

# Characterisation and production of kitchen gardens and their contribution to food security and livelihoods in Karamoja, northeastern Uganda

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# Characterisation and production of kitchen gardens and their contribution to food security and livelihoods in the Karamoja region

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#### Abstract

The food systems are under great pressure to produce enough food to feed the growing population and lower environmental impacts on the already fragile ecosystems, and yet food insecurity remains one of the major global challenges. Food systems are one of the leading contributors in the transgression of the planetary boundaries causing adverse effects that threaten life in all forms. However, incorporating sustainable food system practices and approaches like kitchen garden farming, which are adaptable to adverse conditions and utilise little available resources with minimal or no external support, provides opportunities for enhancing food security and livelihoods in even fragile ecosystems like the drylands.

Drylands cover 44% of Uganda's land surface, supporting food production and livelihood for both the rural and urban populations. The Karamoja region, where this study was conducted, is a dryland area characterised by, hot temperatures, sporadic rains, land degradation, poverty, and 45% of the population being malnourished, has left the area vulnerable to food insecurity and always in need of humanitarian aid. In addition to biodiversity conservation, improved livelihoods, and land restoration, kitchen garden farming presents a beacon of hope.

This thesis aimed to characterise and assess the production of kitchen gardens and their contribution to food security and livelihoods in the Karamoja region, focusing on Moroto district in northeastern Uganda. On that effect, quantitative data was obtained from household surveys while qualitative data was obtained from focus group discussions, and key informant interviews which covered six sub counties and fourteen villages. The quantitative data was organised using KoboToolbox software and analysed using a Statistical Package for Social Sciences (SPSS).

The findings of the study suggest that there is diversity in kitchen garden practise in Moroto district based on the eight characterisation parameters used in this study: location, species diversity, harvest frequency, source of planting materials, landownership, production objective, motivation to start kitchen garden farming, and labour source. Based on the Household Food Insecurity Access Scale, 70% of the respondents were food secure and 30% were mildly food insecure, which can be attributed to a number of factors like good harvest and food availability in 2024 in Moroto district. Kitchen gardens are a source of food and income for households and, to a small extent, influence household food choices. The price for fresh leafy vegetables per square meter is less than one USD, and its yield per square meter is almost 2kg Kitchen gardens also contribute to community cohesion, peace, youth engagement and status uplifting for households and communities engaged in kitchen garden farming. Kitchen garden farming is affected by; knowledge and skills for kitchen garden farming, access to agricultural inputs, access to water, kitchen garden farming approaches used, species of vegetables and crops grown, pests and diseases, thieves, and attitude and mindset of the communities, among others.

Kitchen garden farming has the potential to enhance food security and livelihoods in Moroto district if the factors affecting kitchen garden farming are addressed in combination with more research, use of a holistic approach that caters for knowledge and skills transfer and utilisation and designing context-specific interventions that suit the people of Moroto.

*Keywords*: Drylands, Kitchen Garden, Food security, Food systems, Karamoja region, Pastoralists, Uganda

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# Abbreviations

HFIAS	Household Food Insecurity Access Scale
IPC	Integrated food security Phase Classification
LMIC	Low- and Middle-Income Countries
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NGOs	Non-Government Organisations
SDG	Sustainable Development Goals
SLU	Swedish University of Agricultural Sciences
UBOS	Uganda Bureau of Statistics

# 1. Introduction

Food systems are under great stress to produce adequate food to feed the growing populations and lower environmental impact on the already frail ecosystems, and yet food insecurity remains one of the significant global challenges (Schipanski et al. 2016). As of 2023, six planetary boundaries, namely; novel entities, climate change, land system change, biosphere integrity, freshwater change, and biogeochemical flows, have been transgressed due to human activities (Rockström et al. 2009; Richardson et al. 2023), and the food system is one of the leading causes of impact in these areas. According to Garnett et al. (2016), agricultural production and agriculturally induced land-use change, transport, storage, and food preparation alone contribute to around 20-30% of global human-made greenhouse gas emissions.

In addition to biodiversity conservation, improved livelihoods, and land restoration, kitchen garden farming greatly enhances food security and well-being (Galhena et al. 2013). Furthermore, kitchen garden farming integrates crop production into livestock production in pastoral communities, creating a more resilient food system. This is because kitchen garden farming adapts to diverse conditions and utilises little resources (Maredia et al. 2023). Kitchen garden farming, therefore, contributes to SDG1 (No poverty), SDG2 (Zero hunger), SDG 3 (Good health and well-being) and also to SDG5 (Gender equality) since it is mainly women engaging in kitchen garden farming.

Drylands make up 44% of Uganda's land area and offer livelihoods to people both in the rural and urban areas (Egeru et al. 2010). According to Egeru et al. (2010), drylands in Uganda are an important area for food production, yet they are the second most fragile ecosystem after highlands (NEMA 2007). The Karamoja region falls under the Northeastern drylands agroecological zone (MAAIF 2018), a semi-arid region inhabited by pastoral and agropastoral communities.

Famine, prolonged drought, land degradation, and poverty characteristic of drylands (Berrahmouni et al. 2015), have claimed many lives of people and livestock (GoU., 2013) and left the region underdeveloped and acutely food insecure, with high levels of malnutrition and a need for humanitarian aid (Gelsdorf et al. 2012; Barrantes & Caravani. 2021). According to the IPC report (2024), 45% of the population in the Karamoja region faces acute food insecurity, and almost 22,000 people experience

severe acute malnutrition, which is forecasted to increase. All these aspects, in addition to agricultural activity, industrialisation, and rapid population growth (Dong 2016), hinder the Karamoja region's pastoral way of life, forcing the people to settle. According to Dong (2016), 25% of the world's land surface area supported pastoralism in 2016, but this has declined and given rise to agropastoralism. Agropastoralism is the lifestyle of integrating crop production into the pastoral way of life (Dong 2016), where pastoralists can no longer freely roam with their livestock but are forced to have sedentary livestock farming and settlements (Dong 2016).

The Karamoja region remains the region with the highest presence of national and international development partners (Karamoja Resilience Support Unit 2022). Development partners have designed and implemented interventions like kitchen garden farming, amongst many other programs, to curb the problem of food insecurity and malnutrition. The crisis is far from over.

Previous studies in Asia have shown that kitchen gardens have the potential to enhance food and nutrition security (Santos et al. 2022), and human well-being (Galhena et al. 2013), although there are limited studies of the roles of kitchen gardens in achieving food and nutrition security and improving livelihoods in Africa (Depenbusch et al. 2021). This study responds to the call by Sileshi et al. (2022), that more studies on kitchen garden farming are needed to inform policymakers and development partners on how to design better, structure, and implement kitchen garden farming programs to enhance food and nutrition security. This study was undertaken during the dry season due to the period it was done and also the time limitations that did not allow for studies in both the wet season or dry seasons.

Food and Agriculture Organization (2009) defines food security as "when all people at all times have access to safe, sufficient, and nutritious food." According to Lowe (2021), hidden hunger is a form of malnutrition that occurs due to a deficiency in micronutrients like iron, zinc, iodine, and vitamins, resulting from an individual consuming food that gives energy (kcal) for survival and carrying on with their usual routines without any symptoms of fatigue or low energy but too little micronutrients. Hidden hunger usually occurs from consuming diets that lack diversity, thus are deficient in micronutrients (Biesalski 2013). Some pastoral communities in the Karamoja region embrace agropastoralism, which creates a suitable environment for kitchen garden farming to enhance food security and livelihoods. However, to achieve this, it is necessary to understand how kitchen garden farming is currently practised among the pastoral and agropastoral communities in the Karamoja region.

# 1.1 Aim

The initial idea for this study merged ideas from the Drylands Transform Project team and my interest in understanding and supporting local food systems to be more resilient and sustainable. The Drylands Transform team has carried out studies on the role and use of kitchen gardens in Kenyan drylands (Ward 2024), ecosystem services from woody vegetation in East African rangelands (Swärd 2023), and transforming land, livestock, and livelihoods in drylands (Nyberg et al. 2015), among others.

This study aims to characterise and assess the production of kitchen gardens and their contribution to food security and livelihoods in the Karamoja region, focusing on Moroto district in northeastern Uganda. As the community is predominantly pastoral, the study will offer insights into how kitchen gardens are practised and structured, informing the local community, policymakers, and development partners for the broader adoption of kitchen garden farming.

# 1.2 Specific objectives and corresponding research questions

The specific objectives of this study were to:

- I. Characterise kitchen gardens in Moroto district during the dry season
- II. Assess the production of the kitchen gardens
- III. Investigate the contribution of the kitchen gardens to food security and livelihoods
- IV. Explore the success and failure contributors towards kitchen garden farming

The research questions of the study were:

- I. How are kitchen gardens implemented in practice by the local households in the communities during the dry season?
- II. How productive are the kitchen gardens?
- III. How is household food security and livelihood affected by the kitchen gardens?
- IV. What factors affect kitchen garden farming success or failure?

# 2. Background

This section will give an overview of concepts relevant to the study. It covers the definition of kitchen garden farming, its importance and the factors affecting it. Furthermore, this section explores how kitchen garden farming contributes to or is linked to food security, sustainable food systems, biodiversity, and livelihoods.

## 2.1 Definition of kitchen garden farming

Maredia et al. (2023) states that home gardens can also be referred to as kitchen gardens, backyard gardens, garden patches, or garden beds and often have a local or cultural context.

Bonatti et al. (2017), describes a kitchen garden as part of an integrated system comprised of the family house and garden that produces a variety of foods, such as vegetables, fruits, and medicinal plants, for home consumption or sale.

Niñez (1987), further specifies that "the household garden is a small-scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing, and wage earning. Household gardens tend to be located close to dwelling for security, convenience, and special care. They occupy land marginal to field production and labour marginal to major household economic activities. Featuring ecologically adapted and complementary species, household gardens are marked by low capital input and simple technology".

A kitchen garden has five characteristics as described by Mitchell & Hanstad (2004)

1) are located near the residence; 2) contain a high diversity of plants; 3) production is supplemental rather than a main source of family consumption and income; 4) occupy a small area (Brownrigg 1985) and 5) are a production system that the poor can easily enter at some level (Marsh 1998).

Kitchen gardens vary in size, composition, organization, and structure, but most kitchen gardens provide green leafy vegetables and indigenous horticultural crops (Hansen et al. 2022), and are influenced by household resources and attributes, socioeconomic aspects, and cultural factors (Maredia et al. 2023).

In this study, the definition of a kitchen garden by Murphy (2008) will be used, which describes kitchen gardens as: "small patches of land dedicated to labour and land intensive cultivation of horticultural crops such as leafy greens, medicinal plants, bananas, and tubers often combining organic techniques, and it is close to home".

### 2.1.1 Importance of kitchen gardens

Murphy (2008), suggests that kitchen gardens can be used to help enhance food security, livelihoods, and nutrition for households with limited labour, income, and practical knowledge, as well as vulnerable households suffering from HIV/AIDS. Bonatti et al. (2017), add that kitchen gardens are a local strategy that communities can adopt and practice with limited resources or institutional support. In other words, kitchen gardens are a resource for development and resilience because they do not require much to sustain themselves but utilise what is available and adapt to diverse conditions, while being a rebuilding strategy in crisis and post-crisis situations to improve marginalised and vulnerable communities (Maredia et al. 2023). In addition, kitchen garden farming enhances community empowerment by closing the gaps related to community food insecurity and health (Bonatti et al. 2017).

Kitchen gardens may increase vegetation cover, protect watersheds, preserve local germplasm, and increase biodiversity in regional landscapes (Garí 2003; Nordin & Nordin 2005). Furthermore, kitchen gardens store neglected African greens, legumes, and tubers that exotic vegetables and commercial grain hybrids have displaced (National Research Council et al. 1996; Murphy 2008).

Kitchen garden farming is also a platform that can be used to promote different interventions at the same time to improve quality of life, for instance, promoting nutrition education, waste management, and compost production (Bonatti et al. 2017).

#### 2.1.2 Factors affecting kitchen garden farming

Kitchen garden farming implementation and achievements of its benefits have been greatly influenced and hindered by unfavourable climatic conditions, access to and affordability of inputs, land, and water, and the lack of knowledge and skills like pest and disease management (Maredia 2003; Hansen et al. 2022; Koodagi et al. 2023; Maredia et al. 2023).

## 2.2 Food security

Coates (2013) describes food security as "a state in which all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their

dietary needs and food preferences for an active and healthy life." This definition of food security summarises the pillars of food security, which are availability, accessibility, utilisation, affordability, and stability (Krishnaraj 2005; Coates 2013; Clapp et al. 2022).

The availability pillar of food security is related to food production and all conditions that sustain a desirable production level (Krishnaraj 2005), but availability is not enough; the food must also be nutritious (Farre et al. 2011). At the same time, accessibility is tied to food distribution (Krishnaraj 2005). The affordability pillar of food security is determined by the amount of resources people have at their disposal that will influence their capacity to buy food (Krishnaraj 2005).

According to Aborisade & Bach (2014), to achieve sustainable food security, a holistic approach to factors affecting food security, such as household income and land distribution, household livelihoods and dietary needs, food distribution, and waste, should be incorporated into the food security frameworks and interventions rather than just focusing on improving farm productivity and profitability while reducing environmental impacts. Rosegrant & Cline (2003) state, "Achieving food security needs policy and investment reforms on multiple fronts, including human resources, agricultural research, rural infrastructure, water resources, and farm- and community-based agricultural and natural resources management. Progressive policy action must not only increase agricultural production but also boost incomes and reduce poverty in rural areas where most of the poor live".

According to Murphy (2008), kitchen gardens have gained attention among development partners/agencies (Barnett & Topouzis, 2003; Drimie, 2004; Steiner et al. 2004; Nordin & Nordin, 2005), right from the grassroots groups to the national and regional levels, which use kitchen gardens in their programs and interventions to alleviate food security, nutrition, and livelihoods during and after various crises (Maredia et al. 2023).

Kitchen gardens contribute directly to food security through direct accessibility, availability, affordability, and stability of food as described by Bonatti et al. (2017), that food is directly harvested from the garden, prepared, and fed to the family using locally available materials and indigenous knowledge (Njuguna 2013).

Kitchen gardens can also be a primary source of household food and income in times of crisis like unemployment, harvest failure, economic disruptions, and sickness, among others (Njuguna 2013), and a production system that is easy to implement by the poor to improve food access (Bonatti et al. 2017).

Bonatti et al. (2017), argues that kitchen gardens illustrate how to attain food security and health promotion at the local and national levels across a country with adequate knowledge and skills tailored to local conditions.

According to Clapp et al. (2022), understanding food security as an outcome of a complex food system shows the magnitude to which the systems that result in food and nutrition outcomes interact with other systems such as the ecological, health, economic, political, and socio-cultural. Therefore, the long-term functionality of food systems greatly depends on the health and function of other systems and their relationship and interactions with one another. In other words, to achieve food security in general, or for instance, using kitchen garden farming, a holistic approach or system approach must be undertaken right from production, processing, distribution, preparation, and consumption, and all outputs of these activities, including environmental and social economic outcomes.

In addition, Du Toit et al. (2022), argues that kitchen gardens, despite their numerous positive outcomes on many occasions, fail to provide substantial contributions to food security due to;

- a) The garden composition (vegetables and fruits are not a priority, and ornamentals or bare ground take up most of the garden space)
- b) Small vegetable garden size less than 230 m<sup>2</sup> as recommended by Trainer (1995)
- c) Different motivations for setting up a kitchen garden, not for food but for other reasons
- d) Seasonal/unreliable production of vegetables and fruit in the kitchen gardens
- e) Lack of gardening knowledge and skills
- f) Lack of awareness of the benefits of the kitchen garden

However, the above can be overcome through the provision of skills, resources, and knowledge to be able to grow vegetables for food availability (Du Toit et al. 2022).

## 2.3 Sustainable food systems

According to Clapp et al. (2022), food system sustainability refers to "food system practices that contribute to long-term regeneration of natural, social, and economic systems, ensuring the food needs of present generations are met without compromising the food needs of future generations". Food systems encompass "all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation consumption [and waste management] of food, and the output of these activities, including socio-economic and environmental outcomes". (Abdul-Razak & Kruse 2017; Béné 2020).

The quality of the food system determines food security, and the sustainability of a food system can be measured by focusing on the soil parameters, agrobiodiversity

indicators, agrochemical use, water quality, or compliance with sustainability certification systems (Clapp et al. 2022).

The local food systems of low and middle-income countries (LMIC) are both made up of and benefit many of the world's poorest citizens (Smith 1998; Gómez et al. 2013). Smallholder farmers, pastoralists, or fisher folks make up the actors in the production level of the local food system in LMIC, mostly producing and trading plant staples, fruits, vegetables, wild and domesticated livestock (McCullough et al. 2010; Lowder et al. 2016), and often sell their produce in the local or regional markets (Porter et al. 2007; Veldhuizen et al. 2020).

The local food system feeds the majority of the population in rural and urban population in LMIC as the local food system is often the only source of affordable, nutritious since most of these populations are living under or close to the poverty line and spending more than 50% of their income on food (Minot et al. 2015; Béné 2020).

According to FAO, "a sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised" (Nguyen 2018).

