HOME GARDEN CHARACTERISTICS AMONGST LAO'S VULNERABLE UPLAND RURAL FARMERS IN THE CONTEXT OF FOOD SECURITY

A Thesis submitted by

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ABSTRACT

The government of Lao PDR and local civil society groups are implementing several agricultural initiatives and recognize the importance that home gardens (HG) contribute to household (HH) food security. Despite its importance, studies on HG rural farming vulnerable HHs are limited. Thus, this study assesses the HG characteristics and how it contributes to food security among three types of rural upland vulnerable farmer HHs of 16 villages in Phoukoud District, Lao PDR: People with Disability Households (PWDHH), Female-Headed Households (FHHH), and Other Vulnerable Households (OVHH). It has two specific objectives, first, to assess HG characteristics and second, to evaluate HG relationships to HH food security amongst the 3 types of upland vulnerable HHs. The research used mixed methods of qualitative and quantitative data collection and analysis. The study found home gardens near and far from homes, with sizes varying from smaller to larger plots with FHHHs HG being the largest, furthest from home, and more time was spent, whereas PWDHH's HG were the closest, smallest, less time was spent, but they harvested the most compared to other HHs. Women felt empowered as managers and owners of their HG, whereas men mainly thought it was women's job and only helped with tasks such as fencing, clearing and digging the land. The majority of households used HG crops for HH consumption, with fewer HHs selling surplus crops. The study also found various levels of food insecurity but as the number of HG increased, crop production improved, and food insecurity decreased. The study also revealed significant disparities among the three types of vulnerable HHs, with FHHHs experiencing the most severe food insecurity, and showed the least progress in addressing food insecurity over time. Households primarily used traditional methods to select and store seeds, study found loss of seed amongst HHs due to poor seed storage practices. The study found 83 different types of HG crops, with FHHHs producing the least diverse crop. The study findings support HG as a reliable, year-round food source which has the potential to alleviate food insecurity by increasing food availability, access, utilisation and stability. This study discusses the constraints and opportunities and highlights the positive impact of HG in reducing food insecurity but acknowledges that HG alone cannot eliminate all food security issues. The study offers recommendations for targeted interventions and policies to improve HG practices, address current challenges of food security in rural upland areas of Laos, and contributes to attaining global Sustainable Development Goals (SDGs) #2, #3, #12, and #13.

CERTIFICATION OF THESIS

I Suraj Shrestha declare that the Thesis entitled *Home garden characteristics amongst Lao's vulnerable upland rural farmers in the context of food security* is not more than 31,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes.

This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Date: 20/06/2024

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADRA	Adventist Development Relief Agency
CBSFS	Canada Bay's Sustainable Food Strategy
CDE	Centre for Development and Environment
DAFO	District Agriculture and Forestry Office
DRI	Daily Recommended caloric Intake
FAO	Food and Agriculture Organisation
FANTA	Food and Nutrition Technical Assistance
FHHH	Female Headed Household
HDD	Household Diet Diversity
HG	Home Garden
LBS	Lao Statistics Bureau
LURAS	Laos Upland Rural Advisory Services
LSIS	Lao Social Indicator Survey
MAF	Ministry of Agriculture and Forestry
MPI	Ministry of Planning and Investment
MOH	Ministry of Health
MoU	Memorandum of Understanding
NGO	Non-Government Organisation
NIPN	National Information Platforms for Nutrition
NPAN	National Plan of Action on Nutrition
NTFP	Non-Timber Forest Products
OCHA	Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
OHVV	Other Vulnerable Household
PAFO	Provincial Agriculture and Forestry Office
PICRAIL	Phoukhoud Integrated Climate Resilient Agriculture and Improved Livelihoods
PWDHH	People with Disability Household
SDG	Sustainable Development Goals
SUNCSA	Scaling Up Nutrition Civil Societies Alliance
UN	United Nations

UNDP	United Nations Development Program
UNICEF	United Nations International Children's Emergency Fund
USAID	United State Agency for International Development
WFP	World Food Program

CHAPTER 1: INTRODUCTION

1.1. Background

Home gardens (HG) are traditionally one of the most important and oldest farming systems that have been practiced for centuries around the globe, found in both urban and rural communities (Gosh, 2023; Patience et al., 2014; Marsh, 1998). HG are mostly a small plot of land either next to the home or within its proximity, depending on the topography, suitability, and availability of land (Kunhamu, 2013; Watson & Eyzaguirre, 2001). While HG have common characteristics across the globe, they can vary from HH-to-HH dependent on preferences in crop selection, crop utilization, seasonal planting, and cultural significance as this influences what individuals prefer to plant and the agricultural methods, they apply in managing their HG (Eyzaguirre 2006; Schneider 2004; Ruthenberg 1980).

Women are generally found to be the main contributor to the management of a HG (Mitchell & Hanstad, 2008; Howard, 2006), with some studies suggesting that women and men are equal contributors to the management of a HG (Nguyen et al., 2017). HG are also characterized for their traditional low-cost methods application (Ruthenberg 1980) as the home gardener utilizes local resources, materials, and practices that are often accepted with high confidence as reliable and proven tested methods. Such a notion of confidence generates a stronger sense of ownership among HHs as local methods are often perceived to be in tune with their local context and needs (Dekens, 2008). It is also suggested that such knowledge and practices are found to be sustainable and resilient, that have endured over time without the support of any modern technologies (Clements et al., 2011). As such agricultural methods are often passed down from one generation to another.

Despite the various commonality and diversity attributes in HG characteristics, there are undoubtably numerous common collective benefits to home gardeners and HHs (Raymond et al., 2018). One of the primary characteristics of the HG is its role as a vital food source for family consumption. It provides regular diverse plant-based food that increases HH food quality and improves the dietary diversification that supports HH food security and nutrition (Balika et al., 2019; Galhena et al., 2013; Weinberger 2013; Keatinge et al., 2011; Nair 2001; Ninez, 1984). Because of this prominent feature it is believed that HGs contribute to the food *availability and access* of food supplies which improves its *utilisation* by creating food *stability* for a HH over time. According to the Food and Agriculture Organisation (FAO, 2006), the four

key dimensions of food availability, food access, food utilisation and food stability are generally important in assessing food security. Another important characteristic that fortifies HH food security is the production of a variety of crops including vegetables, fruits, medicinal plants, and herbs as it provides regular fresh diverse food supplies within a close convenient proximity to the home (Gautam et al., 2004). Based on this premise, this thesis examines HG characteristics and how it contributes to food security amongst the most vulnerable segment of upland rural farmer vulnerable households of 16 villages of Phoukoud District, Lao PDR.

The participants are primarily subsistence farmers, who highly depend on their agricultural activities and production for their livelihood. The HHs were selected due to various internal and external risks such as financial, health, and having low adaptive capacity to natural disaster shocks thus making them vulnerable. Due to such vulnerability the ADRA Laos Food security project "Phoukoud Integrated Climate Resilient Agriculture and Improved Livelihood" (PICRAIL) was implemented between 2019 to 2022 in collaboration with the Phoukoud Department of Agriculture and Forestry Office (DAFO). Whilst there are numerous studies that have investigated Laos farmers farming practices, they focused on four key areas; larger farm plots in relation to rice, non-rice annual crops, perennial crops, and livestock (Catherine et al., 2019; UB & Lao PDR, 2018). There are fewer studies conducted on HG characteristics, practices and its linkage to food security amongst different types of vulnerable HHs thus creating a significant gap in empirical knowledge. In this context, this study focused on HGs of upland vulnerable farming HHs that consists of; People with Disability Household (PWDHH), Female Headed Household (FHHH) and Other Vulnerable Households (OVHH). This study provides a deeper understanding into HG characteristics, its linkages and contribution to food security, and its limitations, challenges and opportunities. Thus, the crucial findings and information will be vital to policy makers, development partners, and other relevant key stakeholders on how to improve HG production and reduce food insecurity. Research findings have the potential to inform in addressing SDGs #2 Zero Hunger, #3 Good Health and Wellbeing, #12 Responsible Consumption and Production and #13 Climate Action leading to improved food security amongst the most vulnerable upland farmers HHs in Laos and beyond.

1.2. Vulnerable Households of Phoukoud District

Phoukoud District has a population of 26,721 (OCHA, 2023) with 43 villages and the study was conducted in 16 of these villages. The study site has a high malnutrition rate (46%), high rural poverty head count rate (34.3%), low coping capacity of HHs to deal with food

insecurity and shocks such as flooding, drought, and climate change impacts (ADRA, 2023a; NIPN, 2021; Lao Statistics Bureau and World Bank, 2020). The majority of these HHs are subsistence farmers who primarily rely on agricultural activities and production for their livelihood (CDE, 2018).

Numerous studies suggest that often subsistence farmers are a small landholder that have between 0.5 and 2.99 hectares which is a small size of operation to secure their livelihood (CDE, 2018; Arntzen et al., 2004) which is also the case of this study site. These HHs are mostly weather dependent farmers who grow most of their crops during monsoon season and who rely on the rain that monsoon season brings, except those who have access to a river, creek or small dam. These weather dependent farmers often experience a reduction in average crop yields, have frequent crop failures and have a difficult time recovering from their losses (ECF, 2014; Mendelsohn & Dinar, 2009; UNDP, 2009; Deressa et al., 2008). The HHs are also prone to climate change and lack resources to improve resilience and adapt to climate change negative impacts (O'Neil, 2021; ADRA, 2019; MAF, 2017; UNDP, 2009). Such growing threats of unpredictable extreme weather and disastrous events pose significant negative impacts on agricultural systems to farming HHs that can directly affect their food supplies (Chachibaia, 2015; Clements et al., 2011). In general, vulnerable HHs are found to be susceptible to financial and health risks and are often living in remote and rural communities. They have poor access to key services such as health, safe drinking water and education. These villages were also found to have a higher prevalence of malnutrition amongst children under five years of age, adding burden and stress to HH resources and members wellbeing (ADRA, 2019; USAID 2019; Hart, 2009). Various studies support that remote villages are dependent on agriculture livelihoods often experience seasonal food insecurity. Due to the nature of such fragile livelihoods that lack access to resources means they are limited in their ability to respond adequately to exposed internal and external risk factors making them vulnerable (Bhavana et al., 2021; Yong et al., 2021; Blaikie, 2014; Hart, 2009; Birkmann et al., 2006; Chamber, 1989).

The vulnerable HHs of this study rely mostly on traditional farming methods but are gradually moving towards commercial market-oriented farming. They are adopting various modern practices and technology such as the use of mechanical tools and increasingly applying chemical inputs in their cultivation (CDE, 2018; MAF, 2015). Although such a shift has been perceived to benefit HHs by improving agricultural productivity and efficiency, some researchers argue that it has also exposed HHs to new challenges such as market volatility,

indebtedness, and becoming more dependent on markets for their food supply (Cathrine et al., 2019). There are also a number of other issues such as indiscriminate usage of chemical inputs, clearing of more forests to increase market-oriented crops such as maize, casava, rubber plants, rice, and various livestock production initiatives which effect both the natural environment and human health of upland farmers (LURAS, 2018 & 2016). These trends are found throughout Phoukoud District in farmland that is cultivating market-oriented crops. But when it comes to HGs, HHs mostly apply traditional cultivation practices to improve soil health by using livestock and poultry manure or compost, pests and weed are managed by applying bio pest, and the ground tilled manually using simple tools and the production handpicked. HHs desire to grow healthy food for their consumption that is natural, safe and chemical free and this is prominent in study sites (ADRA, 2023a; World Vision, 2014).

The study sites are geographically remote, prone to climate change, communities are prone to financial and health risks, services are poor with HHs having low capacity to cope with shocks and crisis and face numerous agricultural challenges. The villages and HHs were identified as vulnerable HHs by staff from ADRA Laos, local government authorities of Provincial and District Agriculture and Forestry Offices, Health Office, Planning and Investment Office, and Administration Office. It is acknowledged that vulnerability is a complex phenomenon with multiple factors interacting with each other at different levels in the broader system within which HH livelihood strategies are embedded (Eakin & Luers, 2006; Du Toit & Ziervogel, 2004). It is highly context-specific and often requires deeper engagement as vulnerability causes and presence may not be visible. Often local people have some level of capacity to carry out their own risk assessment and diversify their livelihood patterns, according to their understanding and perception of risk and are able to manage their risk (Ellis 2003). Risk mitigation strategies towards such risk stressors may be reactive or anticipatory based on their experience, education, culture, resources and context. These responses may always not be adequate, proportionate or an informed response. Thus, to ensure that the vulnerability is understood within the local context, we have adopted the definition and understanding of vulnerable HH within ADRA Lao PDR's organizational documents, scholar literature, and literature relevant to Lao PDR's vulnerability (ADRA, 2023a; ADRA, 2023b; WFP 2020, UNDP, 2009). ADRA Laos has developed and implemented PICRAIL project to improve identified vulnerable HH's food security, livelihoods, and improve their agricultural practices (ADRA, 2019). ADRA aims to help vulnerable HHs to be able to adapt to changing climate, shocks and crisis. So, they could respond to those circumstances proportionately

achieving improved resilience amongst vulnerable HHs. This led to the identification of further 3 types of upland vulnerable rural farming HHs as defined below:

People with Disability Households: rural and remote subsistence farmer HHs that have one or more family members with long-term physical, mental, or sensory impairments. These HHs may experience various barriers that hinder family members from fully and effectively participating in society on an equal basis with others (UN, 2021). These HHs are susceptible and exposed to several hazardous events and are poorly resourced with limited social, health, and economic access (Marin-Ferrer, 2017; Blaikie, 2014; Birkmann et al., 2006).

Female-Headed Households: rural and remote subsistence farmer HHs where women are fully responsible for their HH, often living alone or with others, and are the primary income generator and decision maker (ILO, 2007). They may be widowed, divorced, single, or single female parent who is susceptible and exposed to several hazardous events, poorly resourced with limited social, health and economic access (Marin-Ferrer, 2017).

Other Vulnerable Households: rural and remote subsistence farmer HHs that are prone to climate change, financial and health risks and have low coping and adaptive capacity (Maleki et al., 2018). They have poor access to key services such as health, safe drinking water, and education and have a higher prevalence of malnourished children. They experience regular seasonal food insecurity and financial hardship and have low employment options (Bhavana et al., 2021; Marin-Ferrer, 2017; Blaikie, 2014; Birkmann et al., 2006).

1.3. Aim and Objectives

The aim of this thesis is to examine HG of upland vulnerable rural farmer HHs in central Laos in the context of food security. A comparative analysis is conducted of three types of upland vulnerable HHs including: People with Disability Household; Female Headed Households, and Other Vulnerable Households. The thesis presents the similarities and differences between vulnerable HH's HG characteristics, practices, challenges, and opportunities and its linkages to food security. The specific objectives of this thesis are:

1. to assess home garden characteristics amongst three types of upland vulnerable households
2. to evaluate home garden relationship to household food security amongst three types of upland vulnerable households.

1.4. Scope and Limitations

The study focuses on the HG characteristics and how it contributes to the vulnerable HH's food security of 16 remote upland rural villages of Phoukoud District Laos. The vulnerable HHs are primarily weather dependent, subsistence farmers who were selected and supported by the ADRA Laos food security project PICRAIL. The findings of this thesis will be beneficial in the context of similar remote and rural upland vulnerable farmers within Laos and beyond. The study provides insight amongst 3 different types of vulnerable HHs experience, practices and the management of their HG, the gaps, challenges, and opportunities to optimise improvement. This study provides empirical analysis of current HGs situation and what can be done to preserve and protect such a valuable food source. The study also highlights the role of HGs and its contribution to HH food security. Food security is examined by looking at HGs contribution in the context of food availability, access, utilisation and stability within the four key dimensions of food security (FAO, 2006; FAO, 1983). Therefore, such investigation and findings of this study is comprehensive and creates scientific documents that can be used to promote and advocate to improve home gardening practices especially for rural vulnerable communities where food insecurity is prevalent.

The study mainly focused on a small geographical location of 16 villages with 3 types of vulnerable HHs, but it does not provide specific location and ethnicity variability into the consideration and how it may inter-related to each other. The study participants were all from ADRA Lao's food security project who were identified as vulnerable and received inputs and support to improve their HG and livelihood activities. Thus, the changes found and identified are a direct result of targeted interventions, while this may be the case the changes to farming practice and improvement are undeniable in supporting the importance of HG and the role, they can play in providing stable food availability, access and utilisation. The study was unable to include a control group due to the existing Memorandum of Understanding (MoU) between the Government of Lao and ADRA Laos, as only the groups directly supported by ADRA Laos were within the scope of the MoU. This limited the researcher's ability to include a control group in this research that could have added tremendous comparative analysis values of other HHs who were not supported by the project but had a HG.

1.5. Organisation and Dissertation

The thesis is divided into six main chapters. Each chapter covers specific parts of the thesis, and a brief summary is presented at the end of each chapter.

The *first* chapter covers the introduction that contains the background of the research topic, understanding of the rural vulnerable HH within the scope of the research's specific aims, objectives and research significance of scope and limitation.

The *second* chapter is the literature review that investigates the global and local context of the HG key characteristics. Food security and food insecurity and what role HGs can play and how it can contribute to improving HH food security.

The *third* chapters present the research methodology and explains the research process, framework, methods of data collection, data sources, data analysis and interpretation methods applied throughout the research.

The *fourth* chapter is the result section that presents the HG characteristic amongst three vulnerable HHs and its relationship with food security. Results are presented in graphs and tables with descriptive and inference statistics, including content analysis narrative. It also includes the annex of journal articles related to the specific objective 1 and 2.

The *fifth* chapter is the discussion section of the HG characteristics and its contribution to the food security among three vulnerable HHs. The discussion section examines the seven specific themes. It provides further insights, analysis and proposed recommendations that will help improve and optimise HGs and enhance HH food security. It also includes the annex of journal articles related to the specific objective 1 and 2.

The *sixth* chapter provide the conclusion and key recommendations for future researcher, development practitioners and local authorities and stakeholders on how to continue to optimise HGs and its potential to further contribute to food security especially for the most vulnerable groups of people.

Figure 1. Mang village -one of the study site

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The literature review examines various resources, reports and scientific studies on HG characteristics and their relationship on food security and food insecurity. HGs, often characterised by their diversity, sustainability, and accessibility, play a crucial role in enhancing food availability and nutritional quality for HHs. Research indicates that HGs contribute to food security by providing a consistent source of fresh produce, reduce reliance on external food sources, and improve dietary diversity. Conversely, the literature also explores how factors such as socio-economic status, land access, and local agricultural practices can influence the effectiveness of HG in mitigating food insecurity. By synthesizing findings from multiple sources, this review aims to provide a comprehensive understanding of how HGs can serve as a vital resource for enhancing food security in various contexts including Lao PDR. The following sections below will provide with an in-depth analysis.

2.1.1. Home Garden Characteristics

Home Garden Overview: HGs are perceived to be an old agricultural system practiced by humans for thousands of years and found all around the globe (Cerda et al., 2022, Kumar & Nair, 2006; Landon, 2004; Marsh, 1998). HGs have evolved throughout the ages, as societies adapted to newer systems, technology, innovations, topography and demographic changes (George, 2022; Cerda et al., 2022; Santos et al., 2022; Okeke et al., 2020; Eigenbrod and Gruda 2015). This evolution has created opportunities for HHs to cultivated fresh food supplies in both remote and urban areas (Eigenbrod and Gruda 2015; Galhena 2013). HGs can become an integral resource, that is a convenient and accessible activity that all ages and abilities can participate in.

A HG is also known as a “kitchen garden”, “vegetable garden”, “backyard garden” etc. which has been tested throughout time, evolved, and remains a relevant valuable resource to this day. Despite the changes, the primary purpose of the food production for HH consumption remains the same with multiple other complementary benefits. A HG has the potential to generate supplementary income, preserving and protecting traditional gardening practices, maintaining the sovereignty of traditional and resilient seeds, experiencing empowerment and social connectedness, development of newer technologies and gardening methods which

enable HHs to tackle various home-based agricultural challenges (Stanborough, 2020; Galhena, 2013; Marsh, 1998).

Home Garden Proximity and Popularity: The location of a HG is often found close to the HH or at a short distance near the home (Rowe, 2009; Terra, 1958). They are often smaller in size compared to other farm or agriculture lands making HG's *location* and *size* a common characteristic. Due to its close proximity and small size, HG are perceived to be convenient, accessible, practical and functional making it easy to manage (Brownrigg, 1985). It is also less labor intensive and requires less time, minimum resources and tools, and simple home-based agricultural systems often learned from parents, friends or neighbors are applied. HGs are a comparatively much simpler agriculture system both in operation and scale compared to larger agricultural systems like growing staple food such as rice, wheat, maize, or commercial farming etc. Due to its convenient *location and scale* of operation HG activities are often less intensive and everyone in the HH can participate in the simple tasks such as watering, weeding, and collecting fresh vegetables. Some researchers also suggest that such collaborative activities can lead to enhanced connections with family members and has added health benefits (Kingsley et al., 2022). Thus, one might say, it is *user-friendly* valuable activities that all the family can participate in and receive various benefits. Perhaps this is why HG have existed for thousands of years and still remains a popular global agricultural activity, where all ages and people with various physical and mental ability can participate in helping to grow food for their HH. Due to such characteristics the HG workforce primarily consists of the elderly, children, men, with women being the key driver and the manager of HGs (Depenbusch et al., 2022; Wygant, 2021; Ruthenberg, 1980). Home garden proximity, popularity and longevity is undoubtably is an outstanding characteristic that cannot be ignored nor deny.

Figure 2. Various size, location and methods are used in home garden that are found in study area in Phoukoud District, Laos

Home Garden Practices: HGs are also known for its local knowledge and practices that are *high in confidence* and often accepted as tested, proven, and reliable agricultural methods (Deken, 2008). HGs are also known for its local knowledge and practices that are *high in confidence* and often accepted as tested, proven, and reliable agricultural methods (Deken, 2008). Such attributes of practices are perceived to be in tune with the local context and needs. Such knowledge and practices are found to be sustainable and resilient and have endured over time without the support of any modern technologies (Agize, 2013; Clements et al., 2011). It can be described as one of the most natural food production systems which are ecological, economical, and socially accepted (Kunhamu, 2013).

Such HGs seem to apply various methods such as composting kitchen waste, reusing grey water, applying animal manure and other organic matters to improve soil fertility and increase production (Kermen & Miles, 2012). Home gardeners are also active in managing their traditional seeds that have been passed down through the generations. Intercropping and growing several crops in proximity at a time such as fruits, herbs, legumes, green leafy vegetables, roots vegetable, grains, nuts, spices, traditional medicinal plants, and flowers are common traditional practices amongst home gardeners (Ariyadasa, 2002). The use of repellant plants collecting and destroying pests by hands or feeding them to their ducks and chickens, creating scarecrow or other structures, and on some occasions personally guarding the crops at harvest time are a combination of such practices that often extols as "*local practices*" or "*traditional practices*" that have a significant cultural and ecological connection and value,

Figure 3. Herbs grown in hanging bucket and pot covered with a net on the table kept above the ground at the research site, adaption and innovation to protect the plants from pests and small animals and where land is scarce.

more than modern agricultural methods of modernized farming system (Growing to Give, 2024; Clements et al., 2011). Home garden is deeply rooted in our cultural and social psychic that has entranced traditional values that connects us nature and humanity.

