change is to be managed as an integrated system (Ericksen, 2008a,b). According to Folke et al. (2002), resilience can be fostered through policies that encourage openness, learning and building adaptive capacity, while also promoting management flexibility and cooperation. As local ecological knowledge (LEK) declines, scientific research, development policy and extension activities will have a greater role to play in maintaining WEP diversity, production and consumption (Feyssa et al., 2011). When government and community regulations fail to consider the significance of their WEPs to food security, the food production potential of their habitats is ignored and household nutrition suffers (Dansi et al., 2008).

In this study, we sought to analyze WEP harvests from various types of property and the impact this has on individual, household and community access to wild foods as a coping strategy for increasing socio-ecological resilience. The main objectives of this research were to better understand the regulatory context for WEP use in our study area, and to identify how WEP access and use might be better supported to improve food security outcomes in the arid and semi-arid lands (ASALs) of Kenya. This is a particularly vulnerable region to food insecurity, as variable climate and heavy reliance on rain-fed agriculture leave some ten million residents susceptible to environmental and social disturbances (Kamotho, 2007), with climate change likely to worsen the situation (Minaxi et al., 2011). The importance of WEPs in the ASALs of East Africa is well documented (Grivetti and Ogle, 2000; Asfaw and Tadesse, 2001; Harris and Mohammed, 2003), as is the trend of decreasing use, knowledge and protection of these valuable resources (Smucker and Wisner, 2008).

In order to address these study objectives, we first review important background information on public land holdings and management in Kenya (Sections "Government control of forests" and "Legal framework: summary of the Kenya's Forests Act (2005)") and the evolution of land tenure for private and community lands (Section "Communal land and the privatization trend"). We then present our research methods, results, discussion and conclusions.

[1] The Food and Agriculture Organization of the United Nations defines non-cultivated plants as: "plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human action" (Heywood, 1999). While NTFPs are defined by their habitat, the forest, and can include edible and non-edible products, WEPs are limited to only those plants that can be eaten (cf. Termote, 2011). For the purposes of this study all plants that are gathered (not cultivated) are considered wild, including species harvested in agricultural areas, uncultivated or forest land to encompass a greater variety and more specifically categorized groups of natural resources (as predicted by Belcher, 2003), and to move away from the current focus on use and value descriptions towards more useful classification by response to policies and management regimes (Shackleton et al., 2011).

Table 1
Conditions for sustainable management of common pool resources and associated evaluation criteria for forest laws (Ostrom, 1990; Ostrom et al., 1999; Larson et al., 2010).

Management conditions for common pool resources	Congruence between rules and local conditions. Understanding that translates across various enforcement levels.	Clear boundaries and tenure rights that agree with local beliefs	Collective-choice arrangements allowing for the participation of most of the appropriators in the decision making process, stakeholder involvement in policy creation
Evaluation criteria for formal forest policies	1. Are forest products, resources and/or produce (including WEPs) clearly defined?	2. Are traditional use rights and community access to NTFPs and WEPs protected?	4. Is the community included in decisions regarding the use of forested land? Are there specific frameworks set up for villages to create, manage and derive benefits from the forests?
		3. Does the law identify multiple uses as a priority for forest management? Specifically identify jurisdiction over NTFPs like WEPs?	

Institutional factors affecting WEP regulation in semi-arid Kenya

Government control of forests

Many international development organizations and donors have strongly supported large-scale land transfer by African governments from tribes, clans and community groups to individuals or public institutions (Monbiot, 1994). Traditional common property regimes have become scarce as privatization, land titles and formal rights are promoted, leaving approximately two per cent of all forests in Sub-Saharan Africa to community control and nearly all of what remains under government management (Agrawal, 2007). In Kenya, the vast majority of timberlands have been converted to publicly owned conservation areas.[2] Overall, 97.8% (3504 ha) of the nation's forest areas are owned by the State, while 89.9% of other wooded lands (31,608 ha) are managed by the government—leaving a total of only 3590 ha under private control (FAO, 2010).

While government control of forests and wooded land in Kenya may have conservation benefits, such as reducing deforestation by local actors, there are many other threats to these ecosystems. Commercial agents working with government contracts have been known to circumvent regulations, often gaining permission to increase cultivated areas, expand pastures and extract large quantities of natural resources such as timber (Kaimowitz, 2003). Furthermore, public forest management often reduces local community access to resources such as WEPs, which tends to have disproportionate negative effects on more vulnerable populations and poorer households within the community (FAO, 2011). According to Robinson and Lokina (2011), arbitrary access prohibition in designated reserves can also inadvertently cause severe environmental degradation in adjacent natural areas that were previously managed sustainably.

Community natural resource management (CNRM), despite its popularity in scientific literature and constant promotion in policy documents (Kellert et al., 2000), represents a very small fraction of the management regimes in Kenya discussed above. Although international movements towards more local control of forest resources, decentralization and devolution of resource extraction rights, particularly in Tanzania, are yielding some positive outcomes (Wily, 2002) overall impacts are still unclear and possibly detrimental (Lund and Treue, 2008). Institutions and policies supporting community forest management in Kenya are relatively new, lacking a formal legal framework and mostly working with pilot projects on a case-by-case basis (Schreckenberg and Luttrell, 2009).

Legal framework: summary of the Kenya's Forests Act (2005)

Prior to starting fieldwork, the legal framework and implementation of forest laws in Kenyan reserves was investigated to better understand the community-level factors affecting access to WEPs. Although their sustainable harvest is contingent on a wide variety of location-specific factors, general recommendations on how to regulate common property resources like WEPs have emerged from meta-data analysis and large-scale comparative studies (see for example, Ostrom, 1990). Generally speaking, rules that regulate shared resource use, monitor compliance and punish illegal actors are associated with more successful conservation and development outcomes for communal resources (Ostrom et al., 1999). Drawing on the work of Kohler and Schmithfisen (2002), we review the aspects of Kenya's Forests Act (MENR, 2005; obtained through FAOLEX, 2013) that relate specifically to the harvest of WEPs for household consumption (Table 1).

Aspect 1: Definitions—The Forests Act includes definitions of forests, consumptive use, sustainable use and management, and a thorough explanation of forest produce which includes various WEPs (Part 1—Preliminary):

> "forest produce" includes bark, bat droppings, beeswax, canes, charcoal, creepers, earth, fibrewood, frankincense, fruit galls, grass, gum, honey, leaves, flower, limestone, moss, murram, myrrh, peat, plants, reeds, resin, rushes, rubber, sap, seeds, spices, stones, timber, trees, water, waxwithies and such other things as may be declared by the Minister to be forest produce for the purpose of this Act"

'Forest community' is, however, defined in a confusing manner where traditional user groups and registered conservation associations are combined into one category.

Aspect 2: Traditional Use Rights—The Forests Act specifically states that infringement on traditional use rights is not permitted (Sec. 21):

> "Nothing in this Act shall be deemed to prevent any member of a forest community from taking, subject to such conditions as may be prescribed, such forest produce as it has been the custom of that community to take from such forest otherwise than for the purpose of sale".

However, permits are required for entry into State Reserves and the State can take over forest management in cases where it

[2] According to Sec. 20 of Kenya's Forests Act (2005), all forests aside from those owned by private actors or local authorities are property of the state. Some of those State Forests are set aside as National Parks and Reserves, or managed strictly for biodiversity conservation. The majority (80%) of State Forests (Sec. 34.1) allow utilization, silvicultural operations and infrastructural development, provided a management plan has been submitted and other requirements have been met (Matiru, 2000).

(Sec. 25): "supports an important industry and is a source of livelihood for the surrounding forest communities"

Aspect 3: Objectives—In Section 6, the functions of the Forest Board are described, including (h): to "establish and review policies and rules for marketing of trade in forest produce," and (o) to "approve the provision of credit facilities and technical training for community based forest industries, and the provision of incentives to persons who exploit wood and non-wood forest products sustainably." This confers jurisdiction to the Forest Service over NTFPs, including WEPs, for commercial use. Although multiple-use forest management is not specifically mentioned as an objective, the Act does reference the myriad potential benefits from forests, such as ecosystem services, conservation of biodiversity, income generation, research and cultural values (Sec. 17).

Aspect 4: Community Participation—There are many references to community groups and associations throughout the Act, and an entire part (IV) is devoted to explaining the application process, rights and functions of these groups. The responsibility of the Kenya Forest Service to promote community-based projects is clearly stated (Sec. 17f), as are the requirements of the community charged with managing a forest (Sec. 46). The application process is somewhat involved, requiring a formal petition, charter and proposals that detail: (i) use of forest resources; (ii) methods of conservation of biodiversity; (iii) methods of monitoring and protecting wildlife and plant populations and enforcing such protection (Sec. 45e).

Communal land and the privatization trend

The vast majority of traditional agricultural systems in Africa rely on land abundance in order to employ shifting cultivation regimes that included long fallow periods, clearing new land and labour as the main inputs (Sjaastad and Bromley, 1997). In the territories that would become Kenya, land tenure forms varied during the pre-colonial period, from rangeland areas 'held' under 'communal' conditions by pastoral sections or clans, to higher and more humid areas where population densities were greater and land was usually held by clans or even families for cultivation, hunting and honey-gathering in specific territories.[3] Formal tenure under the colonial state was established initially by extending the Indian Land Acquisition Act (Kenya, 1898) to make possible the regularization of colonial land seizures (Okoth-Ogendo, 1991:10–11), and later in 1901 by classifying lands "where there was no settled form of government," as "crown lands," which granted the original title deed to the state. Following the 1902 (Kenya, 1902) and 1915 Crown Lands Ordinances, where long-term leasehold rights on crown lands for settlers were enumerated, "native reserves" were set aside (under the Native Lands Trust Board) as limited areas outside the framework of settler law and delineating areas for African settlement and land use.

