Local food plants for nutrition

IMPROVING DIETS AND REDUCING FOOD SCARCITY WITH THE HELP OF LOCAL FOOD PLANTS IN HUEHUETENANGO PROVINCE OF GUATEMALA

SD=HS Sowing Diversity = Harvesting Security

ASOCUCH

OXFAM Novib

Sweden Sverige

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Acronyms

ASOCUCH	Asociación de Organizaciones de los Cuchumatanes
CTDT	Community Technology Development Trust
CSI	Cognitive Salience Index
DSR	Dietary Species Richness
ESAFF	Eastern and Southern Africa Small Scale Farmers' Forum
FFS	Farmer Field School
FOVIDA	Fomento de la Vida
FVS	Food Variety Score
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HHS	Household Hunger Scale
Li Bird	Local Initiatives for Biodiversity, Research and Development
MAHFP	Months of Adequate Household Food Provisioning
MsHDDS	Micronutrient Sensitive Household Dietary Diversity Score
NAFRI	National Agricultural and Forestry Research Institute
NUS	Neglected and Underutilized Species
PELUM	Participatory Ecological Land Use Management
SD=HS	Sowing Diversity = Harvesting Security
ZAAB	Zambia Alliance for Agroecology and Biodiversity

Foreword

This document presents the main household-level findings of the baseline survey conducted between 2019-2021, during the second phase of the *Sowing Diversity = Harvesting Security (SD=HS)* programme (2019-2023). The results of the baseline are complemented with the main findings of the diagnostic exercises conducted by SD=HS' Farmer Field Schools (FFS). Both activities are part of SD=HS' work on Local Food Plants for Nutrition. SD=HS is a global program, and our work on local food plants is currently implemented by Oxfam Country Offices and partner organizations in seven countries. These partners are the *National Agricultural and Forestry Research Institute (NAFRI)* and the *Agricultural Research Center (ARC)* in Laos, the *Local Initiatives for Biodiversity, Research and Development* (Li Bird) in Nepal, the *Asociación de Organizaciones de los Cuchumatanes (ASOCUCH)* in Guatemala, the *Participatory Ecological Land Use Management (PELUM)* and the *Eastern and Southern Africa Small Scale Farmers' Forum (ESAFF)* in Uganda, the *Zambia Alliance for Agroecology and Biodiversity (ZAAB)* in Zambia, the *Community Technology Development Trust (CTDT)* in Zambia and Zimbabwe, and the *Fomento de la Vida (FOVIDA)* in Peru. SD=HS is coordinated by Oxfam Novib.

The use of the baseline data and FFS diagnosis conducted by farmers allowed us to establish the local and regional nutritional and agroecological conditions in the communities where the Farmer Field Schools (FFS) on Nutrition and Local Food Plants were implemented. The baseline data served to advise and guide the development of a country-specific FFS curriculum and the implementation of FFS activities, by informing FFS participants, collaborators, and other stakeholders about the potential role of local food plants in improving local diets and reducing the food scarcity period.

This Briefing Note is part of a series of briefing notes summarizing the program's findings on nutrition. The comparison of the baseline and FFS diagnosis results across the seven program countries will be consolidated in global SD=HS publications.

We are grateful for the funding support from the Swedish International Development Cooperation Agency (Sida).

We hope this document, which provides new and detailed data, contributes to increased attention on the role of local food plants for healthy and affordable diets, and improved nutrition of indigenous peoples and smallholder farmers.

1 Introduction

1.1 Malnutrition

Malnutrition remains one of the greatest global health challenges, and women and children are its most visible and vulnerable victims. People are malnourished when: (a) their diet does not provide adequate calories or nutrients for their body growth and normal function, (b) they are unable to fully utilize the food they eat due to illness, or (c) they take in too much energy, saturated or trans-fat, salt, and sugar (overnutrition). In all cases, malnutrition is closely linked to disease as it affects the function and recovery of every organ system. Poverty exacerbates the likelihood and effects of malnutrition. Furthermore, malnutrition contributes to higher healthcare expenses, decreased productivity, and hindered economic growth, fostering an ongoing cycle of poverty and ill-health[1].

In Guatemala, there exists a complex relationship between poverty and malnutrition, with socio-economic disparities playing a significant role. Despite being the largest economy in Central America, Guatemala has experienced an increase in poverty rates, reaching 59 percent in 2014, and approximately two-thirds of the population surviving on less than $2 USD a day. Indigenous populations, constituting 40 percent of the total population, bear the brunt of this inequality, facing higher rates of poverty, malnutrition, and mortality, coupled with limited access to education and healthcare services. Factors such as natural disasters and climate change exacerbate the challenges, impacting subsistence farmers and leading to acute food insecurity. The agricultural sector is further strained by poor soil conditions, over-exploitation of resources, and limited access to credit and technical assistance[2].

The consequences of poverty and environmental challenges are starkly evident in the alarming malnutrition rates among Guatemalan children. Approximately 47 percent of children under five are stunted, indicating chronic malnutrition. However, this national statistic conceals significant regional disparities, with stunting peaking at around 70 percent in highly indigenous areas such as Totonicapán, Quiche, and Huehuetenango. Furthermore, stunting prevalence is closely linked to socioeconomic factors, maternal education, and wealth levels. Children of mothers with no formal education and those in the lowest wealth quintile face disproportionately higher rates of stunting. The intricate connection among socioeconomic circumstances, reproductive trends, and malnutrition emphasizes the complex interrelationship between poverty and nutritional outcomes for children under the age of 5 in Guatemala[2].

1.2 Food scarcity

For many people, the availability of food is driven by seasonal cycles, and the availability of food is least in the pre-harvest months. During food scarcity periods, household food stocks from the last harvest have dwindled. This may coincide with food shortages in the local market, meaning that food that is still available is sold at inflated prices. In this period of the year, the nutrition security of the family is most at stake. Rural households may be forced to resort to various coping strategies to deal with food scarcity, such as reducing the diversity and quantity of their meals, which has an effect on macro and micronutrient deficiencies of household members. Other strategies to which farmers resort when food scarcity really hits them, such as mortgaging or selling the land, livestock, and other household assets, may result in further spiralling into poverty. The challenges experienced during the scarcity period can be increasingly aggravated by the consequences of climate change. The psychological effects of food scarcity challenges are profound, and all family members may experience high levels of anxiety and stress during this period. Women are especially affected, as their responsibilities often comprise both food production, income-generating activities, and care for other

household members (including food preparation). The effects of food scarcity periods tend to be overlooked by policymakers, or may only get attention when these result from natural or human-made calamities.

In Guatemala, the intricate relationship between food scarcity and poverty has been exacerbated by prolonged droughts and crop failures. A significant portion of the population, about one-third, grapples with food insecurity, compelling many rural residents to migrate. Despite agriculture employing a substantial 33 percent of the population, its contribution to the gross domestic product is limited, standing at only 13.5 percent. This economic disparity poses challenges for rural Guatemalans in achieving an improved quality of life[3].

1.3 Objective

The objective of SD=HS work on Local Food Plants for Nutrition is twofold: 1. To enhance dietary diversity[a] and food security; 2. To reduce the duration and severity of climate-related food scarcity seasons. This is achieved through promoting access to and consumption of diverse and nutritious local food plants while safeguarding local biodiversity and optimizing the management of these crucial plant resources. By achieving these goals, the initiative aims to improve overall nutrition security and resilience to climate challenges.

In order to improve the nutrition status of smallholder farmers and indigenous peoples, the following questions were addressed:

- What are, according to farmers, the local causes and consequences of malnutrition?
- What characterizes the food scarcity period and which strategies do farmers implement to cope with it?
- What is the role of local food plants in improving the diversity of the diet during the food scarcity and sufficiency periods?
- What is the role of the agroecosystems and local environments in the provision of local food plants?
- Are households that consume more local food plants less prone to suffer from food insecurity, food scarcity, and lower dietary diversity and quality?
- How can we best measure this? What are the implications of local food plant consumption for the most vulnerable households?
- What are the local food plants on which knowledge is shared by men and/or women in the communities?
- Which are the local food plants that are consumed during the food scarcity period?
- Who are the most powerful household members in terms of access to food?
- What are the roles of women and men in the acquisition of local food plants?
- Does gender affect the knowledge of local food plants?