For kitchen gardens to be more sustainable, research and resources should be invested in co-designing kitchen garden projects that are context-specific and not generalised (Hansen et al. 2022).

## 2.4 Biodiversity

Kitchen gardens can have numerous environmental and ecological benefits, such as habitats for animals, nutrient recycling, reducing soil erosion, and enhancing pollination (Pushpakumara et al. 2010), since they serve as the first unit that starts and uses ecologically friendly food production approaches that encourage the conservation of biodiversity and natural resources (Galhena et al. 2013). Kitchen gardens usually have a rich composition of plants and animal species making them a place for ethnobotanical studies (Blanckaert et al. 2004; Albuquerque et al. 2005)

Kitchen gardens could increase vegetation cover, protect watersheds, preserve local germplasm/(landraces that are rare and threatened), and increase biodiversity in regional landscapes (Watson 2002; Garí 2003; Nordin & Nordin 2005; Galhena et al. 2013).

Kitchen gardens also increase the base for cultivated plant materials since they are home to underutilised crop plants and wild relatives; however, there is a huge risk of losing the local genetic diversity if high-yielding modern varieties replace the traditional planting materials (Korpelainen 2023).

# 2.5 Livelihoods/income

Several studies have provided evidence that kitchen gardens contribute to income generation, improve livelihoods and household economic welfare, and promote entrepreneurship and rural development (for example, Trinh et al. 2003; Galhena et al. 2013). Kitchen gardens are widely utilised as a strategy to mitigate poverty and its effects and as a source of income for poor families in developing countries (Galhena et al. 2013).

Incomes from the sale of kitchen garden produce provide a source of disposable income that the household can use to get access to different basic needs (Galhena et al. 2013) and also pay for education and other services, as shown in studies from Nepal, Cambodia, and Papua New Guinea (Vasey 1985; Iannotti et al. 2009).

Studies by Koodagi et al. (2023) in India, show that from 250 m<sup>2</sup> in 6 months, one can earn up to Rs. 2491 (USD 29)—from Rabi vegetables (vegetables sown in winter and harvested in spring) and Rs. 4508 (USD 53)—from Kharif vegetables (vegetables sown at the onset on the monsoon and harvested in Autumn), summing up to Rs. 6999 (USD 82) using organic manure. This shows a huge potential in kitchen garden farming as a source of income for a household, opening the household and rural communities to different opportunities and improving the quality of life that comes with having finances.

# 3. Methodology

This study used quantitative data gathered from a household survey (n=56) and field observations collected in six (6) sub-counties and fourteen (14) villages of Moroto district, Karamoja region, Northeastern Uganda; qualitative data from focus group discussions from two sub counties (Nadunget and Lotisan), in four villages (Ariamawoi, Lakalia, Kidepo, and Kalkalet), and key informant interviews all held in Moroto town in the respective locations of the participants.

### 3.1 Study area

This study was done in the Republic of Uganda, the Karamoja region, Moroto district. Uganda is a landlocked country in East Africa (Okello et al. 2018), at the edge of the equator. It occupies a total area of 241,038 km<sup>2</sup> and averages about 1,100 meters above sea level (Okello et al. 2018). Agriculture, primarily by smallholder farmers, is the backbone of Uganda's economy and the core of economic development (Bamwesigye et al. 2020). About 70% of Uganda's working population is engaged in agriculture (UBOS, 2022). In the financial year of 2021/22, agriculture contributed approximately 24% of GDP and 33% of export revenues (UBOS 2022). The Karamoja region is made up of nine districts in Uganda, namely, Kotido, Kaabong, Karenga, Abim, Napak, Moroto, Nabilatuk, Nakapiripirit, and Amudat (IPC 2024). Moroto district was selected for this study since it was an area with ongoing studies of the Drylands Transform project under which this study was undertaken.

The study area falls under the North-Eastern Drylands agroecological zone (MAAIF 2018), which covers Moroto district. The Karamoja region is most vulnerable due to its semi-arid climatic conditions and the area experiences a highly variable climate characterised by sporadic rainfall and high temperatures all year round (Mugerwa et al. 2014), with annual rainfall ranging between 350-1000 mm (Nalule 2010). The study covered six (6) sub-counties in Moroto district: Nadunget, Northern Division, Loputuk, Katikekile, Rupa, and Lotisan, and 16 villages: Ariamawoi, Kalkalet, Kamera, Katamukono, Kidepo, Lakalia, Longoroko, Matheniko, Moroto hospital quarters,

Moroto junior quarters, Moroto prisons, Municipal primary, Nabuin, Nadiket, Nakapelimen, and Okilala, within a 40 km radius.



Figure 1: Map of Moroto district showing the area of study (Moroto district planning unit, 2025).

# 3.2 Drylands Transform Project Context

This study was conducted in connection with the Formas funded research project Drylands Transform (https://www.slu.se/drylandstransform). The Drylands Transform Project has been implemented in the Karamoja cluster covering Uganda and Kenya 2020-2025. The project aims to gain an in-depth understanding of the links between land health, livestock-based livelihoods, human well-being, and land management and governance and contribute new knowledge to drive transformative change and sustainable development of rangelands (Drylands Transform 2021).

# 3.3 Respondents of the study

The study respondents have been categorised into five categories based on the data collection methods and tools used. The respondent categories include 1) Households, 2) Development partners/NGOs, 3) Kitchen garden trainers, 4) Drylands Transform field facilitator Uganda, and 5) Uganda government representative.

## 3.3.1 Sample size

The study consisted of 78 respondents (Table 1), where 56 households were interviewed using questionnaires (Appendix 1). Seven key informant interviews were carried out (Appendix 2). Four focus group discussions were held (Appendix 3) with a total of 22 participants: 8 participants from the 56 households, 10 participants from the Drylands Transform pastoralist group at the Livestock Café (who, at the time of the study –the dry season- were not actively practising kitchen garden farming), and four participants who were part of a unique kitchen gardening approach that came up during one of the key informant interviews.

Respondent category	Number of	Data collection method
	respondents	
Household	56	Household survey
	22	Focus group discussions
Development partners/NGOs	4	Key Informant Interviews
Kitchen garden trainer	1	Key Informant Interviews
Drylands Transform field facilitator	1	Key Informant Interviews
Uganda government representative	1	Key Informant Interviews

Table 1: Summary of respondents' categories in the study and data collection methods used per category

## 3.3.2 Respondents' participation consideration

#### Household respondents

Initially, households previously engaged in kitchen garden farming were mapped for the study by the Drylands Transform project field facilitator and kitchen garden trainer. However, upon visits to the households, most kitchen gardens had dried since the study was done during the dry season. Also, some households had stopped kitchen garden farming, especially those in projects that had ended, or the inputs and facilitation for maintaining kitchen gardens had stopped. Therefore, the 56 respondents participating in the study were households with kitchen gardens within a 40 km radius of Moroto town. The households were also selected based on references from respondents who had been interviewed, and others were selected through door-to-door visits to find out if the respondents were engaged in kitchen garden farming.

#### **Development partners/NGOs**

The development partners/NGOs were selected based on the information collected during the household survey. The households were asked if they had received any training or support for kitchen gardening, and if yes, a follow-up question on which organisation was asked. Based on the households' responses and the kitchen garden evidence, the organisations mentioned and accepted to be interviewed were selected for this part of the study.

#### Kitchen garden trainer

The kitchen garden trainer was selected since she had trained households on kitchen gardening under the Drylands Transform project in Moroto.

#### The Drylands Transform field facilitator team Uganda

The field facilitator for the Drylands Transform project in Uganda was interviewed based on his experience working with the households and coordinating Drylands Transform activities at the Livestock Café in Moroto district.

#### Uganda government representative

The district agricultural officer was selected to represent the government on the technical side of implementing and coordinating agricultural-related programs in the Moroto district.

### 3.4 Ethical considerations

In this study, the General Data Protection Regulation (GDPR) for processing the collected data was followed. Consent of the participants was duly sought before participating in the study. A self-introduction of the researcher, followed by an introductory letter from the Drylands Transform country director, which explained the purpose of the study and what it entailed, was also provided. This gave the participants the liberty to choose whether to participate or not. Official appointments with some participants, especially for the key informant interviews, were made. For some

participants who were not willing, their choices were respected. Consent from the participants to participate in the study and to take pictures of their vegetable gardens was obtained through oral means. Some participants preferred to take pictures of the kitchen garden by themselves and later sent me the pictures. No pictures of the participants were taken.

For this study, the Drylands Transform research and ethical work permit to work in Moroto district through Makerere University (CAES-REC-2023-1), the institution spearheading Drylands Transform work in Uganda, was used. The participants' right to privacy and confidentiality was ensured, and all participants voluntarily participated in this study.

## 3.5 Data collection

The study used a translator during the household survey and focus group discussions. The translator was taken through the household survey questionnaire. A copy of the questionnaire was given to the translator to familiarise with the questions and ask questions if there was an area that needed clarification. The translator had experience in translation and working in Moroto and the Karamoja region as a whole, which made it very easy to work.

Notes were taken to capture information from the household survey, focus group discussions and key informant interviews. This allowed the respondents to express themselves more freely as opposed to recording an audio version of the interview

To address objectives 1 and 2, two data collection methods were used: 1) Field observations and documentation, and 2) a household survey which was organised using KoboToolbox software.

The data from focus group discussions and key informant interviews were organised into themes. The data was explored to identify patterns that came up in the data set and coded into colours to represent the patterns identified in the data set. The codes were then organised into themes that fitted. The themes were then used to point out narratives backed up with quotes from the respondents. The tools used for thematic analysis were a pen, paper and Excel sheets.

# 3.6 Characterisation of kitchen gardens and their production

This section covers the details of how field observations and documentations, assessments of kitchen garden production and the household survey were done in this study.

#### 3.6.1 Field observations and documentation

Observations on kitchen gardens were done and documented, including the type of species, number of plants of each species, plant arrangement and size of the garden, and any other specific details of the garden. When the household interviews were carried out in the kitchen garden, the field observations were done during the same visit, which aligns with Sharmin Tumpa (2023). Sometimes, when the household survey was done before the field observation, the field observation and documentation template was used to check the information provided earlier by the respondent by asking follow-up questions. For instance, if the respondent had answered yes to mulching their kitchen garden, and there was no mulch on the visit to the kitchen garden. Then, a follow-up question about when they mulch was asked. The field observation and documentation were meant to inform the study about the composition of the kitchen garden, its location, and its uniqueness. Field observations and documentation and the household survey were conducted concurrently between October and November 2024.

#### Assessment of kitchen garden production

During the field observation and documentation, a kitchen garden production assessment was done for 14 kitchen gardens where respondents accepted that their gardens could be used for the purpose of the study.

The assessment for production involved taking measurements of the kitchen garden and taking into account the area covered by the respective vegetable species.

A one square meter quadrant was used to randomly sample the kitchen gardens and the vegetables that were inside the quadrant were counted and their number of leaves was counted. The number of leaves or fruits from 20 plants randomly in the kitchen garden of the same species as the vegetables in the quadrant were counted to get the average number of leaves per plant within the garden. The leaves or fruits of the species of vegetables within the quadrant that were ready for harvest were harvested and weighed. The respondents then measured the harvested fresh leafy vegetables or fruits in the same way that they always measured for sale. I then paid the respondents for the cost of the vegetables that were harvested. The following calculations were done to ascertain the production of vegetables in kilograms per square meter, the area covered by specific vegetables, price per square meter and estimated sales for the area covered by the vegetables in the whole garden, respectively:

- a) Production (kg m<sup>-2</sup>) = fresh weight of the harvested vegetable species from an area of one square meter (Quadrant was placed in an area solely occupied by a single vegetable species)
- b) Area covered by the vegetable  $(m^2) = \text{length}(L) \times \text{width}(W)$  of the total kitchen garden area covered by the specific vegetable species
- c) Price per square meter (USD)= price of the harvested vegetable from an area of one square meter (Soley cropped vegetable species)
- d) Estimated sales for area covered by vegetable (USD) = price per  $m^2 \times size$  of garden in square meter

It is important to note that aspects such as water, manure, variety of vegetables, yield potential, stage of growth of the plant at harvest, planting time, soil conditions, and agronomic requirements, among others, were not measured or tracked throughout the growing period of the plant or considered.

## 3.6.2 Household survey

The household survey questionnaire consisted of short, semi-structured questions that provided insights and information about the household and the kitchen garden, why the household started kitchen garden farming, the distance of the kitchen garden from the homestead, and water source, inputs used in the garden, land ownership, what influences the plant species in the kitchen garden, if they are eaten by the family and/or sold, what are the foods they commonly eat, among others (detailed household survey questionnaire in Appendix 1).

# 3.7 Kitchen garden contribution to food security and livelihoods.

Other sections of the household survey related to food security and livelihoods were adopted in combination with the Household Food Insecurity Access Scale (HFIAS) questions (Appendix 1, section Five (a)) to assess how kitchen gardens contribute to food security and livelihoods. The Household Food Insecurity Access Scale was considered for one month (four weeks). The algorithm in Figure 2 (ICCO 2018) was used to determine the household food insecurity access scale categories, such as whether the household was food secure, mildly food insecure, moderately food insecure, or severely food insecure.

The Household Food Insecurity Access score for individual households was calculated by obtaining the sum of frequencies of occurrence during the four weeks for the nine food insecurity-related conditions represented in the Household Food Insecurity Access Scale questions (ICCO 2018) (Appendix 1, section five (a)). Household Food insecurity score = (Q1a + Q2a + Q3a + Q4a + Q5a + Q6a + Q7a + Q8a + Q9a).

The household scores range from 0 to 27, as represented in Figure 2. Each colour in Figure 2 represents the score range with the respective food security category.



*Figure 2 : Algorithm for calculating Household Food Insecurity Access Categories (ICCO 2018, page 11) based on the total household scores ranging from 0 to 27.* 

Other questions related to food security and livelihoods included (Appendix 1, section five (b)):

a) What are the commonly eaten foods in the household?

- b) How does the household meet the household food requirements all year round?
- c) What influences household food choices?
- d) How does the household supplement low yields from the kitchen garden?
- e) What influences the type of vegetables and crops grown by the household?
- f) What does the household do with the produce from the kitchen garden?
- g) How many people consume the produce from the kitchen garden?
- h) What is the main objective for the kitchen garden, and what is the motivating purpose for starting the garden?
- i) How much has the household received from the sale of the produce from the kitchen garden?

All these questions answer the parts of food security in terms of quantity and nutritional value, food preference, access, stability, affordability, and the economic gain from kitchen gardens for livelihoods.

The minimum Dietary Diversity for Women (FAO and FHI 360 2016) was used to categorise the foods that all respondents, both male and female, commonly ate into food groups. This was to offer insights into the dietary diversity of respondents based on the commonly eaten food groups, number of food groups and food group combinations eaten. Respondents were asked to name the foods they commonly eat daily; however, a 24-hour recall was not used. The minimum Dietary Diversity for Women method (FAO and FHI 360 2016) categorises foods into ten food groups, namely

- 1) Starchy staples (grains, white roots and tubers, and plantains)
- 2) Pulses (beans and lentils)
- 3) Nuts and seeds
- 4) Dairy
- 5) Meat, poultry and fish
- 6) Eggs
- 7) Dark leafy vegetables
- 8) Other vitamin A-rich fruits and vegetables
- 9) Other vegetables
- 10) Other fruits

The food groups listed above follow the culinary classification and description but not the botanical definitions and classifications (FAO and FHI 360 2016).

# 3.8 Success and failure contributors towards kitchen garden farming.

Key informant interview data (Appendix 2), focus group discussions data (Appendix 3), and a section of data from the household survey for recommendations (Appendix 1, section five (b)) were used to answer objective four.

### 3.8.1 Focus Group Discussions

Section 3.3.1 of the study explains the details of focus group respondents (Table 1), section 3.5 how data was collected and 3.9 how the data was analysed. The focus group discussions lasted between 30 to 45 minutes. The focus group discussions offered insights into the community's perception of kitchen garden farming, their experiences, challenges, and recommendations for making it successful. The Drylands Transform field facilitator for Moroto district guided the selection of the participants, who consisted of men, women, and youth. The focus group discussions were conducted per village.

The definition of a kitchen garden used for the household survey and focus group discussion was "small patches of land dedicated to labour and land intensive cultivation of horticultural crops such as leafy greens, medicinal plants, bananas, and tubers often combining organic techniques, and it is close to home" (Murphy 2008). However, respondents pointed out that due to water scarcity, the kitchen gardens have been moved far away from home, close to water sources.

### 3.8.2 Key Informant Interviews

Sections 3, 3.3.1, 3.3.2 and 3.5 explain the details of the key informant interviews. The key informant interviews each lasted between 30 and 60 minutes. The key informant interviews offered insight into the understanding of kitchen garden farming for a pastoral community among the supporters and implementers of kitchen garden farming in Moroto district. It also provided insights into the most typical kitchen garden farming practices or techniques promoted by the stakeholders, which were most successful and those that were not, and why. The respondents for the key informant interviews also provided recommendations based on their experiences with implementing kitchen garden farming to improve it.

# 3.9 Data analysis

The quantitative data were analysed using a Statistical Package for Social Sciences (SPSS) and an Excel sheet to obtain means, median, percentiles and percentages.