Following the Mau-Mau rebellion, a protest by Kikuyu and other central Kenyans against their loss of land to settlers (Elkins, 2005), the Swynnerton Plan (Kenya, 1954) established private title on native reserves, thus laying the basis of the intensification of agricultural production. Through a process of land "consolidation", "adjudication" and "registration", land fragments were integrated into titled farms allocated in Central Kenya to 'loyalists', and later privatized thus empowering a generation of increasingly prosperous African farmers (Kitching, 1980a,b). However, in the semi-arid and arid lands (ASALs), these principals were not applied and the region's farming areas and pastoral regions continued and in some cases continue to be held formally as "trust lands" under their respective County Councils but informally by pastoral sections that recognize customary rights and forms of use.

While the Registered Land Act of 1963 established a single non-racial regime of land law, in principle putting settler and African farms on an equal footing, settlement schemes and actual privatization has not yet completely reached the ASALs. The Report of the Mission on Land Consolidation and Registration in Kenya (1965–66), the 'Lawrence Report', proposed creating Group Ranches under private title in the Maasai (Kajiado and Narok), Samburu and Laikipia districts, and was later to be extended to other arid and semi-arid regions (Kenya, 1966). This program for systematic privatization of Kenya's land under the Registered Land Act, set out in the mid-1960s (Kenya, 1968b) (based on ideas germinating in the late Colonial period), is still underway, as teams from the Ministry of Lands progressively move from location to location, creating land committees to consult residents, registering those deemed normal residents (and through corruption, others who bribe them), surveying lands, and issuing letters of allotment and finally land titles. In this way, the areas of "trust lands[4]" are slowly but surely being reduced and areas under private title are being increased (Kameri-Mbote, 2008). Nonetheless, the principles used in allocating title to private individuals and families rest on customary rights of occupancy, that in law identify those who are the customary residents of given areas.

Many of the Group Ranches created and managed according to the Land (Group Representatives) Act of 1967 (Kenya, 1968a) have foundered due to management failures and corruption, leading many to seek sub-division into individual or family parcel (see, for example, Rutten, 1997). Thus many land owners in drier regions have lost the scale of land holding that would facilitate mobile animal husbandry, while gaining lands too small to manage productively, a situation that has led to land sales and losses of land to pastoralism (Galaty, 1994). Semi-arid regions, such as Tharaka, Makueni and Kibwezi, are generally undergoing privatization as small-holders gain title to their lands, with some farmers taking advantage of land as collateral for taking out loans (Mwangi, 2007).

There are two intertwined stories that concern the evolution of land tenure in Kenya, one about agricultural and pastoral development and the process of intensification, the other about the politics of acquiring and controlling land, with historical tension between elites whose land holding continues to grow and those who are landless or are losing land (Galaty, 2013). Arguably, the titling of the Central Kenyan Highlands from the late colonial period opened up the middle-level farmers to increasing prosperity, in large part because this was coupled with lifting of restrictions on loans and market access. Whether the extension of land registration to the more arid areas of the country, which has occurred over the last 30-years, will have equally positive outcomes remains in question. Such privatization is often promoted as a panacea for overcoming poverty, with supporters suggesting that land titles open the door to credit, secure land tenure and more stable trade (De Soto, 2000, as cited by Obeng-Odoom). However, registering private land comes with its own issues, such as high costs of demarcation and titling or ownership disagreements that can lead to conflicts, and the threat of landlessness if those who acquire titles sell their lands (Deininger et al., 2008; Sikor, 2006).

[3] It has been argued that the Kikuyu, for instance, had developed a highly individualized family-based system of land holding, with lands sometimes being allocated to 'tenants' (ahoi) for use but not for ownership (McKenzie, 1993).

[4] The recently revised Kenyan constitution (2010) sought to redefine existing trust lands, Group Ranches and various other cooperatively managed properties into a single tenure classification defined as community land in Section 63, which is identified in the national land policy (Kenya 2009) as an important area for further research and promotion. However, despite this political progress, the Parliamentary actions and implementation plans that will affect land owners are yet to be decided (Harbeson, 2012).

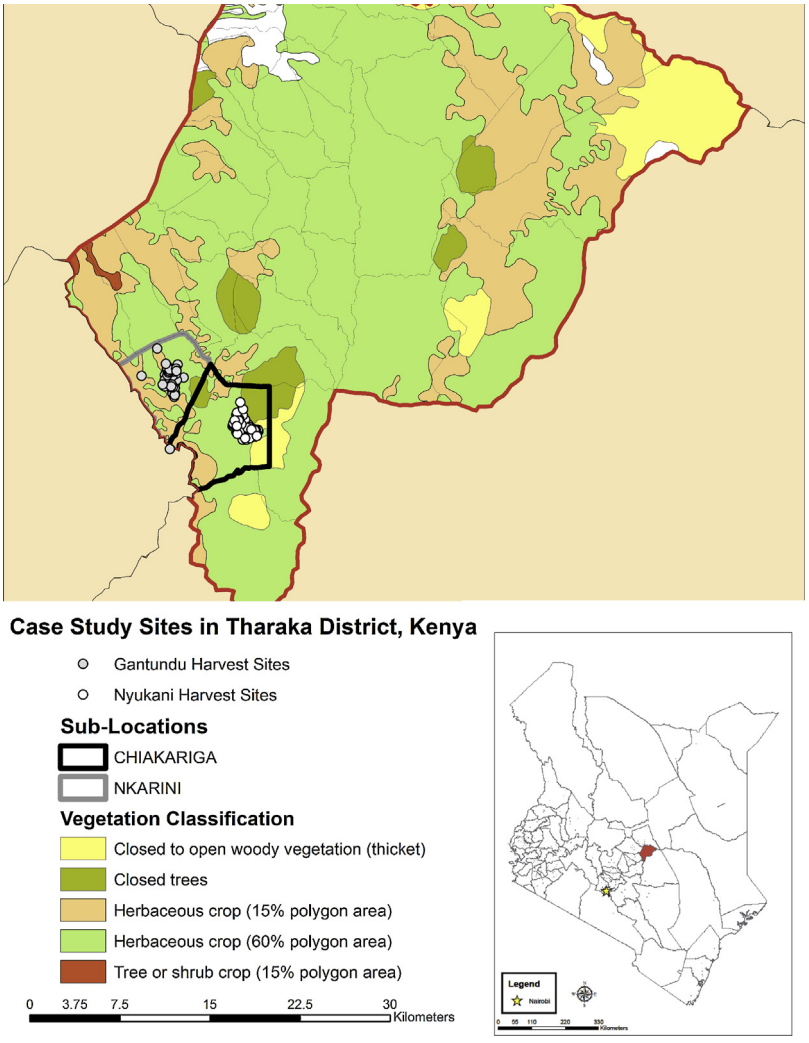

Fig. 1. Study locations in Tharaka District, Eastern Province, Kenya.

Methods

Study area

The study area is located in southern Tharaka Constituency where food insecurity is prevalent and crops fail, on average, once every three seasons (Kenya, 2012). The annual rainfall fluctuates between 200 and 800 mm, and falls mostly between the October and December rainy season or in April. Elevation varies considerably, from 690 m to over 1400 m a.s.l. at the top of Kijege Hill (Wisner, 1977). Two farming communities, Nyukani (0°17′S, 37°56′E) and Gantundu (0°15′S, 37°52′E), were chosen as our case study sites (Fig. 1), both dominated by a mixed livelihood system of livestock, some formal sector income and marginal/subsistence farming of millet, maize, sorghum, cowpeas, pigeon peas, green grams (mung beans) cassava, and cash crops like cotton and horticulture. These communities were selected based on the prevalence and intra-community variation of WEP consumption, diversity of livelihood strategies and proximity to harvest sites covering a spectrum of resource access conditions, (Personal communication, Patrick Maundu, June 11, 2012) (see Fig. 2).

Nyukani is comprised of 54 households in the sub-location of Chiakariga while Gantundu is a larger village of 108 households in the sub-location of Nkarini. Nyukani is located less than a kilometre from a bustling market town, Chiakariga, and sits at the foot of a 3303 ha protected forest, Kijegee Hilltop Reserve. This reserve has been managed by the Kenyan Forest Service for conservation objectives, watershed protection and soil preservation since 1959 (IUCN and UNEP 2010). Settlement on this hilltop has been restricted since colonial times, leaving the forest essentially intact (Smucker

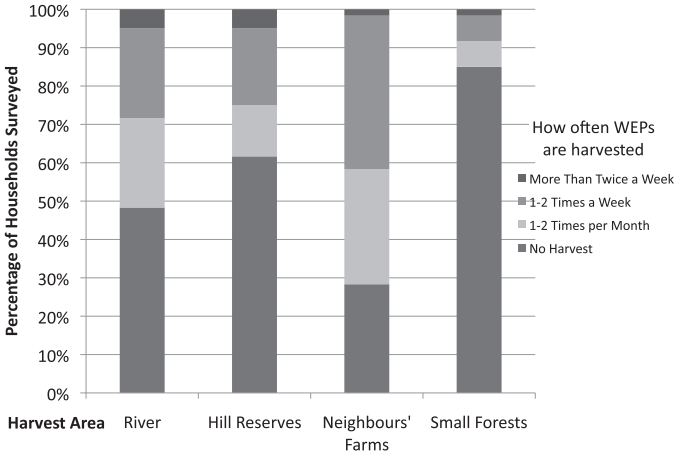

Fig. 2. Average annual WEP consumption frequency by harvest area, with standard deviation bars. From these figures, it is obvious that government hilltop reserves and privately owned farms are important WEP sources despite prohibitions on entry. Over 70% of households collect WEPs from their neighbours' farms at least once a month, and around 40% of families harvest WEPs in hilltop reserves on a regular basis.

