Local food plants for nutrition

IMPROVING DIETS AND REDUCING FOOD SCARCITY WITH THE HELP OF LOCAL FOOD PLANTS IN HUANCAVELICA AND JUNÍN REGIONS OF PERU

SD = HS Sowing Diversity = Harvesting Security

FOVIDA - FOMENTO DE LA VIDA -

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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].

The economic shock of the COVID-19 crisis exacerbated existing challenges in Peru, where high levels of informality and limited social protection left a significant portion of the workforce vulnerable. The impact of job losses was particularly severe among the youth, who were largely pushed to work in the informal sector compared to the general population. Additionally, women, who often engage in informal work and contribute significantly to caregiving responsibilities, were disproportionately affected as they left the workforce at a higher rate than men during the crisis. Despite substantial government responses, poverty in Peru has increased, marking a setback in the country's developmental progress[2].

The consequences of the economic downturn during the peak of the pandemic have had profound effects on food security and malnutrition in Peru[2]. Alarming statistics reveal that anaemia now affects 42 percent of young children, reflecting a worsening health condition. Furthermore, chronic malnutrition and acute malnutrition afflict 11.5 percent and 0.4 percent of children under 5 years old, respectively. These figures underscore the magnitude of the malnutrition crisis among the youngest and most vulnerable members of society. An increase is also expected in the cost of the double burden of malnutrition in Peru after the pandemic[3]. The potential long-term implications of malnutrition and stunting are concerning, with studies indicating a 21 percent decline in the incomes of adults due to undernutrition and stunting in early childhood[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 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 2022, Peru experienced a severe setback in economic, social, and food conditions due to strong inflationary pressures and economic deceleration. The impact on food security was particularly severe, with 13 out of 24 departments experiencing "moderate" hunger, and 10, predominantly from the central and southern highlands and the northern jungle, grappling with a "severe" hunger situation. Notably, regions like Cusco, Junín, and Pasco transitioned from a moderate to a severe state, and others, such as Huancavelica and Apurímac, were on the verge of alarming levels of hunger[4]. The situation was intensified by the fallout from the pandemic and escalating prices of essential commodities like oil, pulses, and cereals, driving inflation to its highest level in 26 years[3]. In 2020, 58 percent of households reported various forms of food insecurity, and even by December 2021, the share of households running out of food remained elevated by 9 percentage points compared to the pre-pandemic period[2]. According to the latest national food security assessment, a staggering 51 percent of Peruvians and 57 percent of migrants and refugees residing in the country—amounting to 16 million people—were deemed food insecure, underscoring the urgent need for comprehensive interventions to address the escalating food crisis[3].

1.3 Objectives

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?

[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.

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 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 during two different periods (scarcity season and sufficiency season) in the Huancavelica and Junín regions of Peru [Table 1]. Data was collected by local enumerators who speak the local language. They were trained by the Fomento de la Vida (FOVIDA) 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 surveyed provinces*

Scarcity season (round 1)	Sufficiency season (round 2)
October 2020	May - August 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)[5] [Table 2]. According to the HFIAS indicator guide[6], 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

[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.

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[6].

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[5].
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"[5].

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[7]. 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[8].
Micronutrient Sensitive HDDS	MsHDDS	It disaggregates and reorganizes the HDDS food groups into 16 micronutrient-based groups[9].
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)[10].
Dietary Species Richness	DSR	It measures the number of different species consumed per day, assessing both nutritional adequacy and food biodiversity[11].

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 more representative is the plant of the knowledge shared by community members)[12]. In addition, the species that are more widely used among households during the food scarcity season were identified using the traffic light exercise[13]. 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[14] 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 15 FFS established during that year in Huancavelica and Junín regions of Peru. 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 FOVIDA 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 15 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 333 households for the baseline survey and 15 FFS for the Diagnostic exercise. Table 4 presents the distribution of the households and FFS surveyed across the Huancavelica region of Peru.