Home Garden Evolution, Innovation and Technology: Although, much of the traditional methods and practices of HGs do require suitable land for cultivation which is a prominent feature. It is also important to recognize that HGs have evolved and adopted numerous new agricultural methods, technology and innovations to make HG production more efficient and accessible despite its traditional characteristics. The *innovation and technology* enable a gardener to grow crops, even when the land is not suitable (Yuan et al., 2022; Ranasinghe, 2009).

The methods and innovations could be simple or complex and can provide alternate opportunities for the keen gardener who wants to grow food even when they do not have suitable land and who are willing to tackle some of the challenges they face with HG. These innovations have helped to maximise plant growth in unique and ingenious ways. Some examples of simple innovations are hanging planters, stick-on vases and pots to windows creating creative solutions, raised garden beds, sack bags garden for cultivating vegetation in small and unsuitable land and spaces. To more complex innovations such as Vertical Aeroponic Planters, smart greenhouses, to the application of App usage in HG management, spreading greenery and growing herbs and vegetables where there may be little or no surface area available (Fussy & Papenbrock, 2022; Al-Kodmany, 2018; Despommier, 2014). Such evolution and improvement of methods and technologies of HG is creating opportunities for HHs to grow their own food and increase the greenery in their space even when they do not have ideal conditions and land for home gardening.

Home Garden Purpose: It is also argued that the primary focus of HGs is to produce food which has shifted and evolved from being more decorative and leisure spaces (Greg, 2023; Santos et al., 2022; Raymond et al., 2018). While this may be correct, the significance of *food production for household consumption* associated characteristic with HG still remains prominent and relevant to this day (Carrad et al., 2022; Eigenbrod and Gruda, 2015). People around the globe are continuing to produce a diverse range of crops of edible plant-based fruits, vegetable, herbs, grains, and nuts primarily for HH food consumption (Cerda et al., 2022; Mugisa et al., 2016; Watson & Eyzaguirre 2001; Marsh 1998). Also, some recent studies show that, HG practices increased during and after the COVID 19 global pandemic with more people

growing their own food. As the global community experienced disruption in the food supply chain, aggravation of the physical and economic barriers restricted access to food during the time of COVID 19 (Cerda et al., 2022; Lal, 2020). Thus, the importance of strengthening local food production and enhancing food availability at the HH and community level is becoming an important food production strategy for both urban and farming HHs.

Home Garden Promoted Policy: The important need for HH food production is highlighted in various governmental land use plans and international initiatives that support the expansion and innovation of HG food production (Carrad et al., 2022; Eigenbrod and Gruda, 2015; Galhena, 2013; Alberto and Luca, 2010). Milan Urban Food Policy Pact have created an international platform for global collaboration between municipal governments in creating a sustainable, resilient and inclusive food system (MUFPP, 2015) and innovative food system policies of City of Canada Bay's Sustainable Food Strategy (CBSFS, 2014) are some notable examples. Such importance of HG potential is also promoted by non-governmental organisation as one of the important means to contribute to the SDGs (Santosh et al., 2022; Sharma et al., 2022). Therefore, various types of HG opportunities including indoor, rooftop gardens, vertical farming, community gardens are promoted for urban areas with lesser space (Yuan et al., 2022). Whereas kitchen gardens, home gardens, and community gardens are promoted for rural areas where land is less of an issue for food production (Cerda et al., 2022; Eigenbrod and Gruda, 2015). Therefore, HG characteristic as a primary *food production for household consumption* remains prominent or one can even argue more realised and of increased importance amongst key national and international decision- makers both of the global north and south. As communities continue to produce a wide range of edible plant-based crops for HH food in both the global north and south, rural and remote areas, food production for consumption is vital and the primary purpose of a HG, while numerous studies suggest it also supports *household livelihoods* by adding economic benefits. HGs can save money, reducing HHs need to spend money on daily herbs, vegetables and fruits. It can also generate extra income by either selling *surplus crops* or growing *specific market-oriented crops* dedicated to commercial orientation

Figure 4. Surplus crop sold to unexpected buyer a project staff. Nakha remote village has poor road access.

(Minh et al. 2016, Abdoellah et al., 2006; Yamada and Osaqui, 2006; Finerman and Sacett, 2003). The economic benefits are often found in the least developing countries as a mean to improve HH income (Samah et al., 2023; Patalagsa et al., 2015; Galhena, 2013). Often poorer and vulnerable HHs, women and marginalised groups of people are supported through various HG programs and incentives implemented by local government and civil societies as a livelihood development initiative to provide an additional source of HH income (Mitchell & Hanstad, 2004).

Figure 5. Freshly picked high value market-oriented crop from home garden for buyer. Xay village has good road access significant improved road connection to market.

Market oriented HG crops are often sold based on local market needs, where HHs appear to have good to fair market linkages so that crops produced in HGs are either sold to local buyers or transported and sold at the market. Market linkages and market access plays a significant role in a HHs motivation to grow market-oriented crops. But not all rural and remote HHs of least developed countries are able to sell their product, due to poor roads, lack of transportation and cold chain infrastructure, poor market knowledge, and limited market access (Minh et al., 2016). Thus, removal of market barriers can provide opportunities for HHs to have improved access to markets thus motivating them to grow food not just for consumption but also to sell, especially in the context of least developing countries where HG surplus and market-oriented crops support *household livelihoods* that add economic benefits.

Home Garden Crop and Diet Diversity: HHs often grow what they prefer to eat but, in some cases, newer plant species, seedlings and plantlets are introduced, planted and harvested and function as a small home nursery (Engels, 2002; Watson & Eyzaguirre, 2002). Thus, HGs can have a *high-density of plant* species (Drescher et al., 2006; Thaman et al., 2006; Watson & Eyzaguirre, 2001) which can provide a significant increase in diversity of edible food plants. Numerous studies suggest that due to this characteristic HGs aids in improving access to the quality and quantity of food which helps improve HH nutrition through the consumption of more diverse healthy and fresh food (Samah et al., 2023; Depenbusch et al., 2022; Sharma IK et al., 2021; Patalagsa et al., 2015; Galhena et al., 2013). Despite of such potential for diversity due to HHs cultural and food preference they may also only grow certain

types of crops that they want to eat and not grow potential high nutrient dense crops. Thus, understanding such gaps generated by preference can be helpful and provide opportunity to further improv crop diversities.

Home Garden Importance: Home garden is dynamic and important, the characteristics and practices of HG outlined above are globally prevalent (Ruthenberg, 1980). According to Michelle and Hanstad (2004) these gardens are particularly appealing due to their manageable size and proximity to the HH. HGs can contribute significantly to both HH food production and income generation and often require minimal resources and technology, relying instead on locally tested knowledge and practices. HGs typically feature a high density of plant diversity (Marsh, 1998; Brownrigg, 1985) with the primary purpose of harvested crops being for HH consumption, although some HG have a commercial orientation. While there are many similar characteristics of HG, it is also worth mentioning that HG practices, methods, sizes, preferences in crop selection, crop utilization, and seasonal planting varies. Geographic, culture, and ethnic orientation has a profound influence on what and how individuals prefer to plant, grow and manage their HG (Schneider, 2004 & Eyzaguirre, 2006). The above characteristics will be further explored below in the context of Lao PDR in the Result Section Chapter 4. Despite various valuable characteristics of HGs, food production for HHs remains one of the most important aspects that drives HHs to engage in HG activities. Thus, it is vital to understand this important food production resource in the context of HH food security. It is a novel investigation that could continue to promote the importance of such a valuable asset and resource which can play a significant role in sustainable development, both for the global south and north.

2.1.2. Food Security and Food Insecurity

Food Security: According to the *Food Security* definition presented at the World Food Summit 1996, it is *'when people at all time have a physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'* (FAO 2008). This definition is commonly used and applied in various programs and initiatives that include the four key characteristics associated with food security. When the HH and individual have physical *availability* of food; have resources and means that enable them to ***access*** food; *utilisation* of food that is adequate for individual and HH nutritional needs and finally, the *stability* of availability; access and utilisation of food (FAO, 2006; FAO, 1983).

Thus, food security is determined by examining the above 4 key characteristics: Food availability, access, utilization, and stability.

Food Availability: It is the physical presence of food supply availability from production and/or cultivation or from the market. It addresses the "supply side" determined by the level of food production, stock levels, net trade with access of economic and resource to obtain the available food (FAO, 2013).

Food Access: It is the resources and means to an adequate supply of quality and quantity of food within individual and households economic, cultural, and social aspects. Often insufficient food access has resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives to reduce poverty, hunger and improve nutritional health (FAO, 2013).

Food Utilisation: Utilisation is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals are the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals (men, women, children). The daily-recommended caloric intake (DRI) for adult males and females is 2600-2800 kcal/day and 2000-2200 kcal/day, respectively. However, DRI depends significantly on the activity status and the physical condition of the body and imbalance in the diet leads to under-nutrition and over-nutrition, both of which are harmful to the body (Faizan and Rouster, 2023). Often measured by including anthropometric measurements of individuals, often children and women (ADRA, 2023; Maxwell and Frankenberger, 1992). It is also investigated by access to water and sanitation related challenges, eating habits, diet diversity and the meal frequencies to estimate the food quality of individual and household (FANTA, 2002; FAO, 2013; FAO, 1983).

Stability: It is commonly understood that individuals and households have a stable condition where food availability, access, and appropriate utilisation of food is at all times. Any experience of inadequate access to food on a periodic basis that effects an individual and household's nutritional status due to extreme weather conditions, politic instability, or economic factors that impacts on any of the above three characteristics would lead to food insecurity (Garcia et al. 2021; FAO, 1983).

When all the above characteristics are found in any location, group, community or HH then they are food secure experiencing *Food Security*. However, if one of these 4 characteristics

are absent then this mean the community, people or HH are experiencing various levels of food insecurity and are often have a “food insecure” status (OECD,2023). However, such food insecurity severity could be different.

Food Insecurity: Food insecurity is often used interchangeably with food security and related respectively to food insufficiency and food sufficiency of food supplies (Butcher et al., 2019). Food insecurity is often used in the context to or intention to either achieve “food security” or reduce “food insecurity” among the individual and HH level (Carlson et al., 2023). Food security and food insecurity are reciprocal and time dependent and the consequential status depends on the interaction between the stresses of food insecurity and the coping strategies to deal with them. The stresses of food insecurity may occur at any point along the food security pathway and affect food availability, accessibility, utilization and stability and may take place at the national, HH or individual levels (Peng and Berry, 2019). This can be often an issue of chronic or transitory food insecurity. Chronic food insecurity is when people are unable to meet the minimum food requirement for themselves or their HHs for an extended period of time. Whereas transitory food insecurity is short term and temporary food shortages (Hart, 2009). This multifaceted issue is exacerbated by various sudden unknown and known events or determinants such as conflicts, climate extreme events, economic downturns, the unavailability of affordable nutritious food, growing inequality, seasonal fluctuations in the climate, cropping patterns, work opportunities and disease (Hasegawa et al., 2018; Messer and Cohen, 2015; FAO, 2008).

Food Insecurity Global and Local: Food insecurity is a complex challenge influenced by societal, cultural, economic, and political factors that directly impact food production, distribution, access, and utilization (Bathfield, 2012). Thus, policies and programs are developed with resources and commitment to address food insecurity and obtain food security (Armstrong, 2018). Based on the recent Global Report on Food Crisis (2023) the world is facing an unprecedented global food crisis due to food, energy, finance, conflict, climate shocks and natural disasters which is even more severe in developing countries. The level of global hunger remains alarmingly high with approximately 258 million people acutely food insecure and in need of urgent assistance across 58 countries/territories, it has increased compared to the previous 2020 report (Global Report on Food Crisis, 2021). Although food insecurity is more prevalent in developing countries, it is increasingly becoming a global concern, affecting

both the global north and south (FAO, 2023; Pollard, 2019). Thus, food insecurity is prevalent and real.

In Lao PDR approximately 20% of the population experiences food insecurity with higher rates in remote areas thus the government regularly requested international aid and agencies to assist in tackling Lao's food insecurity (World Food Programme, 2024; United Nations, 2020). Food insecurity often has multidimensional effects on HHs often affecting the most vulnerable HH members such as children and mothers (MoH, 2021; Betebo, et al., 2016; Andersen, 2011). According to the Lao Social Indicator Survey (LSIS) Lao PDR 33% of children aged 6-59 months were stunted with 8 provinces having a prevalence higher than 40%. Wasting increased between 2012 and 2018, indicating a significant gap in family nutrition as families struggle with food insecurity (LSIS, 2017), despite 70% of Lao PDR's population being in food producing activities and subsistence farmers. HHs are producing rice on 72% of total cultivated land, supplemented with livestock rearing, a collection of non-timber forest products, fish from local water supplies and produce most of their food (CDE, 2018). Although these subsistence farmers are producing the majority of the food, paradoxically, they often experience food insecurity (Rapsomanikis, 2015). Their livelihood is highly dependent on their farm produce products that contribute to their HH food and nutrition (Mapiye et al., 2020). Due to this nature of dependency, they are highly vulnerable and susceptible to experience food insecurity if they experience any financial, social, health, environmental or political shocks (Peng and Berry, 2019).

Food Insecurity and Policy: For years, governments, donor partners and non-government organisations (NGOs) across the globe have promoted various agriculture and livelihood initiatives including HGs to improve food security and nutrition among poor and vulnerable HHs (Garcia et al., 2021; Armstrong, 2018; Galhena et al., 2013), as is the case in Lao PDR with numerous governmental national, ministerial and departmental food security strategies which are supported by donor partners strategies. The Lao PDR 9th Five-Year National Socio-Economic Development Plan (NSEDP 2021-2025) is one of the most important overarching national strategies that identifies the issues of food insecurity and nutrition amongst the people of Lao PDR. It has a specific output that aim to address food insecurity and reduce malnutrition under Outcome number 2, "Food security ensured, and incidence of malnutrition reduced" (MIP, 2020).

The NSEDP's intention to reduce poverty and food insecurity has been adopted and integrated by the Ministry of Health (MoH), Ministry of Agriculture and Forestry (MAF), and

numerous other departmental internal strategic documents and plans to provide community and national incentives and support to address food insecurity and nutrition. Such incentives are supported by various donor and civil society partners to address the various root causes of food insecurity in Lao PDR (SUNCSA, 2023; Armstrong, 2018).

Lao PDR's Ministry of Health's National Plan of Action on Nutrition (NPAN) 2021 - 2025 has a number of multisectoral outcomes and outputs that support the implementation of activities to integrate nutrition promotion in the community and in primary health care in order to reduce chronic malnutrition. Some of the specific activities are providing ready-to-eat supplements to women during pregnancy, providing ready to use therapeutic food to malnutrition children (Aiello et al., 2023) and activities to support HHs with children under 2 years to prevent malnutrition during the first 1,000 days of life, food supplies, and treatment to malnourished children. The MoH has specific health focus initiatives and collaborates with MAF to promote the production of diverse nutritious crops, vegetables, and fruits through clean agriculture initiatives.

MAF also has its own Agriculture Development Strategy 2025- 2030 that aims at improving food availability, accessibility and stability to reduce food insecurity through various agricultural initiatives. MAF supports the rollout of nutrition sensitive agricultural initiatives that promotes a wide range of agricultural activities such as promoting HGs as one of the vital interventions. Most rural subsistence farmers contribute to the agrarian economy and have some kind of HG for some months of the year (MAF, 2017). Despite of such effort and reasonable policy statement integrated through multi sectors, long running, sustained economic growth in past 20 years pre COVID. Food insecurity and malnutrition remain persistently entrenched in Laos (ACIAR 2022). Investigation and evaluating intervention like HG that aim at reducing food insecurity has a high relevance in the field of the research.

Home Garden's Role in Tackling Food Insecurity: Numerous studies have shown that HGs increase food access, availability, utilisation and stability which contributes to regular food supplies to food insecure HHs and makes a positive contribution to towards HH food security and improving family nutrition (Ghassan et al., 2019; Osei et al., 2017; Galhena et al., 2013, Akrofi, 2012, Shrestha et al., 2004). It is argued that HGs have the potential to improve HH dietary diversification, enhance the quality of dietary intake as HGs increase access and availability to diverse plant based edible crops increasing HH food stability (MoH, 2020).

HGs also have a significant potential to increase access, availability and utilization of diverse foods and contribute to HH food security and increase essential dietary micronutrients.

HHs with HGs have access to a wider variety of crops and are able to address micronutrient deficiency and improve HH food utilization behaviors. Micronutrient deficiency is quite common and prevalent in developing countries (Kalle & Headey, 2018), with an estimation of 2 billion people globally living with micronutrient deficiencies, lacking in essential vitamins A, iron, and zinc (Beal et al., 2017). Good nutrition is essential for cognitive and physical development of children and crucial for pregnant and lactating women (UNICEF, 2021); thus, it is important for HHs to access and consume food from diverse food groups. HGs can provide a number of vegetables, fruits, herbs and grains that provides key nutrients essential for improved nutrition such as vitamins A (beta-carotene), C and E, magnesium, zinc, phosphorous and folic acid (Vic. Gov, 2021).

Interestingly, there is also a trend in developed countries to promote urban population resilience and access to food within the city and urban settings through HG (Bjorn, 2019). Urban settles are choosing to grow their own food because it is healthier, tastier, saves money and is available and accessible, contributing to the HH's food security, family health, and financial savings (Poppy, 2014). Developed countries are also interested in how urban agriculture can be integrated into urban planning strategies and plans to improve social, health and well-being of citizens (Chethika et al., 2021). HG connections to improve human health is found and promoted in both developed and developing countries (Poppy, 2014; Galhena et al., 2013, Akrofi, 2012, Shrestha et al., 2004).

Home Garden Limitation: Although HG provide additional food sources, they are not usually the primary source of food, and HG alone cannot address all food and nutritional needs of a HH. Numerous studies have found that even amongst most of Laos upland farming HHs, more than half of a HH's food is collected and purchased (Bartlett 2012) with stable food such as rice coming from their seasonal rice paddy. Upland farmers also depend on collection, gathering, and hunting of food while poorer HHs are more dependent on foraging (Foppes & Ketphone, 1997). Poorer HHs are also reliant on non-timber forest products (NTFP) from their local forest and fish from their local rivers or ponds which are another essential food source (Openshaw & Trethewie, 2006). However, these food sources are becoming scare due to unsustainable practices, overuse, loss of forest coverage and climate change impacts (Agrawal, 2007). This study will add evidence and demonstrate the need to optimize and protect existing food sources for rural upland vulnerable farmer HHs (UN, 2021). Even though most upland farmers are subsistence, their current food needs are not met by what they produce through HG or rice paddy farming, as they still rely on multiple other sources to meet their HH food needs

(MAF, 2021). Upland farmers are seasonally experiencing food shortages, and they are taking a number of steps to cope with food shortages such as borrowing cash, rice, or food from others, collecting food from the forest and rivers, and eating less (Bartlett, 2012). Vulnerable HHs often need to take drastic measures to respond to financial, social, and environmental shocks by selling assets, reducing food consumption, cutting back on health and education expenditure, borrowing food or cash from others (Hart 2009). This makes them even more vulnerable and often causes long-lasting negative effects as they fall deeper into poverty (FAO, 2010) which has a flow-on effect of further neglect of the needs of children, women, and people of disability. For such HHs HGs are an essential resource that provides a number of diverse plant-based food and provided added buffer to food security. While HG is an important food source alone it cannot address complex food insecurity on its own and require comprehensive holistic approach.

Vulnerable Population at a High Risk to Food Insecurity: Food security and insecurity are intrinsically connected, interrelated and multidimensional complex challenges affecting HH's food availability, access, utilization and stability globally. However, the developing nation such as Laos are at a higher risk and exposed to food insecurity. The vast majority of the population are subsistence farmers who are highly dependent on farm produce that contributes to HH food and nutrition. Due to this nature of dependency, they are experiencing food insecurity and are highly susceptible to financial, social, health, environmental or political shocks making them vulnerable. Governments, donor partners and NGOs across the globe recognize the challenges of vulnerable HHs and promote various agriculture and livelihood initiatives to improve food security and reduce vulnerability. Among such initiatives HGs are perceived to be one of the important interventions that has the potential to contribute to regular food supplies, improve food security and nutrition especially among poor and vulnerable HHs. This thesis provides various aspects of investigation and evaluation of HGs characteristics and its interrelationship with food security. This will help practitioners and HHs on how to optimize their home gardening practices, foster innovative methods, and improve HH food production that will contribute to reducing food insecurity.

CHAPTER 3: RESEARCH METHODOLGY

3.1. Research Methodology

The research used a mixed research methodology using quantitative and qualitative methods of data collection and data analysis. The researcher collected primary qualitative and quantitative data between October and November 2022. This included 3 focus group discussions, 13 key informant interviews, and 30 in-depth interviews from 3 vulnerable groups. The research obtained food security project data from ADRA Lao's PICRAIL project. The research utilised project HH survey data collected at 3 distinct points in time: baseline, midterm, and end-of-project HH surveys conducted as part of the PICRAIL initiative. The research followed research code of ethics (USQ 2019) and obtained human research ethic committee approval (H22REA115) before conducting the research**.**

The data was used to obtain 2 key objectives of the research (Figure 6). First, to assess HG characteristics and second, to evaluate HGs relationship to HH food security amongst 3 types of upland vulnerable HHs. The collected data was synthesised, analysed, interpreted and

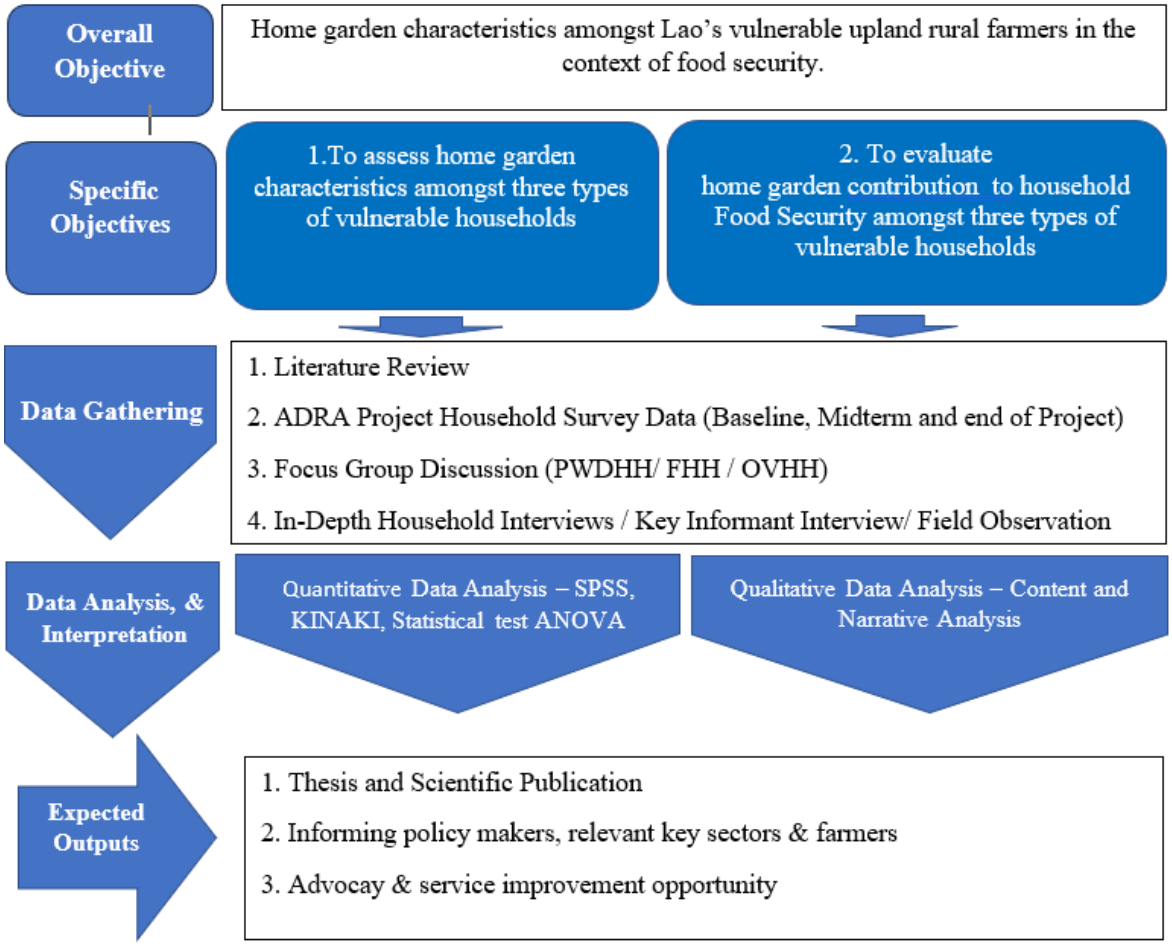

Figure 6. Research process

appropriate statistical tests were applied as necessary. The findings of the research are also submitted in Q1 Journal for each specific objective.