Table 2
t-Test for descriptive statistics between case study sites Gantundu and Nyukani. Gantundu had significantly higher household assets and less food insecurity, greater average education level for the household head and more of the major breadwinners working primarily off-farm. The age of the household head, number of children, household size, and total farm size were not significantly different between the two sites.

Indicator	Gantundu Mean ± S.E.	Nyukani Mean ± S.E.
Total children (<15 years)	1.6 ± 0.24	1.9 ± 0.37
Household size	4.3 ± 0.4	5.0 ± 0.5
Asset value (Ksh)	15,750 ± 2137	4083*** ± 727.8
Heads of Household w/high school education[a]	0.3 ± 0.48	0.07** ± 0.25
Head of Household works off-farm[b]	0.4 ± 0.09	1*** ± 0.00
Age head of household (in years)	49.5 ± 4.1	47.0 ± 2.86
Head of household away (1 = yes; 0 = no)	0.4 ± 0.09	0.03** ± 0.03
Food insecure (1 = yes; 0 = no)	0.6 ± 0.09	0.9** ± 0.06
Time to market (in min)	85.3 ± 14.4	35.3*** ± 3.0
Total farm size (ha)	4.3 ± 0.6	3.6 ± 0.5

[a] Head of household post-primary school education (00 = none) (01 = some secondary education).
[b] Off-farm dummy variable (00 = no off-farm employment) (01 = primarily employed off-farm).
* $P \leq 0.05$.
** $P \leq 0.01$.
*** $P \leq 0.001$.

and Change, 2002). Gantundu is located approximately 10 km away from Nyukani, and the nearest protected area (Fig. 3). Despite being more isolated from local trade infrastructure, Gantundu has had significantly more intervention from non-governmental organizations (NGOs), government extension agents and development projects like the 'work for food' program. When statistics from household surveys were compared, Gantundu had significantly higher household assets and reported less food insecurity, perhaps due to greater average education levels for the household head and more off-farm employment. The household head's age, number of children, household size, and total farm size were not significantly different between the two sites (Table 2).

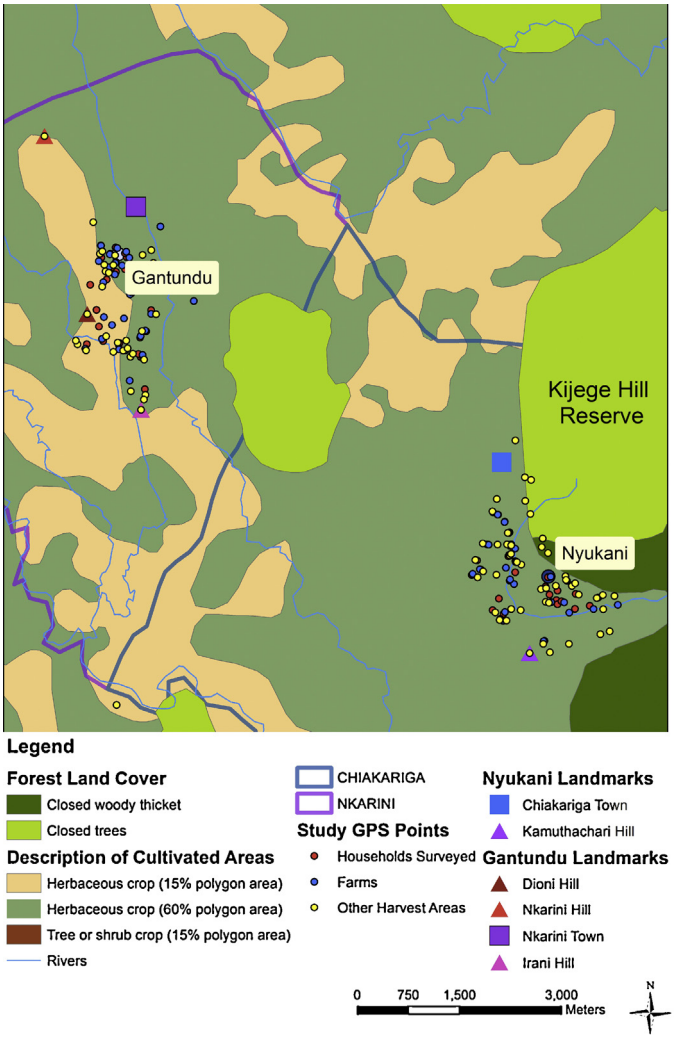

Fig. 3. Study locations in Tharaka District, Eastern Province, Kenya, Author.

Research methodology

The contemporary nature of this project, where context and research are difficult to separate and experimental manipulations are impractical, made using a case study research approach the logical choice, allowing for the inclusion of diverse evidence from observation, documentation and interviews (Yin, 2009). Baxter and Jack (2008) explain how this framework is particularly useful when investigating the context and research question simultaneously, using a variety of data sources and multiple perspectives. Issues of validity and trustworthiness in our results were addressed through data triangulation, specifically using different data sources and methods to answer the same questions, which aids in obtaining results convergence and verification (Thurmond, 2004). Whittemore et al. (2001) outline a number of other measures of validity in qualitative research, which were considered throughout the research process, with special focus on length of engagement in the field, consideration for disenfranchised groups and member checking at the conclusion of interviews and the study as a whole. Despite our best efforts, it is likely that some perspectives and opinions were overlooked in our case study (Pain, 2004; Beverly et al., 2008), and that recall bias may have skewed some of the data collected (Delang, 2006a,b). Nevertheless, the understanding that comes from intense scrutiny of cases has been shown to be critical for addressing 'real world' problems like persistent food insecurity (Flyvbjerg, 2006).

Data collection

Community perspectives and experiences were elicited through semi-structured interviews (Keller et al., 2005; Gordon and Enfors, 2008) and participatory research activities (Herlihy, 2003; Fentahun and Hager, 2009; Maroyi, 2011; Termote, 2011). Insight from higher-level actors, such as community elders and government representatives, was incorporated using key informant interviews similar to those conducted by Pandit and Thapa (2003) (Table 3).

The semi-structured household interviews were conducted between June and August 2012 by trained enumerators with the support of local field assistants. Thirty households were selected

Table 3
Breakdown of interview participants and focus group attendees by study site and activity.

	Nyukani	Gantundu
Total households	54	108
Elders interviewed	1	1
Households interviewed	30	30
Seasonal mapping participants	26	12
Preference ranking Participants	36	35
Participatory mapping Participants	26	25
Key informant interviews	4 Ministry of Agriculture 2 Forestry Service (From district and local offices)	

randomly from a list of all residents provided by the sub-chief of the village, resulting in a total of sixty household surveys that included a mix of male- and female-headed households from diverse age groups, occupations and locations within the community. The main purpose of the household survey was not to make statistical inference applicable to other semi-arid regions of Kenya but to provide a representative picture of the variety of livelihoods and conditions, and the corresponding household WEP harvest behaviors encountered in the study area (see Ellis and Bahiigwa, 2003; Ellis and Freeman, 2004; Ellis and Mdoe, 2003), as well as detail general differences and similarities between the two villages (Table 2).

The questionnaires were initially written in English, and then translated by interviewers into the local dialect of Kitharaka. Each WEP named by participants was collected (Alexiades and Sheldon, 1996; Medley and Kalibo, 2005; Quinlan, 2005) and identified using texts (Maundu et al., 1999) and with the help of botanical experts at the East Africa Herbarium in Nairobi, Kenya (Appendix I). The same translators were employed for the duration of the project, and trained together to ensure accuracy and standardization of response interpretation. The survey and interview questions were pretested in early June 2012, resulting in improved clarity.

Each session began with an oral statement of informed consent that was recorded electronically, followed by a brief household survey designed according to the guidelines for quantitative data collection in developing countries (UN, 2008). The household survey included questions on demographics, family structure, household food security, land tenure and access to natural areas. Information on the harvest and consumption of WEPs from the home, farm, and other privately owned or public lands was collected for the entire year, with particular focus on the access restrictions and permission requirements for each harvest area. A short semi-structure interview was conducted following the survey with the same respondent. The prompts focused on eliciting local opinions and concerns regarding WEPs, cultural considerations, and the manifestations and implications of changes in climate, land tenure and access to common property resources (Appendix II). The interview also provided participants the opportunity to clarify their initial responses and member-check the data collected.

Key informant interviews with government officials were conducted in English, also following a semi-structured format that encouraged the participant to speak freely about land tenure, extension activities, regulatory policy, WEP harvest and a variety of related topics. These sessions were digitally recorded and transcribed for analysis. The translators employed during household visits assisted in facilitating the interviews of elders from each village in the local language to better understand the history and current situation in both study sites.

Various participatory research activities were also conducted to gain a better understanding of the communities, the various categories of land tenure in the study areas, and the impact that these distinctions have on WEP harvest. Participatory mapping exercises were undertaken to bring together various groups within the community and encourage people to speak (Alcorn, 2000). Local facilitators, translators and field assistants were instrumental in organizing and executing community meetings (see Sutherland et al., 1999; Campbell, 2001; Kuhnlein et al., 2006; Günther and Vogl, 2010). Another benefit of bringing the local participants together multiple times was ensuring continuous community input on the research design and results dissemination throughout the field season. Table 3 details the distribution of interview participants, key informants and focus group attendees by study site and activity.

Data analysis

The constant comparison technique was employed to analyze the qualitative data. First described by Glaser and Strauss (1967), this four-step process requires the researcher to compare incidents by creating broad categories and later refine those groups with more concrete rules until a theory can be created to address the research question (Grove, 1988). Coding was then used to identify repeating ideas and themes, as well as to understand the broader theoretical narratives for the various groups of participants and the population as a whole (Auerbach and Silverstein, 2003). This process is especially well suited for the evaluation of factors, variables and categories to understand the knowledge generated using the case study methodology (Patton, 1980).