Under characterisation of kitchen gardens, eight parameters were considered based on the results of the study and characteristics of kitchen gardens done by Niñez (1987) The characterisation parameters include: 1) location, 2) source of planting material, 3) production objective, 4) labour source, 5) land ownership, 6) harvest frequency, 7) motivation for kitchen garden farming, and 8) species diversity.

The qualitative data (focus group discussion and key informant data) were explored to identify patterns that came up in the data set and coded into colours to represent the patterns identified in the data set. The codes were then organised into themes that fitted. The themes were then used to point out narratives backed up with quotes from the respondents. The tools used for thematic analysis were a pen, paper and Excel sheets.

# 4. Results

This section presents the results of the study as per the four objectives: Characterisation of kitchen gardens, production in kitchen gardens, contributions of kitchen garden farming to food security and livelihoods and the success and failure contributors to kitchen garden farming in Moroto district in northeastern Uganda.

# 4.1 Characterisation of kitchen gardens in Moroto district in the dry season

#### 4.1.1 Field observations and documentation

Regarding water access, it was observed that half of the respondents had their kitchen gardens at the homestead and had or were near a water source (Figure 3). |One third of the respondents had their kitchen gardens at the water source away from the homestead, whereas a few had them at the homestead without water access.



Figure 3: Kitchen garden access to water corresponding to the percentage of respondents (n=56)

It was also observed that kitchen gardens had varying characteristics; for instance, some kitchen gardens were fenced with dry thorns or live enclosures, while others were established as open areas. The fences and live enclosures offered security from thieves and/ or livestock.

The majority of respondents (71%) practised kitchen garden farming at the household level, while one-third (29%) practised kitchen garden farming as a group in allotment gardens.

The garden size had a minimum value of 4  $m^2$  and a maximum value of 5000  $m^2$  with a median of 30  $m^2$ , 12  $m^2$  at the 25<sup>th</sup> percentile, and 128  $m^2$  at the 75<sup>th</sup> percentile.

A majority of the respondents (88%) had only vegetables in their kitchen gardens, while the rest had a mixture of vegetables, fruits, staple food or other crops.

A total of 37 plant species were identified in the observed kitchen gardens (Table 2). The kitchen garden with the highest species richness had 11 species, while the average number was five. Kale was the most commonly grown species (in 57% of the gardens), followed by eggplant (46%), amaranthus (30%), black-eyed pea (23%), and Swiss chard (20%).

s/n	Common name	<b>Botanical name</b>	Family	Edible part	Crop type
1	African bird's	Capsicum	Solanaceae	Fruit	Vegetable
	eye chilli	frutescens			
2	African spider	Cleome	Cleomaceae	Leaves	Vegetable
	plant	gynandra L			-
3	Crotalaria	Crotalaria	Fabaceae	Fruits &	Vegetable
	(Alaju)	ochroleuca G.		leaves	-
	-	Don			
4	Amaranth greens	Amaranthus	Amaranthaceae	Leaves	Vegetable
	(bugga, dodo)				-
5	Bananas	Musa	Musaceae	Starchy fruit	Staple
6	Beans	Phaseolus	Fabaceae	Mature seed	Vegetable
		vulgaris			
7	Beetroot	Beta vulgaris	Chenopoidiaceae	Tuberous	Vegetable
				root	
8	Black-eyed bean	Vigna	Fabaceae	Mature seed	Vegetable
	(cowpea)	unguiculata		& leaves	
9	Cabbage	Brassica	Brassicaceae	Leaves	Vegetable
		oleracea			
10	Carrot	Daucus carota	Umbelliferae	Tuberous	Vegetable
				root	
11	Cassava	Manihot	Euphorbiaceae	Tuberous	Staple
		esculentum		root	
12	Eggplant	Solanum	Solanaceae	Fleshy fruit	Vegetable
		melongena			

Table 2: Plant species identified in the kitchen gardens and their corresponding botanical name, family, edible part and crop type

13	Green pepper	Capsicum annuum	Solanaceae	Fruit	Vegetable
14	Guava	Psidum	Myrtaceae	Fruit	Fruit
15	Jack fruit	Artocarpus heterophyllus	Moraceae	Fruit	Fruit
16	Jute mallow	Corchorus olitorius	Malvaceae	Leaves	Vegetable
17	Kale	Brassica oleracea	Brassicaceae	Leaves	Vegetable
18	Lemon grass	Cymbopogon citratus	Poaceae	Leaves	Other
19	Lemon	Citrus limon	Rutaceae	Fruit	Fruit
20	Maize	Zea mays	Poaceae	Seeds	Staple
21	Malakwang (Hibiscus species)	Hibiscus cannabinus	Malvaceae	Leaves	Vegetable
22	Mango	Mangifera indica	Anacardiaceae	Fruit	Fruit
23	Okra	Abelmoschus esculentus	Malvaceae	Green fruit	Vegetable
24	Onion	Alleum cepa	Liliaceae	Bulb	Vegetable
25	Orange	Citrus sinesis	Rutaceae	Fruit	Fruit
26	Papaya	Carica papaya	Caricaceae	Fruit	Fruit
27	Passion fruit	Passiflora edulis	Passifloracceae	Fruit	Fruit
28	Pineapple	Ananas	Bomeliaceae	Fruit	Fruit
29	Pumpkin	Cucurbita pepo	Cucurbitaceae	Fruit &leaves	Vegetable
30	Sorghum	Sorghum bicolour	Poaceae	Seeds	Staple
31	Soursop	Annona muricata	Annonaceae	Fruit	Fruit
32	Sugar cane	Saccharum officinarum	Poaceae	Stem	Other
33	Sunflower	Helianthus	Asteraceae	Seeds	Fruit
34	Sweet potato	Ipomoea batatas	Convolvulaceae	Tuberous root	Staple
35	Swiss chard (Beet greens)	Beta vulgaris	Chenopoidiaceae	Leaves	Vegetable
36	Tobacco	Nicotiana	Solanaceae	Leaves	Other
37	Tomato	Solanum lycopersicum	Solanaceae	Fruit	Vegetable

Regarding proximity to the homestead, most respondents had their kitchen gardens close to the homestead at a distance of between 0 to 0.5 km, and a minor part had the kitchen gardens 1 km or more from their homes (Figure 4).



Figure 4: Distance of kitchen gardens from the homestead corresponding to the percentage of respondents (n=56).

#### 4.1.2 Characterisation parameters

Eight parameters were considered in the characterisation of kitchen gardens in the dry season namely: 1) location, 2) source of planting material, 3) production objective, 4) labour source, 5) land ownership, 6) harvest frequency, 7) motivation for kitchen garden farming, and 8) species diversity (Figure 5).

Source of planting material: The planting materials used in the kitchen gardens were purchased by most respondents, and just a few either received donations or used homesaved planting materials.

Species diversity: Almost half of the respondents had four or more species in their kitchen gardens, while a small number had either just one species or two to three species in their gardens.

Harvest frequency: A significant number of respondents harvested produce from their kitchen gardens weekly, and the rest harvested daily or fortnightly.

Location: The location of kitchen gardens was greatly influenced by water access and proximity to the homestead. The majority of the respondents had their kitchen gardens located at or near the different water sources (tap, borehole and river). Production objective: More than half of the respondents pointed out that they utilized the kitchen garden primarily to produce both food for the family and sale for income, while some either produced solely for food or sale, and the rest for diet or health reasons and for leisure.

Motivation for kitchen garden farming: Food was the major motivation for nearly half of the respondents to set up a kitchen garden while nearly a third responded it was for income and the rest were either motivated by development agencies and government, or passion for farming and leisure as quoted below.

"I got tired of sitting around to wait for food, so I started growing vegetables to pass time". (Male respondents during the household survey)

Labour source: Family labour was the primary source of labour for kitchen garden farming activities by the largest number of respondents as compared to just a few respondents who utilised hired labour to supplement labour requirements.

Land ownership: A large proportion of the respondents used government land for kitchen garden farming and the rest of the respondents used family land, communal land or rented land.



Figure 5: Summary of kitchen garden characterisation results: KGF represents kitchen garden farming:

# 4.1.3 Socio-demographic overview of participants in the household survey

The study comprised of approximately half men and women. Larger-sized households practised kitchen garden farming more as compared to the smaller-sized households (Table 3). Nearly half of the respondents had either received training on kitchen garden farming through the government and other development agencies or relied on traditional knowledge and skills. A few of the respondents used agricultural knowledge and skills acquired from formal education for kitchen garden farming.

Almost half of the respondents had practised kitchen garden farming for two to three years, while about short of a third of the respondents had practised kitchen garden farming for four years and more, and just a few had practised kitchen garden farming for one year.

Gender	5 1	Household size		KGF knowledge	,	Vears	in	
Genuer		Household Size		& skills		KGF	111	
Male	52%	1 person	8%	Received training	48%	1 year		16%
Female	48%	2 to 5 people	26%	Traditional	46%	2 to	3	46%
				knowledge & skills		years		
		6 to 8 people	25%	Academic	5%	4 to	5	14%
				Background		years		
		More than 8	42%	KGF knowledge &		6 to	10	14%
		people		skills		years		

Table 3: Summary of the socio-demographic overview of participants. The percentages represent the proportion of respondents in the different socio-demographic aspects from (n=56)

KGF-Kitchen garden farming

# 4.2 Assessment of the production in kitchen gardens in the dry season

The section includes two sets of results: 1) kitchen garden production assessment results (n=14) and 2) results from the household survey (n=56).

#### 4.2.1 Kitchen garden production assessment results

For the 14 kitchen gardens where the fresh weights were measured in October 2024, the mean vegetable production per square meter was calculated for the three most commonly grown vegetables (kale, round eggplants and Swiss chard (Table 4). Considering fresh vegetable production in kilograms per square meter, Swiss chard (in the communities commonly referred to as 'spinach') had a higher fresh vegetable production per square meter, yet, it covered a small area as compared to kale and round eggplants.

Considering price per square meter, all vegetables when sold were less than 1 USD. In general, the fresh vegetable production was about  $2 \text{ kg m}^{-2}$ .
Table 4: The mean area covered per vegetable  $(m^2)$ , the mean production of different vegetable species  $(kg m^2)$  and the mean estimated sales (USD) obtained from the mean total area of the sampled kitchen gardens at the time of the study. Figures after the mean values are standard deviation (n=14)

Vegetable species	Ν	Area covered per vegetable (m <sup>-2</sup> )	Fresh vegetable production (kg m <sup>-2</sup> )	Price at the time of study per m <sup>2</sup> (USD)	Estimated sales for total area covered by vegetable
Kale	6	67±99	$1.6 \pm 0.7$	0.4±0.2	(0.5D) 25 ± 33
(Sukumawiki) Round	3	87±24	2.1 ±1.7	0.5±0.2	51 ± 30
eggplants Swiss chard	4	18±6	$2.3 \pm 0.8$	0.8±0.3	15 ± 9

Production (kg  $m^{-2}$ ) = vegetable fresh weight harvested from an area of one square meter

Area covered by vegetable  $(m^{-2}) = \text{length}(L) \times \text{width}(W)$  of total area covered by a specific vegetable species Price per square meter (USD)= price of harvested vegetable from an area of one square meter

Estimated sales for area covered by vegetable (USD) = price per  $m^{-2} \times size$  of garden in square meter.

Highest yields of fresh assorted vegetables were reported by respondents to occur in June, followed by October and May, while the months when respondents experienced the lowest yields were in January, December and November, respectively.

### 4.2.2 Kitchen garden production - results from the household survey

The commonly used inputs in the kitchen gardens were water, manure and mulch. Water was a major input used in the kitchen garden, with 60% of the respondents irrigating their kitchen gardens at different stages of plant growth, while 35% added livestock manure, and 5% were practising mulching. More than half of the respondents (54%) did not use any kind of manure in their kitchen gardens, while many (39%) used goat manure and some (9%) used either cow dung or both cow dung and goat manure. Season greatly influenced the type of vegetables and crops grown by nearly half of respondents, followed by the maturity period of the plant, and personal preference (Table 5).

s/n	Aspect	Percentage of respondents
1	Season <sup>1</sup>	41
2	Maturity period	38
3	Preference <sup>2</sup>	25
4	Profitability <sup>3</sup>	21
5	Donors	20
6	Tolerance to drought	18
7	Marketability <sup>4</sup>	16

Table 5: Top seven aspects influencing the type of vegetables and crops grown in kitchen gardens(n=56)

<sup>1</sup>Season in this context represents the major seasons in Uganda, which are the dry season and the rainy season; <sup>2</sup>Preference means what the respondent personally likes; <sup>3</sup>Profitability means the vegetables bring in more money when sold; <sup>4</sup>Marketability means that vegetables are preferred in the market by customers and sell faster.

Almost half of the respondents planted crops and vegetables in their gardens at least twice a year, and a few planted crops and vegetables in their kitchen gardens four times or more (Table 6).

Number of planting times in a year	Percentage of respondents		
2	43		
3	30		
1	16		
4	9		
5	2		

Table 6: Number of times respondents planted crops and vegetables in their kitchen gardens in a year (n=56)

A large proportion of the respondents (75%) only grew annual crops and vegetables, followed by both annual and perennial crops and vegetables, while a few respondents solely grew only perennial crops and vegetables (Table 7). Respondents with kitchen gardens that had crops and vegetables planted in rows dominated (70%), while some (27%) planted their crops in irregular patterns, and a few (4%) planted their crops both in rows and in irregular patterns.

Table 7: Type of crops and vegetables grown by respondents (n=56)

Type of crops and vegetables grown	Percentage of respondents
Annual	73
Perennial	2
Both	25

# 4.3 The contribution of kitchen gardens to food security and livelihoods in Moroto district

### 4.3.1 Household food security

Using the Household Food Insecurity Access Scale (ICCO 2018, page 11), a great majority of the respondents were food secure, while a few were mildly food insecure, and none were food insecure in the last four weeks at the time of the study (Table 8).

Household Food Insecurity Score	Frequency.	Percentage
Food Secure	39	70%
Mildly food insecure	17	30%
Moderately food insecure	0	0
Severely food insecure	0	0
Total	56	100%

Table 8: Food insecurity results from the household survey using the Household Food Insecurity Access Scale (n=56)

The majority (84 %) of the respondents purchased food to meet their all-year-round food requirements, while a smaller part (16%) ate wild leaves and fruits. Low vegetable yields from the kitchen gardens were supplemented through purchase by most (98%) of the respondents, while few (2%) received humanitarian aid. This finding can be illustrated by some quotes:

"The kitchen garden helps us not to spend money on buying vegetables, especially the ones we grow in the gardens". (Focus group discussions).

"From the kitchen garden, we sell the vegetables to get money to buy other foods or other things". (Focus group discussion).

"From the kitchen garden, we get food to eat and sell". (Focus group discussion).

"Kitchen farming is used as a coping strategy or a bouncing back point after, or a resilience mechanism to cope with food insecurity. After a year of drought and famine, usually many households will set up kitchen gardens to provide food". (Key informant).

## Climatic conditions such as rainfall also influence food security according to the key informant interviews:

"This is a good year in 3 years. The rains have been more frequent than before, and the households have had a good harvest, and there's plenty of food in homes". (Key informant).

"2024 has been a good year, it is green everywhere because of the rains, so the households are doing well in terms of food from the harvests". (Key informant).

Kitchen garden farming is a resilience strategy and mitigation measure for drought and its related effects on households.

"Now, kitchen gardens are few, but usually, after a period of long drought and scarcity of food, many households set up kitchen gardens to provide food". (Key informant).

## 4.3.2 Dietary diversity

Following the FAO and FHI 360, minimum dietary diversity for women measurement guide (FAO and FHI 360 2016), all respondents commonly ate starchy staples and dark green leafy vegetables, while also a great majority ate pulses however, a few respondents ate dairy, meat, poultry and fish and eggs (Table 9).

FG	Foods in FG	Foods commonly eaten by	Percentage
		respondents	of
			respondents
1	Starchy staples	Maize, sorghum, millet, cassava, sweet	100
		potatoes, bananas, brewer waste and	
		rice.	
2	Pulses	Beans	94
3	Nuts and seeds	-	0
4	Dairy	Milk	2
5	Meat, poultry and fish	Meat	16
6	Eggs	Eggs	7
7	Dark green leafy vegetables	Vegetables	100

Table 9: The commonly eaten foods by the respondents categorised into food groups(FG) (n=56)

The majority of respondents commonly ate foods from three food groups, followed by those who ate food from four food groups, while a very small percentage of respondents ate foods from five or more food groups (Table 10).

Table 10: Commonly eaten food group (FG) combinations by respondents (n=56)

Number	Food group combination eaten by respondents	Number of	Percentage
		food groups	of
		eaten	respondents
1	FG 1 + 2 + 7	3	77
2	FG1 + 2 + 5 + 7	4	13
3	FG 1 + 7	2	5
4	FG 1 + 2 + 5 + 6 + 7	5	2
5	FG1 + 2 + 6 + 7	4	2
6	FG1 + 2 + 4 + 5 + 6 + 7	6	2

Food group 1= starchy staples, food group 2=pulses, food group 4 =dairy, food group 5=meat, poultry and fish, food group 6=eggs, food group 7=dark green leafy vegetables

## 4.3.3 Influence on food choices, income and household recommendations

Finances greatly influenced the food choices of respondents (32%) followed by the kitchen garden (20%), and availability (19%). Availability in this context means that one can only eat the kind of foods available in the region or within the reach, either in the markets or provided for, especially for those who receive donations. Other aspects that influenced food choices of respondents included season (14%), nutrition (10%), preferences (5%) and health reasons (1%).