3.2. Research Study Area

The study was conducted in 16 rural upland villages of Phoukoud District, XiengKhouang Province of Lao PDR, whereby 97% (97% PWD and OVHH, 92% FHHH) of the population are found to be subsistence farming HHs (ADRA Laos 2023). The study area is primarily mountainous with some plateaus (Phetsakhone, et al. 2021). It is characterised by its rolling hills and grassland and defined to have two seasons: the dry season and the wet season (CDE, 2018). The dry season begins in November and lasts until late April, while the wet season typically runs from May through to October. Often the dry season between November and January is colder, with weather warming from February onwards.

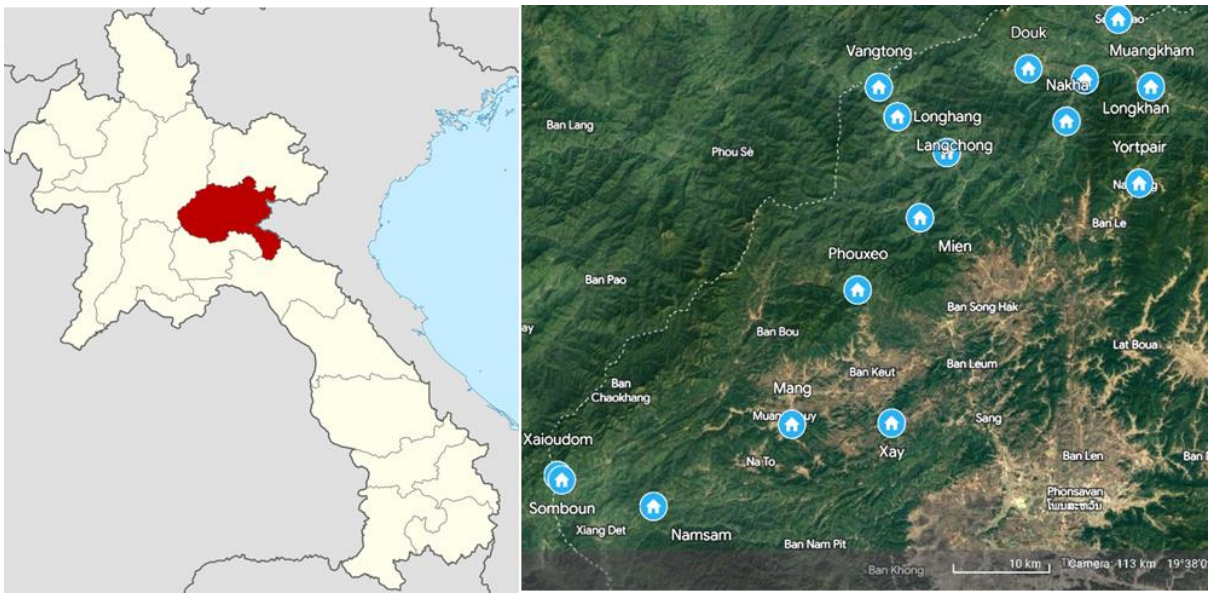

Figure 7 Google image of the study area, 16 villages of Phoukoud District (highlighted in white house symbol), Xiengkhouang province (red), Lao PDR (cream).

Many of the farming HHs practice shifting cultivation and rotating cultivation. Shifting cultivation also known as "swidden" or sometimes "slash-and-burn agriculture" has been practiced for centuries, however there is a wide and open debate around the sustainability, productivity, inefficient use of land, human resources and deforestation (CDE, 2018). Shifting cultivation practices have been discouraged by the local government (Fujita and Phanvilay, 2008) but recently the government has promoted rotational cultivation to support cultural practices that involves a three-plot approach with shorter fallow periods. This approach is also highly questionable with regards to sustainability. Such burning practices are found amongst

some HHs as a cultural and traditional practice to clear the vegetation in preparation of planting a HG.

These farmer HHs are mostly small landholders, with only a small percentage of HHs having access to diverse sources of income opportunities. The HHs livelihoods are primarily dependant on cultivation, and livestock and poultry raising. Poultry and small animals are often left free during the day and fed with maize grains bought at the local market. Whereas cattle are mainly left to graze along pastureland or along the side of roads with some cattle having access to local or improved forage grass, and some being fattened for production for commercial purposes (Paul et al., 2022). Livestock are generally kept for HH consumption or as an asset in case of a need for sudden cash, thus this nature of subsistence dependency to livelihoods of HHs makes them vulnerable. They also experience various other dimensions of vulnerability such as being geographically remote, having poor access to key services, HHs experiencing seasonal food insecurity, financial hardship, high prevalence of malnutrition amongst children, (Marin-Ferrer, 2017) and they are exposed to natural disasters.

Phoukoud District also has a high rate of food insecurity, poverty and a higher rate of children under 5 are chronically malnourished (ADRA Laos, 2023; NIPN 2023; World Bank, 2020; MAF, 2018). The study site is also exposed to significant unexploded ordinance contamination that continues to injure people and occasionally there is loss of life (MAG, 2021). These HHs are also resource poor, experience various financial and health risks, have low coping and adaptive capacity to natural disasters, and are exposed to climate change adverse effects (ADRA Laos 2023; MAF, 2017; UNDP, 2009).

Study Area							
No.	**Village**	**No.**	**Village**	**No.**	**Village**	**No.**	**Village**
1	Muangkham	5	Namsam	9	Nakha	13	Longkhan
2	Xai	6	Douk	10	Phouxell	14	Sopkhau
3	Somboun	7	Mang	11	Yortpare	15	Mien
4	Longhang	8	Langchong	12	Xayoudom	16	Vantong

Table 1 Study area Phoukoud District 16 villages, Xiengkhoung Province, Lao PDR

3.3. Data Collection and Analysis

3.3.1. ***Project Household Survey Data Collection:*** An average HH size was estimated as 5 people per HH at the time of the survey, with the reference used from Lao Statistics Bureau (LBS 2018). Once the PICRAIL project identified its target HHs 835 it used a systematic random selection process to generate the sample, with a sample size overall of 835 target HHs applying Cochran (1963) formula to obtain a 95 percent confidence interval and margin of error of 5 percent (ADRA Laos 2019). However, the project sample size was larger than recommended by Cochran formula to mitigate the possibilities of decline and absentees from HHs to the survey. The first data set was collected in 2019 for the baseline with 504 HHs (168 PWDHH, 75 FHHH and 261 OVHH). The second data set was collected in 2021 among 425 HHs (135 PWDHH, 24 FHHH and 266 OVHH) and the final data set was collected in 2022 at the end of the project with 434 HHs (71 PWDHH, 13 FHHH and 350 OVHH), out of a total of 835 target HHs.

The HH survey questionnaires were designed to inform ADRA's project impact matrix and not all collected data was relevant for this study. Thus, this study only used what is relevant such as information of demographic characteristics, food security and coping methods, income generating opportunities, home gardening practices, seed production and usage, and food storage and processing questions. The project data was analysed before the researcher collected primary data to investigate the findings, and then used information to triangulate the researcher's own interviews.

PICRAIL Project target households from 16 villages of Phoukoud District.		
Types of households	Number of HH	% of HH
PWDHH	235	28%
FHHH	45	5%
OVHH	555	67%
Total	**835 HH**	**100%**
2019 household survey sample size generated through systematic random selection		
PWDHH	168	33%
FHHH	75	15%
OVHH	261	52%
Total	**504 HH**	**100%**
2021 household survey sample size generated through systematic random selection		
PWDHH	135	32%
FHHH	24	7%
OVHH	266	61%

Total	**425 HH**	**100%**
2022 household survey sample size generated through systematic random selection		
PWDHH	71	16%
FHHH	13	3%
OVHH	350	81%
Total	**435 HH**	**100%**
Survey sample size obtain 95 % confidence level based on Cochran formula population size (ADRA Laos reports 2021).		

Table 2. Project target household surveys of 16 villages in Phoukoud District conducted in 2019, 2021 and 2022. respondent sample sizes generated through systematic random selection out of total 835 HHs.

The questionnaire comprised closed-ended questions using single response with single choice, multiple choice with multiple response, multiple choice with single response, and numerical values. The full questionnaires of the HH survey are attached for your pursual (Appendix A).

The study primarily investigated the HG characteristics and food insecurity condition and how HGs contributed to food security among the 3 specified vulnerable HHs.

To determine *home garden characteristics* the following key topics were assessed

- HG status, size, proximity and crop production.
- HG management harvested crops usage, diversity, preference, gardening methods and seed.
- HG applied methods, challenges and opportunities.

To determine *home garden contributions* in relation to *food security*, the following criteria were evaluated of the data collected between 2019 to 2022 HH survey

- HG, its deterrent factors and increase in the number of new HGs.
- Plant based crops varieties grown in HG.
- Monthly HG crop harvested record among vulnerable HHs.
- HG crop harvested and surplus usage among vulnerable HHs.
- Types of crops stored and preserved for future food consumption.
- Food shortage examined to determine food availability, access and stability experienced by household members in the past 12 months and 4 weeks at the time of the HH survey.

- Food utilisation is examined through applying HH diet diversity of an ordinary day by examining 24 hours food consumption record.
- Food shortage coping methods applied to gauge food severity and HH strategies.

The criteria applied to determine whether the vulnerable HH are food secure or food insecure assessing the availability, access, utilisation and stability of the food supplies (FAO, 2018; Bickel, 2000).

- Food secure - HH shows no evidence of food insecurity.
- Food insecure without hunger - Food insecurity is evident in HH members' comments about adequacy of HH food supply, and in adjustments to HH food management, including reduced quality of food and increased unusual coping patterns. Little or no reduction in HH members' food intake is reported.
- Food insecure with hunger - Food intake for adults in the HH has been reduced to an extent that implies that adults have repeatedly experienced the physical sensation of hunger (Bickel, 2000).
- Food quality – 24 hours food consumption of adults in the HH who consumed food varieties from a minimum of 5 food groups from 10 food groups in an ordinary day (FAO, 2021; FANTA, 2002). This provided the information on HH diet diversity (HDD) enabling the food quality consumed by vulnerable HHs to be gauged.

The questions are provided in supplementary files that are used to investigate food insecurity criteria and data extracted from the HH surveys.

3.3.2 Researcher Data Collection:

The study applied numerous methods including key informant interviews (n=13), three focus group discussions (n=43) including one for each type of vulnerable HH and one mixed group, in-depth HH interviews (n=30), and field observation of HG. Data was collected with the support of an experience ADRA Program Officer who helped review the questionnaire to ensure the questions were contextual; acted as an interpreter, and validated the final notes to ensure that the documentation of the notes was accurately representative. The interviews were conducted amongst all key study participants upon

their approved consent form to ensure the purpose and use of interviews was clearly articulated.

Key Informant Interviews (KII): A total of 13 key informants (12 men and 1 woman) were interviewed at the study area. Key informants were selected based on their expertise, experience and relevance of who had significant subject matter technical knowledge and actively engaged in agriculture and HG activities or was a leader overseeing the work in their community. Based on this, we were able to interview 3 government key technical staff who implemented and supported the cultivation initiatives. There were 5 Civil Societies Organisation (CSO) technical experts who were also implementing HG activities in their projects. Five village chiefs who were supporting the project and overseeing their communities in promoting HG activities.

KII used open ended questions and took between 40 minutes to 60 minutes to complete. The thesis objectives specific questionnaire was applied with numerous probing techniques to delve deeper to find specific information, where needed. There were 3 units of 21 questions that informed the thesis key specific objectives. The questions for these interviews explored the policy and program level response and how these key influencers perceived the strategic responses and how it is addressing the current challenges of food insecurity and the impact in their province, district, and village. What kinds of programs and initiatives are implemented and what resources are allocated and available to address the vulnerable HHs agricultural challenges. The detailed interview questions of KII are found at **Appendix A**.

KII provided technical perception and interpretation (LeCompte & Schensul 1991) of sector experts. The researcher took detailed notes of each interview and the information provided strategic perspectives from the leadership, service deliverers, and experts who are responsible for improving service delivery and can advocate for their constituents. The data was later analysed by applying content analysis methods (Bernard 2003) and specific themes were highlighted and investigated that were relevant and informed the research topic and its specific objectives.

Focus Group Discussion (FDG): There were 43 participants (11men and 32 women) from 4 villages who were engaged in 3 FGDs. All participants had HGs and were supported by the project. The 3 FGDs were conducted separately for FHHH group of

women only, PWDHH group (mixed group of both men and women), OVHH group (mixed group men and women). Due to the nature of FGD target participant characteristics, the selection of villages had some limitation as the targeted groups were spread across the 16 villages thus the villages with the highest number of PWD families and FHHHs were chosen to ensure each FGD had an adequate number of people and was logistically manageable and within the limitation of available resources.

The FGDs asked 9 open ended questions and conducted 2 participatory activity tools, the crop calendar of HG, and the weather, seasonal patterns, climate impacts, and natural disasters noticed and experienced in the community over the past 4 years (ADRA 2011). This provided an opportunity to explore first-hand experiences and perceptions of each target group and gather a collective narrative and information. The first participatory activity collected information of crops, plants and trees found in the HGs and identified when those crops were planted and harvested. The second activity collected various climate exposure of the community such as in temperature, seasonal change, extreme weather, rainfall, drought, crop failures, pestilences and frost.

Once the mapping was done then further discussion was conducted around coping methods, adaptive measures, and how it has affected their HG, family nutrition and food security.The detailed questions of FGD are found at **Appendix B**.

In-depth Household Interview: Thirty participants from 3 vulnerable HHs (10 PWDHH, 10 FHHH and 10 OVHH) from 12 villages were interviewed, 22 women and 8 men. The study aimed to interview 50%, women 50% men but due to attendance and logistical challenges there was a deviation to the original intention. The interviews substantially helped unpack the opinions, experiences, and practices, and allowed a deeper understanding of the context and perspective.

There were 17 questionnaire units that informed the thesis' specific objectives, with objectives 1 having 4 units that investigated HG characteristics with 21 questions. The questions investigated HG crop diversity and utilisation, HH members roles and responsibilities on managing HGs, decision making on agriculture practices, crop selection, and seed usage. This helped define and characterize the upland farmer HG and provided supplementary information to further examine the project HH survey findings.

Objective 2 had 4 units with 10 questions that investigated how HG contributed to nutrition and food security. These units consisted of food insecurity, cropping

methods, and how HGs contributed to food security, nutrition, and crops and plant usage. There were also 9 other units with 18 questions that investigated community awareness of climate change, how it is affecting home gardening practices, how they are changing to climate variability, water usage and management, soil, crop and ecological pest management, seed and grain storage, and adaptive and successive traditional practices. The detailed questions of in-depth interviews are found at Appendix C.

Field Observation: The researcher visited a number of HGs and took photos and made notes. This added value to the research as we were able to touch and feel the garden, their crops and saw where it was located and how it looked. It also helped us to validate and cross reference some of the themes that were generated during the in-depth interviews and FGDs.

Key informant interview (13 participants)				
	Key Stakeholders		Men	Women
1	Government technical expert (Provincial and District Agriculture and Forestry Office)		3	0
2	Local Civil Societies Organisations (SAEDA, CASE, ADRA)		4	1
3	Village chiefs (5 villages)		5	0
Focus group discussion (43 participants) from 4 villages				
	Village FGD	PWDHH	FHHH	OVHH
1	Xay and Nakha villages – FHHH group	0	12	0
2	Yotpae village – OVHH group	0	0	7 (1men)
3	Namsam village – PWDHH group	24 (10 men)	0	0
In- depth Interviews of (30 participants) from 12 villages				
	Village Name	PWDHH	FHHH	OVHH
1	Xay	0	0	2
2	Duk	3	3	0
3	Vangtong	0	1	1
4	Longkhan	1	3	0
5	Longchong	0	0	2
6	Mang	2	1	0
7	Nakha	1	0	0
8	Xaiodum	2	1	0
9	Namsam	0	0	2
10	Vangtong	0	1	1
11	Yotpae	0	0	2
12	Mungkham	1	1	0
		10	**10**	**10**

Table 3. Researcher data collection from KII, FGD and In-depth Interviews in Phoukoud District, Xiengkhoung Province

3.3.3. Analysis of Data

Quantitative data was analysed applying Kinaki software, Excel spreadsheets, and appropriate statistical tests (t-tests and ANOVA) to determine whether there is a statistically significant difference between the different types of HHs. The initial project HH survey data findings were examined before and after the collection of the researchers own primary data. This provided an opportunity in the revision of key statistical findings to further verify and cross examine the findings and understand the nuances through qualitative engagement. As quantitative data cannot capture the depth of the subject matter under investigation, qualitative analysis was performed to gain insights into the 'why' and 'how' things happen and to achieve a deeper understanding of issues related to the research objectives and findings. The FGDs, KII, field observation and in-depth interviews provided us this opportunity. The interviews were carefully noted and verified where verification was required at the time of qualitative engagement. Then the *Qualitative data* was analysed by applying content analysis methods (Bernard, 2003). The data was examined with the frequency of key words and phrases, the characteristics of people and groups who produced or appeared in the texts, and the presence of key themes that were highlighted during the engagement. These methods enabled the researcher to find patterns and themes which helped draw conclusions in response to the research questions. Qualitative findings were also used to cross reference project data findings. Finally, the research results were then presented as descriptive statistic, inferential statistic and content analysis within the scope of the research aims and objectives.

CHAPTER 4: RESULT

4.1 Home Garden Characteristics

The result for HG characteristics was generated by examining the data collected by the researcher between October to November 2022 (13 KIIs, 3 FGDs, 30 in-depth Interviews) and ADRA project data sets of 2021. The findings of the study were also submitted after the peer review from the journal *Springer, Food Security*. It is an interdisciplinary journal with the impact factor of 6.7 that aims at addressing the global challenges and constraints to achieving food security. The full submitted publication will be provided upon request.

4.1.1 Livelihood Characteristics Among Three Vulnerable Households

Based on the HH survey data (2021) findings amongst vulnerable HHs (n=425), 11 various livelihood activities and opportunities supported 3 types of vulnerable HHs livelihoods (figure 8). These activities are important to secure resources to support vulnerable HHs and the member's needs. The study found that on an average of 72.9% HH (82% FHHH, 73% OVHH and 70% PWDHH), were involved in crop cultivation with 37% HH (50% FHHH, 38% OVHH and 32% PWDHH) in livestock production making them the top two livelihood activities amongst vulnerable households. They are primarily agricultural dependent subsistence farmers. There were only 9.8% HHs (OVHH 10% and PWDHH 5%) and 5.2% HHs (7% PWDHH and 3% OVHH) of the vulnerable HHs from OVHH and PWDHH had access to

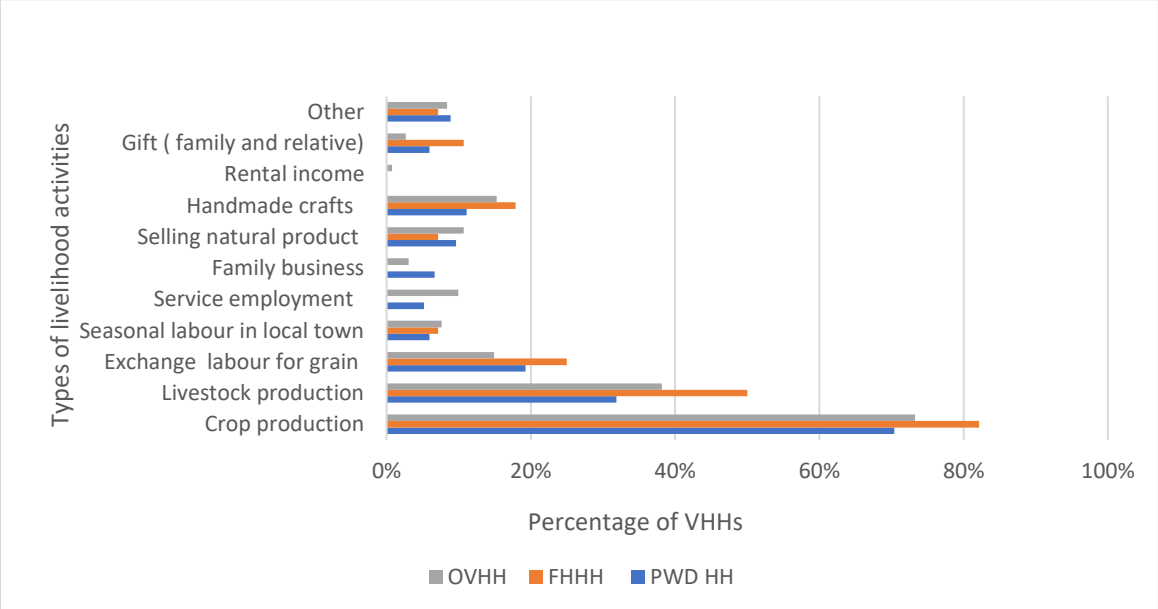

Figure 8. Types of livelihood activities found in 16 villages amongst 3 types of 425 VHHs, PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265) in Phoukoud District.

employment and business opportunities, but there were none from the FHHH. Also, out of 11 types of livelihood activities, FHHH were engaged in a total of 8 types, PWDHH in 10 and OVHH were in all 11 types of livelihood activities.