Results and discussion

State-owned resources: interpretation and application of the Forest Law

Representatives from the Kenya Forest Service and Ministry of Agriculture were interviewed individually to assess their interpretation of the policies and explore the resulting impacts on community access to WEPs for subsistence use. Based on these interviews, two key themes emerged that affect the collection of WEPs in our study area: (1) various interpretations of the rules for gathering WEPs; and (2) differences in the penalties for unauthorized WEP harvest.

Various interpretations of the rules for gathering WEPs

The data that were coded to this theme highlighted confusion amongst government employees regarding traditional use rights, community forest management and regulations related to WEP harvest, which trickled down to the community members.

> Forester #1 explained: "We encourage it. We call them Non-Tree Products. . .the law does not allow anybody to collect material from the forest without a permit, a government document. . .If you want to go collect wild fruits it is good that you get licensed. Even if it's just for household. You have to get licensed. Because our law says you cannot enter there without a permit for any activity. Even collecting the very wild fruits, you have to be licensed."
> Contradicting this account, a district officer from the Ministry of Agriculture stated: "If you go to the forests now, even the hills, although you realize that they are owned by the government, whatever wild fruits are there you don't even have to consult anybody. As long as you are not cutting down the tree." He clarified that "generally it does not affect the tree. You just pick what you want and leave the tree there."
> He went on to clarify that it is all right "because you are not taking the tree, only the fruit or the leaves." He stated that "The economic value is the most important consideration, and since most wild fruits don't have much value there is no problem." This differed from other respondents (Forester #1 and #2)

who based their interpretation of gathering WEPs according to the Forests Act rules related to large-scale NTFP collection for income generation.

Forester #2 made a distinction between WEP users who hold grazing permits for their animals: "So maybe whoever is getting into the forest for grazing he might be helping himself to the wild fruits that are there, which are also conserved. . .it is inevitable. . .but it's not for trading" and those who do not: "It's not allowed, especially for commercial. . .You need to notify the forester in charge of the area, or the guard. . .You know that maybe there are those medicinal plants, herbs and people usually go for them, and those are illegal activities now unless you are permitted to do that."

After discussing the regulations for harvesting WEPs with enforcement officers and extension agents, we asked the community about their interpretation of WEP collection in the government-controlled forests. The majority of participants understood the prohibitions against entering the forest and harvesting wild foods. Each of the following illustrative quotes is identified using the household survey number of the respondent.

36. "They are against people who are cutting down trees, firewood and collecting WEPs without permission."

However, when surveyed about actual harvest locations, only 48% of those collecting WEPs in the hilltops said that permission was required for entry into the hilltop reserve. A few respondents believed that restrictions have recently been eased, and entry into the forest is now less difficult than in the past, especially where WEPs are concerned:

45. "Today the foresters are not so strict on people going into the hills. The rules have changed from the government - in the early days you could not get permission at all to collect firewood, cut trees or collect building materials. Now you can."

53. "There are less restrictions now on WEP collection - this depends on the government in power, and the new constitution which calls for freedom of movement."

55. "The restrictions from his youth seem more strict than today, at least now they can enter the hills with a permit and get materials such as trees, poles, grass and WEPs."

Of the 60 survey participants, 45% explicitly referenced a permit that is required for collecting WEPs. Some went so far as to explain the procedure for obtaining this permit and the cost, which varied from free to 400Ksh ($4.60 CAD).

46. "Must get permission from the forester, even just for WEPs. The permit is a printed paper, free but difficult to obtain because the office is often closed. There is an unlimited number available, but it's only good for 1 day."

"Get permit from forester #1 specific according to the activity you want to do. He doesn't get a permit for collecting WEPs due to cost - 400 Ksh to collect fruits."

These responses are interesting because, according to the foresters we interviewed, no such permitting process for subsistence activities exists in the semi-arid regions of Kenya. These foresters referenced the time required for creating community forest associations (CFAs) and a lack of community interest in WEP collection as the main reasons that no permitting procedures had been developed for subsistence collection.

Forester #2 said: "What we are waiting now is permission to go to the next step to go to the community forest associations, CFAs. . .in drylands, we haven't been having a lot of income to the government . . .there is that mentality of disregarding the marginal areas. The priority might be on the high priority areas because that is where they are generating a lot of revenue."

Ministry of Agriculture Officer #2 explained that: "People don't know the importance of them (WEPs). You know is nasty somehow, you know they are trained to eat it when they are tender, they don't consider as a good vegetable for their consumption. They eat but very little, very rarely."

Forester #1 stated: "We have not started because the interest is not there. . . farmers they can be able to get it (WEPs) from your farmland. . .Maybe in the future because the trees are diminishing from the farmland. Maybe in the future there will be a demand."

Such confusion surrounding formal regulations is fairly common, perhaps due to the numerous types of forest management and the high number of stakeholders involved (Lescuyer, 2003). Unclear property rights might also cause confusion in policy implementation, and often results in increased environmental degradation caused by illegal extraction activities (White and Martin, 2002). The laws themselves are also often somewhat contradictory and do not lend themselves to easy application, which has resulted in disagreements about the legality of many forest activities (Colchester, 2006). Furthermore, a lack of information and outreach to communities has plagued forest agencies in many developing area contexts. These issues range from incomplete records of land ownership, to inaccurately transcribed documents and even laws cobbled together from several different administrations, time periods and languages (Witness, 2001; Rosenbaum, 2004). Laws need to be simple and easy to understand, across all networks or users and enforcement agents, otherwise they run the risk of becoming unenforceable, irrelevant and create loopholes for illegal activities (Contreras-Hermosilla, 2002).

Differences in the penalties for unauthorized WEP harvest

The data supporting this theme revealed confusion regarding the consequences of collecting WEPs in State-managed forests. Some officials reported significant fines and jail time, while others were more lenient:

Forester #1:"If somebody is caught it seems they have committed an offense, we take them to the police station and then the person is charged with illegal entry into the forest. . .there are several penalties stated as per each of the Acts. The minimum is 10,000 Ksh or three months jail. Or both the fine and sentence. . .If I catch you with wild fruits you are in possession of forest produce. In this case the fine, is under Section 52, the fine is 50,000 Ksh or six months in jail. Now, also, if you are caught having cut, now you are in possession of that already, but by picking them you have already cut the produce. the fine is the same. . .you have three counts you have 150,000 Ksh and in the courts you are fined."

Forester #2: "You would be charged with trespass, being in the forest illegally. . .I don't think there would be any other charges, because there is nothing particularly addressing the fruits. Maybe we would be talking of the trespass, it would not be saying that you were harming that tree because maybe you were collecting the fruits on the ground or the top of the tree. . .being in the forest without a license or a permit of the owner as the case may be is liable on conviction of not less that 50,000Ksh or imprisonment of a term of not less than one year or both such fine and imprisonment."

These fines are significant, between $115 and $1,728 (CAD), particularly considering that 67% of the population in Kenya survives on less than $2 a day, and GDP per capita is only $808 (World Bank,

2012). Such large fines were described as presenting a hardship for the community:

38. "...The amount is so large that you cannot afford to pay and must go to jail."

Forester #1:"Once you are fined there, then you will get finished."

The community members reported an awareness of the serious consequences if caught collecting WEPs in the forests. Respondents mentioned fines ranging from 1000 Ksh to 50,000 Ksh, and up to seven years in jail. There were a number of references made to bribing one's way out of the situation. A few participants also reported that no permit will be requested if the only activity observed is WEP harvest:

33. "One needs to sneak in for WEP collection, but if caught can explain and will not suffer consequences."

43. "No permit required, forester won't even ask if they are only collecting WEPs."

These results support the view of Forester #2 who noted a "lack of information by the community members. They don't have, they might not be knowing what are the consequences if they commit an offence. Of what is prohibited and what is not prohibited. You find that some of them are ignorant of the situation or the rules concerning the forest."

However, the majority of our participants reported some degree of trouble for anyone caught inside the forests. Many noted that enforcement agents would assume that some other illegal activity was occurring if one was caught in the forest and claimed to be harvesting WEPs:

2. "The forest officers won't listen if they catch you inside whether you are doing something good or bad and you'll get in trouble either way."

5. "The government restricts WEP harvest in reserves because people pretend they are going for vegetables but really go to collect firewood."

27. "People pretend to harvest WEPs but actually go to collect firewood or grass for cattle."

The general lack of coherence in policy interpretation concerning WEP collection by the foresters from the Forest Service and the extension agents from the Ministry of Agriculture has resulted in confusion regarding WEP harvest regulations, permitting and penalties for illegal entry into government-controlled forests and collection of forest produce. Based on feedback received at community-wide focus groups in Gantundu and Nyukani, it appeared that the local community members were generally unaware of their traditional use rights under The Forests Acts. Despite the education campaigns and sensitization reported by the officials interviewed, community participants did not fully understand community forest associations (CFAs).

Inconsistency in the interpretation and enforcement of forest laws is not unusual. Several studies have found similar trends around the world (for example, Hartter and Ryan, 2010), a situation that often favors the local elites and officials who have the capacity to understand and circumvent the laws to their advantage (Lavigne-Delville, 2000). The harvest of WEPs as a means to increase resilience is primarily undertaken by poorer, more vulnerable populations (Shackleton and Shackleton, 2004), the very groups that suffer as the application of penalties for illegal forest activities tends to concentrate on small scale community actors (Colchester, 2006). Despite protections for community rights and development in many forest laws, including Kenya's Forests Act (2005), enforcement agents often ignore those provisions in favor of applying regulations that give preferential access to larger industrial agents while ignoring community rights (Colchester, 2006). Such biases might be caused by overt prejudices, or simply a product of the isolation of forest adjacent communities (Rosenbaum, 2004).