At the time of the study, a third of the respondents estimated to have earned three dollars or less per season (Table 11), another third had not yet sold any produce while the rest had earned three dollars or more from the sale of kitchen garden produce (Table 11).

Table 11: The income estimate results from the sale of kitchen garden produce of respondents from the household survey per season. 1USD = 3669.44 UGX. at the time of the study (n=56)

s/n	Income estimates from the sale	Income estimates from sale of	Percentage of
	of kitchen garden produce per	kitchen garden produce per	respondents
	season, (UGX)	season, (USD)	
1	0 to 10,000	0 to 3	33
2	10,000 to 50,000	3 to 14	19
3	50 to 100,000	14 to 27	7
4	More than 100,000	More than 27	7
5	Not yet sold	0	33

The top six recommendations by the respondents' for improving food security and livelihoods through kitchen garden farming include (i) more training on kitchen gardening farming, (ii) sensitisation on kitchen garden farming, (iii) provision of vegetable seeds, (iv) access to simple irrigation kits, (v) attitude and mind-set training, and (vi) pest and disease control.

Number	Recommendation	Percentage of respondents
1	More training on kitchen garden farming	21
2	Sensitisation on kitchen garden farming	12
3	Provision of assorted vegetable seeds	12
4	Increase access to simple irrigation kits	17
5	Attitude and mindset training	9
7	Pest and disease control	9
8	Increase access to fertilizers	3
9	Ready markets	2
10	Water desalination	1
12	Use of good agronomic practices	5

Table 12: Summary of urgent recommendations proposed by households to improve food security and livelihoods through kitchen garden farming (n=56)

14	Setting up demonstration gardens	1
17	Identification of people passionate about kitchen garden farming	1
18	Sharing native seeds among community members	1
19	Emphasis on small-scale kitchen garden farming	1
21	Drought tolerant varieties	1

# 4.3.4 Development agencies supporting kitchen garden farming in Moroto

During the household survey and key informant interviews, a total of 17 agencies were identified to have offered training, inputs and other resources to support kitchen garden farming activities in Moroto district. The development agencies include: Caritas Moroto diocese, WeltHungerHilfe, Cooperation and Development, Karamoja Development Program (KADP), Danish Refugee Council, Agromax, St. Jude Family farm Masaka, Jinja remand home, German Development Cooperation (GIZ), Pentecostal Assemblies of God, World Food Program, Food and Agriculture Organisation (FAO), United States Agency for International Development (USAID), Insieme Si Puo (ISP) in Africa, Andre Food International, Catholic Relief Services (CRS) and government of Uganda NUSAF3 program.

### 4.3.5 Community cohesion and status uplift

Kitchen garden farming was perceived to offer intangible benefits like community cohesion, engagement of the youth and improving the status of those engaged in kitchen garden farming in the community.

"The kitchen garden has made other community members admire us. For instance, on Independence Day, we harvested vegetables and gave them to each member. While other people went to buy vegetables, we had ours from the garden. Other community members begged us and also wanted to join the group". (Focus group discussion).

"Kitchen gardening activities bring unity since we manage our group together. Even though everyone has their own plot, this is good for our community". (Focus group discussion).

"We also have youth in our group; kitchen garden activities keep them busy and away from criminal activities and idleness". (Focus group discussion).

# 4.4 The success and failure contributors towards kitchen garden farming in Moroto district

### 4.4.1 Understanding of kitchen garden farming

Kitchen gardens, as understood by the promoters and supporters in Moroto, can be defined as an area fenced with dry thorns, live enclosures or an open area where vegetables, fruits, and different crops are grown close to the homestead or near a water source for food, sale, or both (Table 13).

s/n	Key Informant	Definition of a kitchen garden
1	Government	"A kitchen garden is a small area fenced up with thorns to grow
	representative	vegetables near the household or a water source"
2	Development agency 1	"Kitchen garden farming is a technology that collects locally
		available materials to prepare a small area for growing vegetables for
		the household"
3	Development agency 2	"A kitchen garden is the nearest source for cultivating and picking
		vegetables close to the household. The standard size of a kitchen
		garden is 2m * 4m"
4	Development agency 3	"A kitchen garden is where a household maximises the use of a small
		piece of land to grow crops for food and sale for income"
5	Development agency 4	"Kitchen garden farming is a close-to-home production by the
		household using the most available resources, and the surplus can be
		sold"
6	Drylands Transform	"A kitchen garden is a backyard 5m <sup>2</sup> close to the household where
	field facilitator	vegetables and other crops are grown using household wastewater"
7	Kitchen garden trainer	"A kitchen garden is a small piece of land where you grow vegetables
		to help you in the kitchen"

Table 13: Definition of kitchen gardens by key informants

### 4.4.2 Success contributors to kitchen garden farming

The success contributors mentioned in this section are a combination of recommendations made by the key informants based on their experiences in the implementation of kitchen garden farming programs in Moroto district and from the focus group discussions with members from households practising kitchen garden farming. This covers the aspects on how kitchen garden farming can be used as a tool for enhanced food security and livelihoods. The success contributors have been written in this section based on the frequency as expressed by both the key informants and focus group discussants, but presented in no particular order.

1) Holistic knowledge and skills for households are essential to sustain and boost adoption and value realisation from kitchen garden farming.

"Before setting up kitchen gardens, the households must be trained on the different techniques or practices for producing the crops/vegetables, how to prepare/cook the vegetables, how the vegetables are eaten or consumed, and how the vegetables can be preserved. This will cover many aspects, such as food and nutrition security, as the food will be eaten just as it should be eaten, with minimal nutrient loss during preparation or preservation, and reduce food waste or unnecessary sale of the food much needed by the household just because they don't know how to consume the food". (Key informant).

"More training is needed on how to utilize the available resources for kitchen gardening, such as the abundant cow dung, the sorghum husks after threshing, and how to improve soil fertility". (Key informant).

"Growing vegetables near the home is good, but we need more training on how to keep them alive throughout the year". (Focus group discussion).

2) Access to quality and affordable agricultural inputs, such as seeds and farming tools, is essential for establishing and utilising kitchen gardens.

"Bringing pesticides, fungicides, and other agricultural inputs nearer to the farmers would be good so that we can also buy them when possible". (Focus group discussion).

"Increase access to quality seeds and other agricultural inputs for bringing seeds and other agricultural inputs closer to the people through setting up agro-input outlets and also encouraging agro-input dealers to set up outlets in Moroto, or even government setting up a government agro-input outlet in Moroto. Most of the inputs in Moroto are bought from Kampala or Kenya, which is expensive and wastes time". (Key informant).

"The MAAIF visibility and presence in the Moroto district are lacking and need to be improved. For instance, among many other things, households do not have access to agricultural inputs like seeds, fertilisers, and pesticides. This greatly hinders the adoption and implementation of kitchen gardening to improve food security and livelihoods". (Key informant).

"An irrigation kit for our allotment garden would be very helpful, as it is difficult to water in the dry season". (Focus group discussion).

3) Water access through sustainable water source management and conservation for allyear access to water for production.

"Identifying water sources in the community, such as rivers, boreholes, and wells, intentionally conserving them, and encouraging responsible use and care for them will encourage continuous water supply all year round". (Key informant).

"Increase access to water through the construction of valley dams in partnership with different development partners". (Key informant).

"Drill boreholes and taps to bring water sources closer to households, enabling crops to be grown in kitchen gardens". (Key informant).

4) Use of native species in kitchen gardens.

"Mindfulness of the type of vegetable seeds or seedlings being given to the households is important since some vegetables the households are not familiar with and don't know how to grow or even consume them. Native vegetable and crop species should be prioritised while promoting kitchen gardening. The locals are used to the vegetables, and the species can thrive in the area's harsh weather conditions. Currently, most kitchen gardens in Moroto are made up of exotic vegetables and not native vegetables, yet the native vegetables can grow all year round". (Key informant). 5) Inspiring transformation among households practising kitchen garden farming through refresher training, exchange and exposure visits to successful communities in kitchen garden farming with the same agroecological zone.

"Model households and groups are taken for exchange and exposure visits to learn and get motivated to do even better". (Key informant).

"Taking households for exchange and exposure visits to other communities has motivated them and encouraged them to embrace kitchen gardening. They learn new techniques from the communities they visit". (Key informant).

"We give refresher training to the households". (Key informant).

"Refresher trainings are important to keep households interested and updated with skills, knowledge, and practices". (Key informant).

6) Regular monitoring of households engaged in kitchen garden farming and establishing monitoring structures right from the household, and the community level to the national level, encourages active participation and involvement of different stakeholders for better results and continuity.

"Close monitoring of the kitchen gardens by the group members and the organisation". (Key informant).

"Regular monitoring of households engaged in kitchen gardening". (Key informant).

7) Establishment of sustainable exit strategies by agencies promoting kitchen garden farming that encourage participation among households and continuity of kitchen garden farming activities but also offer extra benefits to the households. For instance, the incorporation of village savings and loan schemes.

"Establish a clear and practical sustainability plan for kitchen gardens, especially among organisations implementing or planning to promote kitchen gardening, so that when the project ends, kitchen gardening will continue". (Key informant).

"Include a sustainability plan and strategy to sustain the kitchen gardening activities in the community". (Key informant)

- 8) A combination of kitchen garden farming approaches used by different agencies that enhance learning at different levels, thus encouraging seeing, practice and implementation of different practices in kitchen garden farming. For instance, use of
  - a) Demonstration sites,
  - b) Farmer field schools,
  - c) Kitchen garden farming as a group in allotment gardens,
  - d) Individual household kitchen garden farming at the backyard or the water source
  - e) Use of model households as learning platforms and trainers for the community,
  - f) Use of trainer of trainers in the community,
  - g) Provision of agricultural inputs or start-up capital to boost kitchen garden farming,

- h) Agricultural-related talk shows on the local radio stations,
- i) Optimum land use methodology,
- j) Establishing good relationship and trust with the community, and/or
- k) E-book learning method

"The farmer field school approach is the approach that we use for kitchen gardening implementation in the community. Community members are trained as a group using the farmer field school approach. A piece of land is reserved from the community near the households and water source, where a demonstration plot is established. The community members are taught and have the opportunity to try out what they have been taught. After the training, the households or participants are given plots in the allotment gardens where each can grow their vegetable and use it for sale or home consumption". (Key informant)

"Demonstration farms should be used to promote kitchen gardening. Here, different approaches to kitchen gardening can be experimented on and displayed, and the household can learn and see that kitchen gardening can indeed work". (Key informant).

"Encourage allotment gardening since it encourages the spirit of community, mobilization of resources (drilling a water source in an allotment garden that can be used by many), and implementation". (Key informant).

"Other learning and information dissemination approaches should be explored to aid the learning and adoption of kitchen gardening. For instance, printed laminated kitchen gardening handbooks with simplified illustrations and steps for kitchen gardening and its benefits should be used for the community to learn about and embrace kitchen gardening. Short YouTube videos with success stories on kitchen gardening and how different households in Moroto practice kitchen gardening can be shared so that youth or other community people can have free access to learning and get inspired ". (Key Informant).

"Creating a good relationship and trust among group members and also between the organization and group members increases the success rate of the kitchen garden interventions". (Key informant).

9) Diversification of crops grown in the kitchen garden for resilience, better nutrition, income and all-year production.

Diversification of crops and vegetables in kitchen gardens must be encouraged. For instance, herbs, fruits, and other crops in the garden greatly benefit the household and the environment instead of growing monocrops". (Key informant).

"Encourage diversification of vegetables grown by households in their kitchen gardens. It is an issue of households growing just one type of vegetable in the garden, and also, households practising kitchen gardening are growing similar vegetables. For instance, sukumawiki (kale) is one of the most common vegetables grown by almost all households practising kitchen gardening or commercial vegetable production. Diversification helps in case of disease outbreaks, improves nutrition and income, and sustains all-year vegetable production, so the garden is not seasonal". (Key informant).

## 10) Integrating poultry into kitchen garden farming to offer a balanced diet but also multiple streams of income, and the enterprises complement each other.

"Chickens would also be a good addition to the kitchen garden projects so that we can make more money and also have different things to eat". (Focus group discussion).

### 11) Promoting kitchen garden farming in schools at different levels

"Promoting kitchen gardening in schools at all levels will help learners acquire knowledge early, practice it later in life, and realize it's a good way of life". (Key informant).

## 12) Use of different avenues that encourage integrating kitchen garden farming to promote kitchen garden farming and other aspects like nutrition among others.

"Utilisation of the health centers as a medium to pass on information about kitchen gardening for the benefit of food and nutrition security as well as livelihoods. The health centers can even have a few kitchen garden demonstration sites where people can learn about growing their own fruits, vegetables, and other foods to improve their nutrition". (Key informant).

13) Establishment of small-sized kitchen gardens eases management and proper utilisation of the kitchen garden to produce crops and vegetables.

It is important to consider setting up small-sized kitchen gardens for better management and resource use". (Key informant).

"Promoting small-sized kitchen gardens which ease management and maximize productivity of the garden". (Key informant).

"Growing vegetables in a small plot is good because it is easy to manage and it does not take a lot of time when you are working in the garden". (Focus group discussion).

14) Government plays a critical role in the success of kitchen garden farming interventions through creating favourable policies and an enabling environment.

"Model farmer households' capacity has been built and have now become learning platforms and trainers to train other community members. They have also been given several agricultural inputs such as irrigation kits. Model households and groups have also been taken for exchange and exposure visits to learn and get motivated to do even better". (Key informant).

### 4.4.3 Failure contributors to kitchen garden farming

This section includes the challenges and experiences in kitchen garden farming as expressed by the key informants and households that practise kitchen garden farming during focus group discussions.

1) Inadequate and unreliable water supply

"We cannot grow vegetables unless we have enough water. When the borehole gets spoiled, we cannot grow vegetables; we have to wait for the rains, which is unreliable". (Focus group discussion).

2) Thieves are a major threat to kitchen garden farming, demoralising households since they don't get to realise the benefits. This has been highlighted by all respondents in the study. "Thieves steal produce from the gardens, sometimes even before the owner harvests, forcing the households practicing kitchen garden farming to lose the zeal to continue". (Key Informant)

3) Pests and diseases have greatly hindered kitchen garden farming with households making great losses.

"Pests and diseases affect vegetables, like aphids, which destroy the sukumawiki (kale), and black-eyed peas (cowpea), which are the most common vegetables we grow. When they attack the garden, you cannot harvest anything. When you mulch the garden, the termites eat the mulch and destroy the crops as well, so it is difficult to mulch to keep the water in the soil". (Focus group discussion).

4) Unclear strategies to sustain kitchen garden farming activities at the closure of kitchen garden programs.

"Include a sustainability plan and strategy to sustain the kitchen gardening activities in the community". (Key informant).

"Challenge with sustainability and continuity of kitchen garden projects when the projects end". (Key informant).

5) Limited vegetable options for households to grow, which has encouraged monoculture and threatens the local species and dietary diversity

"It would be nice to have a variety of vegetables and also choose the type of vegetables we want to grow". (Focus group discussion).

6) Mind-set and attitudes of the community are branded as too dependent on handouts in the form of humanitarian aid

"The dependency mind-set among the community members is that they want to be supported with everything. If support is not available or is withdrawn, they won't participate even in what will benefit them. They prefer handouts". (Key informant).

7) Dry and hard soils that make cultivation and survival of kitchen garden crops difficult

"The land is dry and hard to cultivate, especially during the dry seasons". (Key informant).

"The soil is hard and the long drought conditions, coupled with long distances from the water source makes it hard for kitchen garden activities to take place". (Key informant).

8) Open grazing threatens kitchen garden farming as livestock eat and trample on the crops in the kitchen gardens

"Open grazing destroys crops". (Key informant).

### 4.4.4 E-book learning and the mound kitchen garden

Perception and design of kitchen garden farming approach implemented based on a follow-up on the E-learning books about kitchen garden use and construction—an approach where tablets are given to tablet teachers. The community can learn about kitchen gardening with tablets by watching short clips and illustrations on step-by-step guides and the materials used. The community members touch on an area of their choice on the tablet, which then pops up on the screen with audio translated into Karamojong.

The E-book learning approach was appreciated by the households for its uniqueness and creativity, and lasted for a year. However, regarding the physical gardens that were translated into the E-book during the focus group discussions, the discussants expressed the following views:

"Learning from the tablets has been good in general". (Focus group discussion).

"The mounded gardens lasted for one year". (Focus group discussion).

"The demonstration methods and illustrations could be made simpler and clearer". (Focus group discussion).

"The tablet teachers need more refresher training and knowledge". (Focus group discussion).

The respondents expressed that the construction, maintenance and watering of the kitchen gardens were labour-intensive and time-consuming. Furthermore, pests and diseases, thieves, drought conditions and children playing in the kitchen gardens hindered kitchen garden farming activities and benefits.