4.1.2 Home Garden Status, Size, Proximity and Crop Production

Among the respondents (n=425) on an average of 85% (87% PWDHH, 85% OVHH and 82% FHH) of HHs had a HG and 15% (18% FHH, 15% OVHH and 13% PWDHH) did not. There was no significant difference between the probability of having a HG based on the types of HHs, but the study found that there was a significant difference between various reasons that restricted vulnerable HHs for not able to have a HG (figure 9). The 3 types of HHs that did not have a HG (n=63) faced at least one barrier that deterred them from having a HG, with FHHHs facing multiple deterrent factors. On average 32% of FHHH experienced multiple deterrent factors compared to 25% OVHH and 22% PWDHH.

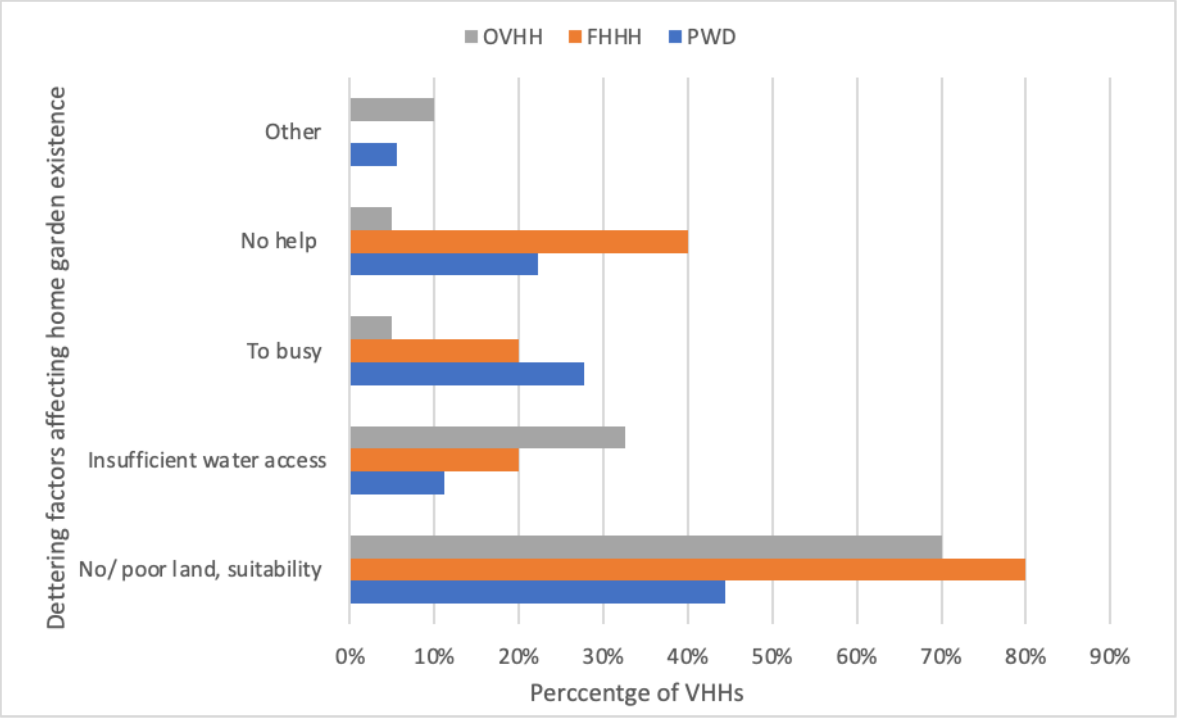

Figure 9. Home gardening deterrent factors among the three types of vulnerable households, PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265) from 16 villages of Phoukoud District, Lao.

The analysis of variance between the land size, proximity from home, and monthly average crop production among the 3 types of vulnerable HHs are displayed below (Table 4). On average FHHHs (n=10) HG are the furthest and significantly different with p value < 0.05 from

their home, whereas PWDHHs (n=10) HG are the closest to their home, smallest but harvested the most plant-based crops.

VHHs (n=30)	Monthly harvest in kilogram	Proximity from home in meters	Home garden area in m²
Average for PWDHH (n=10)	34.00 (SD= ±16)	19.00 (SD= ±46)	77.10 (SD= ±44)
Average of FHHH (n=10)	30.80 (SD= ±23)	145.00 (SD= ±136)	235.70 (SD= ±228)
Average of OVHH (n=10)	28.4 (SD=±23)	52.5 (SD= ±56)	153.1 (SD= ±81)
f value	0.17	5.31	3.11
p value	0.83	0.01	0.06

Table 4. Analysis of variance among the three types of vulnerable households, PWDHH (n= 10), FHH (n= 10) and OVHH (n= 10), from 16 villages of Phoukoud District, Lao.

4.1.3 Home Garden Crops Usage, Diversity and Practices

The study found that on an average 82% of all 3 types of vulnerable HHs (n=423) consumed harvested crops, with an average 29.6% of HHs selling surplus HG harvested crops (Table 5). 83 types of edible plant-based crops (n=30) from various groups were found in vulnerable HHs HGs, including root vegetables, grains and tubers, dark green vegetables, legumes and nuts, herbs, fruits and other vegetables (Appendix E). This included: 25 types of fruits, 19 types of herbs and spices, 13 types of other vegetables, 9 types of grains, root vegetables and tubers, 9 types of dark green vegetables, and 8 types of legumes and nuts. PWDHH HGs had 64 (77%), FHH 55 (66%) and OVHH 74 (89%) types of edible plant-based crops. Amongst them herbs and spices and dark green vegetables were the two most popular edible plant-based crops among all 3 types of vulnerable HHs. However, the overall crops planted varied amongst the vulnerable HHs, with 47% OVHH, 42.5% PWDHH and 36% FHHH, thus OVHH HG had the most different types of crops produced compared to FHHH HG which found a significant difference.

		N	Marginal Percentage
Types of HH	FHH	23	5.4%
	PWDHH	135	31.9%
	OVHH	265	62.6%
HG_Household consumption	NS	76	18.0%
	S	347	82.0%
HG_Surplus sold	NS	298	70.4%
	S	125	29.6%
HG_Processing and preserving	NS	381	90.1%
	S	42	9.9%
HG_used to produce seed	NS	351	83.0%
	S	72	17.0%
Valid		423	100.0%
Missing		2	
Total		425	
Subpopulation		11[a]	

a. The dependent variable has only one value observed in 1 (9.1%) subpopulations.

Table 5. Multinominal case processing summary among VHHs and their home garden harvested crop usage.

The study also found a difference of when each type of vulnerable HHs (n=425) harvested their HG crops. Between November, December, January and February, on

average 64% of vulnerable HHs harvested edible plant crops from their HG making these 4 months the most harvested months (figure 10). However, between March and October the harvest patterns among all 3 types of HHs decreased. The findings found that 39% of PWDHH, 38% of OVHH, and 35% of FHHH harvested crops every month over the past 12 months.

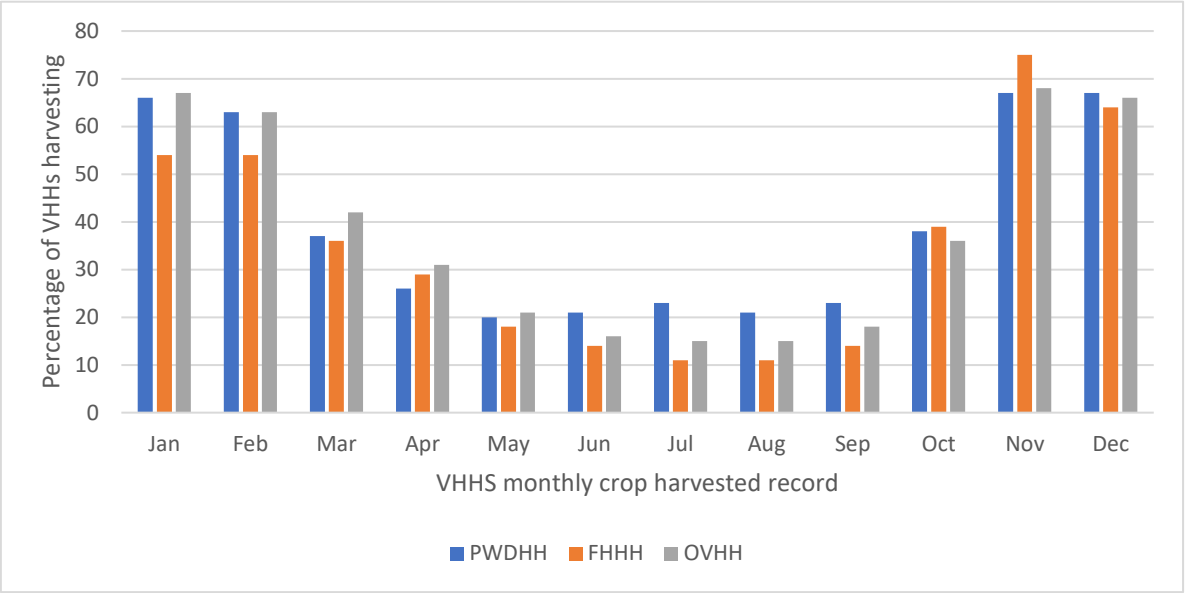

Figure 10. Vulnerable HHs(n=424) harvested record of their crops from HG in past 12 months amongst PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265) from 16 villages of Phoukoud District, Lao.

During the qualitative engagement numerous reasons were provided why so few planted and harvested all year round, with most highlighting the reason as "busy with preparing for their rice paddy" "exchanging labor" "busy with cash crops" and "harvest farm crops" thus respondent seemed to be too busy to look after their HGs. Some also stated that there is too much rain and they experienced issues with water logging which meant they could only grow a few types of crops in their HG between monsoon seasons.

Women were the main workforce and manager of the HG and the findings showed that FHHH spent 1.52 hrs., PWDHHs 1.43 hrs. and OVHHH 1.31 hrs. per day tending to their HG. "Men helped with some tasks such as fencing" but both men and women consistently stated that women looked after the HG with some respondent stating that men also helped sometimes. However, when it comes to managing the HG most of the men and women stated, "home garden is women's responsibility". Women also felt that they were in control of their HG and cultivated what they wanted, sold surplus and shared surplus when they could. A strong sense of control and ownership and pride was amongst many female home gardeners as comments show: "I'm happy to grow healthy and eat tasty food", "good feeling when we share crops to other family and friends" and "we get some money when we sell our crops".

Figure 11. Soil preparation for home garden among VHHs in study villages Naka, Mang and Namsam

The study explored various practice aspects of the HG (figure 12) and found that on average 83% of vulnerable HHs (84% PWDHH, 83% OVHH and FHH 82%) directly applied dried or fresh animal manure to their HG. The respondents also reiterated during qualitative engagement: “we used this animal manure, since I can remember”. The study also found that there was an average of 9% HHs (10% PWDHH, 10% OVHH and 4%FHHH) that applied compost while a further 4% PWDHH and 3% of OVHHs applied chemical fertilizer or pesticides, while FHHHs did not apply any chemicals on their HG.

Qualitative findings are consistent with HH survey results as most of the respondents stated they wanted to eat safe and natural organic food that is safe, tasty and healthy. Although this may not be the case for their cash crops, in their HGs they did not want any chemical inputs. The results also found that on average 30% of HHs (36% FHHH, 27% OVHH, 25% PWDHH) had access to water direct at their home, with on an average 56% HHs (64%

PWDHH, 54% OVHH, 50% FHHH) accessing water from pond or river. Practices such as mulching and intercropping in HG were also found low among vulnerable HHs.

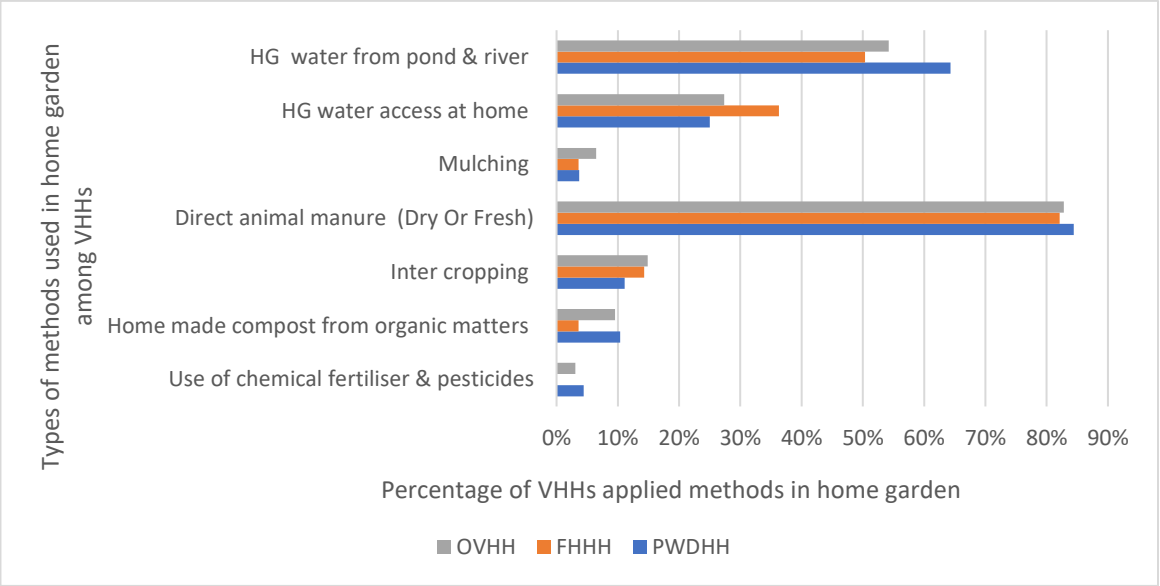

Figure 12. Vulnerable HHs applied methods in their home garden PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265) from 16 villages of Phoukoud District, Lao.

4.1.4 Home Garden Seed Management

Seed management was found to be another prominent HG characteristic amongst vulnerable HH, with 73% (75% OVHH, 74% PWDHH and 71% FHHH) of vulnerable HHs selecting, saving, and utilizing their own saved seeds from their HG (figure 13). They often stated repetitively in qualitative engagement "we mostly save and produce our own seeds" and "our seeds don't cost any money and the food tastes better". However, they also received seeds from friends, relatives, neighbors and bought seeds as well. In qualitative findings they stated, "we only buy hybrid seeds; newer types of crops seeds, and when we do not have enough seeds,

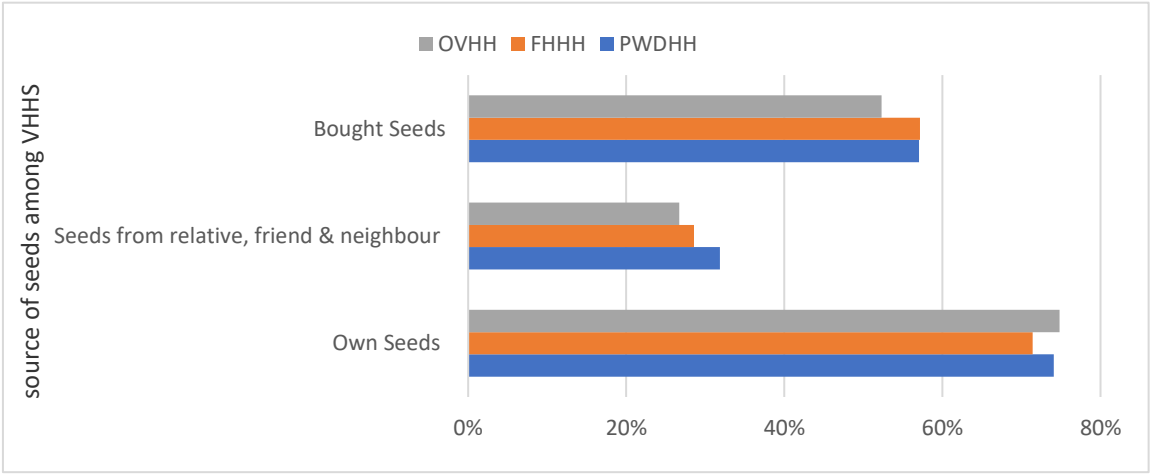

Figure 13. Sources of seed amongst 3 VHHs types

or we lose our saved seeds". While the HHs enjoyed their seeds and found it beneficial some concerns were raised about being needing to by hybrid seeds and some finding it easy to just buy when needed rather than saving them.

The study also examined how these vulnerable HHs stored and saved their seeds and found that on an average of 67% vulnerable HHs (75% FHHH, 66% OVHH and 61% PWDHH) stored seeds on bags made out of plastic, cloth and other materials (figure 14). The result indicates less than 10% of vulnerable HHs used methods of storing in vacuumed glass or plastic containers/jars (11% PWDHH, 9% FHHH and 10% OVHH). Only 4% OVHH and 1% PWDHH stored seeds with ashes and charcoal, but they applied all 6 methods of seed storing, while FHHH only applied 2 methods. The study also found that 81% of PWDHH, 79% of OVHH and 54% of FHHHs stored their seeds in a dry place without moisture, while 32% of FHHH, 5% of OVHH, and 4% of PWDHHs stored their seeds where sunlight was present.

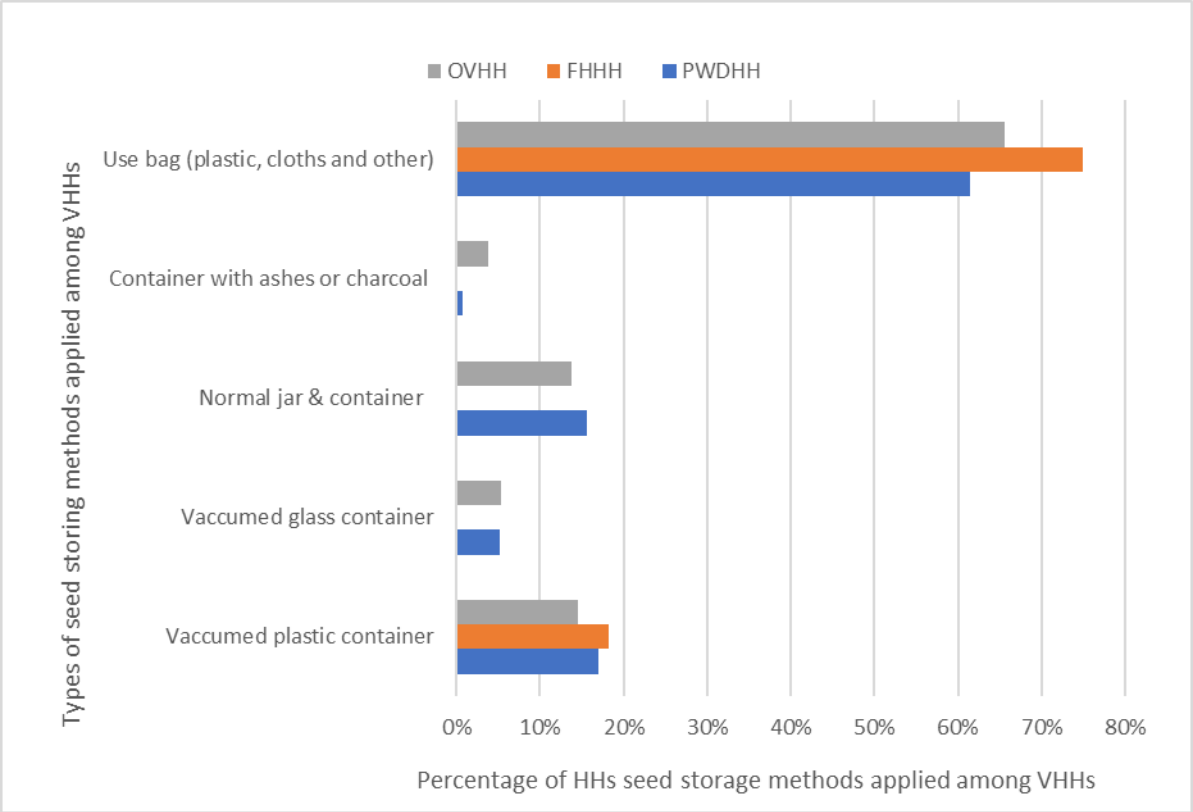

Figure 14. Seed storing methods applied among the three types of vulnerable households, PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265) from 16 villages of Phoukoud District, Lao.

Figure 15. Seed and crops drying and storing methods captured among vulnerable households in villages of Phoukoud District, Lao, Images taken during the data collection and in-depth interviews.

Home garden characteristics among three types of vulnerable households			
Description	**Results**		
	PWDHH	**FHHH**	**OVHH**
1. Average size of home garden (meter square) and home garden proximity			
Average home garden size in meter square	71.25 m²	195 m²	128 m²
Average home garden proximity from home	5 m	75 m	41 m
2. Edible plant-based crop diversities (83 types of crops were found among three types of HHs)			
VHHs types of crops found in their HG	64 (77%)	55 (68%)	74 (89%)
3. Time used daily, overall, for all = 1.42 hrs. per day			
Daily time used in home garden (n=30)	1.43 hrs.	1.52 hrs.	1.31 hrs.
4. Home garden management			
Home garden - fencing local resources	Mostly men except for FHHH if they have no men in their HHs		
Home garden preparation land clearing, & burning	Mostly women - mother, grandmother, daughter-in-law, daughter, etc., only in some cases men participated in breaking the soil and watering the garden but most of the respondent's stated HG are women's responsibility. Most of the HHs stated to be using traditional methods in HG with fewer applying newer learned practices such as, use of bio char, bio pest and bio extract etc.		
Soil preparation (soil breaking, preparing bed, covering bed with leaves and hay, burning, applying wet and dried manure			
Planting, mulching, weeding, watering			
Harvest crop usage - consume, sell & exchange			
Ownership of crops	Many women said they do what they like with the harvest, with some stating family collective ownership.		
5. Seed management			
Traditional practice	Seeds selection, saving and storing methods were passed down from the generations extremely valued practice		
Modern practice	Some new methods of seed storing (vacuumed jars) were practiced among some participants, benefits yet to be experienced since it is truly new		

Table 6. Summary of the Home Garden Characteristics derived from the results among the three types of vulnerable households, PWDHH (n= 135), FHH (n= 23) and OVHH (n= 265), from 16 villages of Phoukoud District, Lao

4.2. Food Insecurity and Home Garden Relation to Food Security

The study attempted to establish if vulnerable HHs experienced any food insecurity at the time of PICRAIL's baseline HH survey and if yes how many and how often they experienced various levels of food shortages by examining food shortage experience over the past 12 months and past 4 weeks, and the quality of food consumed in the past 24 hrs and what coping methods HHs took to cope with such an experience. Once this was established then the study examined the HGs role and how it interacted with the food insecurity comparing the HH result of the baseline survey to the end line survey. The results have been highlighted to make this correlation between HGs and food insecurity among 3 types of vulnerable HHs.

4.2.1 Food insecurity experienced in 12-month period

The research examined the food shortage experienced by FHHH, PWDHH and OVHHs at the time of PICRAIL's HH surveys in 2019, 2021 and 2022. The surveys gathered information on vulnerable HHs past 12 months food shortage experience at the time of the survey. The results demonstrate that on average 52% (57% FHHH, 54% PWDHH & 49% OVHH) of vulnerable HHs experienced food shortages at the 2019 baseline and 33% (54% FHHH, 45% PWDHH and 30% OVHH) at the 2022 end of project HH survey (figure 16). This data reveals a notable food shortage reduction of 19% across all 3 types of HHs.