Table 4. *Distribution of sampled households and FFS across the seven districts in Huancavelica region of Peru*

	FFS diagnostic exercise		Baseline survey	
District Municipality	Number of FFS	Percentage of total number of FFS	Number of households	Percentage of total number of households
Acostambo	5	33%	61	18%
Masma Chicche	3	20%	37	11%
Ñahuinpuquio	2	13%	36	11%
Ricran	1	7%	62	19%
Rosario	0	0%	137	41%
Apata	1	7%	0	0%
Paucará	3	20%	0	0%
Total	15	100%	333	100%

Figures 1 and 2 below show the locations of the surveyed households and FFS within the different regions of Peru. The map figures were prepared by Matteo Petitti.

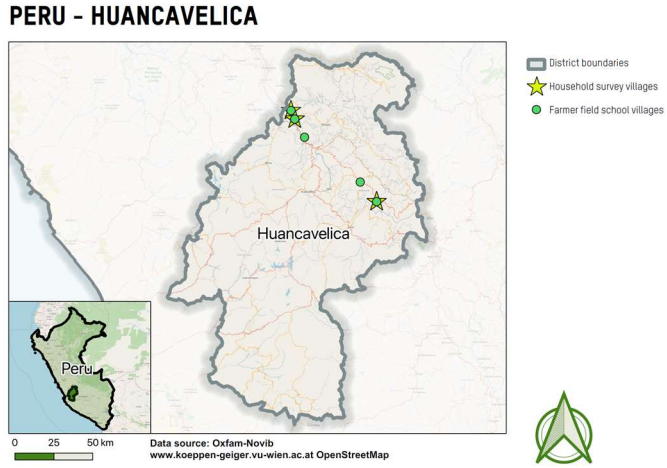

Figure 1. *Map indicating the locations of the households and FFS in Huancavelica region of Peru.*

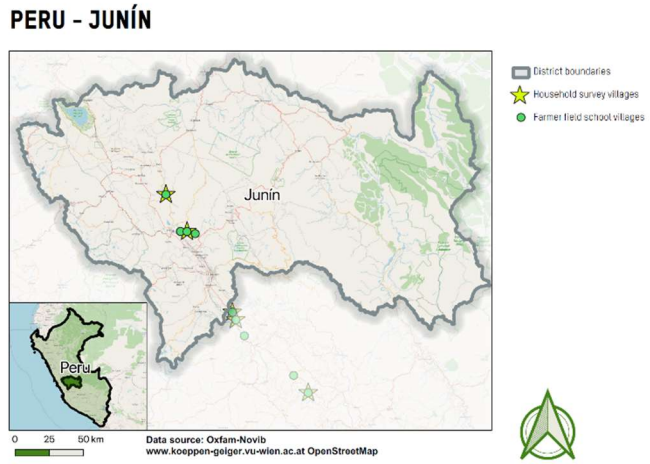

Figure 2. *Map indicating the locations of the households and FFS in Junín region of Peru*

3 Results

3.1 Indigenous peoples and smallholder farmers in Peru

Indigenous peoples and smallholder farmers surveyed in Peru live in the highlands which are located at an altitude of an average of 4000 masl[15]. This region is characterized by an average annual temperature of 11°C, and average annual rainfall of 607mm in Huancavelica and 1176mm in Junín[16]. According to the Holdridge Life Zone classification [17,18], 70% of the communities involved are situated in the cool temperate moist forests zone. The location of the remaining areas classified are in the polar rain tundra zone (19%), and the warm temperate moist forests zone (11%). Köppen Climate classification[19] indicates that the majority (81%) of the implementing areas have a climate of warm temperate winters and dry warm summers. The remaining communities reside in a polar tundra climate (19%). The surveyed communities mostly rely on potato farming to sustain their livelihoods, with 97% of this crop being cultivated for consumption.

Table 5 presents the socio-demographic characteristics of the participating communities. The households investigated had an average size of almost four household members and the majority of them were male-headed (70%), indicating the gender disparity in household dynamics. The educational level and literacy rates of the surveyed households showed that 30% of household heads have never attended formal education and that 16% of them know neither how to read or write. Almost 38% of the household heads have attended primary education.