"The garden needs more watering, which is hard". (Focus group discussion).

"Children found the garden interesting, started playing in it, and later destroyed it". (Focus group discussion).

"The construction of the garden is hard and requires a lot of labour and time". (Focus group discussion).

"Pests and diseases have been a challenge, destroying the crops in the garden and termites became a problem, destroying the mulch and the materials used to build the garden and weakening it". (Focus group discussion).

"The prolonged drought causing water scarcity has also been a challenge in maintaining the garden". (Focus group discussion).

"Thieves have also been a major problem, stealing the vegetables and demoralising".(Focus group discussion).

These views would have been more representative if a large sample size of beneficiaries (participants from the E-learning book approach) had been taken into account, since just a few beneficiaries participated. It was also difficult to get in touch with the contact persons in the community since their mobile phones were off, and local leaders who also doubled as beneficiaries were contacted instead and helped with the study.

## 5. Discussion

This thesis aimed to characterise and assess the production of kitchen gardens and their contribution to food security and livelihoods in the Karamoja region, focusing on Moroto district in northeastern Uganda. The purpose was to answer the research questions of how kitchen gardens are implemented in practice by local households in the communities in Moroto district during the dry season, how productive are kitchen gardens, how are household food security and livelihood affected by kitchen gardens and what factors affect kitchen garden farming in Moroto district? The results of this study are discussed in this section to answer the research questions using existing literature and concepts in section two of this report.

### 5.1 Characterisation of kitchen gardens

## 5.1.1 Where can you find kitchen gardens in the dry season in Moroto?

Kitchen gardening farming in Moroto district is practised both at the homestead and away from the homestead at the water source. To some extent, these study results may agree with Maredia et al. (2023), Murphy (2008), and Niñez (1987) in relation to the distance of the kitchen garden from the homestead. For instance, it was observed that 62% of the respondents had their kitchen gardens at a distance within 0.5km from the homestead.

In contrast to the definition of kitchen garden farming by Murphy (2008), in Moroto, during the dry season, kitchen garden farming is practised away from the homestead, mostly due to water access since it is a dryland area, but also due to the approach of kitchen garden farming used. For instance, in Moroto, kitchen garden farming is practised both at the household level by individual households and as a group in allotment gardens. However, one could argue that water access influences the location of kitchen gardens to a greater extent, even if some of the respondents who did not have access to water still practised kitchen garden farming. This could be attributed to a

generally "good year" in 3 years, as described in the key informant interviews. The region received more rain in 2024 than usual. Hence, the findings cannot be conclusive since this study was done over one season.

## 5.1.2 What is the agrobiodiversity of kitchen gardens in the dry season?

The top five vegetables grown by the respondents in the household survey are exotic and common commercially grown vegetables, with a limited representation of indigenous vegetables. This is in agreement with the finding of Korpelainen (2023) that despite kitchen gardens potentially being a home for cultivating underutilised crops and wild relatives. This indicates that there is a high risk of low plant species biodiversity in the kitchen gardens in Moroto district, which poses a threat to the extinction of some species, while just a few species are cultivated. This is contrary to the studies by Watson (2002); Garí (2003); Nordin & Nordin (2005); Galhena et al. (2013) that indicate that kitchen gardens preserve the local germplasm, protect watersheds and increase biodiversity in regional landscapes.

Despite the results indicating that nearly half of the respondents had four or more species in their kitchen gardens, the other half had two to three or only one species in the garden. This also creates a decreased scope for better dietary diversity and increased risk for crop failure as there might be less diversity in sensitivity level for various pests, and circumstances like drought among others.

The low species diversity in the kitchen gardens in Moroto could be attributed to the top seven aspects that influence the crops grown in the kitchen garden, according to the respondents, such as season, maturity period, individual preference, profitability, donors, tolerance to drought and marketability. Some of these attributes, like individual preference, maturity period, and profitability, are in agreement with Ali (2005) and Galhena et al. (2012), which suggests that decisions related to crop selection, harvesting, and management, among others, are influenced by household income generation and consumption needs. In this study, the planting materials used in kitchen gardens are purchased to great extent. However, donations also play a role, where different developmental agencies provide planting materials of their choice to the households they support in kitchen garden activities. This act influences the kind of species grown in the kitchen garden, which is in agreement with Perrault-Archambault & Coomes (2008), who highlight that access to planting materials and socio-capital influences species diversity in the kitchen garden.

### 5.1.3 What determines kitchen garden adoption and practices

The kitchen garden production objective for most of the respondents in this study was most often for both food and sale, but sometimes also solely for food or solely for sale. Similarly, the findings of Sileshi et al. (2022) from a semi-arid site suggested that respondents used the kitchen gardens mainly for food.

Kitchen garden farming in Moroto mostly utilises family labour just as observed in other studies, (Niñez 1987; Sthapit et al. 2004; Sileshi et al. 2022; Thuku 2022) but also utilise hired labour to a small extent to manage the kitchen garden farming activities, depending on their affordability and economic status, similar to the studies of (Jacob & Alles 1987; Niñez 1987; Méndez et al. 2001; Maroyi 2009).

The sources of planting materials in this study are mainly from purchases, donations from development agencies and home-saved seeds, which is similar to the findings of Thuku (2022). The similarities in the results could be that the study sites both have a semi-arid climate and experience similar challenges (Berrahmouni et al. 2015) that are being addressed using the same approaches, for instance, development agencies provide seeds and other inputs for kitchen garden farming.

The harvest frequency in kitchen gardens in Moroto in the dry season is mostly weekly, followed by daily harvest and then fortnightly, which is different from the description by Niñez (1987), who found that the harvest frequency was daily or seasonal in kitchen gardens. These differences may be due to the type of crops grown in the kitchen garden.

In this study, the water sources utilised for kitchen garden farming influenced to great extent, where the kitchen gardens were established. This is similar to the findings of Thuku (2022), which highlight the water sources most used for kitchen garden farming as river water, rainfall, stored water, kitchen waste water and tap water, respectively. However, in this study rainfall use by the respondents was not directly captured. Since Thuku (2022), and this study were both done in the dryland areas, it therefore presents opportunities to explore other sources of water that can be utilised for kitchen garden farming in Moroto.

Kitchen garden farming in Moroto utilises different land ownership systems with government-owned land being the most utilised followed by communal land. This presents an opportunity for the government of Uganda to take the lead in availing land for kitchen garden activities through its policies or programs, but also explore options of how communal land can be used more for kitchen garden farming, especially since allotment gardening is being used as one of the approaches (Section 4.4.2)

Respondents in this study utilise either knowledge and skills for kitchen garden farming from training by different agencies or indigenous knowledge and skills in almost the same percentages. This opens up opportunities for merging both indigenous knowledge and skills, and other trainings on kitchen garden farming for better results. Kaushik & Baruaha (2024), highlights how indigenous knowledge and skills have been utilised for ages and have provided solutions to control pests and diseases and maintain productivity in kitchen gardens. Ward (2024) highlights how trainings on kitchen garden farming increase the adoption of kitchen garden farming.

Following the characteristics of kitchen gardens by Niñez (1987), kitchen gardens in Moroto during the dry season exhibit characteristics of both household gardens and market gardens. According to Niñez (1987), a household garden is close to the homestead, has a high species diversity, and the commonly grown species of plants are staples, vegetables and fruit, which are usually of cultural value. The plants are grown both in rows and in irregular patterns. The harvest frequency from the gardens is daily or seasonal, and the produce is for home consumption and is maintained using family labour. The household garden provides supplementary income to the household. Whereas, market gardens are located close to the urban market, have medium to low species diversity, and the plants grown are commonly vegetables and fruit, which are usually market-oriented. The plants are grown in rows, have a short (seasonal) harvest frequency and the plants are grown for sale as the major source of income and the garden is maintained by family and hired labour (Niñez 1987).

Despite the kitchen gardens in Moroto exhibiting characteristics of both household gardens and market gardens, certain aspects of kitchen gardens in Moroto are not reflected by Niñez (1987) such as the source of planting materials, land ownership, and location in terms of water access.

#### 5.1.4 Who practices kitchen garden farming?

A trend is observed in kitchen garden farming to be increasingly practised with the increase in family size, where respondents with households of more than 8 people practice kitchen garden farming most, which is in agreement with Sileshi et al. (2022) that highlights that kitchen garden farming increases with family size.

The results showed that men and women practised kitchen garden farming to a similar degree, which is in contrast to other studies, for example, Mitchell & Hanstad (2008), which highlight that women are more involved and contribute more to kitchen garden farming than men. Furthermore, Howard (2006) emphasizes that women are the primary managers of kitchen gardens and enjoy both the environmental and economic benefits of kitchen gardens more than men (Zasada et al. 2020). These results show a shift from the commonly found; for instance, apart from a passion for kitchen garden farming, the high male participation in kitchen garden farming could also be a result as exemplified by one male even doing gardening to pass time. This could also be a result of more men participating in kitchen garden farming due to the decline in pastoralism

and the rise of agro-pastoralism, giving men more time on their hands since pastoralism was mostly practised by men. This is also not conclusive since this study did not focus on studying the trends of pastoralism, agro-pastoralism or the role of gender in kitchen garden farming. Therefore, I believe that while designing kitchen gardening interventions, the motivations of the targeted groups should be explored since even the respondents recognize this and recommend that people who are interested in kitchen garden farming should be brought on board, and they will inspire others to join.

# 5.2 Assessment of the production of kitchen gardens in the dry season.

The vegetable species highlighted in this study have also been cited in the studies of Thuku (2022); Ward (2024) as the commonly grown vegetables in some parts of the drylands of East Africa. The study of Thuku (2022) highlighted that respondents were able to earn and save a maximum of KES 250 (USD 2) and a minimum of KES 30 (USD 0.2) per week from the sales of kitchen garden produce. This is a close range to the mean prices of the vegetables (per square meter) found in this study. However, the study by Thuku (2022) does not specify the kitchen garden produce or the area covered by the crop to earn the amount of money mentioned. Ward (2024, on the other hand, carried out an experiment growing vegetables in the kitchen garden using urine as fertilizer, and the vegetable production results were not conclusive due to several factors, like weeds, drought, and the timing of measurements. For this study, vegetable production was influenced by many factors, for instance, watering, application of livestock manure, type of livestock manure used and mulching of the kitchen garden. However, since the details of water quantity and frequency of application or the nutrient contents and application frequency were not considered in this study, this section also leaves inconclusive, just as the results of Ward (2024). In addition, seasonal fluctuations also play a role in both the price and vegetable production. The study was done during the dry season, and it is possible that the plants yield more in the rainy season, but would the price have been less or more? Assuming marketability, preference or profitability and tolerance to drought as the top aspects that determined what crops or vegetables were grown in the kitchen garden, these would also affect both price and production in the kitchen garden. I would argue that one would grow the vegetable that earns more or that is frequently demanded in the market to get a high turnover. Therefore, the price and fresh vegetable production are influenced by several factors that need to be further investigated to know the depth of the influence and in which areas.

The production of kitchen gardens can also be related to the frequency of planting various crops and vegetables. For instance, the majority of respondents planted vegetables twice a year, which corresponds to the two rainy peaks in Uganda (Jury 2018). However, about 40% of the respondents planted 3 to 5 times indicating that they relied on irrigation. The difference between very high and low planting frequencies among many possible factors can be attributed to water access, since water access has been highlighted in several studies as having a great impact on kitchen garden farming (Niñez 1987; Rybak et al. 2018; Sileshi et al. 2022; Thuku 2022; Ward 2024). In addition, the planting frequencies can also be attributed to aspects that influence the type of crops and vegetables, as a majority of the respondents grew annual crops, which have a short growth cycle and therefore imply frequent harvesting and replanting. However, some households grew both perennial and annual crops, which implies that they have both short growth cycle crops and crops with a longer growth cycle; therefore they can plant multiple times, but not as frequently as those who planted just annual crops.

# 5.3 Contribution of kitchen gardens to food security and livelihoods

## 5.3.1 Food security and nutrition status of households with kitchen gardens

Several studies have indicated that kitchen garden farming improves food security and livelihoods (Murphy 2008; Galhena et al. 2013; Njuguna 2013; Bonatti et al. 2017; Depenbusch et al. 2021; Santos et al. 2022), which agrees with this study's results. Following the pillars of food security, accessibility, availability, affordability, utilisation and stability (Krishnaraj 2005; Coates 2013; Clapp et al. 2022), kitchen gardens provided easy accessibility and availability of fresh vegetables and crops for consumption. With affordability, the majority of the respondents purchased food to meet their all-year-round food requirement, using to some extent money from the sale of kitchen garden produce as quoted from the focus group discussions or other sources, which agrees with Du Toit et al. (2022).

Kitchen gardens are also used as a coping strategy or mitigation measure for food insecurity or effects of drought as reported in the key informant interviews.

Most households that practised kitchen garden farming during the household survey were food secure and only one-third were mildly food insecure based on the household food insecurity access scale categories. However, the food security results cannot be solely attributed to kitchen gardens but to several factors. For instance, the period that the Household Food Insecurity Access Scale covered was four weeks, perhaps the results would have been different if a whole year or season had been considered. Also as highlighted in this study humanitarian aid (donations) could have influenced the response of the respondents who were mildly food insecure in the hope that they would receive humanitarian aid. Another factor can be that the primary motivation for starting a kitchen garden was to produce food, even though most participants utilised the kitchen to produce both food and for sale. These results differ from the findings of Du Toit et al. (2022), who found that one of the reasons kitchen gardens fail to improve household food security and livelihoods is that the primary motivation for households do kitchen garden farming is not for food production but to utilise the available land. Another potential reason why most respondents were food secure was that 2024 was a good year in Moroto, that is to say rains had been relatively plentiful, as mentioned by two key informants. Many households had good harvests, so they had enough food in their households. Furthermore, more from the studies by Ward (2024) are in agreement with the results of this study that the presence of kitchen gardens in households to some extent influenced the food choices of the respondents.

## 5.3.2 What characterises the diet of Moroto households with kitchen gardens in the dry season?

Following FAO and FHI 360 (2016), the commonly eaten foods by the respondents were mostly starchy staples, dark green leafy vegetables, followed by pulses. These results have a small similarity to the findings of Ward (2024), in the 24-hour recall dietary questions that highlighted that there was a high intake of beans (pulses) and grains (starchy staples). Furthermore, the findings of Ward (2024) highlight the high intake of other vegetables and orange fruit, which were not mentioned in my study. However, for this study, the 24-hour recall dietary questions were not used rather the respondents were asked to name the foods that they commonly eat.

When food group combinations are considered, starchy foods, pulses and dark green leafy vegetables were the major food groups eaten by the majority of the respondents which is below the recommended diet (Blakstad et al. 2019) of at least 5 food groups and more, which was only fulfilled by one-quarter of the respondents. The results of this study are in line with studies showing that participants commonly ate starchy foods as a major part of their all-year-round diet, e.g. cassava, maize, millet, bread (Faber et al. 2002; Faber & Laurie 2011; Keatinge et al. 2011; Galhena Dissanayake & Maredia 2020), and with the consumption of vegetables, legumes and animal proteins, seasonally or not at all (Galhena Dissanayake & Maredia 2020). According to Thuku (2022) who also did research in the semi-arid region, the commonly eaten foods were

pulses and energy-giving food (starchy food) and the least eaten food groups were animal meat, nuts and seeds which is similar to the results of this study.

Dietary diversity score has previously been found to be greatly affected by source of food and income (Thuku 2022), which could be related to this study where the factors influencing the food eaten by respondents were finances, access to produce from the kitchen garden, etc. The influence of kitchen gardens is also in line with the study by Thuku (2022) whose findings suggest that most of the respondents grew two types of crops in their gardens; kale was the most grown by the respondents in two seasons followed by Swiss chard.

According to Sly et al. (2023), household dietary scores increased after a kitchen garden farming intervention, from three food groups at the baseline to five food groups at four months to six food groups after one year. Therefore, kitchen garden farming can have the potential to influence dietary diversity in combination with nutrition-related knowledge as it can affect the respondents' practices of how the food is prepared or consumed, i.e. raw versus cooked food (Galhena Dissanayake & Maredia 2020), thus affecting the bioavailability of vegetable-based nutrients (de Pee & Bloem 2007).

### 5.3.3 Economic value and livelihoods

Kitchen garden farming creates a community empowerment process, as highlighted by Bonatti et al. (2017) through improving household social status networks, reducing economic risk, and increasing food and production diversity. These relate to this study, as respondents estimated incomes, they get per season from kitchen garden farming and also the assessment of production in kitchen gardens (section 5.2) shows great potential in kitchen garden farming. Respondents also received recognition in the community, as highlighted in focus group discussions. The income from the sale of kitchen garden produce offers households the disposable income to afford food and other services (Galhena et al. 2013).

Furthermore, even though increases in income over the years was not taken into account in this study, studies by Ogutu et al. (2023) suggest that kitchen gardens have been found to increase the monthly income of an adult by 37%. Kitchen garden farming thus holds the potential to aid development from the household to the community level.