However, when we delve deeper into the specifics of food shortage reduction among these HH types, a distinct pattern emerges. Firstly, it is evident that not all HH types

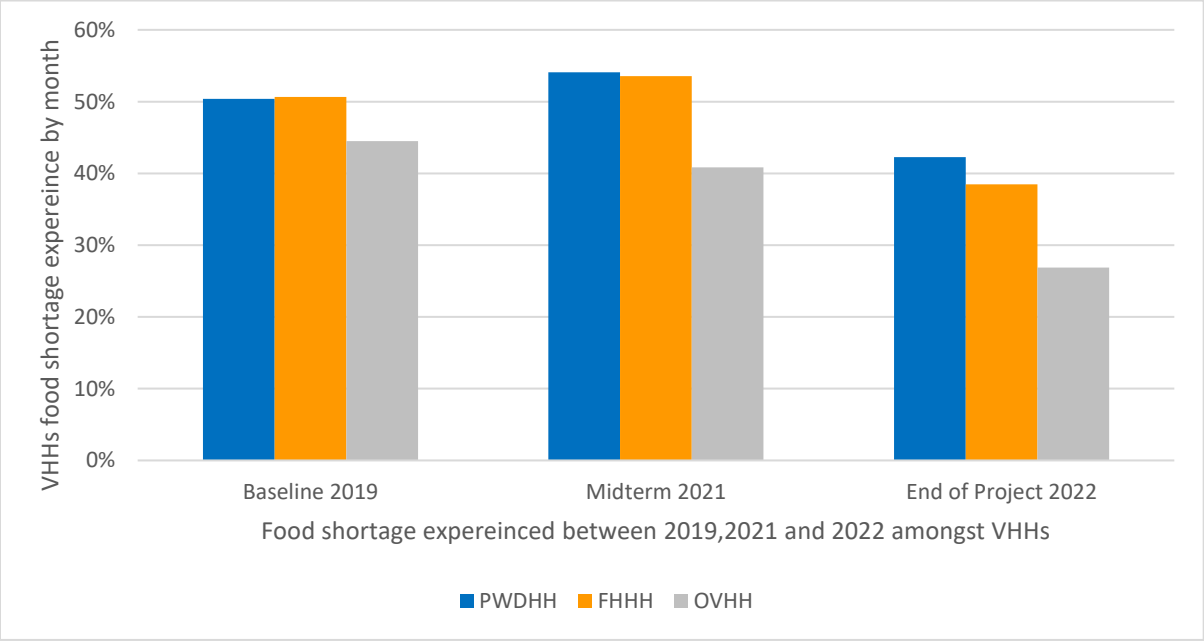

Figure 16. Monthly food shortage experienced in past 12 months at the 2019 (n=504),2021 (n= 425) and end of project 2022 (n= 434) HH survey demonstrates a decrease of food shortage experience at the end of 2022 among VHHs.

experienced the same degree of improvement. Amongst them, FHHH demonstrated the least reduction in food shortages, with a 3% decrease. In contrast, the PWDHH category showed a more substantial improvement, with a 9% reduction in food shortages. Remarkably, the OVHH category exhibited the most significant progress, boasting a noteworthy 19% reduction in food shortage experiences.

The study also found that among those food shortages 46% vulnerable HHs (50% PWDHH, 50.6% FHHH and 44% OVHH) experienced multiple months of food shortage at least a minimum of two months at the time of baseline 2019 and 30% VHHS (42% PWDHH, 38% FHHH and 27% OVHH) at the end of the project a reduction of 16% among all vulnerable HHs (figure 17).

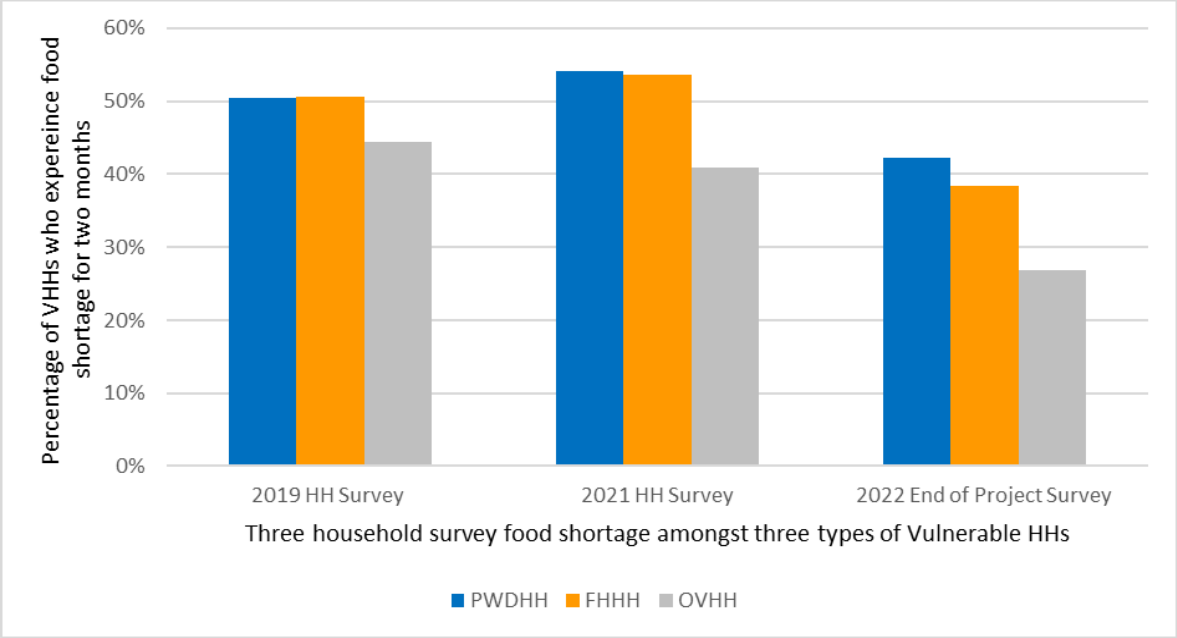

Figure 17. Food shortage experienced amongst all three types of vulnerable households for the minimum of 2 months in past 12 months at the 2019 (n=504),2021 (n= 425) and end of project 2022 (n= 434) household survey demonstrates a decrease of food shortage experience.

Nonetheless hunger and food shortage experiences are still prevalent in those communities even after the HG intervention amongst the HHs. The study also found that there were certain months where vulnerable HHs experienced more food shortage. While the above results demonstrate the experience of food shortages for vulnerable HHs we also examined which months were the worst and compared that to the initial HH survey data from 2019 and

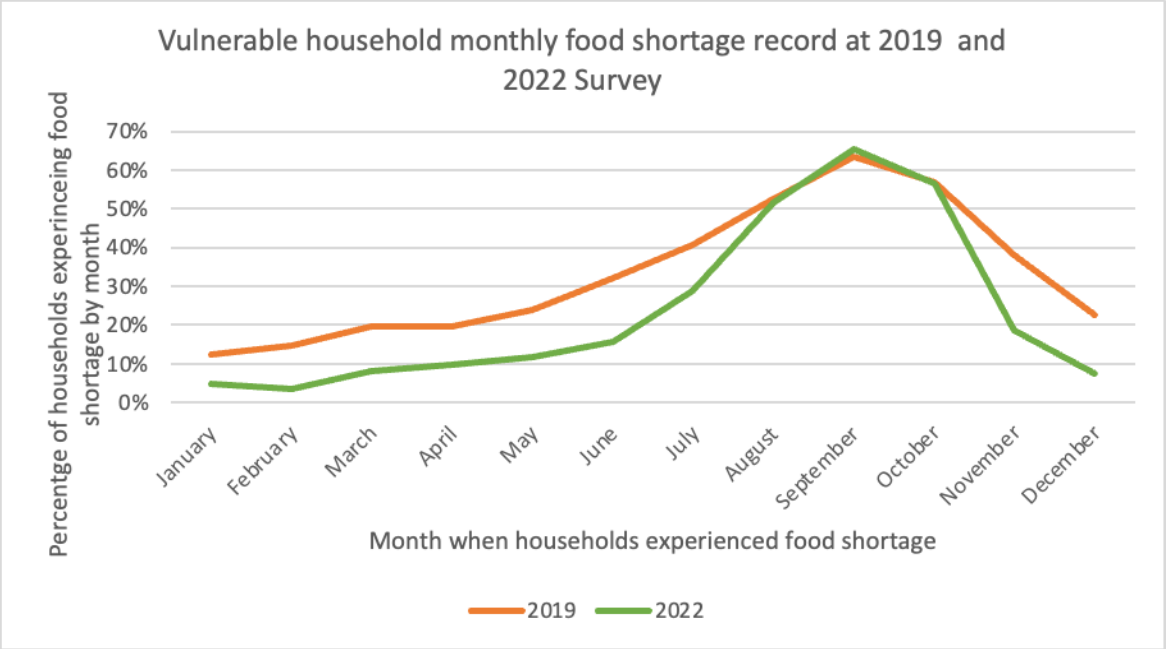

Figure 18. Percentage of households' monthly food shortage experienced in the past 12 months period recalled at 2019 (n=504) and 2022 (n=434) amongst three types of vulnerable household.

the end of the survey results in 2022. The results show (figure 18) that the months of August, September, and October were the months when the majority of vulnerable HHs experienced food shortage. Thus, these particular months can be characterized as having the most food scarcity, with higher percentages recorded across various HH categories.

Figure 19 shows a noteworthy pattern emerging when examining food security across different HH types. On average, 25% of PWDHHs and FHHHs found themselves grappling with food shortages during the crucial August to October period. In contrast, only 18% of OVHHs reported similar experiences, highlighting a comparative disadvantage of food security for PWDHH and FHHHs at the end of 2022.

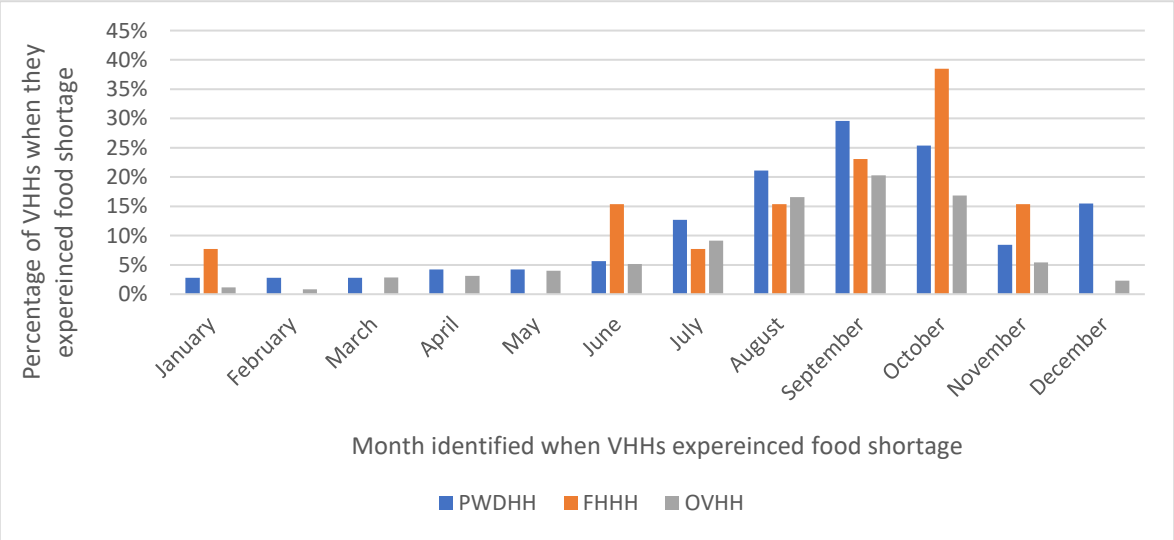

Figure 19. VHHs identifying months when, they experienced food shortage at the end of project 2022 (n= 434) household survey.

4.2.2 Food insecurity experienced among vulnerable households in past 4 weeks

The research examined the past 4 weeks food shortage experience amongst vulnerable HHs at the time of the HH surveys in 2019, 2021 and 2022. The study examined whether any HHs food shortage experience in the past 4 weeks led to any anxiety about food shortage, how often these concerns were experienced and how these HHs coped if there were food shortages such as skipping meals which often occurs when there is not sufficient food, due to the lack of food access, availability and stability.

The study results demonstrate on average 57% HHs (67% FHHH, 56% OVHH and 55% PWDHH) at baseline, 72% at midterm and 35% (46% FHHH, 44% PWDHH and 32% OVHH) at the end of the project were found to be anxious about the possibility of food shortage (figure 20).

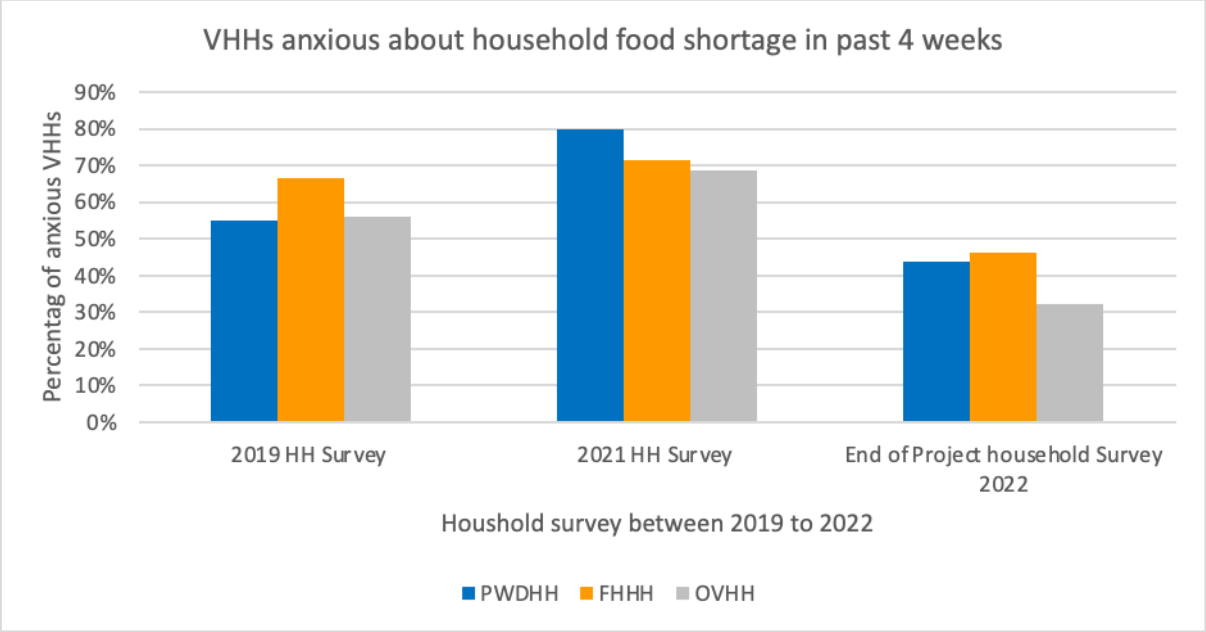

Figure 20. Percentage decreasing food shortage anxiety experienced amongst three types of vulnerable households in past 4 weeks at the time of baseline (n=504), midterm (n= 425) and end of project (n= 434) household survey.

The overall percentage at the end of the project demonstrates that HHs were less worried about food shortages but FHHH and PWDHH were still more worried then OVHH at the end of the project survey. The findings demonstrate that 35% of OVHHs actually worried about not having enough food whereas only 15% (31% FHHH, 25% PWDHH and 13% OVHH) skipped evening meals and went to bed without eating anything, with FHHH experiencing the most severe food shortages (figure 21).

The results show that the overall average of severe food insecurity experienced reduced to 15% (31% FHHH, 25% PWDHH & 13% OVHH) at the end of the project, compared to

2019 HH survey 33% and 2021 HH survey 37%, demonstrating a reduction of severe food insecurity amongst all 3 types of vulnerable HHs.

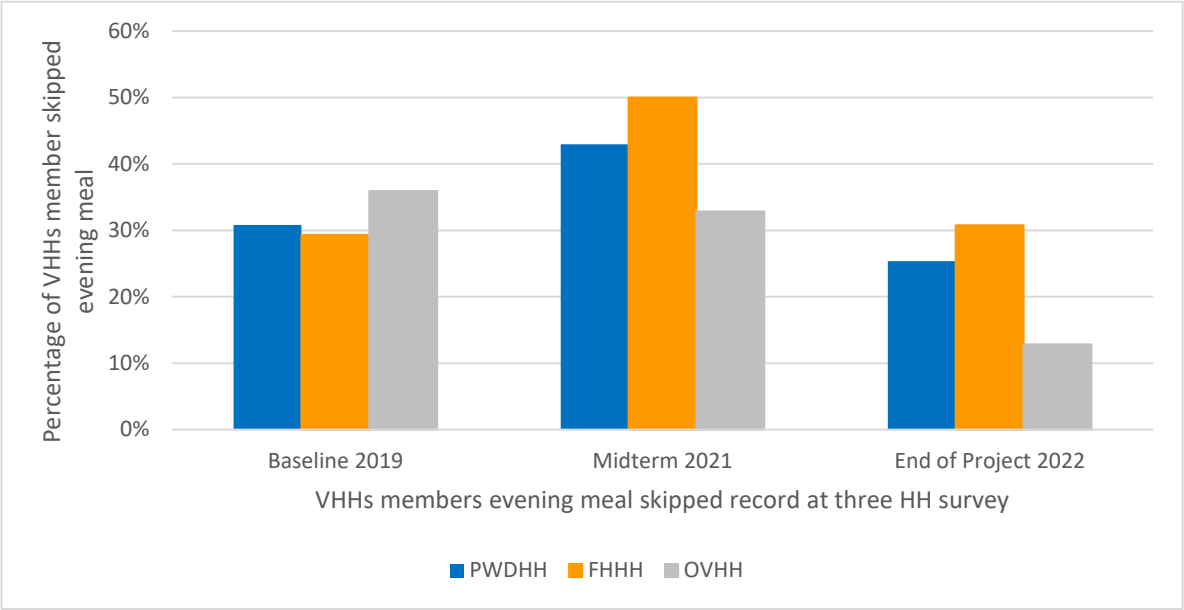

Figure 21. Percentage of VHHs decrease in meal skipping practices amongst three types of vulnerable households in past 4 weeks at the time of baseline, midterm and end of project household survey.

4.2.3 Food insecurity coping methods used amongst vulnerable households

Those who skipped meals in the past 4 weeks were also asked a follow up question to investigate how they coped with such food shortages. The findings highlight the diverse range of strategies employed by HHs to cope with food insecurity, with varying degrees of severity and impact on their food intake (figure 22). The results found 4% of vulnerable HHs (17% FHH, 6% PWDHH, and 3% OVHH) resorted to reducing the number of meals which indicates the dire circumstances faced by these HHs. A more substantial portion, constituting 27% (38% FHH, 28% OVHH, and 22% PWDHH) cut back on their food consumption, reflecting the critical need for immediate intervention and support. In addition to these measures, a significant 52% of HHs (59% PWDHH, 51% OVHH, and 33% FHH) resorted to collecting food from the forest. This foraging strategy highlights the resourcefulness of these HHs in accessing alternative food sources when facing food shortages. Furthermore, 43% of HHs (50% FHH, 44% PWDHH, and 43% OVHH) sought assistance from other family members. This collaborative approach underscores the importance of social support networks in times of food crisis. Interestingly, 32% of HHs (34% OVHH, 33% FHH, and 22% PWDHH) opted to sell their livestock. This decision indicates the extent to which HHs were willing to part with a valuable asset to secure food, while borrowing food was a common recourse for those facing food shortages. The findings reveal a multitude of strategies employed by the vulnerable HHs

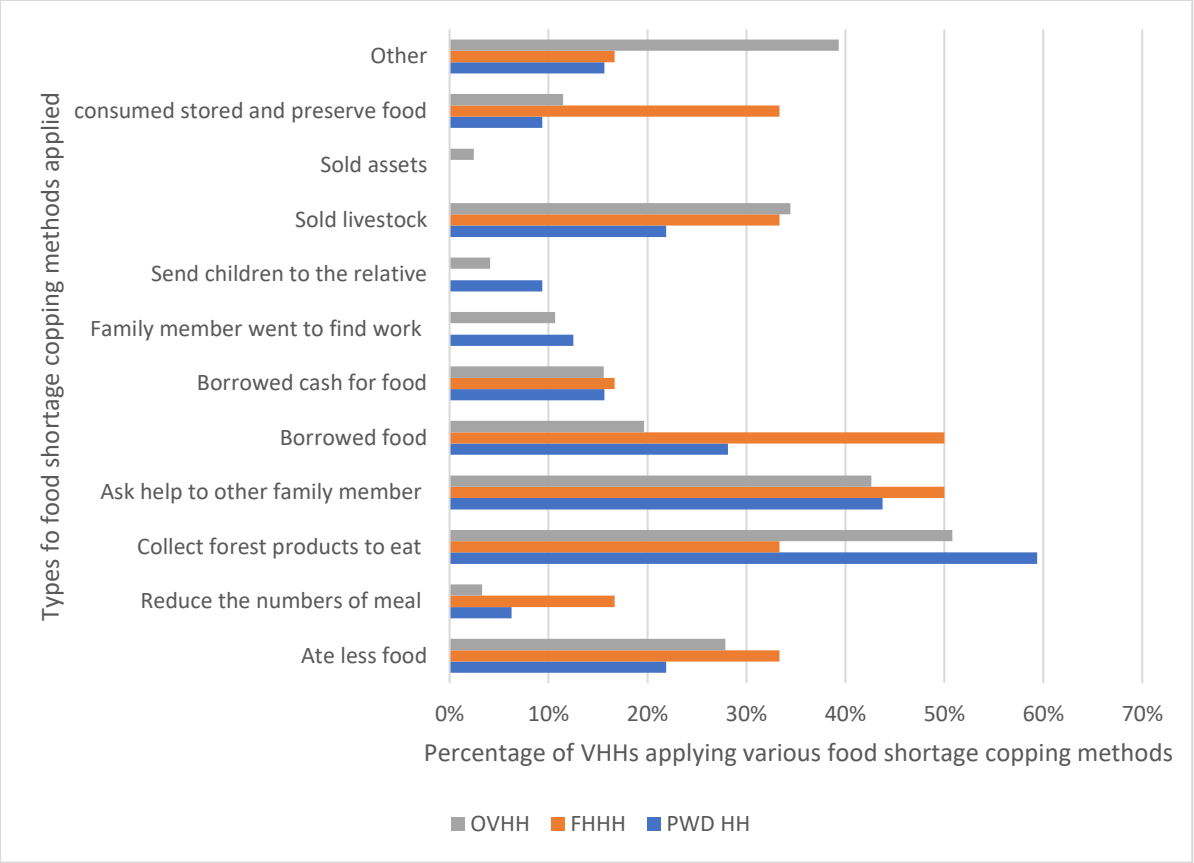

Figure 22. VHHs (n=160) applying various methods to cope with food shortage experience at the end of project HH survey conducted in 2022.

to combat food insecurity, ranging from relatively moderate adjustments to drastic measures. These findings accentuate the pressing need for targeted interventions and support systems to alleviate the hardships faced by these vulnerable HHs. The variables among the different HHs types underscore the diverse nature of food insecurity challenges faced by these groups. It also emphasizes that certain households, such as OVHH, have made remarkable strides in improving their food security situation, while others like FHHH have shown slower progress.