Improving local understanding of Kenya's Forests Act will increase the probability that a given household will participate in a CFA. This participation can have a positive impact on environmental indicators like tree cultivation, and offer benefits to members by allowing them to extract specific forest produce for household and commercial use (Ogada, 2012). As discussed by Mayers and Vermeulen (2002), access to information on forest resources, rights and effective routes to recourse is an integral part of pro-poor development policy. The reported lack of clarity regarding these issues in our study area is a barrier to freedom of choice for the communities involved and may make it more difficult for locals to take part in decision-making.

Common property resources in Tharaka

In the past, community owned and managed land was widespread in Kenya, but such regimes are less common today, mostly associated with national parks and reserves like Narok, Amboseli and Samburu (Kameri-Mbote, 2005). In the villages of Nyukani and Gantundu, the only reported community-controlled lands housed institutions like schools or marketplaces. According to the oral history recorded from village elders in each study site, the sub-division of clan lands happened relatively recently. A female elder from Nyukani shared the origins of her community:

"People came from a place called Mboa a long time ago, around 1944, some kept going and settled in Mt. Kenya or Nambenny. The land in this area is mostly inherited from the forefathers, most have land from their family."

In Gantundu, an elder detailed the arrival of many of the current residents that migrated to the area after land tenure reforms and the break-up of clan holdings:

"Originally this area was home to the Kamarao clan, and the land was owned by them. I come from the Ndegi clan. My parents came here for farmland from another place and originally rented a small plot from the clan in Chiakariga. I came to the village of Gantundu during the 1990 demarcation. Today, many different clans make up the village, and everyone has their land. Some people come now and buy land from the original owners, the clan members. Very few people don't have land."

A Ministry of Agriculture officer referenced the sub-division of land, explaining that all land in this area is: "either still owned by those same families or has been bought from other clan members or outsiders that came to own the land...There is no real shared land anymore...they are all owned."

Local community participants reported a similar story during participatory mapping sessions, with no community lands identified in either village. Riverbeds were often mentioned as common harvest sites for WEPs, especially during the dry season when vegetables are not available in most other locations. In Gantundu (Fig. 4), the group explained through translators that '*in the past it was easy to get vegetables in the hills and streams, but now one must ask permission of the owners.*'

The Nyukani mapping session produced a similar sketch using ephemeral mapping (Fig. 5), which also showed no open access areas. Following demarcation by clan leaders and local government officials in 2010, formal boundaries are being enforced for individual farms and owners can accuse trespassers and report them to the police. In Nyukani, there was some confusion regarding ownership of the riverbeds. The large rivers are owned by the government and access is restricted, but the majority of

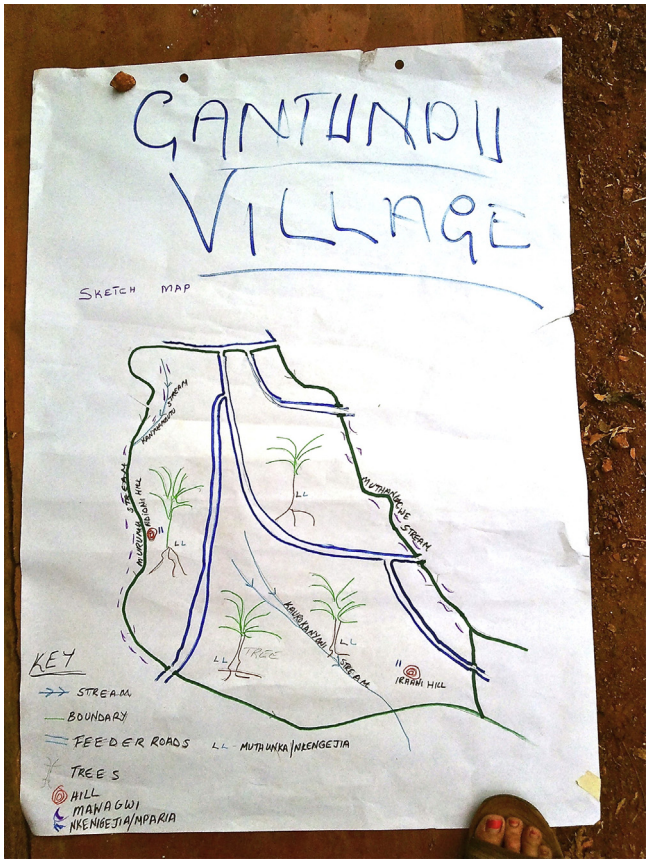

Fig. 4. Participatory Map from Gantundu (July 17, 2012), sketched by community members.

waterways are seasonal, and are considered private property. Two non-formally protected hills are also available to the community for grazing and picking WEPs, but only along the hill base, which is marginal land at best. Outsiders are required to obtain permission to pick WEPs on riverbeds and hills.

The non-protected hilltops were only mentioned as utilized harvest areas by one survey respondent in Nyukani and two in Gantundu, suggesting they do not play a large role in WEP harvest for the community. The prohibition of outsiders is a common theme in common property resource management, since the viability of these regimes often relies on cooperation and understanding within the user groups (Singleton and Taylor, 1992). The community management of these small hilltops is closer to shared resource management than strict private property designation, and could guide the creation of more effective village governance of other collective use areas, similar to those advocated in the literature (Kellert et al., 2000; Pellikka et al., 2009).

Private property rights and access to WEPs

Private land holdings were clearly defined by Ministry of Agriculture Officer #1: "When you own the land, you own everything on it. . .for example trees, soil, rocks and minerals, crops."

Both government and community respondents were in agreement when asked to clarify the rights to restrict WEP harvest and the ownership of forest produce on one's property:

> The same Officer #1 explained: "That would depend on the owner of the farm. There are owners who are generous and allow people to pick the wild fruits and go. There are others who say if you enter their farms you will be in trouble. So long as it belongs to you, now everybody coming there will not be able to take it. So for you to pick a wild fruit there it depends, some owners are very generous and allow people to pick wild fruits, even encourage peoples."
>
> 3. Must ask permission now from owners of private land, who even refuse to grant it. They don't like disturbances in their homes.
>
> 29. Land ownership has created boundaries - since the people own the land they want to secure it and there is no freedom to enter without permission.
>
> 34. One might even report you to the Chief's office if you are caught on their farm without permission, caused by the boundaries creating ownership.

A variety of explanations were given for the reluctance of land owners to allow WEP harvest on their farms, beginning with concerns about soil fertility and crop health:

Fig. 5. Ephemeral mapping in Nyukani (left), sketched by community members (right)—Data Collected August 12, 2012.

8. Private property owners will restrict access to WEPs because they fear reduced soil fertility due to WEP harvest.

14. They believe that people collecting WEPs on the farm can cause soil compaction and make the land less fertile.

33. People don't want others to enter for fear of destroying young cultivated plots.

Some participants described jealous and mean-spirited behaviour, calling their neighbours selfish, while others referred to the potential market value of WEPs:

4. They won't let others use their WEPs because they are being mean and jealous. It's often not because they want to use the WEPs themselves.

23. Don't want others to get WEPs from their farms, want to keep them for themselves.

54. Some people hate their neighbours and so don't want them in their homes.
Ministry of Agriculture Officer #1 agreed: "If I am a farmer and own a piece of land and there is a wild fruit there and I know that that fruit or vegetable has a certain value in the market, I won't just let others come and pick. If I have no idea about the commercial value then maybe it is ok."

A fear of ulterior motives for collecting WEPs was also described as a reason to restrict access, similar to the issue raised in relation to the government controlled forests.

37. Owners fear you may destroy the fence and everyone will enter the farm without permission. Owners don't want their farms to be stepped on and create paths in the there, worry that people may be going to graze animals while pretending to collect WEPs.

39. Owners think that when you cross the boundaries you might be cutting down his trees, breaking the fences or even stealing other (more valuable) fruits from the farm.

Other researchers have also discussed the challenges that arise for community management of NTFPs like WEPs when there is a lack of trust among participants, especially when there have been few interactions with local gatekeepers and occasional negative outcomes (Everett, 2001) such as those discussed by our research participants. Policy makers and practitioners often expect the community members to act as one, single-minded and stagnant group in their management of common resources using unanimously agreed upon rules of access (Turner, 1999). This is often not the case, however, as the regulations governing access to natural resources on common and private lands are apt to change, politically and spatially, due to lack of formal management regimes and weak local institutions (Turner, 1999). Communities that depend on forest resources are not often uniform entities with singular intentions (Adhikari and Adhikari, 2005; Bonilla-Moheno et al., 2013), and this was the case in our study where the villages had members from over ten clans, and were comprised of individuals representing a wide range of religious affiliations and economic levels with their own distinct opinions about WEP harvest on private property.

Ostrom (1990) also cited a lack of jointly defined tenure rules as an impediment to sustainable management of common property resources, such as the marginal lands and riverbeds where access is prohibited due to community concerns about theft, degradation and boundary changing. Permanent land ownership and titling are a relatively new phenomenon in Kenya, resulting in uncertainty about boundary demarcation, exploitation of new land registration protocols and informal channels by opportunistic actors, and higher risks and transaction costs for outsiders attempting to buy property in formerly traditionally managed systems (Atwood, 1990). The combination of lack of trust and mutual understanding, both within the community and between community members and enforcement personnel, community heterogeneity and poorly defined rules makes WEP harvest difficult in the public forests, private farms and marginal lands in our study areas, with negative implications for household food security and community resilience.

Government extension activities and commercialization of WEPs

Commercial trade in NTFPs is rarely a viable option for balancing development and conservation objectives (Kusters et al., 2006). Large-scale WEP extraction for income generation is not necessarily the way to maximize the benefits for communities while maintaining the integrity of the ecosystems under their management. Despite this, WEP-related extension activities in Kenya are almost entirely focused on value-added export production. The fruit most commonly referenced as a commodity by extension agents, foresters and community members, muthithi (*Tamarindus indica*), can be used to make juice, jams and candies that can then be sold in the village or regional markets. Other fruits are included in plans for commercialization, such as muura (*Sclerocarya birrea*), which is known in South Africa as marula and used to make beer, and more recently packaged products like jam, oil, fruit juice and wine have been introduced (Mander et al., 2002). Wynberg et al. (2003) explore options for successful production and export schemes in their South African policy brief on the tree fruit, recommending clarification of user rights and regulations between community members and different government actors–similar to our findings presented below.