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

Socio-demographic variables	Scarcity season interviews (R1)			
	N	%	Mean	St. D.
Household size			3.7	1.6
Sex of household head				
Man	172	57%		
Woman	105	35%		
Both	26	9%		
Main occupation of household head				
On farm	259	86%		
Outside farm	18	6%		
Both	26	9%		
Age of household head			48.9	15.0
Literacy of household head				
Only read	16	6%		
Only write	35	14%		
Both	165	65%		
None	40	16%		
Education of household head				
Never attended formal education	84	30%		
Primary	105	38%		
Secondary	79	29%		
Highest education	9	3%		
Number of migrants per household			0.7	1.2
Number of children (incl. orphans) per household			1.2	1.3
Number of chronically ill people per household			0.3	0.6
Number of women in child-bearing age per household			1.0	0.8
Total land area (ha) per household				
Main productive activities per household				
Agriculture	293	66%		
Livestock farming	128	29%		
Fishing	2	1%		
Hunting	1	0%		

Socio-demographic variables	Scarcity season interviews (R1)			
	N	%	Mean	St. D.
Gathering	3	1%		
Other	17	4%		
Number of crops grown in the past 12 months, and for what use			4.1	1.7
Sales			1.7	1.9
Consumption in the household			3.8	1.9
Barter			0.1	0.5
Other			0.0	0.2
Market orientation (proportion of harvest for sale)			39.2%	40.8%
Presence of income from non-agricultural activities	118	39%		
Presence of home garden	106	35%		

** The results are based on the baseline household survey in which 333 households participated. Household size: N=303 (missing value=30) ; Sex of household head: N=303 (missing value=30); Main occupation of household head: N=303 (missing values=30); Age of household head: N=198 (missing values=135); Literacy of household head: N=256 (missing values=77); Education of household head: N=277 (missing values=56); Number of migrants: N=303 (missing values=30); Number of children: N=303 (missing values=30); Number of chronically ill people: N=303 (missing values=30); Number of women in child-bearing age: N=303 (missing values=30); Main productive activities: N=303 (missing value=30); Number of crops grown on the past 12 months: N=303 (missing value=30); Market orientation: N=303 (missing value=30); Presence of income from non-agricultural activities: N=302 (missing values=31); Presence of home garden: N=303 (missing values=30). The percentages are calculated over the valid number of responses for each variable, excluding missing values.*

In terms of their productive activities, more than 65% of the households interviewed work in agriculture and almost 30% of them in livestock. An average total of four crops were grown by the households in the past 12 months and the average sale proportion from their harvest was almost 40%, while the rest was mostly consumed in the household. Interestingly, almost 40% of the households have an income from non-farming activities and 35% of them operate a home garden.

3.2 Local causes and consequences of malnutrition

The diagnostic exercises identified the causes and consequences of malnutrition using the Malnutrition Tree as a tool. An important cause of malnutrition mentioned by the FFS participants was the imbalanced diets, highlighting the low consumption of fruits and vegetables and the preference for junk food [Table 6]. This response reflects mostly on the current eating habits, rather than the deeper causes of poor nutrition, and it might be attributed to the way the question was asked. The second most important cause of malnutrition as it was reported by the FFS participants was the lack of important nutrition knowledge and food composition. Poverty and lack of financial resources were mentioned eight times by the FFS participants, while social problems like the lack of governmental support were reported three times. The lack of hygiene was mentioned only once within the participating FFS.

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

Malnutrition cause	Number of answers	Percentage of answers	Details and examples
Imbalanced diet	19	44%	Not consuming vegetables and fruits, inadequate food balancing, junk food, industrialized foods
Knowledge lack or gap	10	23%	Lack of awareness about food balancing, lack of knowledge about nutritious foods
Poverty	8	19%	Lack of economic resources, insufficient money
Social problems	3	7%	Lack of support (from the government)
Environmental challenges	2	5%	Prolonged water scarcity
Lack of hygiene	1	2%	Lack of food hygiene
Total	43	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=43) collected from the 15 FFS.*

The most important consequence of malnutrition, reported by all surveyed FFS, was the appearance of both communicable and non-communicable diseases, like cancer, anaemia, tuberculosis and flu. [Table 7]. Weight loss and development problems, like stunting, were reported 17 times within the FFS. Interestingly, overweight and health problems related to obesity, like diabetes and cardiovascular malfunction were reported eight times by the FFS participants, confirming the double burden of malnutrition in the country. Death and poor life expectancy were also mentioned as important malnutrition consequences, seven times within the FFS, highlighting an awareness of the effects of poor nutrition.