This Briefing Note is an attempt to answer these questions, by comparing the consumption of local food plants in food scarcity and sufficiency periods, and its effects on achieving dietary diversity and quality throughout the year. It further addresses the role of local food plants in strengthening communities' coping strategies, in view of their demographic and socio-economic profiles. It also reflects the intention to raise awareness, stimulate discussions, and trigger feedback from a wider audience of stakeholders on the role that local food plants may

[a] Diverse diets include a variety of foods from different food groups, including cereals; white roots and tubers; vitamin A-rich vegetables and tubers; dark green leafy vegetables; other vegetables; vitamin A-rich fruits; other fruits; organ meat; flesh meat; eggs; fish and seafood; legumes, nuts and seeds; milk and milk products; oils and fats; sweets; spices, herbs, and beverages. A diverse diet is important to ensure the intake of a wide variety of nutrients, which is needed for a healthy life.

play in improving nutrition and ensuring healthy and affordable diets. Finally, it provides information to support policies and legislation that promote diverse and healthy diets through the improved and sustainable use of biodiversity available in the environment.

2 Methodology

2.1 Household survey

The household survey took place from 2019 to 2021 at two different periods (scarcity season and sufficiency season) in the Huehuetenango province of Guatemala [Table 1]. Data was collected by local enumerators who speak the local language. They were trained by the Asociación de Organizaciones de los Cuchumatanes (ASOCUCH) and pilot-tested the questionnaire before collecting the data. The household survey was conducted in a representative sample of communities, representing each agroecosystem and ethnic group in the project region. In each selected community, a random household sampling equivalent to 30% of all households living in the community took place to ensure statistical representativeness. For villages with 30 to 100 households, a sample of 30 households was used; for villages with 30 or fewer households, all households were interviewed. Households that had been living for less than one year in the community or households that had not been engaged in farming were excluded from the sample. All informants participated freely and with prior informed consent.

Table 1. *Data collection periods during scarcity and sufficiency seasons in the Huehuetenango province of Guatemala*

Sufficiency season (round 1)	Scarcity season (round 2)
December 2019	March 2021

This Briefing Note presents the results of the following survey modules: (1) demographic and socio-economic characteristics, (2) severity of food insecurity, (3) dietary diversity, (4) local food plant acquisition, (5) free-listings of local food plants, (6) features of the food scarcity season, and (7) sources of information modules of the household survey[b]. The demographic and socio-economic module includes collected data that allowed the calculation of variables related to gender and household vulnerability, and that gave a general indication of the main productive activities of the household, among others. All interviews (except for the demographic and socio-economic module) were conducted in both food scarcity and sufficiency periods.

Food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS) and the Household Hunger Scale (HHS)[4] [Table 2]. According to the HFIAS indicator guide[5], a food-secure household experiences no food insecurity conditions, or it might rarely experience concerns about sufficient access to food. A mildly food insecure household often worries about not having enough food, it might be unable to eat preferred foods and have a more monotonous diet than desired, or it can even consume some foods considered undesirable. A moderately food insecure household often sacrifices quality more frequently, by eating a monotonous diet or undesirable foods and can start to cut back on quantity by reducing the size of meals or number of meals. Finally, a severely food insecure household has resorted to cutting back on meal size or number of meals and its members can still run out of food, go to bed hungry, or go a whole day without eating[5].

[b] The detailed explanation of each module, including the survey questionnaire, is accessible in the Baseline Tool document (http://bit.ly/2WSHfTf). The tool was revised and agreed upon with all partner organizations.

Table 2. *Food insecurity indicators and their definitions*

Food Insecurity Indicators	Abbreviation	Definition
Household Food Insecurity Access Scale	HFIAS	It measures the severity of household food insecurity during the past four weeks (30 days). It ranges from 0 to 27, indicating the degree of insecure food access. Households are categorized as food secure, mildly food insecure, moderately food insecure, or severely food insecure[4].
Household Hunger Scale	HHS	It is derived directly from the HFIAS and it includes only three hunger-related aspects of insecure food access: "little to no hunger in the household", "moderate hunger in the household", or "severe hunger in the household"[4].

A 24-hour dietary recall-based interview was also conducted to capture detailed information about all foods and beverages consumed by the respondent in the past 24 hours[6]. Based on the results of the 24-hour recall, the Household Dietary Diversity Score (HDDS), Micronutrient Sensitive HDDS (MsHDDS), the Food Variety Score (FVS) and Dietary Species Richness (DSR), were all calculated [Table 3].

Table 3. *Dietary diversity indicators calculated based on the 24-hour recalls, and their definitions*

Dietary Diversity Indicators	Abbreviation	Definition
Household Dietary Diversity Score	HDDS	It assesses a household's economic access to food (i.e. its ability to produce, purchase or otherwise secure food for consumption by all household members). The potential score range is 0-12[7].
Micronutrient Sensitive HDDS	MsHDDS	It disaggregates and reorganizes the HDDS food groups into 16 micronutrient-based groups[8].
Food Variety Score	FVS	It measures the number of different food items consumed from all possible items eaten (individual foods, food mixtures, food categories, or a combination of these)[9].
Dietary Species Richness	DSR	It measures the number of different species consumed per day, assessing both nutritional adequacy and food biodiversity[10].

Local food plant acquisition events, based on a recall period of seven days, also captured the multiple environments from which local food plants were acquired, and gender roles related to their harvesting or gathering. A detailed explanation of how each index was calculated, alongside the rationale of each survey module, and the survey questionnaire itself are accessible upon request. The tools were revised and agreed upon by all partner organizations. Each partner could adapt, test the tools, and include specific sections relevant to their own context.

The free listings of the food plants aim to provide an overview of local knowledge and were used for the development of a list of species based on the knowledge that is shared by community members. Given that knowledge is intrinsically related to gender, free listings were requested from the head of household and his/her spouse separately. The results of the free listings were analysed by using the cognitive salience index (CSI). The CSI combines frequency and order of mention across men's and women's lists for each plant species and reflects the knowledge of a specific plant (the higher the CSI, the higher the knowledge of that specific plant[11]. In addition, the species that are more widely used among households during the food scarcity season were

identified using the traffic light exercise[12]. For that, the enumerator asked men and women to give a colour to each plant species in relation to the period when it is consumed, as follows:

- Green light: local food plant species are consumed during the sufficiency period, or when food may not be plentiful but generally available to the community in adequate quantities and qualities.
- Amber light: local food plant species are consumed during a period in which food reserves are alarmingly low.
- Red light: local food plant species are consumed during a situation in which the food supply is depleted, which condition requires emergency measures.

The food scarcity module not only assessed the months in which households have reduced access to food[13] but also captured the variety of local food plants consumed in times of food scarcity. The sources of information module captured the current and preferred sources of information for the community households on health, sanitation, and nutrition issues, to help design strategies to communicate with farmers by using preferred channels.

The data was analysed with descriptive and non-parametric statistics. Spearman rank correlations were calculated between ordinal or continuous variables. Kruskal-Wallis ranked tests estimated correlations between one nominal variable that has two or more categories and a continuous variable. Mann-Whitney tests estimated correlations between one nominal variable that has two categories and a continuous variable. Finally, Chi-Square tests were calculated between two nominal variables.

2.2 FFS diagnostic exercises

The FFS diagnosis took place in 2021 for 8 FFS established during that year in the Huehuetenango province of Guatemala. Data was collected by FFS facilitators who speak the local language. They were trained on the FFS approach for the work on nutrition and local food plants, including the conduction of diagnostic exercises and FFS activities, by the Asociación de Organizaciones de los Cuchumatanes (ASOCUCH) as part of the training of trainers. All FFS members participated freely and with prior informed consent.

This Briefing Note presents the results of the malnutrition problem tree, decision-making with respect to intra-household food distribution, and timeline analysis of local food plants and nutrition exercises from 8 FFS for which we had complete and good-quality data. The analysis of the data was mainly a descriptive exercise, showing patterns, frequencies, and means, where applicable. The FFS diagnostic exercises are detailed in the illustrated module 'Diagnostic Phase' of the FFS Field Guide, which also includes the forms by which results were reported. More information on the FFS work on Nutrition and Local Food Plants is provided on the SD=HS website and is summarized in the Online Course, accessible through the SD=HS website.