While the Kenya Forest Service in Chiakariga was not actively working with communities to manage State Forests for subsistence WEP collection, they are promoting commercialization of these resources by encouraging farmers to plant tamarind and marula trees on their land, and to establish CFAs that aim to profit from the sale of the final products.

Forester #1: "We have a project here called, a community based forest project that is encouraging the farmers to get into enterprises like those with fruits. Like to make the juice or make conservation of the same and also to start now establishing the trees. . .So we are actually working for the wild fruits, we go to what is now actually in demand and where farmers can get an income like the tamarinds they are sold. There is someone who collects them and takes it to Mombasa. . .we would establish those trees, form kind of plantations and then we could call the farmers to come and collect the things."

Ministry of Agriculture Officer #2. "Mostly the government is insisting that the people look after their ordinary (wild) fruits for the areas which are dry areas. And once they have them, they can be trained how to preserve them as the other (domesticated) fruits."

Forester #2: There are those viable things like muthithi (tamarind), this is something which is we can harness it or domesticate it so it can be managed by the village farmers so that they can reap higher yields from it and also see how they can join a network, like the farmer field school network, so that they would be able to do marketing of the produce. . .We also have the marula, the marula, is a viable investment taking into consideration that marula wine comes from it and its processed especially in S. Africa. If it's something that can also be domesticated and be well managed, then it could be a viable project. Because apart from maybe feeding on the fruits, those fruits they can also be processed, they can also be the jam for the bread they can also come from marula.

The Ministry of Agriculture is also working to promote the harvest and processing of tamarind for income generation.

> Ministry of Agriculture Officer #3: "So we actually taught them how to make the juices, the jam and candies, but they didn't go for the candies, so they went for the jam and juice. . .They also collaborate with the catholic diocese of Meru who do some marketing promotion for them. . .they are the first customers themselves and then they sell it to the other people members of their networks, when they have visitors they take them to their group and the can buy there."

Local entrepreneurs are also involved, with one man in Chiakariga collecting kilograms of tamarind fruit to sell in bulk to a juice processing facility in Mombasa.

The focus on commercial value of WEPs is taking away from the major subsistence role of these products within the communities, ignoring the myriad nutritional benefits of these resources in lieu of economic gains. Studies in Southeast Asia have demonstrated that poorer households are often forced to sell high value WEPs like mushrooms and vegetables in order to be able to buy staple foods (Yen et al., 1994). In addition to the economically driven inequalities that result from WEP commercialization, considering NTFPs primarily as an income-generating resource can lead private landowners to refuse entry to harvesters who formerly were permitted on the property. Such changes in resource access have been demonstrated elsewhere [see, for examples, Peach Brown and Lassoie (2010) and Brown and Lapuyade (2001)]. This situation can be especially detrimental to poorer households without land, and more vulnerable demographic groups, like widows and children, who are generally more dependent on WEP resources (Paumgarten and Shackleton, 2009) yet the first to lose access when resources collection sites are privatized and formally managed (Sick, 2008).

WEP collection in the forest is also being affected by the concentration on economic valuation, where subsistence harvest is regulated like a commercial activity. This occurs despite no formal pricing for the required licenses according to our Kenya Forest Service participants. According to these key informants, subsistence collection is not differentiated from larger harvests meant for processing and export, and the same licenses and permits are required whether the harvester is taking a few leaves for the family dinner or a hundred kilograms of fruit to make juice. The resulting disparity in access and benefit sharing has been demonstrated in a number of other studies where local elites are often the only ones that can afford initial investments in certification (Pierce et al., 2003; Pierce et al., 2008), fees to join CFAs (Pokharel and Nurse, 2004) and the price of access permits (Malla et al., 2003), and thus tend to receive the majority of benefits from NTFP development projects (Thoms, 2008). Importantly, these elites are not generally reliant on WEPs as a coping strategy to increase household resilience, as they tend to have alternative assets and sources of income that decrease their vulnerability (Block and Webb, 2001; Iiyama et al., 2008). The contribution of coping strategies like WEPs to increased socio-ecological resilience and household food security becomes more significant when their harvest benefits poorer populations in addition to the local elites (Ericksen, 2008a,b).

Summarizing the history, challenges and opportunities for resilience-focused policy and institutions

Based on our findings, Fig. 6 presents a summary of the evolution of forest policy and land tenure in Kenya over time and

a

Private and community lands

Initial Conditions	Actions	Outcome	Current WEP access
WEPs available in common areas, traditionally subsistence collection is allowed.	Clans break up and distribute land	No more common property resources	WEPs cannot be collected
	Privatization of all areas, demarcation and title deeds.	Distrust between neighbours ends access to private lands.	

State Owned Forests and Reserves

Initial Conditions	Actions	Outcome	Current WEP access
Unregulated Forests and Hilltops provide WEP access for household use	Gazettement of hilltops. Forestry service created	Complicated, restricted forest access - many regulations, fines for entry and illegal harvests	WEPs cannot be collected
	2005 Forest Law regulates NTFPs, creation of CFAs	WEPs treated like commercial NTFPs - high costs/penalties	
		CFA formation is difficult, expensive for subsistence use	

b

	Policy Recommendations	Possible Outcomes	Impact on WEP access
Private and community lands	Community dialogue, identifying possible open access areas (Riverbeds, bush, ungazetted hills)	Trust increases access to WEPs on private land	**WEP Collection Increases System Resilience, contributes to household food security**
		Collection permitted in some open areas	
State Owned Forests and Reserves	Change regulations for subsistence collection	Legal WEP collection for subsistence in reserves and state forests	
	Forester education outreach on regulations		

Fig. 6. (a) Policy recommendations and possible outcomes grouped by harvest area type (private/community property and publicly managed reserves). Improving communication within communities and between farmers and government agents could have positive impacts on understanding motives, regulations and actual harvest practices. Furthermore, creating distinct rules for subsistence collect of WEPs, as compared to commercial NTFP harvests, would help standardize forest law interpretation and implementation in rural areas, increasing legal access for locals. (b) Policy recommendations and possible outcomes grouped by harvest area type (private/community property and publicly managed reserves). Improving communication within communities and between farmers and government agents could have positive impacts on understanding motives, regulations and actual harvest practices. Furthermore, creating distinct rules for subsistence collect of WEPs, as compared to commercial NTFP harvests, would help standardize forest law interpretation and implementation in rural areas, increasing legal access for locals.

the impact of those changes on WEP access. The issues identified in this study, and corroborated in the literature, are presented as actions and associated WEP harvest outcomes (Fig. 6a). One of the most obvious issues that arose for both private lands and publicly-controlled forests was the communication breakdown and high levels of confusion and mistrust related to the rules for harvesting WEPs. The interpretation of the formal rules varied considerably in relation to permission requirements, permits and penalties for illegal entry. The spectrum of responses ranged from defining the government reserves as open access areas where anyone can collect WEPs, to considering these forests as closed systems where harvesters face severe penalties if caught. Several respondents described a fear that WEP collection would be misconstrued as illegal firewood collection or charcoal burning in the forests, and attempted theft and boundary changing on their neighbours' farms.

The focus on commercialization of WEPs and other NTFPs also had substantial effects on harvest policies, community perceptions and enforcement activities for private landowners and State Forests alike. Conflating harvest of WEPs for subsistence and income generation in government-managed forests was associated with greater access inequality and negative impacts on the contribution of WEPs to socio-ecological resilience for vulnerable populations. There were also consequences on private lands, where the perception of high economic value for WEPs led to loss of harvest access for community members. Some policy recommendations are presented below, and also integrated into Fig. 6b along with the possible outcomes of such interventions.

Distinguishing between commercial and subsistence NTFP harvest

Based on our results, there is a need to address the inconsistent interpretation of the 2005 Forests Act to clarify traditional use and subsistence-level collection of forest produce. WEPs may need to be considered as a separate category in the Act, enabling the creation of a permit structure that is not based on market price. This would lend itself to more effective regulation, since the vast majority of WEPs were not considered to be economically valuable by the study participants. Furthermore, making a distinction between small-scale WEP harvest and the significant extract that often occurs with processing NTFPs for commercial use and export would open the door for simplified CFA formation requirements when collecting WEPs for subsistence.

The Forests Act stipulates a number of expensive pre-requisites for creating a CFA, including professionally designed management plans and methods for monitoring and conserving biodiversity in the entire forest. These formal plans are an important precaution for commercial collection, which even under non-destructive harvest conditions can have significant ecological impact (Peters, 1994). However, WEPs collected for household use may not require such formal management controls, since extraction is generally low-level with limited impacts on the target species or ecosystem as a whole (Laird et al., 2010). This is an area that requires more research.

In order for WEPs to contribute to food security and act as a coping strategy for increased resilience, policy interventions need to better consider user groups when implementing restrictions that will almost certainly have a detrimental impact on local livelihoods and food security (Mbuvi and Boon, 2009). Equitable access, especially for the more vulnerable groups within communities, is imperative if forest-based livelihood interventions like WEP harvest are to be considered a positive development activity across demographic groups (Sunderlin et al., 2003; Mahanty et al., 2009). There is also some evidence that WEP users are more inclined to conserve forests, due to their interest in continuing to benefit from these resources in the future, which further contributes to the sustainability of such resource management regimes (Delang, 2006a,b). This is another area that would benefit from further research.