## 5.3.4 Contribution of kitchen garden farming to sustainable food systems

The health and quality of a food system determines the food security and sustainability of the food system (Clapp et al. 2022) which can be measured by focusing on the soil parameters, agrobiodiversity indicators, water quality, agrochemical use, or

compliance with sustainability certification systems. However, in this study, only a few parameters have been considered like agrobiodiversity, water quality, and agrochemical use. In Moroto during the dry season, the agrobiodiversity is dominated by exotic vegetables, which threaten the native species of vegetables in the area. A very small percentage of respondents claimed the water was salty and could not be used to irrigate crops, which raises an issue about water quality. This calls for more studies to confirm these claims and come up with suitable interventions to improve water quality. One could argue that in the dry season respondents practise organic kitchen garden farming since respondents mostly used manure in the gardens, while some never used manure at all. However, since this study did not dive into the details of organic farming or ask the respondents if they had organic farming certifications, this could be an area for further investigation.

From a general perspective, the kitchen gardens in Moroto contribute to the local food system by providing affordable food to the rural and urban population while providing income from the sale of produce. This is in agreement with Minot et al. (2015) and Béné (2020), who suggest that local food systems are often the only source of affordable and nutritious food since most of the populations in LMIC live below the poverty line and spend 50% of their incomes on food. However, to get in-depth insight into how sustainable kitchen garden farming in Moroto is and the level of contributions to both environmental, economic and social aspects, research and resources must be invested, which is in agreement with the studies of Hansen et al. (2022.

# 5.4 Success and failure contributors towards kitchen garden farming in Moroto district

### 5.4.1 Success contributors to kitchen garden farming

#### Water access

Water is an important aspect of kitchen garden production in terms of access, availability, and utilization, as highlighted by Maredia et al. (2023), where water scarcity was a major hindrance for kitchen garden farming in their study, and proposed training on local water harvesting methods to save the situation. This suggestion responds to the respondents' recommendations for water harvesting equipment, simple irrigation kits, water desalination, and increased water access, which is in agreement with the studies of Bonatti et al. (2017) too. Therefore, a holistic approach in designing kitchen garden interventions should include water as an important factor since, in this study, it influenced the location of the kitchen garden when all the water sources

combined outweigh the backyard as the primary location of kitchen gardens. Therefore, water access for kitchen garden farming can be increased through sustainable water source management and conservation for all-year access production through;

- a) Identification of water sources in the community and setting participatory community conservation measures
- b) Construction of valley dams
- c) Drilling more boreholes and building the capacity of the community in maintenance and repairs.

#### Use of native vegetable species for kitchen garden farming

In contrast to the practice of using seeds of exotic vegetables found in this study, use of native crops and vegetables in a kitchen garden is encouraged (Thuku 2022) due to their several advantages, such as being adapted to the local environment, the locals being used to them and therefore know how to grow and consume them. Furthermore, native species also carry environmental benefits such as agrobiodiversity conservation of the local germplasm (Galhena et al. 2013).

#### **Trust and good relationships**

Key informants claimed it is essential to establish trust and a good relationship with the community to ease the implementation and adoption of kitchen garden farming. Owing to this approach, the households were more united, and the kitchen gardens were more successful as compared to other approaches. This is in agreement with Bonatti et al. (2017) that the organisations and implementation team of kitchen garden interventions should be trustworthy, competent, and have a good reputation among the beneficiaries, donors and staff and have knowledge of the target group.

#### Access to agricultural services and inputs

Just as in the study by Bonatti et al. (2017) carried out in Tanzania, the government of Uganda is generally supportive of kitchen garden farming in Moroto. For example, they support model farmers with training on kitchen garden farming, provision of agricultural inputs, and taking them for exchange and exposure visits to different communities to learn and get motivated to do better. However, to achieve significant results in kitchen garden farming, efficient and effective implementation strategies and/or cooperation (Bonatti et al. (2017) should be emulated by the government to address access to agricultural services and inputs, for instance through public-private partnerships and improving the presence of MAAIF in Moroto district.

#### Knowledge and skills for kitchen garden farming

Through interviews, it was found that kitchen garden farming requires a well-organized series of stages in knowledge and skills dissemination and implementation to achieve the desired results in food security and livelihoods. For instance, the preparatory stage that involves sensitization of what kitchen garden farming is and its benefits in all aspects; the practical stage where households are practically trained on agronomic practices for growing vegetables and environmental conservation; the nutrition and culinary stage, where households learn about nutrition and how to prepare and eat nutritious foods are also important; and the post-implementation stage, where the whole process is evaluated for areas of improvement and what went well to inform future interventions. Furthermore, despite little input requirements and little know-how for kitchen garden farming, knowledge and skills for households are essential to mitigate challenges that may arise in kitchen garden farming, like crop losses (Turner & Brush 1987). Indigenous knowledge and skills have been used for ages, and have helped improve productivity and reduce crop losses Kaushik & Baruaha (2024). In this study, nearly half of the respondents used it, and another half had received training, and a few had an educational background in agriculture, together indicating a great potential success for future kitchen gardening in Moroto. Kitchen garden farming requires multidimensional knowledge and skills for its success to ensure that nutrition is not compromised (de Pee & Bloem 2007; Galhena Dissanayake & Maredia 2020), that productivity is increased with sustainable agronomic practices that conserve the environment (Blakstad et al. 2019; Kaushik & Baruaha 2024), and also for understanding the target group and area. Inspiring transformation among households practising kitchen garden farming through refresher training, exchange and exposure visits to successful communities in kitchen garden farming with the same agroecological zone is an avenue of knowledge and skills transfer which is essential for navigating factors that hinder kitchen garden farming (Maredia 2003; Hansen et al. 2022; Koodagi et al. 2023; Maredia et al. 2023).

#### Integration of livestock and poultry enterprises into kitchen garden farming

Integration of poultry and livestock into kitchen garden farming boosts food and nutrition security for households (Cuanalo de la Cerda & Guerra Mukul 2008), providing the main or the only source of animal protein for the households.

#### Practices and approaches for kitchen garden farming used

Approaches and practices for kitchen garden farming used must be easily adoptable, and the barriers for starting and maintaining the kitchen garden should not outweigh its potential benefits (Galhena Dissanayake & Maredia 2020). Furthermore, for

continuity, the kitchen garden farming practices should be easy to replicate within the target group without the need for extensive and continued intervention, as well as the kitchen garden must be easy to maintain and sustain all year round (Galhena Dissanayake & Maredia 2020).

#### Access to financial services

Kitchen garden farming increases with an increase in credit use, access to information, district (location), and access to water for irrigation to supplement rainfed cultivation (Sileshi et al. 2022). Therefore, it is important to consider initiatives that increase access to finance for households practising kitchen garden farming, for instance, the incorporation of village savings and loaning schemes among households practising kitchen garden farming.

### 5.4.2 Failure contributors to kitchen garden farming

Limited Access to agricultural inputs such as seeds, planting materials, tools and capital (Brownrigg 1985; Niñez 1985, 1987; Fernandes & Nair 1986; Brownrigg 1985; Niñez 1985; Fernandes & Nair 1986; Talukder et al. 2000) have been cited as major hindrances to kitchen garden farming which is a similar situation for Moroto. Inadequate water access hinders kitchen garden activities in Moroto just as reported in several studies by Niñez (1985); Galhena Dissanayake & Maredia (2020) leading to losses and the cessation of all kitchen garden farming activities in the dry season.

Damage due to pests, diseases, animals and theft (Thaman 1977; Brownrigg 1985; Pandey et al. 2007; Galhena Dissanayake & Maredia 2020) are similar struggles that respondents in this study face. Poor environmental conditions (Thaman 1977; Howard 2006) coupled with low soil fertility and soil erosion, a characteristic of drylands, is a challenge to the households practicing kitchen garden farming.

Lack of information on nutritional benefits of kitchen garden farming (Talukder et al. 2000; Miura et al. 2003) coupled with a lack of knowledge, information and advisory services (Thaman 1977; Hoogerbrugge & Fresco 1993) hinder kitchen garden farming to provide the benefits that it is capable of in food security and livelihoods.

Failure contributors to kitchen garden farming, like thefts, can be addressed by setting up kitchen gardens at settlements (manyatas) for security. Since water access greatly influences the location of kitchen gardens, water sources such as boreholes, tap systems and water harvesting systems should if possible be placed centrally in the settlements (manyatas) where allotment gardens can also be set up, offering opportunities for extra security and increased water access. However, this poses another challenge of financial resources to set up the water sources, and priorities for

households to utilise the water for other domestic purposes or for kitchen garden farming.

## 6. Conclusions

Kitchen garden practices are diverse in Moroto. Interventions should be contextspecific to cater for the diverse nature of kitchen gardens. Water access, manure application, and vegetable type all have an influence on the yield of produce in kitchen gardens and the income that can be generated to support the household. Therefore, these factors should be considered while designing or promoting kitchen garden interventions.

The yield of leafy vegetables per square meter is less than a dollar. However, some vegetables such as Swiss chard fetch higher price and can contribute to substantial income even from a small garden size. Therefore, households should be educated on vegetable selection for both household consumption and sale without compromising on food security or livelihood improvement through kitchen garden farming.

Community empowerment for ownership of the kitchen garden intervention processes, outcomes and supporting amenities will ensure and sustain the benefits of kitchen garden farming. For instance, empowering the community to be able to make minor repairs on the borehole when it breaks down, continuous sensitization to know the benefits of kitchen garden farming that they are motivated to continue with it even when the development agencies pull out

Kitchen garden farming from this study has shown numerous contributions to food security and livelihoods by 1) being a are a source of food for households, 2) being a source of income for households, providing disposable income for access to other services and necessities required by households, 3) influencing food choices which carry great potential for dietary diversity, and creating community cohesion, peace, status uplift and rehabilitation in the community.

However, despite the above contributions, kitchen gardens in Moroto during the dry season do not contribute to agrobiodiversity since monoculture is being practised to some extent and only a few select vegetables are grown widely. Furthermore, challenges affecting kitchen garden farming, such as theft, water access, gardening knowledge and skills, among others, can be addressed through approaching kitchen garden farming from the group level rather than the household level. At a group level,

water access can be improved by establishing water sources and kitchen gardens close to settlements (manyatas), which address the issue of security and water access. Also, access to agricultural inputs and knowledge dissemination might become easier.

## 7. Recommendations

### 7.1 Recommendations based on the findings of the study

There is diversity in kitchen garden practice in Moroto. Therefore, interventions should be context-specific to cater for their diverse nature. Research and resources should be invested in co-designing kitchen garden projects and interventions that are context-specific and not generalized.

Kitchen gardens influence food choices and have the potential to boost household income. Therefore, strategies for promoting kitchen garden farming interventions should target specific household food security and income outcomes, and how they can be achieved with the local context in mind.

Kitchen gardens are generally located where water can be accessed. Therefore, water sources should be identified and access facilitated near the settlements (manyatas) and the community empowered to manage and protect the water sources for kitchen garden farming activities all year round. Furthermore, households should also be trained on water harvesting and water conservation techniques. Identification of water catchment areas for conservation and water quality analysis should also be done to gain insights into water in Moroto for better management and utilisation.

Kitchen gardens enhance community cohesion, boost status in the community and create a form of peace and rehabilitation. Therefore, kitchen garden farming can be used as a tool to foster peace in communities and a source of employment for the youth to them away from criminal activities and idleness.

Providing knowledge and skills in kitchen gardening is not enough; a holistic approach to knowledge and skills transfers and utilisation by the community covering a wide range of thematic areas like nutrition, agronomic practices, post-harvest handling, soil and water conservation, and marketing must be considered.

Kitchen garden farming can be used as a platform for addressing thematic areas like education, health and nutrition, entrepreneurship, and community building. It can also be used to create a more resilient local food system through the integration of other enterprises, like poultry, which complement each other but also provide diversified incomes and diets.

Pilot studies on the kitchen garden practices being introduced must be done to avoid wastage of resources and abandonment when the projects or interventions end. A sustainability plan and strategy for maintaining kitchen garden activities must be developed and implemented in a sustainable way that ensures continuity.

Native vegetable and crop species should be promoted in the kitchen garden to promote local agrobiodiversity. Indigenous knowledge and kitchen garden farming practices should be explored to inform and or be incorporated into the approaches or interventions in kitchen garden farming being introduced.

Access to agricultural inputs must be addressed by the government and concerned agencies to ease the stress burden of pests and diseases, and low yields which hinder households from reaping the full benefits of kitchen garden farming.

### 7.2 Recommendations for areas for more research.

In-depth studies should be done to ascertain how sustainable kitchen garden farming in Moroto is and the level of contributions to the local food system in Moroto district with respect to environmental, economic and social aspects. Studies on the contributions of kitchen garden farming to nutrition aspects in Moroto should be explored. More studies on how much is earned from kitchen gardens annually should be done, since in this study, it was done per season. In addition, exploration of which kitchen garden practices are most used by households, and their benefits and drawbacks, to inform the design and promotion of kitchen garden interventions. Exploration of why native species are not common in kitchen gardens should be done. The efficacy of model farmers in promoting kitchen garden farming should be explored as a kitchen garden farming adoption and sustainability strategy.

Research on why goat manure is preferred for kitchen garden farming over cow dung and also investigate the nutrient value of both goat and cow manure in Moroto and offer recommendations on which one has a higher nutrient value. Research on the effect of application rates of goat and cow manure on vegetable yields in kitchen gardens in Moroto should be done to offer recommendations on the application rates that offer optimal yield.

## References

- Abdul-Razak, M. & Kruse, S. (2017). The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana. *Climate Risk Management*, 17, 104–122.
- Aborisade, B. & Bach, C. (2014). Assessing the Pillars of Sustainable Food Security. *European International Journal of Science and Technology* 3 (4), 117–125.
- Albuquerque, U. de, Andrade, L.H. & Caballero, J. (2005). Structure and floristics of homegardens in Northeastern Brazil. *Journal of arid environments*, 62 (3), 491–506.
- Ali, A.M.S. (2005). Homegardens in smallholder farming systems: examples from Bangladesh. *Human Ecology*, 33, 245–270.
- Bamwesigye, D., Doli, A., Adamu, K.J. & Mansaray, S.K. (2020). A Review of the Political Economy of Agriculture in Uganda: Women, Property Rights, and Other Challenges. Universal Journal of Agricultural Research, 8 (1), 1–10. <u>https://doi.org/10.13189/ujar.2020.080101</u>.
- Barnett, T. & Topouzis, D. (2003). Mitigation of HIV/AIDS impacts through agriculture and rural development. *Workshop Report*, May 27<sup>th</sup>–29<sup>th</sup>, 2003, HSRC, Pretoria, South Africa.
- Barrantes, A. & Caravani, M. (2021) Situational Analysis of Food, Nutrition and Income Security in Karamoja "A normalizing view of Karamoja" <u>Working</u> <u>Paper, 2020</u>.
- Béné, C. (2020). Resilience of local food systems and links to food security–A review of some important concepts in the context of COVID-19 and other shocks. *Food security*, 12 (4), 805–822.
- Berrahmouni, N., Regato, P. & Parfondry, M. (2015). Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods. *FAO Forestry Paper*, Food and Agriculture Organisation of the United Nations, 148.
- Biesalski, H.K. (2013). First international conference on hidden hunger, Hohenheim, Stuttgart, Germany March 6–9, 2013. *Food Security*, 5, 457–473.
- Blakstad, M.M., Bellows, A.L., Mosha, D., Canavan, C.R., Mlalama, K., Kinabo, J., Kruk, M.E., Masanja, H. & Fawzi, W.W. (2019). Neighbour home gardening predicts dietary diversity among rural Tanzanian women. *Public Health Nutrition*, 22 (9), 1646–1653. https://doi.org/10.1017/S1368980018003798.