2.3 Household and FFS locations

In total, data were collected from 282 households for the baseline survey and 8 FFS for the Diagnostic exercise. Table 4 presents the distribution of the households and FFS surveyed across four districts of the Huehuetenango province of Guatemala.

Table 4. *Distribution of sampled households and FFS across the four municipalities, involved in the activities indicated*

	FFS diagnostic exercise		Baseline survey	
Municipalities	Number of FFS	Percentage of total number of FFS	Number of households	Percentage of total number of households
Todos Santos Cuchumatán	1	13%	63	22%
Concepción Huista	2	25%	129	46%
Santa Eulalia	1	123%	81	29%
Chiantla	1	13%	9	3%
Petatan	3	38%	0	0%
Total	8	100%	282	100%

Figures 1 below show the location of the surveyed FFS and households within the Huehuetenango province of Guatemala. The map figures were prepared by Matteo Petitti.

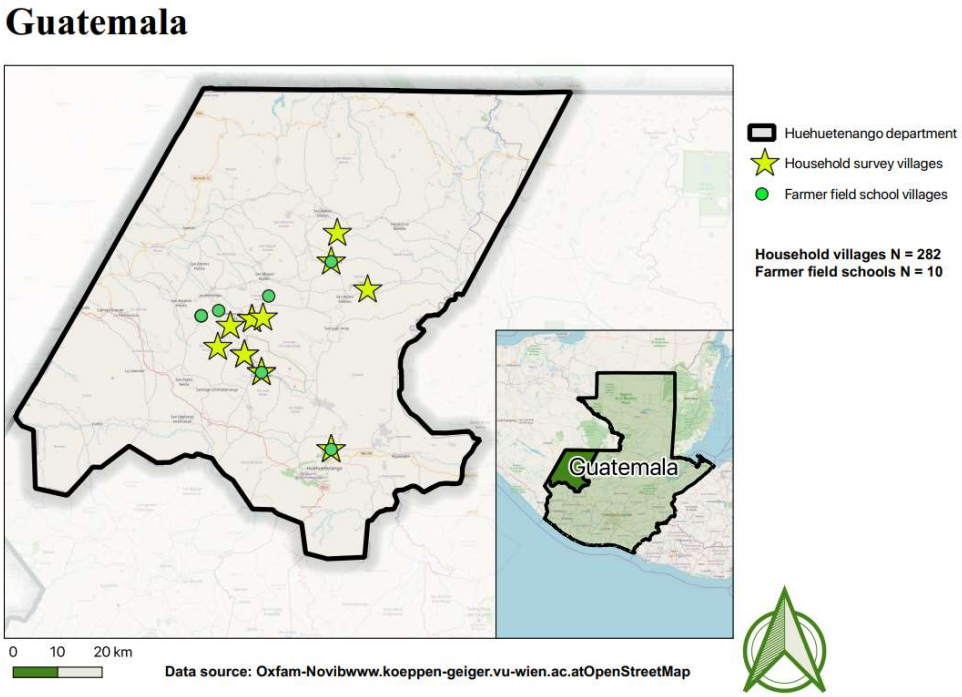

Figure 1. *Map indicating the location of FFS and households within the Huehuetenango province of Guatemala*

3 Results

3.1 Indigenous peoples and smallholder farmers in Guatemala

Indigenous peoples and smallholder farmers surveyed in Huehuetenango province live in the Western highlands of Guatemala[14], which are characterized by high altitude (>1200 MASL) and moderate annual rainfall (1200 – 2000mm)[15]. According to the Holdridge Life Zone classification [16,17], 68% of the communities involved are situated in the *subtropical dry forests* zone, while the location of 29% of the areas classified are in the *warm temperate dry forests* zone. The remaining 3% of the implementing locations belong to the *cool temperate moist forests* zone. Köppen Climate classification[18] indicates that the majority (79%) of the implementing areas have a climate of *warm temperate/fully humid warm summer*, while the remaining communities reside in a *warm temperate winter/dry hot summer climate* (21%). The surveyed communities mostly rely on maize and bean farming to sustain their livelihoods.

Table 5 presents the socio-demographic characteristics of the participating communities. The majority of the households investigated had an average size of almost six household members. The most common ethnic group among the interviewed households was Popti' (46%), followed by Q'anjob'al (29%) and Mam (22%). Male household heads were present in almost 80% of the households interviewed, indicating the gender disparity in household dynamics. The educational level and literacy rates of the surveyed households showed that 80% of household heads have never attended formal education, although 52% of them know both how to read and write. Almost 20% of the household heads have attended primary education. The results point out a strong divergence in literacy and formal education levels within and between these communities.

Table 5. *Results from socio-demographic module of baseline survey*

Socio-demographic variables	Sufficiency season interviews (R1)			
	N	%	Mean	St. D.
Ethnic Groups	282			
Mam	63	22%		
Mestizo	9	3%		
Popti'	129	46%		
Q'anjob'al	81	29%		
Household size			5.6	2.3
Sex of household head				
Man	208	78%		
Woman	60	22%		
Main occupation of household head				
On farm	212	79%		
Outside farm	31	12%		
Both	25	9%		
Age of household head			46.6	15.5
Literacy of household head				
Only read	23	9%		
Only write	4	2%		
Both	140	52%		
None	101	38%		
Education of household head				
Never attended formal education	213	80%		
Primary	49	18%		
Secondary	3	1%		
Highest education	3	1%		
Number of migrants per household			1.3	0.9
Number of children (incl. orphans) per household			2.5	1.7
Number of chronically ill people per household			0.0	0.2
Number of women in child-bearing age per household			1.3	0.9
Total land area (ha) per household			0.5	0.6
Main productive activities per household				
Agriculture	263	42%		
Livestock farming	164	26%		
Fishing	2	0%		
Hunting	84	14%		
Gathering	108	17%		
Other	263	42%		
Farm ownership				
Owned	215	68%		
Rented	70	22%		
Borrowed from family or friends	32	10%		

Socio-demographic variables	Sufficiency season interviews (R1)			
	N	%	Mean	St. D.
Number of crops grown in the past 12 months, and for what use			3.3	2.0
Sales			0.8	1.5
Consumption in the household			2.9	1.9
Barter			0.0	0.1
Market orientation (proportion of harvest for sale)			21%	32%
Presence of income from non-agricultural activities	172	64%		
Presence of home garden	174	65%		

** The results are based on the baseline household survey, in which 282 households participated. Ethnic groups: N=268 (missing values=14); Household size: N=268 (missing value=14) ; Sex of household head: N=268 (missing value=14); Main occupation of household head: N=268 (missing values=14); Age of household head: N=268 (missing values=14); Literacy of household head: N=268 (missing values=14); Education of household head: N=268 (missing values=14); Number of migrants: N=268 (missing values=14); Number of children: N=268 (missing values=14); Number of chronically ill people: N=268 (missing values=14); Number of women in child-bearing age: N=268 (missing values=14); Total land area: N=268 (missing values=14); Main productive activities: N=268 (missing value=14); Farm ownership: N=266 (missing values=16); Number of crops grown on the past 12 months: N=260 (missing value=22); Market orientation: N=260 (missing value=22); Presence of income from non-agricultural activities: N=268 (missing values=14); Presence of home garden: N=268 (missing values=14). The percentages are calculated over the valid number of responses for each variable, excluding missing values.*

In terms of their productive activities, more than 40% of the households interviewed work in agriculture, more than 25% of them in livestock farming and almost 70% also own a farm. An average total of three crops were grown by the households in the past 12 months and the average sale proportion from their harvest is 21%, while the rest was mostly consumed in the household. Interestingly, more than 60% of the households have an income from non-farming activities and 65% of them operate a home garden.

3.2 Local causes and consequences of malnutrition

The diagnostic exercises addressed the causes and consequences of malnutrition using the Malnutrition Tree as a tool. An important cause of malnutrition mentioned in eight FFS was the limited dietary diversity and the low consumption of diverse vegetables [Table 6]. Seed system limitations, poverty and lack of knowledge on food preparation and the nutrition of native plants were also scored as important causes of malnutrition with each one being reported five times within the FFS. Interestingly, limited access to food due to food scarcity and environmental challenges causing extensive droughts were each reported three times by the FFS participants, indicating awareness of the impacts of climate change. Answers like poor hygiene and limited access to land were also mentioned three and two times, respectively. In conclusion, seed system limitation exacerbated by the impacts of the changing climate, accompanied by the lack of knowledge on native plants and on the preparation of nutritious food, prevails in the list of malnutrition causes.