Creating a culture of mutual trust and communication

A major finding of our study was the reported lack of trust and communication between the community and government officials, and between neighbours concerning entry to private lands and the sharing of food resources. Our participants described being somewhat fearful of their neighbours or the Forest Service refusing to believe that subsistence WEP collection was their singular motivation for being in the forest or on a private farm. The tendency to jump to conclusions of anti-social behaviour like theft, boundary changes and illegal forest product extraction, could be mitigated by encouraging greater community dialogue (Turner, 1999). This discourse might even allow user groups to agree on community open access areas, like seasonal streams and unprotected hilltops that are currently operating under vague management regimes.

Bringing together the Forest Service officials and the local community would be an excellent step in reducing the confusion surrounding forest access regulations and penalties for subsistence activities. Such a process could also provide an opportunity for foresters and farmers to interact, dispelling some of the negative opinions held by both parties, reducing ambiguity and risks of abuse for local populations of harvesters (also suggested by Ashley et al., 2006). Despite the claims by forest officers that the villages surrounding Kijege reserve had been sensitized on access restrictions and CFA creation procedures, it was apparent during our household interviews and focus group discussions that there were significant gaps in local knowledge related to the 2005 Forests Act and its enforcement.

Social capital, or the existing sum of social relationships in a society, varies greatly within and between groups of people and can have significant impacts on community development and resource management (Piazza-Georgi, 2002). Our respondents briefly touched upon these differentiations when referring to local elites and their capacity to circumvent regulations and invest capital to derive greater benefits from forest resources like WEPs (Thoms, 2008). However, other types of social capital are involved in determining which groups can access WEPs and the benefits they can derive from these resources, such as linkages that create rules and conventions as well as relationships between actors that help develop networks (Barr, 2000). Bonding social capital, evident in connected and cohesive community groups, and bridging social capital that supports inter-community connections and cooperation between communities and institutions are also important components of successful local forest management (Hyakumura and Inoue, 2006).

Increased household resilience from WEP harvest is only possible when vulnerable populations are able to access resources as a coping strategy; otherwise they are just another mechanism for local elites to benefit to the detriment of disadvantaged populations (Lavigne-Delville, 2000). Confusion about existing forest laws, poor communication and inconsistent enforcement is disproportionately harmful to poorer populations attempting to benefit from forest resources and will continue to increase inequality unless pro-poor policies are instituted (Mayers and Vermeulen, 2002). Social capital plays a role in this situation, as socially subordinate populations often depend more on natural resources despite encountering greater barriers to access such products (Wiersum and Shackleton, 2005). Increasing social capital, through strengthening social organizations and group ties, has been suggested as a means of increasing socio-ecological system resilience (Ladio and Lozada, 2009) and is important for sustainable development and biodiversity conservation as a whole (Pretty, 2003).

Moving beyond value addition and income generation

In addition to the issues surrounding access conditions and harvest rights, government extension activities and attitudes were almost entirely focused on WEPs as inputs for value addition, export and income generation. The main product, muthithi (*Tamarindus indica*), has a very low demand, which is reflected in the prices paid for semi-processed fruits (3 Ksh/kg) by the major buyers on the coast of Kenya, and the lack of a local market for the product. International trade in tamarind is limited due to complex health standards, difficulties finding exporters, and competition from Indian and Mexican producers (Betser, 1999).

The combination of low profits and inequitable benefits distribution suggest that a change in WEP extension activities to focus on simpler preparation and preservation of WEPs for household use would aid food security objectives. According to the Ministry of Agriculture officers we interviewed, projects were underway to promote vegetable gardens with leafy greens like kale and cabbage, and this could include wild varieties like nterere (*Amaranthus dubius*) and muthunka (*Launaea cornuta*) that are already found in and around farms. Programs also exist to promote the use of cowpea (*Vigna unguiculata*) leaves through educating community members about their nutritional properties, cooking techniques and methods of drying to preserve it for later use. These activities could also be modified to include wild vegetables, something in which extension agents have expressed interest.

In an era of decreasing funding and increasing environmental uncertainty, accurate targeting of funding and extension activities is ever more important (Ansoms and McKay, 2010). It is therefore time to focus on resilience-focused policy interventions that have a high likelihood of ensuring that benefits from forest ecosystems go to those who need them most, subsistence collectors of NTFPs that lack alternative livelihood options and additional income (Shackleton et al., 2009). Broad analyses suggest that "the very same characteristics that make them important and attractive to the poor in the first place also limit the potential for further income increases," (Angelsen and Wunder, 2003) which makes promoting subsistence use of WEPs all the more attractive as a means of increasing food security and resilience without relying on unlikely income generation-related gains (Campbell and Luckert, 2002).

Conclusion

This study investigated the various access regimes associated with the harvest of WEPs in two communities in semi-arid Kenya, and the effect that changing institutional conditions have had on the ability of food insecure populations to use WEPs as a coping strategy to increase socio-ecological resilience. The results suggest that there are serious communication and interpretation breakdowns regarding the application of national forest policy described in Kenya's Forests Act (2005), where subsistence collectors are disadvantaged due to strict enforcement that targets small-scale harvesters and substantial barriers to CFA creation for community groups. The focus on commercialization of WEPs by foresters, agricultural extension agents and private landowners also contributes to negative impacts on poorer households, such as loss of access to WEP resources on public and private lands and reduced benefits when local elites are better prepared to take advantage of value-addition activities and markets. Furthermore, concentrating on WEPs for income generation minimizes the subsistence value of these products, limiting the education and outreach programs that might otherwise benefit local users and contributes to a belief that WEP harvesters have ulterior motives for entering collection areas.

The results obtained through this research contribute to a greater understanding of the resource access conditions that exist in rural semi-arid Kenya and inform sustainable food security policy as the traditional land tenure systems transition to private ownership, State-managed forests and community owned resources. Future policy analyses should consider how Kenya's Forests Act could be amended to better support national and international food security objectives. In particular, policy and research efforts to better support the sustainable use of WEPs for subsistence purposes will likely result in improved household food security and increased socio-ecological resilience in the rural communities of arid and semi-arid Kenya.

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Appendix A. Local and Scientific Species Names

Fruit tree name	Fruit name	Family name	Genus species
Chiamaguna	Mbuu	Tiliaceae	*Grewia villosa* spp.
Gintujia	Ntugia	Euphorbiaceae	*Tragia impedita* (*prain*)
Kirigurigu	-	Cataceae	*Opuntia ficus-indica*
Mubata mukundo	Batamukundo	Vitaceae	*Cyphostemma adenocaule*
Mubiru	Mbiru	Rubiaceae	*Vangueria madagascariensis*
Mubobua	Mbobua	Balanitaceae	*Balanites aegyptiaca*
Mubuu	Mbuu (Sphere shaped variety)	Tiliaceae	*Grewia villosa*
Mubuyu	Buyu	Rhamnaceae	*Ziziphus mucronata*
Muchicha	Machicha	Amarantheacea	*Amaranthus dubius*
Mucimoro	Macimoro	Verbenaceae	*Lantana camara*
Mucuura	Ncuura	Sapindaceae	*Deinbollia kilimaudscherica*
Mudura	Ndura	Tiliaceae	*Grewia similis*
Mugumo	Ngumo	Moracea	*Ficus* spp.
Mujee	Njee	Euphorbiaceae	*Bridelia taitensis*
Mujuria	Njuria	Malvaceae	*Sterculia Africana*
Mukawa, Mukagwa	Nkawa, Nkagwa	Apocynaceae	*Carissa edulis*
Mukenia	Nkenia	Verbenaceae	*Lantana trifolia*
Mukoro	Makoro	Ebenaceae	*Diospyros mespiliformis*
Mukumangao	Nkumangao	Loganiaceae	*Strychonos madagascariensis*
Mukunduthi	Nkunduthi (oval shaped variety)	Olacaceae	*Ximenia americana*
Mukuru	Makuru	Annonaceae	*Uvaria scheffleri*
Mukurungu	Nkurungu	Rubiaceae	*Meyna tetraphylla*
Mukururu	Makururu	Euphorbiaceae	*Flueggea virosa*
Mukuura	Makuura	Caesalpiniaceae	*Piliostigma thonningii*
Mukuyu	Makuyu	Moracea	*Ficus sur*
Mungo (Moongo)	Maongo	Apocynaceae	*Saba comorensis*
Mupuuru	Mpuuru	Verbenaceae	*Vitex payos*
Muragwa	Ndagwa, Ndawa	Tiliaceae	*Grewia bicolor*
Muramba	Uramba	Bombacaceae	*Adansonia digitata*
Murenda	Ndenda	Tiliaceae	*Grewia* spp.
Mururoma	Ndoroma	Olacaceae	*Ximenia americana*
Muruguyu	Nduguyu, Ncomo	Palmae	*Hyphanene compressa*
Muthana	Nthana	Capparidaceae	*Maerua decumbens*
Mutherema	Ntherema	Anacardiaceae	*Lannea rivae*
Muthigora	Nthigora	Combretaceae	*Combretum aculeatum*
Muthigu	Mithigu	Bignoniaceae	*Kigelia pinnata*
Muthithi	Uthithi	Caesalpiniaceae	*Tamarindus indica*
Muthwana	Nthwana	Rhamnaceae	*Berchemia discolor*
Mutoo	Matoo	Malvaceae	*Azanza garckeana*
Mutuunka	Ntuunka	Rubiaceae	*Tennantian sennii*
Muura	Maura	Anacardiaceae	*Sclerocarya birrea*
Muyumu	Irumu	Minosaceae	*Acacia senegal*
Ngatu	-	Cyperaceae	*Cyperus blysmoides*

Local vegetable name	Family	Genus species
Magendenakuru	Fabaceae	*Senna didimobotrya*
Mathorokwe	Papilionaceae	*Vigna membranaceae*
Mathuma-mbiti	Icacinaceae	*Pyrenacantha kaurabassana*
Mathunju	Fabaceae	*spp.*
Maturankunu (ruturankuru, kuturankunu)	Convolvulacease	*Ipomoea mombassana*
Mparia	Fabaceae	*Clitoria ternatea*
Muchicha	Amarantheacea	*Amaranthus dubius*
Mucungurira	Cucubirtaceae	*spp.*
Muthunka	Asteraceae	*Lauaea cornuta*
Ngonko	Polygonaceae	*Oxygonum sinuatum*
Nkengejia	Commelinaceae	*Commelina bengalensis*
Nkenia	Verbenaceae	*Lantana trifolia*
Nkunda, Nkuuda	Papilionaceae	*Clitoria ternatea L.*
Nterere	Amaranthaceae	*Amaranthus dubius*
Rugoya	Leguminosae	*Indigofera lupatana*
Rwoga	Amaranthaceae	*Amaranthus graeciazans*

Appendix B. Household survey, semi-structured interview questions

_____ _____ _____

Signature Print Name Date

*If the participant cannot read and understand English, this form will be read to them in a local language and their consent recorded orally.