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

Malnutrition consequence	Number of answers	Percentage of answers	Details and examples
Diseases	27	46%	Cancer, anaemia, tuberculosis, major flu problems
Weight loss/poor growth	17	29%	Short stature, lack of growth
Overweight and/or associated non-communicable diseases	8	14%	Diabetes, overweight, high blood pressure
Low life expectancy or death	7	12%	Malformation, low academic performance, stress, mortality
Total	59	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=59) collected from the 15 FFS.*

The majority of the FFS participants (87%) reported that their nutrition status had worsened in their village in the last 30 years [Table 8]. Only twice within the 15 FFS, it was reported that nutrition has improved over the past 30 years. The overall results may be related to an increased share of staple crops in a less diverse diet and decreased access to additional minor crops, including local food plants.

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

Changes in nutrition	Number of answers	Percentage of answers
Worsened	13	87%
Improved	2	13%
Total	15	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=15) collected from the 15 FFS.*

Poverty and low affordability for food were the major influencing factors that affected the nutritional status of the household during the last years, mentioned nine times by the FFS participants [Table 9]. Globalization and Westernized eating habits were reported also as important influencing factors affecting nutrition, seven times within the FFS, underlining the consumption of monotonous and highly processed foods. Climate change and the low consumption of local food plants were each reported six times, indicating some awareness of the impacts of climate change on the local diets, and the nutritional benefits of local food plants.

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

Factors influencing the change	Number of answers	Percentage of answers	Details and examples
Poverty and lack of access to food	9	32%	Economic problems regarding the cost of food; increase in the cost of food
Globalization and change in eating habits	7	25%	Changes in dietary habits due to the increase in the availability of processed foods; Increased consumption of processed foods and poor food balancing
Climate change	6	21%	-
Loss of local foods in the diet	6	21%	There is not a good utilization of local foods; low demand and promotion of local foods; it is difficult to meet market standards; there is not a good utilization and use of local foods because most preparations are soups
Total	28	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=28) collected from the 15 FFS.*

3.3 Understanding local diets

The baseline survey showed that household dietary diversity (HDDS) and micronutrient-sensitive dietary diversity (MsHDDS) were higher during the sufficiency season compared to the scarcity season [Table 10]. It is important to note that both the HDDS and MsHDDS indicators group food plants in food group 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, in line with the HDDS and MsHDDS indicators, the indicator FVS[20], which measures the variety of different food items, also scored higher during the food sufficiency season. On the contrary, DSR[21], which measures the diversity in plant species consumption scored lower during the food sufficiency season compared to the scarcity season. This indicates that when food is more available, households consume a smaller variety of food plant species that belong to the same food group category, but consume foods from different food groups. For example, they might consume a lower variety of different vegetable species which all belong to the vegetable food group. The lower food plant species (DSR) consumption during the sufficiency season could be due to the increased availability and consumption of main staples.

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

Dietary diversity	Scarcity season (mean ± sd)	Sufficiency season (mean ± sd)
HDDS (0-12)	7.6 ± 1.8	8.8 ± 1.6
MsHDDS (0-16)	8.8 ± 2.4	11.0 ± 3.4
FVS (>0)	13.9 ± 4.0	16.9 ± 4.2
DSR (>0)	13.1 ± 4.4	7.1 ± 2.8

** The results come out the baseline household survey, in which 333 households participated. During the first survey round (scarcity season) 30 values were missing for MsHDDS (N=303), 32 for HDDS and FVS (N=301), and 34 for DSR (N=299), while during the second survey round (sufficiency season), 40 values were missing (N=293).*