Table 6. *Causes of malnutrition as reported by FFS participants*

Malnutrition cause	Number of answers	Percentage of answers	Details and examples
Poor diet/Limited dietary diversity	8	24%	Low consumption of herbs and vegetables; children have stopped eating greens; high consumption of junk food
Seed system limitations	5	15%	Planting commercial products; low availability of seeds; scarcity of native plants in the field; disappearance of species
Poverty	5	15%	Limited family income; lack of employment
Knowledge lack or gap	5	15%	Unfamiliarity with native plants; lack of knowledge in preparing nutritious dishes
Limited access to food	3	9%	Food scarcity; high food prices
Environmental challenges	3	9%	Climate change; climatic conditions have affected the development of species; droughts during harvest and resulting losses
Poor hygiene and personal care	3	9%	Poor hygiene; mothers neglect hygiene, thinking that if they have malnourished children, they will receive more socio-economic assistance
Limited access to land	2	6%	Limited land for cultivation; access to land
Total	34	100%	

**The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=34) collected from the 8 FFS.*

The most important consequence of malnutrition, reported 10 times by the FFS participants, was the manifestation of illness and disease [Table 7]. Poor life expectancy, and early death were mentioned five times within the FFS, while overall weakness and decreased productivity also scored 4 responses as important malnutrition consequences. Weight loss and stunting were mentioned only three times by the FFS participants, indicating that although this is an earlier manifestation of malnutrition than illness and death, its severity could be overlooked. Finally, migration which was only mentioned once, was the only socio-economic consequence of malnutrition reported.

Table 7. *Consequences of malnutrition as reported by FFS participants.*

Malnutrition consequence	Number of answers	Percentage of answers	Details and examples
Illnesses	10	43%	Increased presence of diseases; chronic illnesses; sick children
Poor life expectancy or death	5	22%	Weak and underweight children; stunted growth
Overall weakness, lethargy and poor productivity	4	17%	Decrease in lifespan; abortions; child deaths
Weight loss/Stunted growth	3	13%	Low intellectual level; limited learning in school; higher incidence of children with learning disabilities
Emigration	1	4%	-
Total	23	100%	

**The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=23) collected from the 8 FFS.*

Regarding the changes in nutrition over the past 30 years, the responses of the FFS participants were divided. In particular, four out of eight responses (50%) reported that nutrition has improved during the past three decades, while three responses (38%) reported the exact opposite [Table 8]. No change in the nutritional state of the population surveyed was mentioned once by the FFS participants. The difference in these results might be because of how the question was perceived by the participants, and might not reflect the actual nutrition situation over the past years in the Huehuetenango province. This particular response might need follow-up.

Table 8. *Nutrition changes in the village in the last 30 years*

Changes in nutrition	Number of answers	Percentage of answers
Worsened	4	50%
Stayed the same	1	13%
Improved	3	38%
Total	8	100%

**The details and examples are taken directly from the FFS diagnostic reports. The question asked was "Has the nutrition in the village changed in the last 30 years?". The percentages are calculated over the total number of answers (N=8) collected from the 8 FFS.*

Globalization and westernized eating habits was the major influencing factor that affected the nutritional status of the household, mentioned 8 times by the FFS participants [Table 9]. Interestingly, the decreased consumption of local food plants, especially in children, scored second, by 32% of the total responses, indicating some awareness of the potential benefits of the native plants. Overall poverty and limited access to land are mentioned again as important factors of the change in the nutritional status over the past 30 years, as they were reported four times within the FFS. Interestingly, climate change was only reported once by the FFS participants, suggesting an existent but weak association between nutrition and prolonged droughts in the participants' perceptions. It is noteworthy that all the factors listed suggest a worsening of the nutritional status over the past years and contradicts the division in Table 8.

Table 9. *Major factors that affected the nutritional status of the households*

Factors influencing the change	Number of answers	Percentage of answers	Details and examples
Globalization and changing habits	8	42%	Other sources of employment have replaced agriculture; people consume packaged foods (soups, sardines, butter, pasta); the economy, migration, and technology have affected dietary habits, and the influx of junk food is one of the biggest problems
Loss of local foods in the diet	6	32%	Interest in planting local plants diminishes; less consumption of herbs and vegetables, especially among children
Poverty and lack of access to food/land	4	21%	Lack of food due to a decrease in economic income; lack of access to land
Climate change	1	5%	
Total	**19**	**100%**	

**The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked ("What were the major factors that affected the nutritional status of the households?") allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=19) collected from the 8 FFS.*

3.3 Understanding local diets

The baseline survey showed that household dietary diversity (HDDS) and micronutrient-sensitive dietary diversity (MsHDDS) were slightly higher during the scarcity season compared to the sufficiency season [Table 10]. It is important to note that both the HDDS and MsHDDS indicators simply group food plants in categories such as cereals, tubers, vegetables, fruits, and legumes and measure to what extent the household diet contains crops from these groups. That means that unfortunately these indicators cannot capture the diversity of food plants consumed within each food group, e.g. diversity of vegetables, fruits, etc. However, the indicator FVS, which measures the variety of different food items, and DSR, which measures the diversity in species consumption[9,10], scored slightly lower during the food scarcity season, in contrast to the household dietary diversity indicators (HDDS and MsHDDS). This indicates that during the food scarcity season, households consume a slightly smaller variety of foods and plant species that belong to the same food group category of the HDDS and MsHDDS indicators. For example, they might consume a lower variety of different vegetables which all belong to the vegetable food group. The lower variety of foods (FVS) or plant species (DSR) consumption during the scarcity season could be a result of low food availability.

Table 10. *Dietary diversity (HDDS, MsHDDS, FVS and DSR) differences between scarcity and sufficiency seasons*

Dietary diversity	Sufficiency season (mean ± sd)	Scarcity season (mean ± sd)
HDDS (0-12)	7.1 ± 1.6	7.9 ± 2.3
MsHDDS (0-16)	7.8 ± 2.2	8.8 ± 3.2
FVS (>0)	9.4 ± 2.8	9.1 ± 3.6
DSR (<0)	4.0 ± 1.5	3.8 ± 1.8

** The results come out the baseline household survey, in which 282 households participated. During the first survey round (sufficiency season) 14 values were missing (N=268), while during the second survey round (scarcity season), 33 values were missing (N=249).*

Regarding the specific food groups that households mostly include in their diets, we noted that cereals, vegetables, legumes, nuts and seeds, sweets and spices are the most consumed food groups during both the scarcity and sufficiency seasons, with all being consumed slightly higher during the sufficiency season [Table 11]. White tubers and roots are consumed equally in

both seasons consisting the 9% of the households' diets, while fruits are consumed much less frequently. In fact, fruits consist only the 4% of the households' diets during the sufficiency season, and 6% during the scarcity season. Whereas available food quantities might be less during the scarcity periods, the dietary diversity appeared not statistically different between these two seasons, suggesting that improving the role of local food plants in local diets might be important throughout the year and regardless of the nature of the season.

Table 11. *Main food groups consumed during the scarcity and sufficiency seasons*

Food Group	Sufficiency season		Scarcity season	
	N	%	N	%
Cereals	268	14%	249	13%
White tubers and roots	167	9%	178	9%
Vegetables	255	13%	225	12%
Fruits	73	4%	112	6%
Meat	66	4%	95	5%
Eggs	146	8%	137	7%
Fish and other seafood	3	0%	30	2%
Legumes, nuts, and seeds	239	13%	203	11%
Milk and milk products	25	1%	62	3%
Oils and fats	149	8%	165	9%
Sweets	247	13%	232	12%
Spices, condiments and beverages	263	14%	234	12%
Total	1901	100%	1922	100%

** The results are deduced from the baseline household survey, in which 282 households participated. During the first survey round (sufficiency season) 14 values were missing (N=268), while during the second survey round (scarcity season), 33 values were missing (N=249). The percentages reflect the number of households that mentioned the source of information, divided by the number of multiple responses each category received.*

3.4 Local food plants diversifying the diet

Table 12 presents the food groups in which some important local food plants in Huehuetenango province are categorized. These plants have been selected for their importance in food scarcity season and/or due to their high nutritional value.