Date _____ Survey Number _____ Village_____ Household Number _____

SECTION 01: HOUSEHOLD RESPONDENT AND TYPE

Household Members:

	First Name	Other Names	Relationship To Head of Household	Sex (M/F)	Age	Education Level (Code A)	Primary Occupation
Respondent							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Household Type:

1. Male headed, with a wife or wives;
2. Male headed, divorced, single or widowed;
3. Female headed, divorced, single or widowed

Where is the head of household?

1. Permanently at home
2. Temporarily away from home
3. Absent at least 6 months of the year
4. Other _____

SECTION 02: HOUSEHOLD ASSETS AND FOOD SECURITY

A- RESIDENCE & OTHER STRUCTURES

Q1. What is the type of dwelling? (as observed by enumerator) [__ __]

01.Mud hut with grass thatch roof; 02. Mud hut with asbestos/iron roof; 03 = Brick house with grass thatch roof; 04.Brick house with asbestos/iron roof;05.Block house with grass thatch roof; 06.Block house with asbestos/iron roof; 07.Pole and dagga with grass thatch; 08.Other (specify) _____

Q2. Does the house have electricity? 01. YES, 00. NO [__ __]

Q3. Does the house have a latrine (either outside or inside the house)? 00.NO; 01.YES, inside; 02. YES, outside [__ __]

Q4. In addition to your primary residence, how many other residences do you have? [__ __]

B – HOUSEHOLD ASSETS

Household Asset	Total Number		Household Asset	Total Number
Plough			Tractor	
Cart			Radio	
Wheelbarrow			Mobile phones	
Bicycle			Television	
Car				

Q1. In the past 12 months, were there months in which you did not have enough food to meet your family's needs?01. Yes, 00. No [__ __]

Q2-14. If yes, which were the months (in the past 12 months) in which you did not have enough food to meet your family's needs?

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__]	[__ __]

Q3 – If yes, what kinds of coping strategies did you use?

General Questions

1. How are people who eat wild fruits and vegetables viewed in general?

   a) Does this view depend on the plant or the person eating the plant?

2. Are you aware of any local traditions, customs or cultural practices associated with the harvest and use of wild foods?

SECTION 03: COLLECTION OF WILD PLANTS IN YOUR HOMESTEAD FOR CONSUMPTION

We want to collect information about wild uncultivated plants growing in your homestead that are eaten:

	Local Name	Part used (Code A)	Household use, sold or both?	What season is it available? (Code B)	Who harvests the plant? (Code C)	Is it difficult to harvest? **Why?** (Code D)	What changes have you seen since 2000 in plant consumption? (Code E)	What changes have you seen since 2000 in abundance? (Code E)	Comments
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Code A	Code B	Code C	Code D	Code E
1. Whole Plant	1. Year round	01 = Everyone	01 = Too far	1. Increased
2. Leaf	2. Before rainy season	02 = Women only	02 = Thorny	2. Stayed the same
3. Root	3. During rainy season	03 = Women and children	03 = Not abundant	3. Decreased
4. Flower	4. After rainy season	04 = Men only	04 = Tall tree, hard to climb	4. Don't know
5. Fruit		05 = Other	04 = Other (specify)	5. Other (Specify)
6. Bark				

SECTION 04: FARMLAND

Questions:	**Land 1**	**Land 2**	**Land 3**	**Land 4**
How far is the land from the homestead (minutes)?				
Size of land (acres)?				
What is the tenure situation? (Code A)				
What is the current use of the land? (Code B)				
For how many years have you used this land?				

SECTION 05: COLLECTION OF WILD EDIBLE PLANTS ON AND AROUND THE FARM

	Local Name	Part used (Code C)	Household use, sold or both?	What season is it available? (Code D)	Who harvests the plant? (Code E)	Which land is it from? (# above)	Is it difficult to harvest? **Why?** (Code F)	What changes have you seen since 2000 in plant consumption? (Code G)	What changes have you seen since 2000 in abundance? (Code G)	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Code A (Tenure)	**Code B (Use)**	**Code C**	**Code D**	**Code E**	**Code F**	**Code G**
01. Hold a formal title to the land	01. Grow crops	1. Whole Plant	1. Year round	01 = Everyone	01 = Too far	01 = Increased
02. Have customary but exclusive rights over the land	02. Pastures	2. Leaf	2. Before rains	02 = Women only	02 = Thorny	02 = Stayed the same
03. Rent the land from someone else	03. Fallow land	3. Roots	3. During rains	03 = Women, children	03 = Not many	03 = Decreased
04. Borrow the land from someone else	04. Other (Specify)	4. Flower	4. After rainy season	04 = Men only	04 = Tall tree	04 = Don't know
06. Have use of land you consider your own but that has never been allocated to you		5. Fruit		05 = Other	05 = Other	05 = Other (Specify)
		6. Bark				

SECTION 06: OTHER AREAS WHERE WILD EDIBLE PLANTS ARE FOUND

What are the other areas that wild fruits and vegetables are found? - These can be neighbours homesteads and farms,unowned property, community land, protected areas, government forests and other properties.

	Type of Natural Area (Code A)	How far from your household (**minutes**)?	Do you obtain wild foods from this area? **(Y/N)**	If not, why not? (Code B)	Who owns this area? (Code C)	Do you need to ask permission to get wild foods here? **Y/N and who**?
1						
2						
3						
4						
5						
6						

SECTION 7: WILD EDIBLE PLANTS FOUND IN OTHER AREAS

	Local Name	Part used (Code D)	Household use, sold or both?	What season is it available? (Code E)	Who harvests the plant? (Code F)	Which area is it from? (# above)	Is it difficult to harvest? **Why?** (Code G)	What changes have you seen since 2000 in plant consumption? (Code H)	What changes in abundance? (Code H)	What changes in access restrictions? (Code H)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Code A	Code B	**Code C**	Code D	Code E	Code F	Code G	Code H
01 = Forest	01 = Too far	01= Government	1. Whole Plant	1. Year round	01 = Everyone	01 = Too far	01 = Increased
02 = Hills or hill top	02 = No access allowed	02 = Private owner (Who?)	2. Leaf	2. Before rainy season	02 = Women only	02 = Thorny	02 = Stayed the same
03 = Neighbours' farms	03 = Not abundant	03 = Community owned	3. Root	3. During rainy season	03 = Women and children	03 = Not abundant	03 = Decreased
04 = Rangeland	04 = Don't want them		4. Flower	4. After rainy season	04 = Men only	04 = Tall tree, hard to climb	04 = Don't know
05 = Wetland	05 = Don't have time		5. Fruit		05 = Other	05 = Don't want them	05 = Other (Specify)
06 = Streambed			6. Bark				

SECTION 8: PREPARATION AND CONSUMPTION OF WILD FRUITS AND VEGETABLES

From the Homestead	How prepared? (Code A)	When is this plant eaten? (Code B)	Who eats this plant? (Code C)	During what months is this plant eaten?	During those months, how many times a week is the plant eaten?	Why consume this plant? (Code D)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
From the Farm						
1						
2						
3						
4						
5						
6						
7						
8						
9						

Code A	**Code B**	**Code C**	**Code D**
01 = Eaten Raw	1. As a snack	1. Everyone	1. Very tasty
02 = Cooked alone	2. When grazing animals	2. Children	2. For fun
03 = Cooked with Ugali	3. When en route	3. Women	3. Many vitamins/health benefits
04 = Cooked with Kitheri	4. As part of a meal	4. Elders	4. To prevent hunger
05 = Cooked with porridge	5. On special occasions	**5.** Others (specify)	5. Tradition
06 = Roasted	**6.** Other (specify)		**6.** Medicinal

From Other Areas	How prepared? (Code A)	When is this plant eaten? (Code B)	Who eats this plant? (Code C)	During what months is this plant eaten?	During those months, how many times a week is the plant eaten?	Why consume this plant? (Code D)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Code A	Code B	Code C	Code D
01 = Eaten Raw	01 = As a snack	01 = Everyone	01 = Very tasty
02 = Cooked alone	02 = When grazing animals	02 = Children	02 = For fun
03 = Cooked with Ugali	03 = When en route	03 = Women	03 = Many vitamins/health benefits
04 = Cooked with Kitheri	04 = As part of a meal	04 = Elders	04 = To prevent hunger
05 = Cooked with porridge	05 = On special occasions	05 = Others (specify)	05 = Tradition
06 = Roasted	06 = Other (specify)		06 = Medicinal

Final Interview Questions:

3. Are there wild foods you remember eating as a child that are no longer harvested?

   a) Why do you think this has happened?

4. Have you noticed any changes in climate since you were a child?

   a) Do you think this is affecting the availability of wild fruits and vegetables?

5. Have you noticed any change in the places where wild fruits and vegetables are collected since you were a child?

   a) Why do you think this is?

6. Have you noticed any changes about the rules related to collecting wild fruits and vegetables since you were a child?

   a) Why do you think this is?

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