4.2.4 Food quality, vulnerable household food consumption record of past 24 hours

The research conducted an analysis of the dietary diversity within HHs over a 24-hour period, with the primary goal of assessing the nutritional quality of food consumed by HH members. The record was collected of the normal day eating habit that wasn't changed by special celebration, festival or function. The result demonstrates the improvement of HH food quality when comparing between the baseline to the end line results (figure 23). The results show 14% of HHs (17% FHH, 15% OVHH and 11% PWDHH) were consuming food from 5 food groups at the baseline compared to 62% (67% OVHH, 62% FHH and 41% PWDHH) at

the end of the project. Demonstrating, a significant improvement of 48% in food quality and diversity that members were consuming.

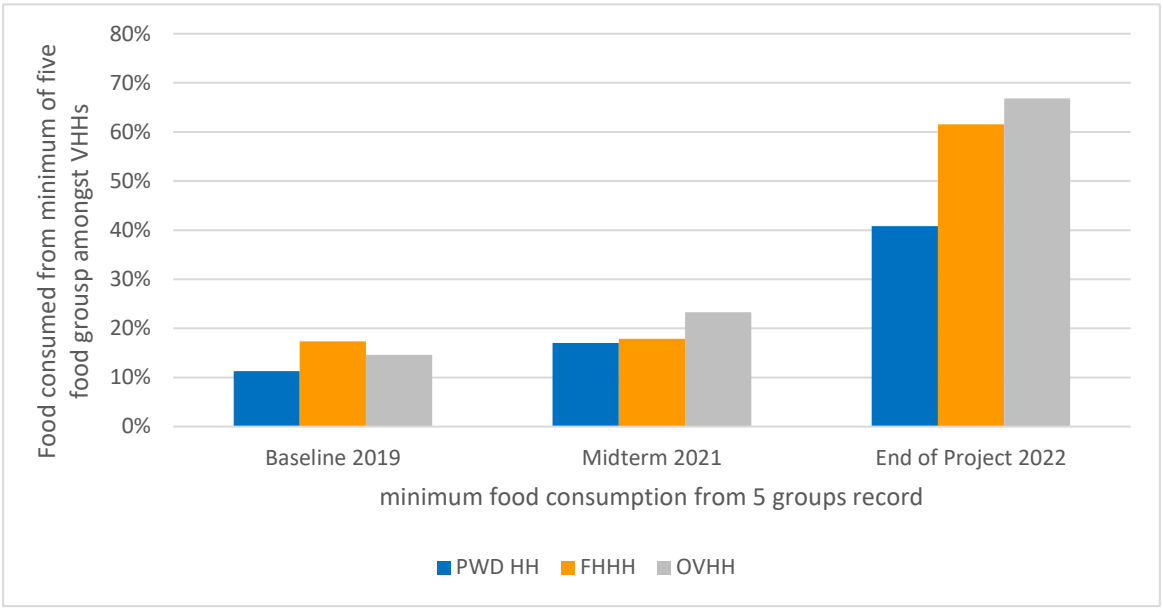

Figure23. VHHs minimum five food group consume record of past 24 hrs between 2019 (n=504),2021 (n= 425) and end of project 2022 (n= 434) HH survey, demonstrates significant improvement of household diet diversity among all three vulnerable HHs.

The detailed analysis of food quality at the end line survey is depicted (figure 24) which illustrates a profound transformation in HH dietary intake. Strikingly, 7 out of 10 food groups under scrutiny are rooted in plant-based crops, which have the potential to be cultivated and

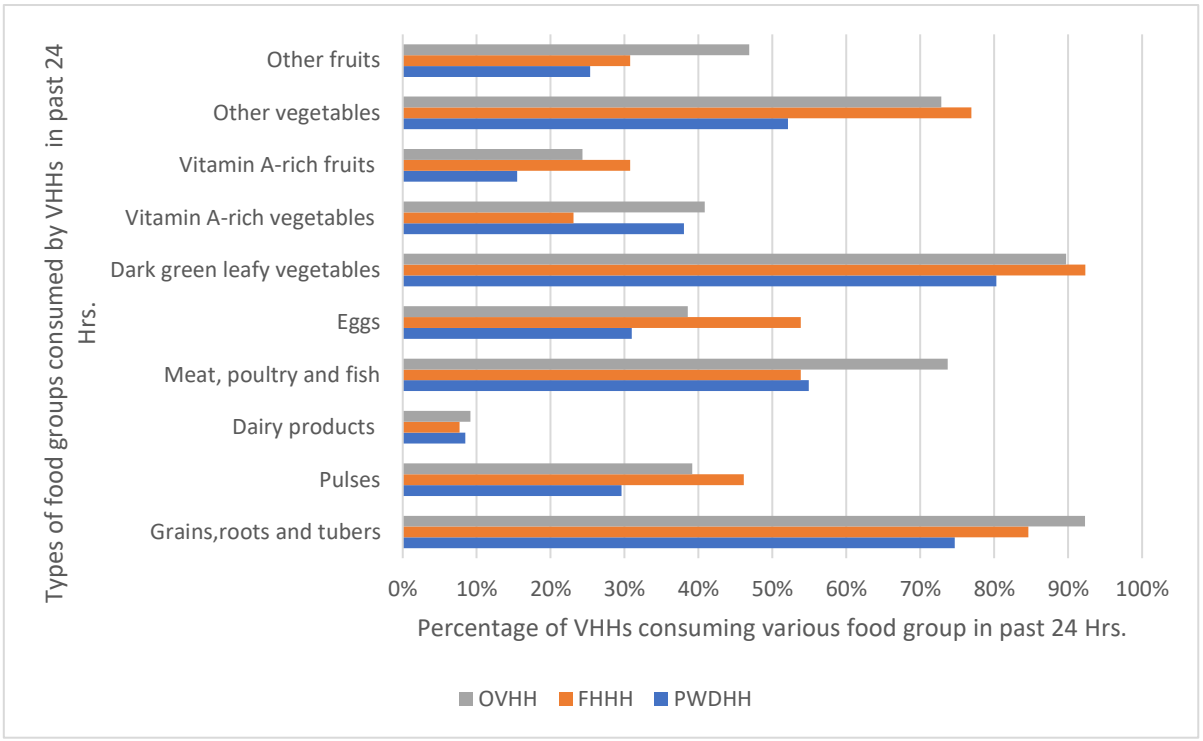

Figure 24. VHHs (n=434) food group consumption record of past 24 hrs at the end of project HH survey 2022

harvested right in one's own HG. While the issue of food insecurity continues to be a pressing challenge within these communities, it is promising to note that there has been gradual improvement across various criteria related to food security between 2019 and 2022. The result establishes the level of various food insecurity experience by all HHs and noted the reduction of food insecurity among vulnerable HHs. It is further examined below how HG have played a role in reducing food insecurity in target villages among vulnerable HHs.

4.2.5 Home gardens relation to food security

The study examined the presence of HGs amongst vulnerable HHs to understand its relationship with food production and food security. The study found a consistent growth in HG amongst all vulnerable HHs over the course of time. In the 2019 HH survey an average of 68% of HHs were engaged in home gardening (73% PWDHH, 70% OVHH, and 63% FHHH) (figure 25). As time progressed, there was a notable increase in home gardening participation across all HHs. In the 2021 HH survey the percentage had risen to an average of 80% (87% PWDHH, 82% for FHHH, and 78% OVHH). This demonstrates a substantial 29% increase in

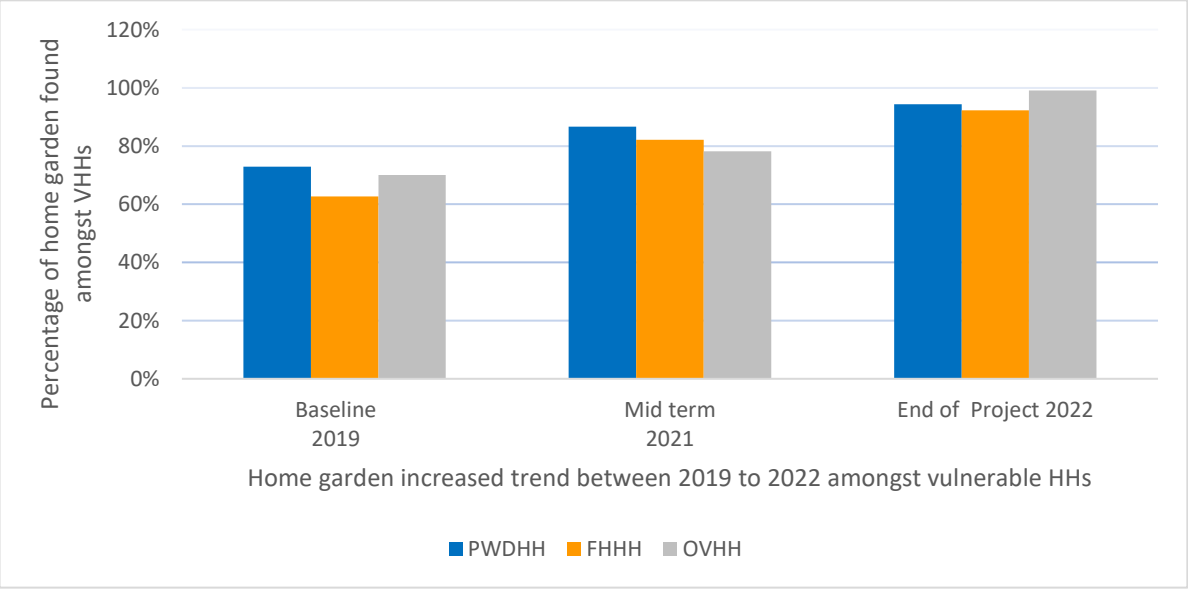

Figure 25. Home garden found amongst vulnerable HHs between 2019 (n=504),2021 (n= 425) and end of project 2022 (n= 434), demonstrates increase in the home garden amongst all three vulnerable HHs.

home gardening among OVHH and FHHH, and a commendable 21% growth among PWDHH. By 2022 at the end of project HH survey, the trend continued upward, with an impressive 97% (9% OVHH, 94% PWDHH, and 92% FHHH) HHs actively involved in home gardening.

The study also investigated how the vulnerable HHs utilised their HG harvested crops. The result at the end of project survey in 2022 showed that a unanimous 100% of vulnerable HHs harvested crops were primarily used for HH consumption (figure 26). The results also

demonstrate the significant increase of HHs who were able to sell surplus crops when comparing 2019 and 2022, with 57% OVHH, 50% FHHH, and 47% PWDHH 47%.

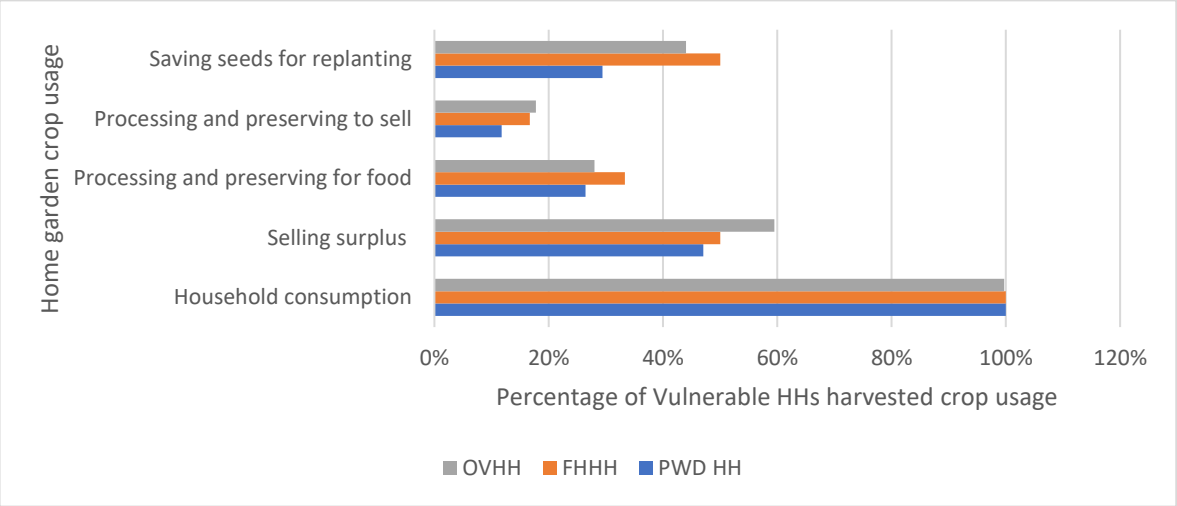

Figure 26. Home garden crop usage amongst vulnerable HHs at the end of project HH survey 2022 (n=434).

This suggests a considerable economic aspect to HG where families are not only satisfying their own needs but also contributing to their livelihoods by selling excess produce. Additionally, on average 28% vulnerable HHs (33% FHHH, 28% OVHH and 26% PWDHH) processed and preserved their crops for future consumption. This reflects an understanding of the importance of vulnerable HHs desire to extend the utility of their homegrown crops. It is also worth noting that some HHs saved seeds from their crops for future replanting. This practice not only ensures a continuous cycle of harvest but also promotes sustainability and self-reliance in home gardening. While HH consumption remains the primary use, the combination of selling surplus crops, processing for future use, and seed preservation demonstrates the multifaceted benefits and strategies employed by vulnerable HHs in managing their HGs.

Throughout the year, HG crops were harvested by HHs, but there were variations in the number of HHs who were able to harvest. The study demonstrates that during the baseline survey all vulnerable HHs HGs harvest started to decline from the month of June, with 47% of HHs engaged in harvesting decreasing to 17.6% in August. However, the HG harvest reached its peak in the month of December with 73.5% of HHs participating in crop harvesting. Interestingly, by the end line survey those HHs were consistently harvesting crops throughout the year, with a minimum of 51% of HHs engaged in harvesting. The peak of HG harvest occurred in November when an impressive 90% of HH members from all 3 types of HHs were actively involved in crop harvesting (Figure 27). This signifies November as the most effective month for crop harvesting during the project. This study finds a positive trend in crop

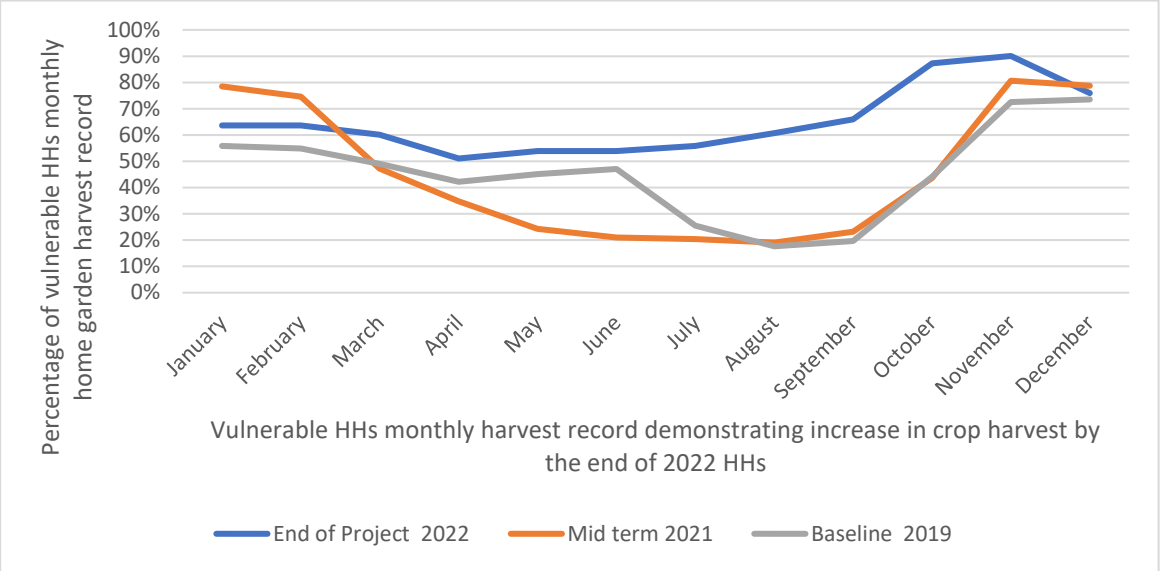

Figure 27. Vulnerable HHs home garden monthly harvest record between 2019 (n=504),2021 (n= 425) and end of project 2022 (n= 434), demonstrates increase in the HHs crop harvest trend amongst all three vulnerable HHs.

harvesting with findings showing all 3 types of HHs accessing more food from their HG compared to the beginning and midpoint of the project. Consequently, this suggests an increase in HHs' access to fresh plant-based food throughout the year, thereby improving food availability and stability. Furthermore, the study found that on average each month the 3 types of vulnerable HHs collected plant-based crops, ranging from a minimum of 28.4 kilograms for OVHH, 30.08 kilograms for FHHH, to 34 kilograms for PWDHH. This data highlights the significant contribution of HG cultivation to HH's food security and nutritional needs.

The study also revealed significant improvements in HG crop diversity when comparing the baseline and end of project surveys across all 3 categories of vulnerable HHs (figure 28).

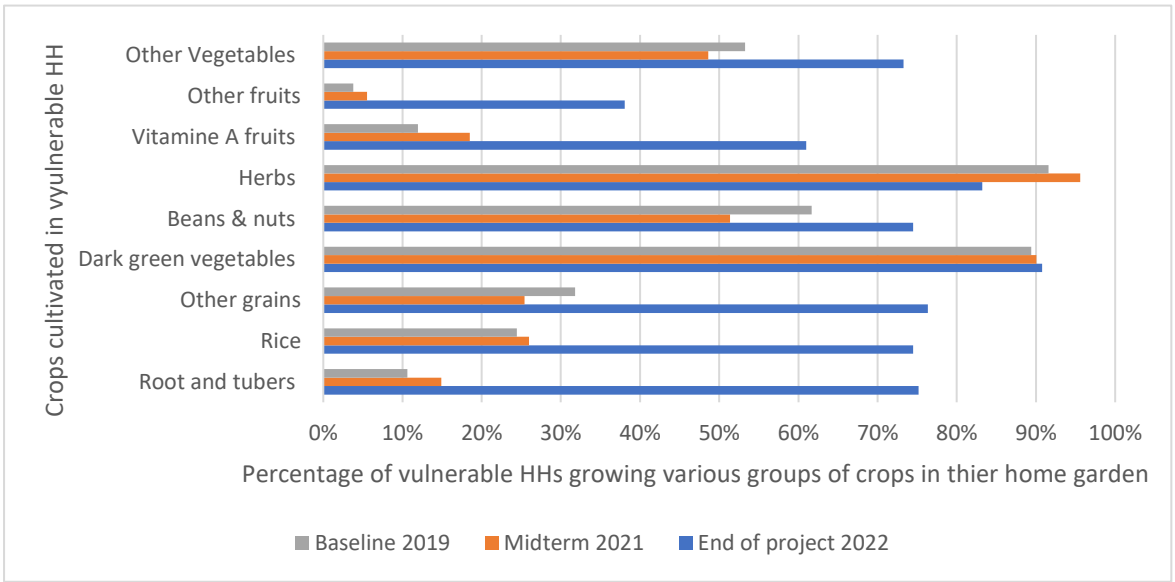

Figure 28. Crop harvested amongst vulnerable HHs between 2019 and 2022 demonstrate increase in diversity amongst all HHs

We found 83 types of edible plant-based crops distributed among six key groups: 1. Root vegetables, tubers, and tuber crops; 2. Dark green vegetables; 3. Legumes and nuts; 4. Herbs; 5. Fruits; and 6. Other vegetables within these home gardens (Appendix E). An astounding diversity of plant varieties was discovered including 26 different fruit varieties, 19 herb and spice varieties, 13 other vegetable varieties, 9 varieties of dark green vegetables, 8 types of grains, root vegetables, and tubers, and 8 varieties of legumes and nuts. PWDHHs cultivated 66 different types, FHHs managed 55 species, and OVHH maintained an impressive 74 types of edible plant-based crops. Interestingly, the 2 most favoured groups of edible plant-based crops among all 3 types of HHs were herbs and spices and dark green vegetables.

However, it is worth noting that the overall crop composition varied among these HHs. OVHH had the highest number of species comprising 47% of the total, followed by PWDHH with 42.5%, and FHHH with 36%. This indicated that OVHH HGs contained the greatest variety of species, while FHHH HGs exhibited slightly fewer species compared to PWDHH and OVHHs. The study also revealed a significant portion of HHs with agriculture surplus exhibiting a commendable practice of preserving and processing crops. Furthermore, the study shed light on the admirable tradition of sharing with other HHs. Among those with surplus produce, the majority extended their generosity to friends and family, exemplifying the enduring values of communal support that thrive within these HHs (Table 7).

Table 7. Home garden contribution to food security amongst three types of vulnerable households

Description	Results		
	PWDHH	FHHH	OVHH
1. Home Garden monthly crop produced amongst three vulnerable HH (n=30)			
Average monthly crop harvested	34.5 kilos	30.8 kilos	28.4 kilos
2. Number of Eeible plant-based crop varieties produced in home garden			
Grain roots and tubers	8	7	8
Dark green vegetable and salad	9	8	9
Legumes, nuts and seeds	3	2	7
Herbs and spices	19	19	19
Fruits	17	12	19
Other vegetables	10	7	12
Total varieties	**66**	**55**	**74**
3. Home garden harvest crop usage amongst three vulnerable HH (n=435)			
Harvest - households' consumption	100%	100%	100%
Harvest – surplus sold	47%	50%	59.5%
Harvested crop – Shared with others	92%	100%	96%
Harvested crop saved for future use	96%	100%	96%
% of HH average monthly harvested record	49%	73%	68%

Home gardens are highly important amongst all 3 types of vulnerable HHs. They often associate HG as a valuable food source that provides a regular supply of fresh healthy and tasty food. The study investigated various factors of HG characteristics and the discussion below will further inform the understanding of HG of rural upland Laos vulnerable HH and how it contributes towards HH food security.

CHAPTER 5: DISCUSSION

5.1 Laos Upland Livelihood Activities Among Three Types of Vulnerable Households

Two-thirds of Lao PDR's population consists of small farmer HHs, with the majority relying on the agriculture sector for food and livelihoods (MAF, 2015). The results from cross tabulation of livelihood activities shows that of 11 groups agricultural activities such as cultivation and livestock are the main livelihood activities amongst the 3 identified types of vulnerable HHs in this study. A significantly large proportion of vulnerable HH's rely and depend on the land and agriculture. Results also indicate that various vulnerable HHs were engaged in off farm activities, such as working as casual laborers in the nearby district or province, or in a small business, or were employed. The findings showed that a small percentage of PWDHH and OVHH had employment opportunities and family businesses, while FHHHs had no employment or family business opportunities. FHHHs often lacked adequate education and are trapped in time-consuming unpaid domestic tasks with limited options to work or build a business (UN Women, 2023). During the in-depth interviews, the FHHH respondents disclosed, "If I did not receive the money from my daughter regularly, it would be difficult for me to meet my needs on my own", and such sentiment was common amongst most FHHHs. Their agricultural production was insufficient and did not meet their daily needs without monetary aid from relatives, making them more dependent on others and having less opportunities for employment. Although FHHH may have lesser livelihood opportunities compared to PWDHH and OVHH, FHHHs primarily relied on agricultural activities for their livelihood.