Table 12. *Important local food plants during the food scarcity season and/or due to their high nutritional value*

Scientific name	English name	Local name	Food group
Solanum nigrescens	nightshade	hierba mora	vegetables
Brassica rapa	turnip	nabo	roots and tubers
Bidens pilosa	black jack	amor seco	vegetables
Phaseolus coccineus	bean	frijol	legumes
Sonchus oleraceus	lettuce	lechuguilla	vegetables
Nasturtium officinale	watercress	berro	vegetables
Coriandrum sativum	coriander	cilantro	vegetables
Crotalaria longirostrata	longbeak rattlebox	chipilin	vegetables
Colocasia esculenta	taro	malanga	roots and tubers

3.5 Measuring the severity of food insecurity

The results of the HFIAS indicator showed that household food insecurity was generally low during both seasons, while the high standard deviations suggest the existence of households far from the average food insecurity rates [Table 13]. As expected, food insecurity scored higher during the scarcity season compared to the sufficiency season. This demonstrates the crucial negative impact that lean periods, linked to growing seasons, have on household food security.

Table 13. *Food insecurity (HFIAS) differences between scarcity and sufficiency seasons*

Food Insecurity	Sufficiency season (mean ± sd)	Scarcity season (mean ± sd)
HFIAS (0-27)	1.3 ± 2.9	2.9 ± 4.3

** The results come out the baseline household survey, in which 282 household participated. During the first survey round (sufficiency season) 14 values were missing (N=268), while during the second survey round (scarcity season), 33 values were missing (N=249).*

The HHS is derived directly from the HFIAS, but it only assesses the most severe experiences of food insecurity. Therefore, the results show that – while there is some degree of food insecurity as indicated by the HFIAS – food insecurity is not severe given that no household was experiencing severe hunger during the scarcity season, and only 2% of the interviewed households were experiencing moderate hunger.

Table 14. *Percentage of households that suffer from hunger throughout the year*

Household Hunger Scale (HHS)	Sufficiency season		Scarcity season	
	N	% Hhs	N	% Hhs
Little to no hunger (% total Hhs)	242	90%	243	98%
Moderate hunger (% total Hhs)	25	9%	6	2%
Severe hunger (% total Hhs)	1	0%	0	0%

** The results are calculated based on the data from the baseline household survey, in which 282 households participated. During the first survey round (sufficiency season) 14 values were missing (N=268), while during the second survey round (scarcity season), 33 values were missing (N=249). The percentages are calculated over the valid number of responses for each variable, excluding missing values.*

3.6 The food scarcity period

Given the important links between food scarcity and food insecurity, it was important to look into the current length of the scarcity period within the investigated areas in Guatemala. Table 15 presents the percentage of the investigated households in Huehuetenango province that suffer from food scarcity throughout the year. March and April are the months showing the largest shortages, with 35% and 25% of households experiencing food scarcity, respectively. These months are also the final months of the dry season, while the rainy season lasts between May and October.

Table 15. *Percentage of households that suffer from food scarcity indicated per calendar month*

Months	Percentage of households
January	1%
February	3%
March	35%
April	25%
May	12%
June	1%
July	0%
August	0%
September	0%
October	0%
November	0%
December	0%

**The results come out the baseline household survey, in which 282 household participated and 19 values (Hhs) were missing (N=263).*

The most important characteristic of the food scarcity season, mentioned in five of the 14 responses within the FFS, was the poor yields and crop failures [Table 16]. Related to this low agricultural productivity, climatic challenges were reported next, four times by the FFS participants. Cash crop production was mentioned twice as a characteristic of the food scarcity period, indicating a priority to cover financial needs over nutritional needs. Indeed, poverty was

reported twice by the FFS participants, while limited access to food was mentioned only once. Interestingly, no mention of the households' diets or nutritional status was recorded, suggesting again a weak association between nutrition and food scarcity in the participants' perceptions.

Table 56. *Characteristics and definition of the scarcity season as mentioned by the FFS participants*

Characteristics of the scarcity season	Number of answers	Percentage of answers	Details and examples
Poor yields/crop failures	5	36%	Low productivity; increased appearance and proliferation of pests and diseases in crops
Climate challenges	4	29%	Drought; strong winds; excessive rainfall
Cash crop prioritization	2	14%	Focus on the main crop (coffee)
Poverty	2	14%	Limited access to agricultural and non-agricultural jobs; scarcity of work during the rainy season
Poor access to food	1	7%	No harvesting of wild herbs
Total	**14**	**100%**	

**The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=14) collected from the 8 FFS.*

3.7 Food plants during the food scarcity season

The average number of food plant species used in times of food scarcity per household was 1.9 (± 1.5). Table 17 presents the most frequently used food plants in times of scarcity. Black nightshade and bell tree dahlia are the plants mentioned with the highest frequencies of consumption during the food scarcity period (more than 30% of the households). Although beans and potatoes are considered to be major staple foods, they seem to play an important role during food scarcity, perhaps in reduced volumes.

Table 17. *Key food plant species used during food scarcity period*

Food plants used in food scarcity	Scientific name	Number of households	Percentage of households
black nightshade (hierba mora)	*Spolanum nigrum*	38	40%
bell tree dahlia (santa catarina)	*Dahlia imperialis*	31	33%
turnip (nabo)	*Brassica rapa*	17	18%
giant potato creeper (hierba de espina)	*Solanum wendlandii*	12	13%
common sow thistle (lechuguilla)	*Sonchus oleracea*	12	13%
mirliton squash (chayote)	*Sechium edule*	9	9%
arrowleaf elephant's ear (quequexte)	*Xanthosoma sagittifolium*	9	9%
Asian pumpkin (chilacayote)	*Cucurbita ficifolia*	8	8%
green amaranth (bledo)	*Amarantus hybridus*	7	7%
bean (frijol)	*Phaseolus vulgaris*	5	5%
longbeak rattlebox (chipilin)	*Crotalaria longirostrata*	3	3%
mustard (mostaza)	*Brassica juncea*	3	3%
potato (papa)	*Solanum tuberosum*	3	3%

**The results come out the baseline household survey, in which 282 households participated. In total, 187 values were missing (N=95).*

It is important to note that out of the 69 local food plants identified in the 8 FFS, 36 of them were mentioned because of their good taste, indicating the important sensory role that food plays in local diets [Table 18]. Nutritional value was recognized for 35 of the plants mentioned, almost

equally in importance as the good taste. Medicinal value and the easiness of preparation were reported for less than 10% of the 69 species mentioned. These results show that local food plants can play a major role in combatting food and nutrition insecurity during the entire year, which includes the scarcity periods when they are mostly needed.

Table 68. *Perceived importance of local food plants used in times of food scarcity*

Perceived importance	Number of plants	Percentage of plants
Good taste	36	52%
Nutritional value	35	51%
Medicinal value	6	9%
Easy to prepare	4	6%

**The results come out the FFS diagnostic exercise, for which data was collected out of 8 FFS. In total, 69 local food plants were identified. Percentages reflect the number of plants divided by the total number of plants identified in this exercise (N=69). For some plants, no perceived importance was assigned.*

3.8 Multiple environments can support diverse diets: Local food plant acquisition

Sourcing of local food plants

In the scarcity period, a significant number of households (27%) are reported to have purchased at least one of the local food plants they mentioned. At the same time, an almost equal number said they sourced the local food plants they mentioned through gathering (22%) or harvesting (22%). As expected, the figures reported for the sufficiency period are higher, indicating that 36% of the households purchased at least one of the plants they mentioned, while 24% harvested them. Interestingly, a much higher parentage of households compared to the scarcity season, reported that they gathered (38%) at least one of the plants mentioned.

In line with the aforementioned results, a lower variety of species (21) was reported to be gathered during the food scarcity season compared to the sufficiency season (37). This difference between the seasons did not appear for plants that were purchased or harvested. These results indicate the important role of food scarcity season in the sourcing preferences of smallholder farmers.

Sites where the local food plants originate from

The majority of the local food plants listed are collected from the agricultural field or the home gardens during both the scarcity and sufficiency periods, high higher frequencies reported during the sufficiency period [Table 19]. Interestingly, during the scarcity season, 44% of the mentioned plant species are brought from public spaces, especially from roadsides (42%), compared a 20% during the sufficiency season. This indicates the important role of public spaces such as the roadsides in food provision during the period of food scarcity.