Regarding the dietary diversity in relation to the specific food groups, we noted that cereals, white tubers and vegetables are the most consumed food groups during both the scarcity and sufficiency seasons, together with oils or fats, sweets and condiments [Table 11]. Interestingly, fruits and legumes, nuts or seeds are two of the least consumed food groups, during both seasons. 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	Scarcity season		Sufficiency season	
	N	% HHS	N	% HHS
Cereals	284	12%	292	11%
White tubers and roots	292	13%	281	11%
Vegetables	291	13%	275	11%
Fruits	155	7%	169	7%
Meat	113	5%	207	8%
Eggs	70	3%	103	4%
Fish and other seafood	39	2%	56	2%
Legumes, nuts, and seeds	89	4%	177	7%
Milk and milk products	136	6%	169	7%
Oils and fats	268	12%	282	11%
Sweets	289	13%	277	11%
Spices, condiments and beverages	278	12%	282	11%
Total	2304	100%	2570	100%

** The results are deduced from the baseline household survey, in which 333 households participated. During the first survey round (scarcity season) 31 households were missing (N=302), while during the second survey round (sufficiency season), 40 households were missing (N=293).*

3.4 Local food plants diversifying the diet

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

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

Scientific name	English name	Local name	Food group
Chenopodium quinoa	quinoa	quinua	cereals
Lupinus mutabilis	tarwi	tarwi	legumes
Taraxacum officinale	dandelion	diente de león	vegetables
Equisetum arvense	horse tail	cola de caballo	other
Hordeum vulgare	barley	cebada	cereals
Vicia faba	faba bean	haba	legumes
Pisum sativum	green pea	arveja	legumes
Triticum aestivum	wheat	trigo	cereals
Avena sativa	oatmeal	avena	cereals
Mentha spicata	mint	hierba buena	cereals
Chenopodium pallidicaule	kaniwa	cañihua	cereals
Amaranthus caudatus	amaranth	kiwicha	cereals

It is important to note that out of the 131 local food plants identified in the 15 FFS, 98 of them were mentioned because of their medicinal importance, and 56 of them because of their nutritional value [Table 13]. It shows 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 13. *Perceived importance of local food plants*

Perceived importance	Number of plants	Percentage of plants
Medicinal value	98	75%
Nutritional value	56	43%

**The results come out the FFS diagnostic exercise, for which data was collected out of 15 FFS. In total, 131 local food plants were identified. Percentages reflect the number of plants divided by the total number of plants identified in this exercise (N=131). For some plants, no perceived importance was assigned.*

3.5 Measuring the severity of food insecurity

The baseline survey showed that household food insecurity, measured with the HFIAS index, was higher during the scarcity season compared to the sufficiency season [Table 14]. As expected, this demonstrates the crucial negative impact that lean periods, linked to growing seasons, have on household food security.

Table 14. *Food insecurity (HFIAS, HHS) differences between scarcity and sufficiency seasons*

Food Insecurity	Scarcity season (mean ± sd)	Sufficiency season (mean ± sd)
HFIAS (0-27)	7.2 ± 3.6	4.5 ± 5.5
HHS (0-6)	3.7 ± 1.6	0.7 ± 1.7

** The results come out the baseline household survey, in which 333 household participated. During the first survey round (scarcity season) 30 values were missing (N=303), while during the second survey round (sufficiency season) 40 values were missing for HFIAS (N=293) and 44 for HHS (N=289).*

The HHS index, which measures hunger, is derived directly from the HFIAS, but it only assesses the most severe experiences of food insecurity. Table 15 shows that during the scarcity season, more than half of the interviewed households were experiencing severe hunger (58%), with the rates of moderate hunger being more than 30%. Less than 15% of the households experienced moderate or severe hunger during the sufficiency season, while the vast majority (86%) experienced little to no hunger. Again, this demonstrates the crucial impact that lean periods have on household food security.