- Blanckaert, I., Swennen, R.L., Flores, M.P., López, R.R. & Saade, R.L. (2004). Floristic composition, plant uses and management practices in homegardens of San Rafael Coxcatlán, Valley of Tehuacán-Cuicatlán, Mexico. *Journal of Arid Environments*, 57 (2), 179–202.
- Bonatti, M., Homem, L.H.I.R., Graef, F., Mbwana, H.A., Rybak, C., Lana, M. & Sieber, S. (2017). Social organization, constraints and opportunities for kitchen garden implementation: ScalA and ScalA-FS assessment tools in Morogoro and Dodoma, Tanzania. *Food Security*, 9 (6), 1299–1308. https://doi.org/10.1007/s12571-017-0726-7.
- Brownrigg, L. (1985). Home gardening in international development: what the literature shows (including an annotated bibliography, and inventories of international organizations involved in home gardening and their projects). *League for International Food Education*, 250.
- Clapp, J., Moseley, W.G., Burlingame, B. & Termine, P. (2022). Viewpoint: The case for a six-dimensional food security framework. *Food Policy*, 106, 102164. https://doi.org/10.1016/j.foodpol.2021.102164.
- Coates, J. (2013). Build it back better: Deconstructing food security for improved measurement and action. *Global Food Security*, 2 (3), 188–194.
- Cuanalo de la Cerda, H.E. & Guerra Mukul, R.R. (2008). Homegarden production and productivity in a Mayan community of Yucatan. *Human Ecology*, 36 (3), 423–433. <u>https://doi.org/10.1007/s10745-008-9166-5</u>
- de Pee & Bloem, W. (2007). The bioavailability of (pro) vitamin A carotenoids and maximizing the contribution of homestead food production to combating vitamin A deficiency. *International Journal for Vitamin and Nutrition Research*, 77 (3), 182–192.
- Depenbusch, L., Schreinemachers, P., Roothaert, R., Namazzi, S., Onyango, C., Bongole, S. & Mutebi, J. (2021). Impact of home garden interventions in East Africa: Results of three randomized controlled trials. *Food Policy*, 104, 102140. <u>https://doi.org/10.1016/j.foodpol.2021.102140</u>
- Dong, S. (2016). Overview: Pastoralism in the world. In Dong, S., Kassam, K.-A.S., Tourrand, J.F., & Boone, R. (eds.). Building resilience of human-natural systems of pastoralism in the developing world: Interdisciplinary perspectives. Springer International Publishing. 1–37. <u>https://doi.org/10.1007/978-3-319-30732-9\_1</u>.
- Drimie, S. (2004). Food security and HIV/AIDS in southern Africa: case studies and implications for future policy. <u>ActionAid International</u>, Southern Africa Partnership Programme, 2005.
- Drylands Transform: <u>https://www.slu.se/drylandstransform</u> (Accessed 20 December 2024).
- Du Toit, M.J., Rendón, O., Cologna, V., Cilliers, S.S. & Dallimer, M. (2022). Why Home Gardens Fail in Enhancing Food Security and Dietary Diversity. *Frontiers* in *Ecology* and *Evolution*, 10.https://doi.org/10.3389/fevo.2022.804523
- Egeru, A., Okello, P., Majaliwa, M., Mukwaya, P. & Isubikalu, P. (2010). The effect of land use/cover change on biomass stock in dryland areas of Eastern Uganda.

A case study of olio sub-county in Soroti district. *Journal of Applied Sciences* and Environmental Management, 14 (4).

- Faber, M. & Laurie, S. (2011). A home gardening approach developed in South Africa to address vitamin A deficiency. In: *Combating micronutrient deficiencies: food-based approaches*. CABI Wallingford UK. 163–182.
- Faber, M., Phungula, M.A., Venter, S.L., Dhansay, M.A. & Benadé, A.S. (2002). Home gardens focusing on the production of yellow and dark-green leafy vegetables increase the serum retinol concentrations of 2–5-y-old children in South Africa. *The American journal of clinical nutrition*, 76 (5), 1048–1054.
- FAO and FHI 360 (2016). Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO.
- Farre, G., Twyman, R.M., Zhu, C., Capell, T. & Christou, P. (2011). Nutritionally enhanced crops and food security: scientific achievements versus political expediency. *Current opinion in biotechnology*, 22 (2), 245–251.
- Fernandes, E.C. & Nair, P.R. (1986). An evaluation of the structure and function of tropical homegardens. *Agricultural systems*, 21 (4), 279–310.
- FAO (2009). The state of food and agriculture *Livestock in the balance*. ISBN 978-92-5-106215-9; doi:10.1017/S2078633610001128 .
- Galhena Dissanayake, D.H. & Maredia, K.M. (eds) (2020). *Home Gardens for Improved Food Security and Livelihoods*. London and New York: Routledge. https://doi.org/10.4324/9781315471778.
- Galhena, D., Mikunthan, G. & Maredia, K. (2012). Home gardens for enhancing food security in Sri Lanka. *Farming Matters*, 28 (2), 12.
- Galhena, D.H., Freed, R. & Maredia, K.M. (2013). Home gardens: a promising approach to enhance household food security and wellbeing. *Agriculture & Food Security*, 2 (1), 8. <u>https://doi.org/10.1186/2048-7010-2-8</u>.
- Garí, J.A. (2003). Agrobiodiversity strategies to combat food insecurity and HIV/AIDS impact in rural Africa. Advancing grassroots responses for nutrition, health and sustainable livelihoods. <u>Population and Development Service</u>, Food and Agriculture Organisation, Rome, Italy.
- Garnett, T., Benton, T., Nicholson, W. & Finch, J. (2016). Overview of food system challenges, in T. Garnett, & E. Röös, Evidence-based resources on sustainable food systems. *Food Climate Research Network, University of Oxford*, 3–22.
- Gelsdorf, K., Maxwell, D. & Mazurana, D. (2012). *Livelihoods, basic services and social protection in Northern Uganda and Karamoja*. Working Paper.
- Gómez, M.I., Barrett, C.B., Raney, T., Pinstrup-Andersen, P., Meerman, J., Croppenstedt, A., Carisma, B. & Thompson, B. (2013). Post-green revolution food systems and the triple burden of malnutrition. *Food Policy*, 42, 129–138.
- Government of Uganda (GoU) (2013). <u>The State of Uganda Population Report:</u> <u>Population and Social Transformation: Addressing the Needs of Special</u> <u>Interest Groups</u>. Kampala, Uganda.
- Hansen, L., Sorgho, R., Mank, I., Nayna Schwerdtle, P., Agure, E., Bärnighausen, T. & Danquah, I. (2022). Home gardening in SUB-SAHARAN Africa: A scoping review on practices and nutrition outcomes in rural Burkina Faso and Kenya. *Food and Energy Security*, 11 (3), e388. https://doi.org/10.1002/fes3.388.

- Hoogerbrugge, I.D. & Fresco, L.O. (1993). Homegarden systems: agricultural characteristics and challenges. *Gatekeeper Series Sustainable Agriculture Programme, International Institute for Environment and Development,* 23.
- Howard, P.L. (2006). Gender and social dynamics in swidden and homegardens in Latin America. In: *Tropical Homegardens: A time-tested example of sustainable agroforestry*. Springer. 159–182.
- Iannotti, L., Cunningham, K. & Ruel, M. (2009). *Improving diet quality and micronutrient nutrition: homestead food production in Bangladesh*. Intl Food Policy Res Inst.
- ICCO-Cooperation, I. (2018). *Effectively Assessing Household Food Security Status*. Working Paper. Available online: https://www.icco-cooperation.org/en.
- Integrated Food Security Phase Classification (IPC) (2024). <u>Uganda-Karamoja Acute</u> Food Insecurity and acute malnutrition analysis March 2024-Febuary 2025.
- Jacob, V. & Alles, W. (1987). Kandyan gardens of Sri Lanka. *English, Journal article, Agroforestry Systems*, (123–137). doi:10.1007/BF00047517.
- Jury, M.R. (2018). Uganda rainfall variability and prediction. *Theoretical and Applied Climatology*, 132, 905–919.
- Karamoja Resilience Support Unit (2022). Karamoja Donor Mapping Report. <u>Karamoja Resilience Support Unit II, United States Agency for International</u> <u>Development (USAID)/Uganda, Kampala.</u>
- Kaushik, K. & Baruaha, K. (2024). Use of Traditional Control Practices for the Management of Insect-Pest in Kitchen Gardens of Assam. *Just Agriculture*, 4 (6), 329–334.
- Keatinge, J., Yang, R.-Y., Hughes, J. d'A, Easdown, W. & Holmer, R. (2011). The importance of vegetables in ensuring both food and nutritional security in attainment of the Millennium Development Goals. *Food security*, 3 (4), 491–501.
- Koodagi, K., Mahesha, H.M. & Arpitha, S. N. (2023). Empowering rural livelihoods and enhancing nutritional security through homestead kitchen gardening. *International Journal of Statistics and Applied Mathematics*, 8(6): 10-13.
- Korpelainen, H. (2023). The Role of Home Gardens in Promoting Biodiversity and Food Security. *Plants*, 12 (13). https://doi.org/10.3390/plants12132473.
- Krishnaraj, M. (2005). Food security: how and for whom? *Economic and Political Weekly*, 2508–2512.
- Lowder, S.K., Skoet, J. & Raney, T. (2016). The number, size, and distribution of farms, smallholder farms, and family farms worldwide. *World development*, 87, 16–29.
- Lowe, N.M. (2021). The global challenge of hidden hunger: perspectives from the field. *Proceedings of the Nutrition Society*, 80 (3), 283–289.
- Maredia, K. (2003). Integrated pest management in the global arena: introduction and overview. In: *Integrated pest management in the global arena*. Cabi Publishing Wallingford UK. 1–8.
- Maredia, K.M., Dissanayake, D.H.G., Freed, R., Madan, S., Mikunthan, G., Attorp, A., Patidar, N., Blanco-Metzler, H., Meka, R.R. & Gonsalves, J. (2023). Building sustainable, resilient, and nutritionally enhanced local food systems through

home gardens in developing countries. *Development in Practice*, 33 (7), 852–859. https://doi.org/10.1080/09614524.2023.2218068.

- Maroyi, A. (2009). Traditional homegardens and rural livelihoods in Nhema, Zimbabwe: a sustainable agroforestry system. *International Journal of Sustainable Development & World Ecology*, 16 (1), 1–8.
- Marsh, R. (1998). Building on traditional gardening to improve household food security. *Food nutrition and agriculture*, 4–14.
- McCullough, E.B., Pingali, P.L. & Stamoulis, K.G. (2010). Small farms and the transformation of food systems: an overview. *Looking east looking west*, 47–83.
- Méndez, V.E., Lok, R. & Somarriba, E. (2001). Interdisciplinary analysis of homegardens in Nicaragua: micro-zonation, plant use and socioeconomic importance. Agroforestry systems, 51, 85–96.
- Ministry of Agriculture, Animal Industry and Fisheries. (2018). National Adaptation Plan for the Agricultural Sector, *The Republic of Uganda Ministry of Agriculture*, https://www.agriculture.go.ug/sector-strategies/.
- Minot, N., Stringer, R., Umberger, W.J. & Maghraby, W. (2015). Urban shopping patterns in Indonesia and their implications for small farmers. *Bulletin of Indonesian Economic Studies*, 51 (3), 375–388.
- Mitchell, R. & Hanstad, T. (2004). Small home garden plots and sustainable livelihoods for the poor. *FAO LSP WP*, 11.
- Mitchell, R. & Hanstad, T. (2008). Innovative Approaches to Reducing Rural Landlessness in Andhra Pradesh: A Report on the Experience of the IKP Land Activities. *Seattle, WA: Rural Development Institute*.
- Miura, S., Kunii, O. & Wakai, S. (2003). Home gardening in urban poor communities of the Philippines. *International journal of food sciences and nutrition*, 54 (1), 77–88.
- Moroto district local government (2024): <u>*Third district local government development plan FY 2020/2021 2024/2025.*</u>
- Mugerwa, S., Kayiwa, S. & Egeru, A. (2014). Status of livestock water sources in Karamoja sub-region, Uganda. *Resources and Environment*, 4 (1), 58–66.
- Murphy, L.L. (2008). AIDS and kitchen gardens: insights from a village in Western Kenya. *Population and Environment*, 29 (3), 133–161.
- Nakalembe, C., Dempewolf, J. & Justice, C. (2017). Agricultural land use change in Karamoja Region, Uganda. *Land Use Policy*, 62, 2–12. https://doi.org/10.1016/j.landusepol.2016.11.029.
- Nalule, S. (2010). Social management of rangelands and settlement in Karamoja. Food and Agriculture Organisation.
- NEMA (2007). State of the environment report for Uganda. National Environment Management Authority (78).
- National Research Council, Policy, Global Affairs, Office of International Affairs, Board on Science, & Technology for International Development (1996). *Lost crops of Africa: volume I: grains*. National academies press.
- Nguyen, H. (2018). Sustainable food systems: Concept and framework. Food and Agriculture Organisation, <u>Factsheet (8)</u>.

- Niñez, V. (1985). Working at half-potential: constructive analysis of home garden programmes in the Lima slums with suggestions for an alternative approach. *Food and Nutrition Bulletin*, 7 (3), 1–9.
- Niñez, V. (1987). Household gardens: Theoretical and policy considerations. *Agricultural Systems*, 23 (3), 167–186. https://doi.org/10.1016/0308-521X(87)90064-3.
- Njuguna, J.M. (2013). The role of kitchen gardens in food security and nutritional diversity: a case study of workers at James Finlay Kenya-Kericho. *MSc thesis*. University of Nairobi, Department of Sociology and Social Work.
- Nordin, S. & Nordin, K. (2005). Permaculture network of Malawi. Personal communication with Stacia Nordin, World Food Program, Malawi.
- Nyberg, G., Knutsson, P., Ostwald, M., Öborn, I., Wredle, E., Otieno, D.J., Mureithi, S., Mwangi, P., Said, M.Y. & Jirström, M. (2015). Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. *Pastoralism*, 5, 1–12.
- Ogutu, S.O., Mockshell, J., Garrett, J., Labarta, R., Ritter, T., Martey, E., Swamikannu, N., Gotor, E. & Gonzalez, C. (2023). Home gardens, household nutrition and income in rural farm households in Odisha, India. *Journal of Agricultural Economics*, 74 (3), 744–763.
- Okello, J., Okullo, J.B.L., Eilu, G., Nyeko, P. & Obua, J. (2018). Morphological variations in Tamarindus indica LINN. Fruits and seed traits in the different agroecological zones of Uganda. *International Journal of Ecology*, 2018 (1), 8469156.
- Pandey, C., Rai, R., Singh, L. & Singh, A. (2007). Homegardens of Andaman and Nicobar, India. Agricultural Systems, 92 (1–3), 1–22.
- Perrault-Archambault, M. & Coomes, O.T. (2008). Distribution of agrobiodiversity in home gardens along the Corrientes River, Peruvian Amazon. *Economic Botany*, 62, 109–126.
- Porter, G., Lyon, F. & Potts, D. (2007). Market institutions and urban food supply in West and Southern Africa: a review. *Progress in Development Studies*, 7 (2), 115–134.
- Pushpakumara, D., Wijesekara, A. & Hunter, D. (2010). Kandyan homegardens: a promising land management system in Sri Lanka. *Sustainable use of biological di-versity in socio-ecological production landscapes*, 102.
- Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S.E., Donges, J.F., Drüke, M., Fetzer, I., Bala, G. & Von Bloh, W. (2023). Earth beyond six of nine planetary boundaries. *Science advances*, 9 (37), eadh2458.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E., Lenton, T.M., Scheffer, M., Folke, C. & Schellnhuber, H.J. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and society*, 14 (2).
- Rosegrant, M.W. & Cline, S.A. (2003). Global food security: challenges and policies. *Science*, 302 (5652), 1917–1919.
- Rybak, C., Mbwana, H.A., Bonatti, M., Sieber, S. & Müller, K. (2018). Status and scope of kitchen gardening of green leafy vegetables in rural Tanzania:
implications for nutrition interventions. *Food Security*, 10 (6), 1437–1447. https://doi.org/10.1007/s12571-018-0869-1.

- Santos, M., Moreira, H., Cabral, J.A., Gabriel, R., Teixeira, A., Bastos, R. & Aires, A. (2022). Contribution of home gardens to sustainable development: Perspectives from a supported opinion essay. *International Journal of Environmental Research and Public Health*, 19 (20), 13715.
- Schipanski, M.E., MacDonald, G.K., Rosenzweig, S., Chappell, M.J., Bennett, E.M., Kerr, R.B., Blesh, J., Crews, T., Drinkwater, L., Lundgren, J.G. & Schnarr, C. (2016). Realizing Resilient Food Systems. *BioScience*, 66 (7), 600–610. https://doi.org/10.1093/biosci/biw052.
- Sileshi, M., Sieber, S., Friedrichs, K., Rybak, C., Feyisa, B.W. & Lana, M.A. (2022). Adoption and Impact of Kitchen Garden on Food and Nutritional Security of Farming Households in Tanzania. *Ecology of Food and Nutrition*, 61 (6), 651– 668. https://doi.org/10.1080/03670244.2022.2116433.
- Sly, B.C., Weir, T.L., Cunningham-Sabo, L., Leisz, S.J., Stull, V.J. & Melby, C.L. (2023). Increasing Household Diet Diversity and Food Security in Rural Rwanda Using Small-Scale Nutrition-Sensitive Agriculture: A Community-Engaged Proof-of-Concept Study. *Nutrients*, 15 (14), 3137. https://doi.org/10.3390/nu15143137.
- Smith, D.W. (1998). Urban food systems and the poor in developing countries. *Transactions of the Institute of British Geographers*, 23 (2), 207–219.
- Steiner, K., Kienzle, J. & Ribeiro, F. (2004). Mitigating the impact of HIV/AIDS by labour saving technologies. *African Conservation Tillage Network. www. act. org. za.*
- Sthapit, B., Rana, R., Hue, N. & Rijal, D. (2004). The diversity of taro and sponge gourds in traditional home gardens in Nepal and Vietnam. *Home gardens and agrobiodiversity*, 234–254.
- Swärd, A.L.E. (2023). Ecosystem services from woody vegetation in East African rangelands. MSc thesis. Umeå: SLU, Dept. of Forest Ecology and Management.
- Talukder, A., Kiess, L., Huq, N., De Pee, S., Darnton-Hill, I. & Bloem, M.W. (2000). Increasing the production and consumption of vitamin A–rich fruits and vegetables: lessons learned in taking the Bangladesh homestead gardening programme to a national scale. *Food and Nutrition Bulletin*, 21 (2), 165–172.
- Thaman, R.R. (1977). Urban root crop production in the Southwest Pacific. *Technical Paper South Pacific Commission*, 73-82.
- Thuku, N. L. (2022). Role of kitchen Gardens in Diversifying Diets among Semi-arid Inhabitants of Igamba Ngombe in Tharaka Nithi county, Kenya. *Journal of Nutrition And Dietetics, Nairobi*, 5 (1), 3–10.
- Trainer, T. (1995). "Food and agriculture," in *The Conserver Society: Alternatives for Sustainability*, ed. T. Trainer (London: Zed Books), 18–37.
- Trinh, L.N., Watson, J.W., Hue, N.N., De, N.N., Minh, N., Chu, P., Sthapit, B.R. & Eyzaguirre, P.B. (2003). Agrobiodiversity conservation and development in Vietnamese home gardens. *Agriculture, Ecosystems & Environment*, 97 (1–3), 317–344.