Table 7. *Number of plant species and sites where they originate from*

Place of origin	Sufficiency season		Scarcity season	
	Number of species	Percentage of species	Number of species	Percentage of species
Agricultural field	45	83%	30	67%
Home garden	39	72%	32	71%
Forest	15	28%	14	31%
Public spaces	11	20%	20	44%
Roadside	10	19%	19	42%
Lake	0	0%	0	0%
Riverside	1	2%	1	2%
Market	36	67%	33	73%
Other	12	22%	11	24%

** The results come out the baseline household survey, in which 282 households participated. In total, 16 households were missing in the sufficiency period (N=266), and 33 during the sufficiency period (N=249). During the first survey round (sufficiency season), 54*

plant species were mentioned, while during the second survey round (scarcity season) 45 species were mentioned. The percentages reflect the number of species brought from each different place, divided by the total number of different species mentioned.
***Public spaces are a grouped category and consist of the combination of roadsides, lakes and riversides.*

3.9 Women's and men's roles: Local food plant acquisition

Household members that acquire local food plants for the household

The baseline survey data showed that women bring home the majority of species during both the scarcity (96%) and sufficiency (96%) seasons, compared to other family members [Table 20]. Men also bring quite a variety of local food plants to their households, with higher frequencies during the scarcity season. Whereas the species provided by women and men show considerable overlap, the total number provided by women is substantially larger. This demonstrates the important role women have in sourcing local food plants and nourishing the family.

Table 20. *Number of plant species that are acquired by various family members*

Family member	Sufficiency season		Scarcity season	
	Number of species	Percentage of species	Number of species	Percentage of species
Man	35	65%	35	78%
Woman	52	96%	43	96%
Both genders	4	7%	7	16%
Children	13	24%	8	18%

**The results are based on the baseline household surveys, in which 282 households participated. In total, 16 households were missing in the sufficiency period (N=266), and 33 during the sufficiency period (N=249). During the first survey round (sufficiency season), 54 plant species were mentioned, while during the second survey round (scarcity season) 45 species were mentioned. The percentages reflect the number of species brought by each different family member, divided by the total number of different species mentioned.*

3.10 Women's and men's knowledge on local food plants

Individual men (4.7 ± 2.2) listed a lower number of plants than individual women (5.8 ± 2.0), indicating that women have a slightly better knowledge of local food plants. However, as a group men reported a similar total number of different plant species (54 different species/ 175 men), compared to women (59 different species /263 women). Almost all plant species were listed by the two genders with similar frequencies, with blackjack, giant potato creeper, black nightshade, turnip and bell tree dahlia being listed more frequently by women. Interestingly, these were also some of the key plants during the food scarcity season. Annex 1 presents the full list of plants and the frequencies in which they were mentioned by men and women, including the Sutrop CSI index[19].

3.11 Relationships with dietary diversity and food insecurity indicators

A significantly negative relationship was found between the number of crops grown in the past 12 months for consumption and household hunger (HHS) during the sufficiency season ($p<0.05$). No significant correlation was found for this relationship during the scarcity season. This means that when food is more available, the households that grow more crops suffer from less from hunger.

A significantly positive relationship was found between the number of local food plants that were acquired and household food insecurity ($p<0.01$), but this time the correlation was significant only during the food scarcity season. This might suggest that, when food is scarce, the more food-insecure households consume a larger number of local food plants, perhaps as a coping strategy to hunger and malnutrition.

A significantly positive relationship between the number of crops grown in the past 12 months for consumption and the household dietary diversity (HDDS and MsHDDS), during the sufficiency season ($p<0.001$). No significant correlation was found for this relationship during the scarcity season. This indicates that, when food is more available, the households that grow a larger number of crops for consumption have more diverse diets.

During food scarcity season, a significantly positive relationship was found between the number of local food plants that were brought home and the household dietary diversity (HDDS and MsHDDS) ($p<0.01$). This relationship suggests that, when food is scarce, the households that manage to acquire more local food have a higher dietary diversity.

3.12 Intra-household decision making

Worldwide, women play a key role in safeguarding the nutrition of their families through their wide knowledge of local food plants, which allows diversification of diets and higher nutrient intake. Empowering them can contribute to their own food and nutrition security and that of their families[20]. However, in many cultures, there are major gender inequalities in relation to the access and control of resources, including food, with major consequences for the nutrition of women and children.

In Huehuetenango province, agricultural roles are distinctly divided between men and women. Women take on a prominent role in small-scale gardening, contributing significantly to improving household nutrition. Conversely, commercial agriculture and the cultivation of crops for sale are predominantly carried out by men, though this pattern can shift in instances where men are absent due to migration, prompting women to assume leadership roles.

Land inheritance practices in the region still largely adhere to the tradition of fathers passing down land to their sons, a custom that has endured through several generations. However, there is a noticeable shift as daughters are increasingly becoming recipients of land inheritance, albeit to a lesser extent. In terms of deciding the types of crops to plant, men traditionally hold sway, particularly in the cultivation of commercial crops intended for sale. Nevertheless, there has been an evolution in this dynamic, with decisions in some cases becoming collaborative efforts between men and women. Additionally, the traditional responsibility of deciding what to cook for the family has historically rested with women, who bring their knowledge of food preparation and exert control over the family pantry and ingredient availability.

In line with the aforementioned, seven responses within the eight FFS indicated that mothers are the ones who decide what to eat in the household, while fathers were reported only three times to also make such decisions [Table 22].

Table 22. *Decision making member regarding what to eat in the household*

Decision making member	Number of answers	Percentage of answers
Mother	7	70%
Father	3	30%
Total	10	100%

** The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked ("Who decides what to eat in the household?") allowed FFS to give more than one response: 1= Father, 2= Mother, 3= Children, 99= Other, please specify [multiple options allowed]. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=10) collected from the 8 FFS.*

Fathers (45%) were reported to be equally powerful household members in providing access to food at large as women (45%). Children (9%) were reported only once to have that role by the FFS participants [Table 23].

Table 23. *Most powerful household members in terms of access to food*

Most powerful member	Number of answers	Percentage of answers
Father	5	45%
Mother	5	45%
Children	1	9%
Total	11	100%

** The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked ("Who are the most powerful household members in terms of access to food?") allowed FFS to give more than one response: 1= Father, 2= Mother, 3= Children, 99= Other, please specify [multiple options allowed]. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=11) collected from the 8 FFS.*

Half of the FFS participants (50%) reported that children are the least powerful household members in terms of access to food, while the elderly and mothers were each reported twice as the least powerful household members [Table 24].

Table 24. *Who are the least powerful household members in terms of access to food?*

Weakest members	Number of answers	Percentage of answers
Children	4	50%
Elderly	2	25%
Mother	2	25%
Total	8	100%

** The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked ("Who are the least powerful household members in terms of access to food?") allowed FFS to give more than one response: 1= Father, 2= Mother, 3= Children, 99= Other, please specify [multiple options allowed]. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of answers (N=8) collected from the 8 FFS.*

Overall, Tables 22, 23, and 24 indicate that although women are most important in the intra-household food distribution, that is they decide what to do with the food that is already available, they mostly have equal power to men in accessing food from any source and providing it to their household.

3.13 Evaluation of coping strategies and possible solutions

Eating less quantity and diversity of foods was mentioned as the most popular copying strategy during food scarcity, although this is not supposed to improve food security [Table 25]. This certainly reflects the reduced access to food during this period, alongside the lack of economic resources to acquire food. Increased consumption of local food plants was mentioned as a copying strategy seven times within the FFS, suggesting at least some awareness of the nutritional benefits of the native plants. Changes in agronomic management like the sowing of early varieties and harvesting before maturity was also mentioned as an important strategy during food scarcity four times by the FFS participants. Responses like income diversification and debt accumulation were also mentioned as copying strategies but less than 10% of the total responses.