Thus, the Lao government's policy direction to support and improve agriculture production for domestic consumption and improve supply chain to markets, improving food security, and reducing rural poverty (ACIAR, 2021) are relevant to these communities. However, due to the high agricultural dependency nature of current livelihood activities of rural vulnerable HHs, it presents an opportunity to better understand the livelihood constraints and challenges in this context and what livelihood diversification opportunities can be expanded that will enable vulnerable HHs to not only rely on agriculture activities but expand into other areas. Livelihood diversification opportunities for vulnerable HHs will be a desirable policy aspiration that could provide vulnerable HHs with more capabilities to improve livelihood security and living standards (Frank, 2007). There are plenty of opportunities to expand livestock production, handmade crafts, natural products, support local businesses incentives,

and employment opportunities within the current context and scope. Increasing public, private, and civil society collaboration to develop tailored programs that builds on current potential and the strengths of vulnerable HHs. Supporting opportunities to start local business ventures, improving infrastructure, access to low-interest loans and market, improving knowledge and technology, investing in crop packaging, processing and transportation opportunities, and supporting incentives to improve and increase agricultural production. Further investigation and analysis of existing current livelihood activities could be conducted, and plans developed to strengthen and diversify livelihood activities for vulnerable HHs.

5.2 Home Garden Understanding and Crop Production Among Vulnerable Households

The results indicate that the smallest size of a HG was 16m², with the largest being 800m², making the HG size significantly different among all vulnerable HHs. The HGs that were observed during the study were found in various locations, both on flat and steep land. For the villages on flat land with sufficient land within their village boundary, HGs were found next to their home or close by. However, if the village lacked land within the village the HG was further away from their home but most likely with access to water. The villages that had hilly terrain had HGs on steep hills or slopes or below the hills where the land was carefully selected for adequate moisture, was fertile, and cultivated their preferred crops which required less maintenance.

The difference in land preference, garden location, and crops cultivated were noticed between the different ethnic groups, but the research was not able to differentiate as this was beyond the scope of the research.

The study also noted the idea of HG being extended amongst all vulnerable HHs during the period of farm and rice planting season, especially between May to August. A variety of crops are cultivated near paddy fields or cash crops, with other crops grown around the field as vulnerable HHs spend most of their time in the field, thus production of a HG nearby the home was slightly neglected. This explanation was provided over and over again during the qualitative engagement.

The research findings showed that PWDHH HGs were the smallest, closest, and harvested the most, while the FHHH HGs were the largest, furthest, and harvested the least. There is an opportunity to further explore why PWDHHs are producing more compared to other vulnerable HHs and why FHHH HG were located further from their home.

HGs produce food for a long time in tropical conditions (Kumar and Nair, 2004) and are found to be a vital food source amongst the majority of the agricultural dependent

vulnerable HHs within the study site. Due to various constraints, vulnerable HHs (n=425) did not have a HG. This presents an opportunity to improve HG production among those who currently do not have a HG. Methods such as indoor or hanging garden crop planting techniques and crop types that will grow in small areas should be promoted. Leafy green vegetables and herbs such as arugula, bok choy, kale, micro green, lettuce, spinach, basil, dill, mint, and coriander can be grown in tall 4-inch (10 cm) containers 4 to 6 inches (10-15 cm) apart. They are not a new crop, but HHs mainly grow them in a garden bed. Carrot, garlic, spring onion, radish, cabbage and cruciferous vegetables can also be grown in a deeper container that requires only space for pots and containers. Such vegetables could be grown on a window ledge, hanging from posts, on a table or trestle, or simply placed in empty spaces around or inside the house. Pots and containers could be made out of local resources such as bamboo, wood, straw or use recycled materials such as sack bags, pots, used tires etc. Interestingly, some HHs were found to be doing this already in the communities which can be replicated, promoted, and scaled up.

Water scarcity is also limiting HG production among all vulnerable HHs. Although globally, most agricultural land is rainfed (Rockstrom et al.,2002), the proportion is highest among developing countries. Improving water access and management can maximize crop yield and production, with one participant stating, “when water gets scarce in the driest season, we can’t produce much, so we grow less in our HG”.

In villages where a gravity feed system (GFS) water was available it was primarily used for HH drinking purposes, with only a few villages having sufficient GFS water for HG usage when water was plentiful it was held in a reserve tank. Some villages watered their HG using an irrigation system from a small dam, pond or creek but in the dry season the irrigation system does not work as effectively as the water level reduces or dries up. There were only a few villages that used ground water.

Thus, in the current context there is potential to improve and expand water sources for HG such as small dams, small irrigation systems, investigating the feasibility of ground water usage, and improving the rain and surface water management that could be stored for drier periods. There is potential to benefit not only HGs but the whole agriculture system. The qualitative engagement identified that there was a lack of resources, and technical expertise and knowledge on how to maximize water resources. Various strategies could be taken to improve the knowledge, skills set and coordination of the current water authority technical staff of the Department of Agricultural Office for Irrigation and the Department of Health Office NamSaat Division in relation to HH and HG water consumption purposes. Better planning and

communication are needed within the water authorities that have responsibility over rural and remote water facilities.

There is also an opportunity to develop community level water management and watershed conservation, and public private partnerships to strengthen and equip local water governance. Such practices have worked well in various similar settings in other countries (Koppen et al, 2007). Additionally, alternate low-cost water harvesting methods, small-scale dams, drip water systems, and water-saving devices are also effective methods that can improve water access and management.

While HHs face water scarcity during the dry season, they also face several monsoon season-related challenges. Too much rain causes plant bacteria and fungi with continued leaf wetness and excess moisture affects the roots (Hughes and Jacqueline, 2023) as waterlogging is one of the abiotic stresses that affects crop growth (Lone et al., 2018; Setter and Waters, 2003; Linkemer et al. 1998). These challenges are not new, but if not mitigated, crop loss or poor yield are eminent (IFAS, 2023). Many surveyed HHs stated that during the wet season, farmers witnessed "slow growth, wilting, yellow leaves and issues with poor germination rate" for crops such as pumpkin, squash, corn and beans. Often, participants stated, "there is too much rain in the wet season, making it difficult to grow vegetables in our HG. They grew only a few types of crops in wet seasons" such as herbs, eggplant and some leafy vegetables, with several HH stating, "if we have greenhouses, we will grow crops all year round."

Participants also expressed that weather variability, such as too much rain or cold and frost, negatively affected crop yield. Greenhouse owners have witnessed a difference in crop yield compared to crop yield on the same land without a greenhouse. Local materials and plastic were used to construct greenhouses that helps maintain solar radiation, temperature, humidity and protect the crops from cold snaps, frost in winter, and heavy rainfall during the monsoon season. Participants also stated, "after the rain, the soil gets hard" and "we sometimes don't know how to resolve these issues." While greenhouses are effective, there are other improved soil management methods that can help farmers, such as increasing infiltration, reducing surface runoff, improving the availability of nutrients to plants, and increasing organic matter in soil. Methods of building a raised bed, creating drainage or trenches, and growing cover crops are simple, effective and low-cost (Manik et al., 2019) which can improve HG production. Some HHs were already applying these methods but plenty were not.

Thus, this study suggests that HG location, size and distance from the home needs to be contextualized. We found larger HG that were further away from homes and of transitional nature were particularly during planting seasons. FHHHs lacked resources and faced multiple

deterrent factors with HG being further away from the home and producing less. It is important to further examine indoor and alternative crop planting methods for all seasons, improving water management plans, improving soil management methods and applying greenhouses. This will enable HHs to access alternative and improved methods to grow crops, improve crop yield and have a larger harvest that provides them with increased access to fresh, healthy and organic food sources all year round.

5.3 Improving Edible Plant-Based Usage, Crop Diversity, Preference and Practices

HG are undoubtfully one of the most natural diverse food production systems that enhance access to a wide variety of local crop domestication and diversity (Agbogidi and Adolor, 2013; Kunhamu, 2013; Gautam et al., 2004; Engels, 2002; Watson & Eyzaguirre, 2002; Engels, 2001; Eyzaguirre & Watson, 2001;). Edible plant-based crops are harvested from HGs primarily for HH food consumption among all vulnerable HHs, with some selling crop surplus. Several participants stated, “We wish we could sell our products, but the market is too far. We only sell sometimes when a buyer comes to our village to buy”. The lack of market linkage, poor postharvest management, poor road conditions, and limited cooperative organisations, limits vulnerable HHs’ ability to sell surplus crops and access markets. Interestingly, the study found that PWDHH and OVHH preserved and processed some of their surplus harvested crop mainly through drying, fermenting or pickling methods that preserved and extended the time of harvested food, while FHHHs did not.

The study documented 83 varieties of edible plant-based crops among all vulnerable HHs. FHHH HG were the least diverse, and OVHH HG were the most diverse. Most of the vulnerable HHs planted and harvested herbs and dark green vegetables, making them the 2 most harvested edible plant-based crops, whereas fruits, root vegetables and legumes were subsequently the least planted and harvested. The results provide an opportunity to further examine the 3 least grown edible crops (legumes, fruits, and root and tuber vegetables) and find opportunities to expand and share with communities the advantages of intensive gardening systems by growing legumes (Blair et al., 2016), which is both beneficial for soil health and food consumption. During the interviews, most participants said, “We love to eat green vegetables, salad and herbs, and we ensure we have them most of the year. Herbs make food tasty, and green vegetables and salads are easy to grow.” They also stated that they grow herbs and vegetables “In our rice paddies, slash and burn fields and corn fields” during the rainy season.

Participants mentioned that HG management is not that difficult compared to farm work, as it is less labor intensive, requires less time, and simple tools are sufficient. The HG workforce mostly involved women who prepare, plant, maintain and harvest produce while men collect and make fences for the HGs. In some exceptional cases, men helped with watering, breaking the soil or preparing beds for home gardening, with many women commenting, "Men help with eating" and they laughed.

The vulnerable HHs perceived that despite who worked the most, the harvest belonged to the HH. Women work on the farm, in the HG, cared for small livestock, and have the responsibility for domestic chores. While the disparity in domestic workload is high among women (ILO, 2023) it should not be underestimated that HG contributions are an empowering experience for women, as they make most of the decisions on HG crop varieties and management (Ebile et al., 2022). Many women disclosed that "Even it belongs to the HH, we have full control with what we do with the crop harvest".

Capacity development, equity, employment and sustainable economic growth are major strategies to reduce poverty, where women play a key role in socioeconomic development (Ardrey et al., 2006; Thomson and Baden, 1993), which is reflected in the study results among vulnerable HH women. Women's interaction with HG and the choices they have of what to plant and what they do with the harvested crops seem to be an empowering experience as the women confidently shared their experiences during the interviews. However, FHHHs spend the most time on HG compared to OVHH and PWDHH, often stating they had no help. FHH felt burdened with multiple responsibilities, and their experience of empowerment was different from that of the PWDHH and OVHHs women.

For crop preferences and practices, most HHs applied manure from cattle, poultry, pigs or goats, and participants often commented that "Our methods keep food safe, natural (organic), tasty and healthy". A HG often starts with preparing the land by clearing and slashing green vegetation. Once the burnt green vegetation is dried, ashes are sprayed over the tilled soil and manure is added and the seeds are and sowed, then the soil is covered with hay, green leaves, twigs, or mulch. The order of this process may vary, but it appears to be the general practice among many vulnerable HHs. Some HHs who had a HG near or below a hill selected the best patch of land, where they found plenty of moisture and nutrients, and simply sowed the seed and did little maintenance and only returned to harvest.

Survey findings found that all vulnerable HHs suffered from pestilence. They manually picked the pests and squashed them or sometimes fed them to their chickens or ducks. Many said that pestilence is a challenge for their larger rice and corn farms, but they are able to

manage them in their HGs. The respondents described “Our food we grow without using any chemicals and we like to follow our old ways for safe food”. This practice needs to be noted that this in context of the HG as there are numerous other studies suggest high use of chemical inputs in agriculture production mainly associated with commercial crop production (Rassapong et al., 2018).

The research also found that some HHs applied integrated pest management on their HGs by applying newly learned methods, such as biopest spray, different traps and nets. While some HHs apply compost and biochar made from locally sourced materials. Compositing can hold a large volume of water, prevent erosion, reduce water runoff, and improve soil structure and nutrient content (EPA, 2023). Other HHs produced biochar from green waste, which is increasingly recognized as a green, cost-effective approach and an environmental remedy that improves soil fertility (Xinda et al., 2011 and Liang et al., 2006). Therefore, integrating traditional agriculture and innovative safe modern agriculture practices is beneficial in adapting to weather and seasonal challenges (Shrestha, 2017) for HGs. The government recognizes the benefits of modern and traditional practices and promotes the development of clean, safe and sustainable agriculture with a gradual shift toward the modernization of the production of comparative and competitive agriculture commodities (Lao PDR, MAF 2015).

Therefore, there are plenty of opportunities to increase HG crop diversity, preferences, practices, and production usage year-round by exchanging and sharing existing edible plant-based variety seeds and produce among the wider community. Wet, humid, and dry season adaptable varieties of crops, fruits, root vegetables and legumes, can be promoted as they are currently planted and harvested the least. Vulnerable HHs desire to sell surplus produce which can be beneficial as production volume increases in communities, requires improved market linkage and road conditions and supporting the creation of collective organizations among the most vulnerable, so they have active agency and skills set to engage with the market. While women felt empowered to have full control of the HG, further encouragement of men to help women in HH and domestic chores, including home gardening, can create a more balanced distribution without women losing control over the HG. There is also an opportunity to expand knowledge and practices among trainers and vulnerable HHs, such as compost making, biochar production and integrated pest management, which will not only help soil health and address pestilence but also contribute to better environmental management.

5.4 Improving Home Garden Seed Management

Most vulnerable HHs select, save, and store seeds practices handed down from their parents and grandparents. Households often use various terms when referring to traditional methods including “old methods”, “our methods” in qualitative findings to select and store seeds in small quantities in clean cotton cloths or small-weaved jars. Containers and some plants are kept on top of the cooking area to dry in a warm place away from moisture, sunlight, pests, and rats. Although there is an attempt to store the seeds safely, seeds are exposed to insects and room temperature and are prone to moisture, which ultimately affects them (Ellis and Roberts, 1980). Participants often stated, “sometimes seeds are not germinating and lasting as they should”, and it was found that poor seed storage conditions resulted in frequent seed loss in both quantity and quality.

Therefore, improvement in seed management could minimize seed loss among the 3 groups of vulnerable HHs. Seed management passed down from generation to generation is a strong characteristic found among vulnerable HHs, with responders stating, “we value our seeds, we don’t have to buy them, and seeds suit our environment”. High ownership of seeds can maintain seed independence, and vulnerable HHs do not have to rely on seed suppliers. These seeds are suitable for the local environment and conditions. They believe “the food tastes better than with bought seeds”, and they can save money. While the study did not quantify the loss of seeds, many participants strongly expressed the theme of seed loss. During interviews/FGDs, the researcher explored mitigation methods to control the issues of seed loss, and some HHs commented that they were applying newly learned methods of seed storage in vacuum plastic bottle containers to maintain the quality of the seeds, while others did not and kept their traditional practices.

The study also found that HHs who saved and stored seeds were also purchasing new hybrid seeds namely, cabbage, Thai mustard, lettuce (green and red), coriander, broccoli, choy sum and occasionally spring onion, cucumber and pumpkin seeds. Often, these seeds were of new varieties. Few participants stated that hybrid seeds germinate better and have better yield for the first few seasons, but then the seeds struggle to maintain consistent yield. They also said they prefer their own seed because the produce is tasty. All vulnerable HHs valued their traditional seeds, even though they did not store seeds in an appropriate condition, they like the taste of the crops, enjoy seed sovereignty, and appreciate the benefit of not buying seeds and saving money.

Thus, it would be beneficial for government departments to promote and support the improvement of seed selection and storing methods for vulnerable HHs to ensure seed sovereignty among vulnerable HHs. Since many traditional seeds are still available, creating seed bank systems at the provincial level to protect and preserve precious and valuable traditional local seeds is a worthy investment. It is crucial to maintain the balance between traditional local seeds and hybrid seeds. Thus, raising awareness and establishing provincial seed banks to preserve and save local seeds for future generations is an investment for future seed sovereignty.

5.5 Food Insecurity Experience and Severity Among Vulnerable Households

In the 16 villages all 3 vulnerable HHs faced different degrees of food insecurity. They grappled with food shortages, struggled to maintain consistent access to food supplies, resorted to extreme coping mechanisms, and endured reduced dietary diversity, all of which collectively rendered them as food-insecure vulnerable HHs (Bickel, 2000). During the baseline survey, it was revealed that less than half of the vulnerable HHs considered themselves as food secure and many HHs encountered food shortages lasting for several months with some months emerged as the most critical periods where HHs grappled with food shortages.

Analysis of these findings highlights that FHHHs suffered the most from food insecurity, followed by PWDHHs and OVHHs. When they were asked about the reasons behind this disparity, qualitative responses substantiated various factors: "Our stored food supplies, especially rice, were running critically low at that time"; "We were occupied with work in the rice paddies and shifting cultivation fields, leaving us with little time to cultivate crops in our home gardens"; "Excessive rainfall made it challenging to plant crops in our home gardens due to the waterlogged conditions." Additionally, some vulnerable HHs pointed to the lack of support, with sentiments like "I have minimal assistance and am responsible for both farming and household chores; without support from my extended family, it's tough to meet our HH's food needs." Such concerns were frequently echoed among FHHHs.

The study revealed that food-insecure HHs resorted to various coping strategies, including "borrowing food," "seeking help from other family members", "borrowing both money and food", and "foraging for food in the forest and river". Furthermore, some HHs took drastic measures such as "reducing meal portions and frequency". Typically, food-insecure HHs employed a combination of consumption and asset-based coping strategies, such as consuming less preferred, lower-quality, or less expensive foods and receiving donations from relatives or friends (Asesefa et al. 2018). Notably, severe coping mechanisms like "eating less

and reducing the number of meals" were prevalent during the baseline survey but were decreasing by the end of the survey results. In summary, the study highlights varying levels of food insecurity among the 3 types of vulnerable HHs, with FHHHs and PWDHHs facing the most significant challenges and resorting to extreme measures like "eating less and reducing the number of meals" more frequently than OVHHs. These findings stress the urgent need for targeted interventions to alleviate food insecurity and improve the well-being of OVHHs.

The study also delved into the food quality consumption among all vulnerable HHs using the minimum diet diversity proxy indicator as a measure to assess food quality (FAO 2018). The findings revealed that only 14% of vulnerable HHs (17% FHHH, 15% OVHH, and 11% PWDHH) were meeting the minimum HH diet diversity criteria, which involves consuming at least 5 out of 10 food groups at the beginning of the project. Numerous studies have demonstrated that cultivating HG can lead to increased consumption of nutrient-rich vegetables, fruits, and leafy greens, particularly in developing countries (Baliki et al., 2019; Schreinemachers et al., 2019; Schreinemachers et al., 2016; Bushamuka et al., 2005). Our study corroborates this hypothesis, as it showed that by the end of the project survey, the dietary habits of all 3 types of vulnerable HHs had improved significantly, with minimum diet diversity increasing to 62% (67% OVHH, 62% FHHH, 41% PWDHH) among all vulnerable HHs.

This suggests that the overall food quality among all vulnerable HHs has improved, with PWDHH and FHHHs being the least improved. However, despite the progress in reducing food insecurity, some vulnerable HHs continue to experience anxiety, stress, and adjustments in HH food management, resorting to measures such as "eating less" and reducing meal frequency. Consequently, vulnerable HHs still struggle to achieve adequate food diversity in their diets.

It is important to note that food insecurity can have far-reaching negative impacts, affecting not only access to food but also other critical aspects of life, including education, the economy, and health among vulnerable HHs, potentially perpetuating the cycle of poverty and further disadvantaging them (FAO 2023). Moreover, it is well-documented that women and people with disability are more vulnerable to food insecurity due to systemic disadvantages, limited access, and opportunities. Consequently, various measures have been implemented globally to bridge these disparities and disadvantages for both women and people with disabilities (Tagesse, 2023; Bagni et al., 2022; Brucker, 2017).

In summary, while food insecurity among all vulnerable HHs decreased compared to the project baseline, there are still significant disparities among different HH types, with FHHH and PWDHH being the most affected. Therefore, specific vulnerable HHs will require

additional support to completely eliminate the experience of food insecurity in the study villages. However, the project interventions, which aimed to increase and enhance HG and plant-based crop production, has brought about changes in the food security situation. Further investigation to explore how these changes were achieved, and their potential implications are examined below as we delve into all vulnerable HHs HGs.

5.6 Home Garden's Role in Improving Food Security Among Vulnerable Households

The HG can play a vital role in improving access to, availability of, utilisation of, and stability of food among 3 types of vulnerable HHs. The study finds HGs as an instrumental food source as over the course of the project, the number of HG increased significantly in 16 villages. The increase in HG led to improved access to fresh produce among vulnerable HHs and the importance of HG was repeatedly expressed. They described HG as a "source of food and fresh vegetables that taste good and provide vitamins to our body"; "don't have to buy and ask food from others"; "regular supplies of food"; "we have vegetables all year round" and they contribute to "our food security". Numerous studies support such hypothesis and studies show that HG are a contributing factor in reducing food insecurity (Baliki et al. 2022; Lal 2020; Rammohan et al. 2019). HGs provide daily fresh food to vulnerable HHs and each vulnerable household (PWDHH, FHHH, OVHH) has yielded substantial quantities of fresh produce for their own consumption.

The study found that while some HHs were able to harvest crops from their HG every month, others struggled to do so. However, as HGs increased so did the ability of vulnerable HHs to regularly harvest produce, further confirming that HGs has the ability to provide steady access to fresh and diverse food. HGs primarily served the purpose for HH consumption, with many vulnerable HHs selling surplus produce, saving seeds, and preserving surplus crops for future use. This suggests that HGs not only contribute to food consumption but also have the potential to generate additional income, although this benefit may vary among different HH types and locations (Galhena et al., 2013).

The study identified a remarkable diversity of edible plant-based crops in HGs, with a total of 83 species found. It is undoubtfully one of the most natural diverse food production systems that enhance access to a wide variety of local crop domestication and diversity (Kunhamu, 2013; Gautam et al. 2004; Engels, 2002; Watson & Eyzaguirre, 2002; Engels, 2001; Eyzaguirre & Watson, 2001;). Despite having smaller gardens, PWDHH planted the most varieties and harvested the most crops, while FHHH planted and harvested the fewest. This diversity contributed to a wide range of food groups, enhancing dietary diversity. The

HGs played a crucial role in providing access to different food groups, including root vegetables, grains, dark green vegetables, legumes, herbs, fruits, and other vegetables. This diversity in food sources was essential for improving HH diet quality and nutrition (FAO 2018, Wijk et al. 2018) and often research participants commented that HG produce was “healthy, tasty and nourishing”.