- Turner, I. & Brush, S.B. (1987). Comparative farming systems. *New York, United States The Guilford Press.*
- UBOS (2022). Statistical abstract. Uganda Bureau of Statistics. Government of Uganda
- Vasey, D.E. (1985). Household gardens and their niche in Port Moresby, Papua New Guinea. *Food and Nutrition Bulletin*, 7 (3), 1–7.
- Veldhuizen, L.J., Giller, K.E., Oosterveer, P., Brouwer, I.D., Janssen, S., van Zanten, H.H. & Slingerland, M. (2020). The Missing Middle: Connected action on agriculture and nutrition across global, national and local levels to achieve Sustainable Development Goal 2. *Global Food Security*, 24, 100336.
- Ward, C. (2024). The knowledge spread and role of kitchen gardens in Kenyan drylands. Including a fertiliser experiment with human urine. MSc thesis. Uppsala: SLU, Dept. of Crop Production Ecology.
- Watson, J.W. (2002). Home Gardens and in Situ Conservation of Plant Genetic Resources in Farming Systems: Proceedings of the Second International Home Gardens Workshop, 17-19 July 2001, Witzenhausen, Federal Republic of Germany. Bioversity International.
- Zasada, I., Weltin, M., Zoll, F. & Benninger, S.L. (2020). Home gardening practice in Pune (India), the role of communities, urban environment and the contribution to urban sustainability. *Urban Ecosystems*, 23 (2), 403–417.

# Popular science summary

Kitchen gardens have been acknowledged in several studies to have the potential to enhance food security and livelihoods in both urban and rural areas. Kitchen gardens utilize little and readily available resources with limited or no support from government or other agencies.

This study, therefore, seeks to help the government, organizations, and different institutions better support households in drylands by offering insights and understanding of how households in Moroto, despite the harsh conditions, practice kitchen garden farming. It is also to find out how kitchen garden farming provides enough food that is cheap, easy to get, nutritious, and available all year round. Kitchen garden farming is the growing of different vegetables, fruits, and other crops by a household in a small area for food or income to support themselves.

This study was conducted in Moroto district, Karamoja region, in the northeastern part of the Republic of Uganda, covering six sub-counties and sixteen villages.

Moroto district is inhabited by pastoralists who keep livestock as their source of livelihood. The semi-arid climate of the area, characterized by hot temperatures, dry conditions, and long periods without rain or very little rain, has left the area with insufficient food for long periods, and the people suffer from illness due to eating little food or a limited variety of foods. The area also suffers from water shortages for the people, livestock, and for growing crops, which has led to the death of both people and livestock. These conditions have left the people in the area always needing relief aid from the government, different organizations, and well-wishers.

This study's results suggest that households in Moroto district practice kitchen garden farming in their backyards or near a water source. The kitchen garden in a household provides food and income; however, some households started kitchen garden farming primarily because of government or NGO motivation. Other people started kitchen garden farming to pass the time, especially among the men, instead of sitting and waiting for food, and some for food, income, or both. To improve kitchen garden farming, participants suggested more training on kitchen garden farming, more sensitization about kitchen gardening farming, provision of seeds, including native and traditional species, and simple irrigation kits, and training on attitude and mind-set change, among others. Some participants in the study were food secure while others were mildly food secure, and they commonly ate vegetables, beans, maize, cassava, rice, and sorghum. Both men and women practised kitchen garden farming. In kitchen garden farming, both indigenous knowledge and skills and knowledge and skills acquired from the government and NGOs are used.

In conclusion, kitchen garden farming can be used to improve the quality and quantity of food and household incomes by following the recommendations provided by the households and the way kitchen gardens are practiced in the Moroto district to design programs and interventions.

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# Appendix 1

# **Household Survey Questionnaire**

# SECTION ONE: OBSERVATION AND GENERAL INFORMATION

Species diversity (high: 4+ species, moderate: 2-3 species, low: 1 species)

- $\circ$  High: 4+ species,
- Moderate: 2-3 species,
- Low: 1 species

# Species type (vegetable, fruit, staple, mix?)

- o Vegetable Fruit
- o Staple
- All the above

# Number of species in the garden:

# Vegetables, staples, and other Species in the garden

- Eggplant the round species
- o kale (sukumawiki)
- o Amaranthus (greenish purple) nyamujogo species
- o Amaranthus red species
- Amaranthus light green species
- Eggplant the slim long species
- Boo (eboo) gobe species (black-eyed pea)
- Spider plant
- o Pumpkin
- Swiss chard (spinach as locally called)
- o carrots
- $\circ$  Onions
- $\circ$  Beans
- o Cassava
- o Beetroot
- o Green pepper
- $\circ$  Onions
- o Okra

- o Lemon grass
- $\circ$  Tomatoes
- Red pepper (African chili)
- o sweet potatoes
- $\circ$  Bananas
- $\circ$  Sugarcane
- $\circ$  sorghum
- o maize
- o Alaju
- o malakwang
- o Jute
- $\circ$  Sunflower
- $\circ$  Tobacco

### Fruits in the garden

- Pine apples
- o Mangoes
- o Lemon
- $\circ$  Sour sop
- o Sugar cane
- passion fruits
- o Pawpaw
- o Guavas
- o Bananas
- o Jack fruit

### **Production Objective**

- $\circ$  Food
- o Sale
- o Both food and sale
- $\circ$  To pass time
- Reduce household expenditure
- o Diet /Nutrition/health reasons
- o To increase household savings and income

### Labor Source

- o Family labor
- Hired labor
- $\circ$  shared /communal labor

### Harvest frequency

o Daily

- o weekly
- o Fortnightly
- Monthly
- o Harvest all at once

# **Space utilization**

- o Vertical gardening
- Horizontal gardening Both

### Village Name:

### Sub-county:

### Location

- Near the water source
- Near the homestead

### Type of water source

- o Tap water
- o Borehole water
- o River

# Distance of kitchen garden from homestead

- $\circ$  0 to 0.5 km
- $\circ$  0.5 km to 1 km
- $\circ$  1 km to 5 km more than 5 km

# Where the Kitchen Garden is Located

- o Near River
- Near borehole
- Near tap water
- o Backyard
- Away from home

# **Cropping Patterns**

- o Irregular
- In rows

# Contribution to household income

- o 0 to UGX 10000
- o UGX 10000 to UGX 50000
- o UGX 50000 to UGX 100000
- $\circ$  More than UGX 100000
- Not yet sold

# **Technology** (tools used)

- Hand hoe
- o ox plough

- o Tractor
- Watering Can

# Input source (planting materials etc)

- Buying
- Home saved
- From neighbor or community
- o Donations from NGOs

# Inputs used in the garden

- o Manure
- Inorganic fertilizers
- o Mulch
- o water

# Type of manure used

- o Goat manure
- Cow dung
- Chicken manure
- o Household organic waste
- o Non

# Gardening skills

- Training in kitchen gardening
- use traditional knowledge and skills
- Educational background in agriculture

# **Financial assistance**

- Credit facilitation from bank or savings group
- $\circ$  own savings
- o None

# Why did you start kitchen gardening?

- o Food
- Passion for gardening
- To pass time
- Motivation by NGOs and Government
- o Illness
- o Income

# When did you start kitchen gardening?

- $\circ$  less than 1 year
- o 1 year
- $\circ$  2 to 3 years
- 3 to 5 years

- $\circ$  5 to 10 years
- More than 10 years

# Have you attended any training in kitchen gardening?

- o Yes
- o No

# If yes, from whom? (organization or individual), was the training helpful?

- o Yes
- o No

# Do you own this garden, or do you own it jointly?

- o own garden
- o shared ownership

# SECTION TWO: SPECIES PRODUCTIVITY

Is the plant used for fodder?

- o Yes
- o No

# What part (s) of the plant is eaten

- o Leaves
- o Seeds/grains Fruits
- o Tubers Bulbs

# SECTION THREE: KITCHEN GARDEN PRODUCTIVITY

# How many people consume produce from the garden

- $\circ$  2 to 5 people
- $\circ$  6 to 8 people
- More than 8 people, 1 person

# What do you do with the produce from the kitchen garden? – (benefits of Kitchen gardening)

- o Food
- o sale
- Barter trade
- Preserve
- o other

# How does the season affect the kitchen garden and utilization of wild leaves and fruits?

How many times do you plant vegetables in your kitchen garden in a year? When do you get the highest yields in your kitchen garden?

# When do you get the lowest in your kitchen garden?

# How do you supplement the low vegetable yields in the kitchen garden?

- o Buy
- Eat wild leaves and fruits.
- Donations from relatives or neighbors
- o Humanitarian aid

# What type of vegetables/crops do you grow?

- Perennial
- o Annual
- o Both

# What influences the type of vegetables/crops you grow in your kitchen garden?

- o Season
- Maturity period
- Availability of planting materials
- $\circ$  Preference
- Tolerance to drought
- o Donors
- Marketability /market demand/ vegetables that will be consumed
- Profitability
- o Nutritional Value
- o Thieves
- Livestock
- Harvest multiple times (long harvest time) /long-lasting
- o Does not seed faster
- Water availability
- Low attack from pests and diseases/ resistant to pests and diseases Cheap (cost of seeds and general management for growth)
- Experimentation
- o Sure, that you will harvest the crop no matter what

# SECTION FOUR: LAND AND WATER ACCESS

# How does land access affect kitchen gardening and the species of vegetables and crops grown?

# How does water access affect kitchen gardening and the species of vegetables and crops grown?

# How did you get this land for your kitchen garden?

 $\circ$  Family owned.

- Communally owned,
- Leased/ rented.
- Government land

# SECTION FIVE: FOOD SECURITY AND LIVELIHOOD SECTION FIVE (B)

#### Household Food Insecurity Access Scale categories

**Conditions for the Household Food Insecurity Access Scale categories** 

### **HFIAS category = 1 (Food secure)**

if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]

### **HFIAS category = 2 (Mildly food secure)**

if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]

### **HFIAS** category = 3 (Moderately food insecure)

if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0]

#### **HFIAS** category = 4 (Severely food insecure)

if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3]

#### Household Food Insecurity Access Scale questions

- 1. In the past four weeks, did you worry that your household would not have enough food?
  - o Yes
  - o No

#### 1 (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)

- 2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred due to lack of resources?
  - o Yes
  - o No

# 2 (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)
- 3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to lack of means to buy them? \*
  - o Yes
  - o No

# **3** (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)
- 4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
  - o Yes
  - o No

# 4 (a). If yes, how often did it happen?

# Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)
- 5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
  - o Yes
  - o No

### 5 (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)

# 6. In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?

- o Yes
- o No

# 6 (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)
- 7. In the past four weeks, was there ever (a day when there was) no food to eat of any kind in your household because of lack of resources to get food?
  - o Yes
  - o No

# 7 (a). If yes, how often did it happen?

# Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- $\circ$  Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)
- 8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?
  - Yes

o No

# 8 (a). If yes, how often did it happen?

Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).

- Often (>10 times) during the past 4 weeks)
- 9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?
  - o Yes
  - o No

# 9 (a). If yes, how often did it happen?

# Freq. Codes

Tick yes or no and indicate the frequency for the last four weeks/1 month

- Rarely (1-2 times)
- Sometimes (3-10 times).
- Often (>10 times) during the past 4 weeks)

# **SECTION FIVE (B)**

# What are the foods you commonly eat?

- o Posho (maize)
- Sorghum
- o Millet
- o Cassava
- Sweet potatoes
- o vegetables
- o Rice
- o Meat
- o chicken
- matooke (cooking type banana)
- o Beans
- $\circ$  Groundnuts
- o Milk
- o Eggs
- Local brew solid leftovers (adakayi)

# How do you meet your food requirements all year round?

- Buy
- Eat wild leaves and fruits
- Humanitarian aid

# What influences your food choice?

- Nutrition (nutritional value)
- Season
- Finances

- Kitchen garden
- Health reasons (illness)
- Preference (favorite food or what is preferred by the household/children or individual or what they are used to eating)
- Availability

# Recommendations to improve kitchen gardening practice/Adoption

- Increase access to pesticides
- Increase water access (closeness to affordable water source)
- Desalination of water for agriculture
- Increase sensitization on kitchen gardening
- More training on kitchen gardening
- Attitude and mindset change training
- Increase access to simple irrigation kits
- Increase access to water harvesting equipment
- Provision of vegetable seeds
- Plastic management in gardens
- Emphasis on small-scale vegetable gardening
- Preservation of vegetables
- Provision of watering cans
- Following a watering schedule for the vegetables twice a day (early morning and evening)
- Slash and burn farming method
- Dig and burry weeds in the garden
- o Mulching
- o Pest and disease control
- Securing a ready market for vegetables
- Selection of individuals who are interested and passionate about kitchen gardening.
- Encourage sharing of traditional seeds among community members
- o slashing of vegetables when mature to allow regrowth
- Encourage diversification of vegetables grown
- Set up a demonstration farm or site
- Increase access to fertilizers
- o Cultivation of drought-tolerant vegetable varieties

# Appendix 2

# **Key Informant Interview Questionnaire**

# Kitchen garden trainer's questionnaire

Have you heard about Kitchen gardening/ growing of vegetables and other crops around or near the home?

o Yes

o No

If yes, in your own words how would you define kitchen gardening and a kitchen garden

What kitchen gardening techniques or methods did you train the households on?

What was the purpose of the kitchen gardening training you did?

Approximately how many people did you train in kitchen gardening?

What are your experiences with the adoption of kitchen gardening?

How do you think kitchen gardening can best be used as a tool to enhance food security and livelihood?

Do you know of any organizations offering training in kitchen gardening and the types of approaches they use?

Please share with me any recommendations for future trainings in kitchen gardening.

# The Drylands Transform project team Questionnaire

Have you heard about Kitchen gardening/ growing of vegetables and other crops around the home?

- o Yes
- o No

If yes, in your own words how would you define kitchen gardening and a kitchen garden

What are some of the technologies and practices that have been experimented with in Livestock café?

What are some of the hindrances you have encountered in implementing kitchen gardening at your level and within the community?

What are some of the hindrances you have encountered in implementing kitchen gardening at your level and within the community?

Do you know of any organizations offering training in kitchen gardening and the types of approaches they use?

How do you think kitchen gardening can best be used as a tool to enhance food security and livelihood in Moroto district?

# The government district representative questionnaire

What are some of the food security and livelihood programs that are currently being implemented or that are upcoming within your office? And how can we get more community members to benefit from them.

How are model groups or households that are doing well in food security and livelihood programs being used to encourage others to achieve improved food security and livelihoods?

What are some of the things you are doing to create an enabling environment to boost food security and livelihood in the area?

Have you heard about kitchen gardening, and how would you define kitchen gardening or a kitchen garden?

What are some of the challenges experienced in kitchen gardening in Moroto? Do you know of any organizations offering training in kitchen gardening and the types of approaches they use?

How do you think kitchen gardening can best be used as a tool to enhance food security and livelihood?

How does land access affect agricultural activities like kitchen gardening?

Humanitarian assistance is important, but not sustainable help in the long run - what does the government do to prepare to deal with effects of drought on food insecurity (and famine) in Moroto district since it's something that reoccurs.

Do you have any recommendations for improving kitchen gardening as a tool for enhancing food security and livelihoods?

# The development partners/NGO Questionnaire

Have you heard about the Drylands Transform project?

What are some of the livelihood and food security activities that you implement in Moroto district?

Have you heard about kitchen gardening, and how would you define kitchen gardening or a kitchen garden?

Do you know of any other organizations promoting /implementing kitchen gardening in Moroto district?

Do you have a way you measure the contributions of kitchen gardening to food security and livelihoods?

What Kitchen gardening approach do you as an organization promote and also consider the most successful

What are some of the challenges experienced in the kitchen garden in Moroto from your experience?

What are your thoughts on collaboration with other organizations or projects like Drylands Transform?

Do you have any recommendations for improving kitchen gardening as a tool for enhancing food security and livelihoods?

# Appendix 3

# **Focus Group Discussion Questionnaire**

What are your thoughts/perceptions about kitchen gardening (do they find it useful; they don't see any future in it, is it difficult)?

Since you started kitchen gardening, what are some benefits you have achieved?

What are some of the challenges you experience with kitchen gardening?

What are some of your thoughts on how to best implement for food security and livelihoods?

What are some of the things you do during the drought season or in preparation for the drought season to meet your food requirements?

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