Table 25. *Main strategies used to cope with the scarcity season and their severity as reported by the FFS participants*

Coping strategies	Number of answers	Percentage of total answers	Details and examples
Changes in the diet	9	39%	Less quantity of food for each family member; less variety is consumed; meal times are rationed.
Increased consumption of local/wild plants	7	30%	Collection of native herbs; increased consumption of local edible plants; more consumption of root plants (taro, cassava); herbs are collected between crops
Changes in agronomic management	4	17%	Early varieties are sought; corn and beans are harvested before maturity
Diversification of income	2	9%	Credit to establish a small business; sale of spare parts
Accumulation of dept	1	4%	Loans and food on credit
Total	**23**	**100%**	

** The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of responses (N=23) collected from the 8 participating FFS.*

Malnutrition is often a consequence of food scarcity. The most popular counter-strategy to combat malnutrition according to FFS participants was the cultivation of local food plants [Table 26]. Food preparation and cooking demonstrations were also mentioned five times by the FFS participants as a possible solution to malnutrition, with hopes that this activity will increase knowledge on how to better integrate NUS into local diets. In similar frequencies, seed and food fairs for the promotion of local food pants, as well as vegetative propagation were also reported as possible solutions to malnutrition. Responses like harvesting of local food plants (10%), seed storage (7%), seed germination (7%), and improved food preservation (2%) were also proposed as potential solutions to malnutrition. In general, practical demonstrations of applicable knowledge (including growing or managing food plants, processing, cooking and preserving) were often reported as a desired contribution to better nutrition, indicating their significance in knowledge sharing.

Table 26. *Possible solutions to malnutrition by farmers*

Solutions	Number of answers	Percentage of answers	Related research objective
Cultivation of local food plants	12	29%	Rescue of varieties with high nutritional value; knowledge and seed exchange; recovery and conservation of ancestral species
Food preparation and culinary demonstrations	5	12%	Learning new recipes with native, underutilized species; discovering new ways of preparing dishes with herbs that have bitter leaves
Seed fairs and food fairs	5	12%	
Vegetative propagation	5	12%	Propagation methods
Harvesting of wild edible plants	4	10%	Harvesting practices
Seed storage	3	7%	
Seed germination and breaking seed dormancy	3	7%	
Other activities	3	7%	E.g. conducting adaptation tests for new crops
Improved food preservation	1	2%	
Total	**41**	**100%**	

** The details and examples are taken directly from the FFS diagnostic reports. The way the question was asked allowed FFS to give more than one open responses. During data analysis, the responses were then grouped into categories. The percentages are calculated over the total number of responses (N=41) collected from the 8 participating FFS. Other activities category includes answers like the creation of home gardens and special nutrition topics.*

3.14 Preferred ways to promote the use of local food plants by local communities

Health facilities and community health services were the channels by which most households obtain information, and these are also most preferred [Table 27]. NGOs were the next source of information that was being used and acknowledged by 18% and 21% of the responding households, respectively. It is important to notice that no reference is made to extension services and that agriculture-related information sources are preferred by none of the interviewed households. This suggests that support to cope with food scarcity and dietary needs is better received when obtained from health providers.

Table 27. *Current and preferred sources of information*

Sources of information	Current sources		Preferred sources	
	N	% Hhs	N	% Hhs
Neighbour	27	4%	10	3%
Health facilities	174	28%	83	27%
Community health	143	23%	69	22%
Support group, farmer group, FFS	1	0%	0	0%
NGOs	115	18%	64	21%
Radio	57	9%	27	9%
School children	61	10%	24	8%
TV	19	3%	5	2%
Church	10	2%	7	2%
Cell phone	5	1%	3	1%
Other	18	3%	16	5%

* The results come out the first round of baseline household survey, in which 282 household participated, while 14 values are missing for the *Current sources* (N=268) and 19 values are missing for the *Preferred sources* (N=263). The questions were asked in a way that allowed households to provide multiple responses. Percentages reflect the number of households that mentioned the source of information, divided by the number of households that responded the question.

4 Conclusions

The majority of the households investigated had an average size of almost six household members, with almost 80% of the interviewed households male-headed indicating the gender disparity in household dynamics. Most household heads have never attended formal education.

More than 40% of the households interviewed work in agriculture and more than 25% in livestock farming, while 70% also own a farm. An average total of three crops were grown by the households in the past 12 months and the average sale proportion from their harvest was 21%, while the rest of the production was mostly for home consumption. Remarkably, more than 60% of the households have an income from non-farming activities. 65% of households have a home garden, which is mainly cultivated by women.

An important cause of malnutrition was the limited dietary diversity and the low consumption of diverse vegetables. Seed system limitations, poverty, lack of knowledge of food preparation, and the nutritional qualities of native plants were also scored as important causes of malnutrition. The most popular counter-strategy to combat malnutrition was the cultivation of local food plants. Food preparation and cooking demonstrations were mentioned as possible solutions to malnutrition, with hopes that these will increase knowledge on how to better integrate NUS into local diets. In similar frequencies, seed and food fairs for the promotion of local food pants, as well as vegetative propagation were also reported as possible ways to tackle malnutrition.

According to local informants, the most important consequence of malnutrition was the manifestation of illness and disease. Globalization (e.g. other sources of employment replacing agriculture) and Westernized eating habits were perceived as the major influencing factors that affected the nutritional status of the household.

Food insecurity scored higher during the scarcity season compared to the sufficiency season. This demonstrates the crucial negative impact that lean periods, linked to growing seasons, have on household food security.

Cereals, vegetables, legumes, nuts and seeds, sweets and spices were the most consumed food groups during both the scarcity and sufficiency seasons, with all being consumed slightly more during the sufficiency season. Whereas available food quantities might be less during the scarcity periods, the dietary diversity appeared not statistically different between these two seasons, suggesting that improving the role of local food plants in local diets might be important throughout the year.

The most important characteristic of the food scarcity season was low agricultural productivity, followed by climatic challenges. March and April, which are the final months of the dry season, show the largest shortages, with 35% and 25% of households experiencing food scarcity, respectively.

When food is scarce, the more food-insecure households consume a larger number of local food plants, as a coping strategy to hunger and malnutrition. Increased consumption of local food plants was also mentioned as an important coping strategy during times of food scarcity. When food is more available, the households that grow a larger number of crops for consumption have more diverse diets. Crop diversification plays a positive role in enhancing household food security. The diversity of crops cultivated contributes to dietary variety, improving overall household food security. In rural, remote areas heavily reliant on locally produced food, crop diversification proves crucial by providing farmers access to a variety of

crops that may be otherwise inaccessible due to cost or poor infrastructure constraints, including physical access limitations4.

Purchasing, gathering and harvesting were the most common ways to acquire local food plants in both seasons. The majority of the local food plants listed were collected from the agricultural field or the home gardens during both the scarcity and sufficiency periods. Public spaces such as roadsides play an important role in food provision during the period of food scarcity.

Almost all plant species were listed with similar frequencies by women and men, with blackjack, giant potato creeper, black nightshade, turnip and bell tree dahlia being listed more frequently by women. Interestingly, these were also some of the key plants consumed during the food scarcity season. Whereas the species provided by women and men show considerable overlap, the total number provided by women is substantially larger. This demonstrates the important role women have in sourcing local food plants and nourishing the family, particularly during times of scarcity.

The results of this study suggest that local food plants should play a key role in addressing micronutrient deficiencies and reducing the food scarcity period of indigenous households in Huehuetenango. The findings also highlight the importance of local knowledge as the basis for building solutions to malnutrition that are locally sound (culturally and environmentally). Healthy and nutritious diets should be promoted together with the conservation of biodiversity at genetic, species and ecosystem levels, and the recognition of local knowledge and cultures.

The support to indigenous people in Huehuetenango with strategies that help them to cope with food scarcity and satisfy their dietary needs is better received when obtained from health providers. Therefore, it is encouraged to engage health and nutrition departments in the promotion of local food plants, in order to better tackle malnutrition, while preserving plant biodiversity. This work could also be done involving other key actors, like agriculture departments.