The trend among all vulnerable HHs accessing diverse fresh plant-based foods on a monthly basis has shown significant improvement throughout the project's duration. At the least harvested period, there was an impressive increase in access, and during the most active period of the harvest, a commendable increase was observed. This finding highlights the positive impact of having produce from a HG as it indicates that people from all 3 types of HHs were able to access a greater quantity and variety of food from their HGs compared to the beginning of the project.

Notably, there has been significant changes in the types of crops grown between the baseline survey and the shift in crop varieties which aligns with the changes in food intake. These changes collectively signify a substantial increase in the cultivation, harvest, and consumption of a wider array of crops. This trend is in line with recent studies that have investigated the role of HGs in enhancing food and nutritional security (Mullins et al. 2021, and Lal, 2020). These studies consistently found that HGs play a crucial role as a food source, primarily catering to family consumption needs. Furthermore, they provide access to a diverse range of fresh plant-based crops across various food groups, thereby increasing the likelihood of dietary diversification. In this manner, HGs significantly contribute to family nutrition, food security, and the livelihoods of subsistence farming HHs. This corroborates the findings of previous studies (Balika et al., 2019; Galhena et al. 2013; Weinberger, 2013; Keatinge et al. 2011, FAO, 2006; Nair, 2001 and Ninez 1984).

The study supports the improvement of HGs shows remarkable success in enhancing the accessibility and variety of fresh plant-based foods for all vulnerable HHs, aligning with broader research that emphasizes the pivotal role of HGs in promoting food security, dietary diversity, and the well-being of subsistence vulnerable farming HHs. As a result, HGs have become a multifaceted asset in our quest to combat food insecurity. This approach does not just provide quantity; it adds quality to diets, thereby promoting good nutrition.

The study also noted the social aspect of HG that contributes to food sharing. The majority of vulnerable HHs that had surplus vegetable produce shared them with family, friends, and neighbours, fostering social connections and increasing social capital (Machida,

2019; Gallaher et al., 2013). HG crops were also preserved for extended periods, serving as a buffer during food scarcity or emergencies.

The study also found that HG offer a means to preserve crops for extended periods which can contribute to food security. Preserving minimizes food waste, prolongs the availability of food, and enriches diet diversity. The importance of preserving HG crops extends beyond immediate consumption; it plays a pivotal role in maintaining diet diversity, a key factor in ensuring that nutrition remains robust and well-rounded especially during times of food scarcity or emergencies, when it can be the difference between sustenance and hunger.

While HGs have undoubtedly reduced food insecurity for many, it is essential to acknowledge that challenges persist. Despite the positive impact of HG, the study reveals that there are still individuals and HHs experiencing food shortages. These findings underscore the complexity of food insecurity and the need for continued efforts to address it comprehensively. However, a glimmer of hope emerges from the research: not all vulnerable HHs are fully optimizing the potential of their HGs. Approximately 35% of HHs are unable to regularly harvest crops from their HG. This suggests a path forward. If these HHs can enhance their production capacity through training, resources, and support, it has the potential to significantly reduce food insecurity among vulnerable HHs.

In conclusion, HGs are a valuable asset in our battle against food insecurity. They offer both immediate sustenance and long-term resilience through crop preservation and diet diversity. To further alleviate food shortages, it is imperative that vulnerable HHs are supported and empowered to maximize the potential of their HGs, ultimately leading to improved food security and which can provide opportunities for income generation, social cohesion, and food preservation. By continuing to support and enhance HG initiatives, we can further improve the lives and needs of vulnerable communities.

5.7 How to Further Reduce Food Insecurity Among the Vulnerable Households

Home gardens represent a crucial component of food security initiatives, contributing significantly to the sustenance and dietary diversity of vulnerable HHs. HG serve as an invaluable source of various fruits, vegetables, and herbs that are replete with essential minerals and vitamins. Aid organizations and governmental bodies have recognized the pivotal role of HG in addressing hunger and food crises while vulnerable HHs themselves underscore the paramount importance of HG, often stating, "It is our primary food source," highlighting the convenience and consistency they offer in terms of food supply. Many vulnerable HHs

emphasize that HG led to cost savings, as they negate the need for market purchases, thereby benefiting the entire family.

However, the persisting issue lies in the fact that despite these advantages, approximately 35% of vulnerable HHs still grapple with food shortages, with 15% experiencing severe food insecurity, leading to reduced meal frequency and quantity. An analysis of the findings reveals a clear potential for enhancing plant-based crop production. Currently, only 65% of vulnerable HHs manage to harvest monthly, leaving room for improvement among the remaining 35%. Such improvements could substantially mitigate food insecurity and, in the words of some vulnerable HHs, "save money since we don't have to buy from the market." It is noteworthy to delve into strategies for addressing food shortages during the months of August to October, which appear to be the most challenging period for HHs.

It is crucial to recognize the multifaceted nature of food insecurity and sole reliance on HG will not suffice to eliminate the food insecurity issue entirely among vulnerable HHs. The majority of the population depends on agriculture for their livelihoods, yet they continue to grapple with food insecurity. This presents an opportunity to explore livelihood diversification, where vulnerable HHs can generate income through alternative avenues beyond agricultural production.

Despite the existence of 83 edible crop varieties, the highest crop diversity is observed among OVHHs. Promoting and facilitating the exchange of crop diversification practices could prove instrumental in mitigating the risks associated with crop failures and market fluctuations. While HG are indispensable for enhancing food security among vulnerable HHs, they should be integrated into a broader strategy that includes livelihood diversification and sharing of crop diversity practices. This comprehensive approach holds promise for addressing the intricate challenges of food insecurity faced by vulnerable HHs.

CHAPTER 6: CONCLUSIONS

This study used mixed research methods using both statistical and content data and analysis. The study used data collected between 2019 to 2022 by the researcher and the Adventist Development and Relief Agency's food security project. This study provides empirical insight to upland farmers vulnerable HHs HG characteristics, their experience of various levels of food insecurity, and what role HGs play in the context of food security. The pivotal role of HG as a significant food source to combat food shortages and enhance dietary intake are highlighted, particularly among FHHH, PWDHH, and OVHH residing in 16 rural upland villages of Phoukoud District, Xiengkhouang Province in Lao PDR. These vulnerable HHs live in rural and remote areas with inadequate access to critical services and infrastructure and are exposed to various internal and external risks. The government of Lao PDR has current strategies and policies that aim to support and improve agricultural production and enhance HH food security.

The study finds that the majority of vulnerable HHs are primarily agriculture dependent and subsistence HHs with fewer other livelihood opportunities. This presents an opportunity to improve diversification of livelihood opportunities rather than solely depending on agricultural livelihood activity. Due to various deterrents many HHs did not have a HG in 2019 but by the end of the project, survey findings in 2022 show that nearly all vulnerable HHs had a HG, reflecting significant growth in HGs that provided regular food supplies. The study also found 83 different types of edible plant crops (55 FHHH, 64 PWDHH, 74 OVHH). While HGs are a family affair, women still remain the key contributor and manager of the HG and harvests crops primarily for HH consumption, with a small portion of HHs selling market-oriented crops. While there is strong interest among vulnerable HHs to grow market-oriented crops and sell them, there are a number of constraining factors that limits them in doing so. It provides an opportunity to work towards removing those constraining factors by enabling more vulnerable HHs to grow crops and also sell produce at the market and earn some additional income.

The study also indicates that all vulnerable HHs experienced various hindering issues in relation to HG production such as poor management of existing resources, inadequate infrastructure, lack of technical knowledge, inability to deal with weather variability-related cropping, poor soil management, and incompatible seed management. There were only a few vulnerable HHs that applied new methods such as improving soil infiltration, applying mulch, creating trenches to reduce surface runoff, increasing organic matter in their HG soil by applying compost biochar, crop rotation, building a raised garden bed, growing cover crops, or

using greenhouses. The study found plenty of opportunities to support vulnerable HHs to improve their home gardening methods and practices to bring efficiency in productivity. Notwithstanding, by the end of the project, HG harvested crops for food consumption increased and remained a vital food source for HHs, and there was an increase in the number of vulnerable HHs selling harvested crops. This trend was consistent with the increase in crop harvest and diversities of crops that were grown amongst vulnerable HHs, making positive contributions towards food availability, access, utilisation and stability.

The findings of this research demonstrates that the expansion of HG has contributed to gradual improvements in food security for all vulnerable HHs, leading to an enhanced quality of food consumption through increased HH dietary diversity. The empirical evidence presented in this study establishes that HGs do, indeed, boost food security among the most vulnerable HHs and make a positive contribution in reducing food insecurity levels. The evidenced of an average of 19% decline in food insecurity experiences among all vulnerable HHs from baseline to end of project is a praiseworthy outcome. But it is important to note that there are still on average 33% of vulnerable HHs who continue to experience seasonal food insecurity. It demands further investigation and targeted interventions that can support particularly the most vulnerable HHs who are still suffering seasonal food insecurity as HGs alone will not be able to illuminate food insecurity. While there is some support provided by government agencies and civil society organisations, local agricultural extension services lack the resources and skills to support vulnerable farmers in their catchment. The challenges and issue of rural and remote vulnerable HHs regard to livelihood, agricultural challenges, vulnerability and food insecurity are real.

The study aims to inform the Lao PDR government, key stakeholders and vulnerable HH farmers so that the necessary agriculture development policy and strategic objectives can be considered. The following recommendations are proposed for consideration so that the importance of HG as a vital food resource are highlighted and continue to receive support and relevant investments are made to optimise HGs production.

Table 8. Research recommendation

No.	Recommendation	Targeted Key Stakeholders
1	Expand existing livelihood opportunities in livestock production, handmade crafts, nature-based products, service employment, and supporting an enabling environment for local business ventures.	Central, Provincial and District - Department of Agriculture and Forestry,

2	Increase private and public collaboration, promote post-harvest management, support and link empowered women-led organic, safe, and healthy food production effectively and efficiently beyond HH consumption to market knowledge access and networks.	Industry and Commerce, Private Business and Market, Civil Societies, Farmer HHs
3	Promote indoor and small space crop production methods for those who lack access to suitable land and continue to support and promote the increase of HGs, as this contributes significantly to reducing food insecurity among upland vulnerable HHs.	Provincial and District Agriculture and Forestry Office, Civil Societies, Farmer households
4	Promote crop diversities within HG by offering types of crops that improve the overall nutritional quality of the food consumed by vulnerable HHs.	
5	Address seasonal food insecurity, notably from August to October, requiring targeted interventions to alleviate its severity among vulnerable HHs	
6	Build the capacity and technical skills set among local government water and irrigation authorities at district and province levels that will enable improved water management plans that effectively manage, regulate, and use surface and ground water while strengthening community water governance.	Central, Provincial and District Agriculture and Forestry Office, Health Office, Civil Societies, Farmer HHs
7	Tailor specific initiatives to support FHHHs and PWDHHs since they experience the highest levels of food insecurity	Central, Provincial and District Agriculture and Forestry Office, Health Office, Lao Women Union, Labor Social and Welfare Office, Civil Societies, Farmer HHs

8	Train vulnerable HHs to adapt to seasonal challenges and improve soil management, including biochar production, compost making, mulching, cover crops, crop rotation, raised beds, good drainage and irrigation management systems, and the application of plastic greenhouses to improve wet, dry, and cold season HG production.	Central, Provincial and District Agriculture and Forestry Office, Civil Societies, Local Seed producer and Industry, Farmer HHs
9	Train vulnerable HHs in integrated pest management and promote low-cost technologies for rain harvesting, water saving technologies, and application methods.	
10	Protect and preserve traditional seeds through local seed banks and support vulnerable HHs to improve seed selection quality and seed storage methods to reduce seed loss.	
11	Further research topics could be explored such as # Livelihood diversification opportunity within existing and present livelihood scope identified by this research. # Ethnic and location variability to understand any significant difference in the food insecurity, crop preferences, and gardening practices. # Why FHHHs found it difficult to improve their food insecurity condition/ comparative analysis on HG production, location and efficiency between PWDHH, OVHH and FHHH. # Climate change and HGs # Including nutritional assessment to strengthen food security investigation and analysis	Central, Provincial and District Agriculture and Forestry Office, Health Office, Universities, Civil Society Organisations

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APPENDIX A

Key Informant Interviews Questionnaires

1. Home Garden Characteristic

a. How do you characterise the home garden in your Province/district/village? Tell us some of the key characteristic of the home garden?

b. How do you define good home garden & how do you define poor home garden?

c. Who are responsible for home garden management?

d. Is there a different methods and practices amongst different communities, if you've notices the difference what are those differences and why?

e. What are some of the challenges faced by HH in relation to their home garden function, management, and usage?

2. Home Garden and Nutrition/ Food security

a. Does your province/district/ village face undernutrition amongst children and women?

b. If yes what approaches/ initiatives are taken to address these challenges in your experience and understanding?

c. Does, your province/ district/ villages face food insecurity- food shortages issues?

d. If yes what approaches/ initiatives are taken to address these challenges in your experience and understanding?

e. What role do you think home garden plays in relation to household nutrition and food security?

Government Incentives and Support

a. What program, incentive, policies or resources are there to improve Nutrition through home gardening in the district?

b. Can you tell me if there are any other sectors or agencies who are supporting or promoting home garden in your province/district?

c. Is there any opportunity and initiative that you think could improve home gardening?

3. Home Garden and Climate Smart Agriculture

a. Have you noticed change in weather patterns that may have affected home garden?

b. What are those changes you have noticed? (Weather, rainfall, temperature, drought, flood, soil, etc.)

c. How does these changes have impacted home garden in your area?

d. What actions are community members taking to address these challenges?

e. How vulnerable do you think your area is to the climate changes and provide some examples of vulnerability?

 # Government Incentives and Support

a. What program, incentive, policies, or resources are there to mitigate climate change impact for home gardening in your area?

b. Can you tell me if there are any other sectors or agencies who are supporting or promoting home garden in your province/district?

c. Is there any opportunity and initiative that you think could improve and adapt to climate changes?

APPENDIX B

Focus Group Discussion Questionnaires

1. **Home Garden Characteristic**

   a. How do you characterise the home garden in your district? Tell us some of the key characteristic of the home garden?

   b. Are there any challenges or barriers identified in relation to your home garden? If yes, what are they?

   c. Who is responsible to take care of home garden, who decide what to grow, who decide what to do with the crops that is produce in the home garden?

   Activity 1. list all the crops, tree, plants, herbs that is found in your home garden and then identity the crop calendar with planting and harvesting for each crop. Discuss finding validate, verify and conclude.

2. **Home Garden and Food Security and Nutrition**

   a. What is Nutrition and what is Food security?

   b. How do you see the connection between home garden, food security and nutrition?

   c. How important is your home garden to you & why?

   d. Any agencies or government departments are supporting to home garden development or improve food security in your village.

3. **Home Garden and Climate Smart Agriculture**

   Activity 2. Let map out all the weather-related patterns, natural disaster, pestilence and disease outbreak that we've noticed in three key seasons (Dry – Wet – Cold season) for last 4 years. (2018-2019-2020-2021) temperature Low and high - drought – rainfall patterns / pestilence & # of events. Once the mapping is done then discuss the followings,

   a. How this has impacted their home garden, food security and nutrition

   b. What are you doing to mitigate such problem and what adaptive measure should we take? What are new and traditional methods?

c. How have those changes impacted home garden in your district?
d. Any agencies or government departments are supporting to make your community climate resilient in your village and if yes, what are they doing?

APPENDIX C

In-depth Interview Questionnaires

1.1 Home Garden Characteristics

Size of home garden =

Location of home garden =

#	Key area of investigation	Questions
1	Home garden crop diversity and crops utilization	1. When and which types of crops, plants and fruits did you grow in your home garden over the past 12 months? List all the crops 2. List dry, wet and winter crops? 3. Identify types of plants and its usage? (Food, spices, medicinal, fuel, wood, shades, cultural significance, ornaments, fence, shade for crops) 4. Identify local plant species & newly introduce species? 5. What do you do with crop and plant grown in your home garden?
2	Home garden responsibilities, labour and decision making	6. Who decides what gets planted? 7. Who keeps the seeds & (germplasm)? 8. Who decides what to sell and how to use the money? 9. Who own what you grow in the home garden? 10. In average how many hrs. per week you spent in your home garden? 11. Who prepares the land? Who plant? Who weed? Who harvest and Who sale produce? & Why?
3	Home garden practices or methods	12.What agricultural practices or methods do you use in your home garden? 13. What are the traditional practices and what are the modern new practices? 14. What are the benefits & challenges of tradition practices and new modern practices?

		15. What methods you use to improve your soil condition traditional and new modern technology?
4	Seed management	16. Do you produce your seeds? If yes 17. What types of seeds did you buy and why? 19. How long have you have been saving seeds? 20. what is the difference between your and bought seeds? 21. Why it is important to save your own seeds?

1.2 Home Garden and Nutrition

#	Key area of investigation	Questions
5	Experience of food insecurity / meal frequency	22. Recall 24 hrs. meal frequency- How many meals and snacks you had? (Ordinary day food consumption) 23. What are the main food sources for your household? Where does food come for you and your family? 24. Does your house have a food shortage during the last 12 months? If yes, then how many days in 12 last months? And which months were the worse in past 12 months? 25. Do you have enough food in your house for this week? – what food is scares?
6	Copping methods	26. What do you do when food is scares?
7	Home garden linkage to food security/insecurity	27. How many months home garden provides you a plant-based food? 28. On average how many kilos of crops you harvest every month from your Household gardens? 29. Explain, how home garden contributes to food security and Nutrition? Does not now about the food related to nutrition 30. Explain how home garden contributes to family nutrition?
8	Crops usage	31 What is the main purpose of the crops and plant that you grow in your garden?

9	Malnutrition/ District Health Office	33. Wasting rate in your community 34. Stunting rate in your community 35. Underweight rate in your community 36. Nutrition of mother and child

1.3 Home Garden and Climate Change

#	Key area of investigation	Questions
10	Climate Change	37.Have you noticed change in weather patterns? 38.What are the changes you've noticed? 39. How have those changes impacted your home garden?
11	Mitigation	40. Have you taken any actions to mitigate the Climate Change impact in your home gardens, if yes what are those actions? 41. How have those actions been working for you? 42. If no what is preventing you from taking any actions?
12	Climate Change monitoring and services	43. How and what are you using to monitor Climate Change? 44. Do you have knowledge or access to seasonal to interannual prediction? 45. Is there any early warning system that notify you about the natural disaster? 46. Is there other climate service that you know of that you can access or have been accessing?
13	Water use and management	47. What water source you are using to for your garden? 48. What is the water availability like for your home garden in past 12 months? 49. How far is your water source for your home garden? 50. Any methods you use that helps you to save, collect or preserve water in the home garden?
14	Soil management	51. Slow forming terraces, conservation tillage, integrated soil nutrient management

15	Crop management	52. Crop diversification/ new varieties / any hybrid variety biotechnology etc.
16	Pest management	53. How do you control pest in your home garden? Please tell us all methods you use?
17	Crop and seed storage	54. How and where do you save all you seed and grains?
18	Farming system	55. Please tell us the if you have any successful farming techniques that you use that have been able to cope and resilient with climate change?

APPENDIX E

Crop diversity, edible plant-based crops collected during qualitative data collection through focus group discussions and in-depth interviews among three types of vulnerable households in 16 villages, Phoukoud District.

Plant based edible crop found in the vulnerable home garden (n=30)				
1. Eight types of grains, roots, and tubers				
	Description	**PWDHH**	**FHHH**	**OVHH**
	Total types of crops found among VHHs	**64**	**55**	**74**
	% of total crop found in VHHs	**77%**	**66%**	**89%**
1	Cassava	1	1	1
2	Maize, (white & yellow)	1	0	1
3	Taro	1	1	1
4	Yam bean	0	1	1
5	Sweet Potatoes	1	1	1
6	Yam bean	1	1	1
7	Yacoon	1	1	1
8	Arrowroot	1	0	0
Total		**8**	**7**	**8**
2. Nine types of dark green vegetables and salad				
9	Chinese Cabbage	1	1	1
10	Choy sum	1	1	1
11	Thai mustard	1	1	1
12	Red and green lettuce	1	1	1
13	Spinach	1	0	1
14	Chaya	1	1	1
15	Crown Daisy	1	1	1
16	Kale Leaf	1	1	1
17	Morning Glory	1	1	1
Total		**9**	**8**	**9**
3. Eight types of legumes and nuts				
18	Yard/Long Bean	1	1	1
19	Flat Bean	0	0	1

20	Flat winged bean	0	0	1
21	Peanut	1	1	1
22	Soybean	0	0	1
23	Mung bean	0	0	1
24	Chestnut	0	0	1
25	Red beans	1	0	0
Total		**3**	**2**	**7**
4. Nineteen 19 types of herbs and spices				
26	Basil	1	1	1
27	Coriander	1	1	1
28	Dill	1	1	1
29	Mint	1	1	1
30	Cilantro	1	1	1
31	Galangal	1	1	1
32	Garlic	1	1	1
33	lemongrass	1	1	1
34	Mint	1	1	1
35	Spring onion	1	1	1
36	Winged prickly ash	1	1	1
37	Ginger	1	1	1
38	Tamarind	1	1	1
39	Chillie	1	1	1
40	Wasabi mustard	1	1	1
41	Radish rat tailed	1	1	1
42	Heartleaf	1	1	1
43	Paracress	1	1	1
44	Piper lolot	1	1	1
Total		**19**	**19**	**19**
5. Twenty-six types of fruits				
45	Lemon	0	0	1
46	Kaffir lime	1	0	0
47	Mango	1	1	1

48	Peach	1	1	1
49	Plum	1	1	1
50	Banana	1	1	1
51	Watermelon	0	0	1
52	Muskmelon	1	0	1
53	Guava	0	0	1
54	Gac Fruit	1	1	1
55	Orange	1	0	1
56	Jack Fruit	1	1	1
57	Pomelo	1	0	1
58	Pear	1	1	1
59	Star fruit	0	0	1
60	Pineapple	0	0	1
61	Longan	1	0	1
62	Wild olive	0	0	1
63	Papaya	1	1	1
64	Eggyolk	1	1	0
65	Jujube	1	0	1
66	Star Apple	1	0	0
67	Strawberry	0	1	0
68	Dragon Fruit	0	1	0
69	Fruit Amla	0	1	0
70	Custard Apple	1	1	1
Total		**17**	**13**	**20**
6. Thirteen types of other vegetables				
71	Chayote	1	1	1
72	Eggplant	1	1	1
73	Pumpkin	1	1	1
74	Gourd (Sponge, Snake)	1	1	1
75	Bamboo Shoot	0	0	1
76	Sugarcane	1	1	1
77	Tomatoes	1	0	1

78	Turkey Berry	1	0	1
79	Cucumber	1	1	1
80	Winter Melon	1	1	1
81	Avocado	0	0	1
82	Broccoli	0	0	1
83	Peas	0	0	0
Total		**9**	**7**	**12**