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6 ANNEX 1. KNOWLEDGE OF LOCAL FOOD PLANTS

			Freelistings												Food Scarcity		
Food plant	English name	Scientific name	Total percentage (men + women)	Percent of men	Percent of women	Sutrop CSI men	Sutrop CSI women	% of men that indicated traffic light:			% of women that indicated traffic light:			% of hh that indicated traffic light:		
								green	amber	red	green	amber	red	green	amber	red
acelga	chard	Beta vulgaris	10%	8%	12%	0.02	0.03	43%	29%	29%	45%	35%	16%	100%	0%	0%
aguacate	avocado		2%	3%	1%	0.01	0.00	60%	20%	20%	50%	50%	0%			
amor seco	black-jack, beggarticks, hairy beggarticks	Bidens pilosa	18%	11%	22%	0.03	0.06	75%	15%	10%	56%	34%	10%			
anona			0%	1%	0%	0.00	0.00	100%	0%	0%	0%	100%	0%			
apazote			4%	3%	5%	0.01	0.01	60%	20%	20%	67%	25%	8%			
apio			1%	1%	1%	0.00	0.00	50%	50%	0%	33%	67%	0%			
arveja			1%	1%	1%	0.00	0.00	100%	0%	0%	50%	0%	50%			
berro	watercress	Nasturtium officinale	9%	8%	10%	0.02	0.02	50%	36%	14%	46%	31%	23%	100%	0%	0%
bledo	green amaranth, slim amaranth	Amarantus hybridus	38%	36%	39%	0.11	0.10	37%	52%	11%	53%	35%	12%	29%	71%	0%
brocoli	broccoli		7%	6%	8%	0.02	0.02	30%	60%	10%	24%	57%	19%			
calabaza	squash	Cucurbita spp.	5%	4%	6%	0.01	0.01	43%	43%	14%	44%	50%	6%	50%	50%	0%
cebolla	onion		3%	3%	2%	0.00	0.01	40%	60%	0%	17%	83%	0%			
cebollín			1%	2%	0%	0.01	0.00	25%	50%	25%	0%	0%	0%			
chilacayote	Asian pumpkin, black seed squash	Cucurbita ficifolia	13%	14%	13%	0.03	0.03	60%	36%	4%	62%	32%	6%	75%	25%	0%
chile	chilli		1%	1%	0%	0.00	0.00	100%	0%	0%	100%	0%	0%			
chipilin	chepil, chepilin, chipilin and longbeak rattlebox	Crotalaria longirostrata	6%	5%	7%	0.01	0.02	63%	25%	13%	39%	28%	33%	33%	67%	0%
cilantro	coriander	Coriandrum sativum	6%	3%	8%	0.01	0.01	67%	33%	0%	45%	50%	0%			
ciruela			0%	1%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
clavillo			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	0%	100%			
colibin			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
coliflor	caulifiower	Brassica oleracea	13%	11%	14%	0.03	0.03	37%	63%	0%	32%	54%	14%			

			Freelistings											Food Scarcity		
Food plant	English name	Scientific name	Total percentage (men + women)	Percent of men	Percent of women	Sutrop CSI men	Sutrop CSI women	% of men that indicated traffic light:			% of women that indicated traffic light:			% of hh that indicated traffic light:		
								green	amber	red	green	amber	red	green	amber	red
durazno			0%	1%	0%	0.00	0.00	0%	0%	100%	0%	100%	0%			
ejote			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
espinaca	spinach		3%	2%	3%	0.00	0.01	33%	33%	33%	38%	13%	50%			
frijol	bean	Phaseolus vulgaris	16%	12%	18%	0.03	0.04	48%	48%	5%	64%	34%	2%	40%	40%	20%
garbanzo			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
granadilla			0%	1%	0%	0.00	0.00	100%	0%	0%	0%	100%	0%			
guayaba			0%	1%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
guisquil	mirliton squash (chayote)	Sechium edule	31%	33%	30%	0.10	0.09	63%	28%	9%	61%	35%	4%	33%	67%	0%
haba			3%	3%	2%	0.01	0.00	40%	20%	40%	50%	17%	33%			
hierba blanca	turnip mustard	Brassica campestris	19%	17%	20%	0.05	0.06	59%	34%	7%	66%	28%	6%	0%	100%	0%
hierba buena			1%	0%	1%	0.00	0.00	0%	0%	0%	100%	0%	0%			
hierba cleta dulde			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
hierba de espina	giant potato creeper	Solanum wendlandii	38%	33%	41%	0.11	0.11	57%	36%	7%	63%	32%	5%	42%	50%	8%
hierba de pajaro			2%	2%	2%	0.01	0.00	75%	25%	0%	75%	25%	0%			
hierba de paloma			2%	0%	3%	0.00	0.01	0%	0%	0%	57%	29%	14%	0%	100%	0%
hierba de trapo			4%	3%	5%	0.01	0.01	60%	40%	0%	69%	15%	15%			
hierba de zorro			1%	2%	1%	0.01	0.00	0%	33%	67%	33%	33%	33%			
hierba mora	black nightshade	Spolanum nigrum	66%	59%	71%	0.26	0.29	74%	22%	4%	69%	21%	10%	58%	37%	5%
izote			1%	1%	2%	0.00	0.00	50%	0%	50%	25%	25%	25%			
lechuga	lettuce	Lactuca sativa	9%	5%	12%	0.01	0.03	13%	88%	0%	32%	65%	3%	100%	0%	0%
lechuguilla	common sow thistle and milk thistle	Sonchus oleracea	15%	12%	17%	0.03	0.04	71%	29%	0%	65%	26%	9%	83%	17%	0%
limon	lime		0%	1%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
mabal														92%	8%	0%
maíz	maize		2%	2%	2%	0.00	0.00	67%	33%	0%	80%	20%	0%	100%	0%	0%
malanga			3%	1%	4%	0.00	0.01	50%	50%	0%	45%	36%	18%	100%	0%	0%
mano de leon			4%	3%	4%	0.01	0.01	60%	40%	0%	55%	36%	9%			

			Freelistings											Food Scarcity		
Food plant	English name	Scientific name	Total percentage (men + women)	Percent of men	Percent of women	Sutrop CSI men	Sutrop CSI women	% of men that indicated traffic light:			% of women that indicated traffic light:			% of hh that indicated traffic light:		
								green	amber	red	green	amber	red	green	amber	red
maq			1%	0%	1%	0.00	0.00	0%	0%	0%	100%	0%	0%			
miltomate			0%	1%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
momon			0%	0%	1%	0.00	0.00	0%	0%	0%	50%	50%	0%			
mostaza	musterd	Brassica juncea	24%	23%	24%	0.08	0.06	56%	34%	10%	55%	41%	5%	33%	67%	0%
mozote														100%	0%	0%
nabo	turnip	Brassica rapa	34%	29%	38%	0.08	0.11	63%	31%	6%	67%	27%	6%	47%	53%	0%
pacaya			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	0%	100%			
papa	potato	Solanum tuberosum	7%	7%	7%	0.02	0.01	67%	33%	0%	63%	32%	5%	33%	33%	33%
po´ tzitam			0%	1%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
quequexte	arrowleaf elephant's ear, American taro.	Xanthosoma sagittifolium	11%	9%	13%	0.02	0.04	50%	25%	25%	59%	35%	6%	11%	78%	11%
rabano	radish	Raphanus sativus	6%	7%	6%	0.01	0.02	58%	33%	8%	44%	44%	13%			
remolacha			3%	3%	3%	0.01	0.01	50%	33%	17%	0%	75%	25%			
repollo	cabbage	Brassica oleracea var. capitata	29%	26%	30%	0.10	0.09	35%	54%	11%	43%	48%	10%	0%	100%	0%
ruda			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
santa catarina	bell tree dahlia	Dahlia imperialis	50%	41%	56%	0.14	0.17	71%	28%	1%	68%	27%	5%	55%	42%	3%
señorita			2%	1%	2%	0.00	0.00	100%	0%	0%	60%	40%	0%	100%	0%	0%
tomate	tomato		0%	1%	0%	0.00	0.00	0%	0%	100%	100%	0%	0%			
tomate de arbol	cherry tomato		3%	2%	3%	0.00	0.01	0%	100%	0%	50%	38%	13%			
trigo	wheat		0%	1%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
zanahoria	carrot	Dacuus carota	7%	8%	6%	0.02	0.01	36%	50%	14%	13%	88%	0%			

**The table presents the results of the ´free listing´ module, and the ´plants in food scarcity´ module of the baseline analysis; In total, 175 men and 263 women out of 282 participating households, responded to the ´free listing´ module and listed 554 (men) and 59 (women) species; Regarding the ´plants in food scarcity´ module, out of the 282 households, 187 were missing and 95 did actually participate and listed a total of 25 species; Sutrop CSI reflects the knowledge of a specific plant (the higher the CSI, the more representative is the plant of the knowledge shared by community members); Colour visualization: Green= used in affluent period, Amber= used in moderate food scarcity period, Red= used during severe food scarcity period.*