Table 15. *Percentage of households that suffer from hunger throughout the year*

Household Hunger Scale (HHS)	Scarcity season		Sufficiency season	
	N	% Hhs	N	% Hhs
Little to no hunger (% total Hhs)	30	10%	247	86%
Moderate hunger (% total Hhs)	97	32%	17	6%
Severe hunger (% total Hhs)	176	58%	25	9%

** The results are calculated based on the data from the baseline household survey, in which 333 households participated. During the first survey round (scarcity season) 30 values were missing (N=303), while during the second survey round (sufficiency season) 44 values were missing (N=289). 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 in the investigated areas in Peru. Table 16 presents the percentage of households in Huancavelica and Junín regions that suffer from food scarcity throughout the year. January, February and March, which correspond to the rainy season, were the months when the largest food shortages were reported. Food shortages however continue to appear until August (>20% of the households).

Table 16. *Percentage of households that suffer from food scarcity indicated per calendar month*

Months	Percentage of households
January	50%
February	48%
March	38%
April	26%
May	23%
June	24%
July	25%
August	22%
September	11%
October	7%
November	4%
December	16%

**The results come out the baseline household survey in which 333 household participated and 31 values (households) were missing (N=302).*

The most important characteristic of the food scarcity season, mentioned in 14 of the 22 responses within the FFS, was the consumption of stored and conserved foods which they have maintained since the sufficiency season [Table 17]. Low yields and crop failures are also reported as important characteristics of the scarcity period, while the consumption of local food plants is mentioned only once within the 15 FFS. This suggests a lack of knowledge of the nutritional benefits of the available local food plants especially during the lean periods.

Table 17. *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
Consumption of stored food	14	64%	Increased consumption of locally stored foods and crops
Poor yields/crop failures	7	32%	During this period, they do not plant local crops
Consumption of local plants	1	5%	Food from backyard gardens (biohuertos) and local crops is consumed
Total	22	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=22) collected from the 15 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 3.6 (± 1.3). Table 18 presents the most frequently used food plants in times of scarcity. Potato, barley, fava bean, and wheat were the most frequently mentioned plants (<25% of the households). The list of plants includes major staple crops (perhaps consumed in reduced quantities) and local food plants, including a few NUS.

Table 18. *Key food plant species used during food scarcity period*

Food plants used in food scarcity	English name	Scientific name	Number of households	Percentage of households
papa	potato	*Solanum tuberosum*	185	62%
cebada	barley	*Hordeum vulgare*	109	37%
haba	faba bean	*Vicia faba*	105	35%
trigo	wheat	*Tritium vulgare*	81	27%
yuyo	green amaranth	*Amaranthus quitensis*	68	23%
avena	oats	*Avena sativa*	55	18%
col	cabbage	*Brassica oleracea*	53	18%
arveja	pea	*Pisum sativum*	47	16%
quinua	quinoa	*Chenopodium quinoa*	30	10%
cebolla	onion	*Allium cepa*	25	8%
lechuga	lettuce	*Lactuca sativa*	25	8%
berros	watercress	*Nasturtium Officinale*	24	8%
oca	yam	*Oxalis tuberosa*	21	7%
olluco	olluco	*Ullucus tuberosus*	20	7%
cushuro	Andan caviar	*Nostoc spaericum*	19	6%
mashua	mashua	*Tropaeolum tuberosum*	19	6%
acelga	chard	*Beta vulgaris*	18	6%

**The results come out the baseline household survey, in which 333 households participated. In total, 35 values were missing (N=298).*

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 (70%) are reported to have purchased at least one of the local food plants they mentioned. A far lower number said they sourced the local food plants they mentioned through gathering (10%) or harvesting (16%). During the sufficiency season, fewer households (39%) reported to have purchased at least one of the local food plants they mentioned, compared to the scarcity season. At the same time, the number of households that reported they harvested (36%) and gathered (21%) at least one of the local food plants they mentioned is quite large compared to the scarcity season. This indicates how food scarcity influences the extent and the way in which households source local food plants for consumption.

In the scarcity period, a great variety of different species was reported to be purchased (68) compared to the sufficiency season (46). On the contrary, fewer species were reported to be gathered (30) and harvested (28) in the scarcity season compared to those gathered (48) and harvested (47) during the sufficiency season. This suggests that gathering and harvesting are used less during the food scarcity period, possibly due to low availability or lack of knowledge.

Sites where the local food plants originate from

During both the food scarcity and sufficiency periods, the majority of the local food plants listed are collected from the market, with a slightly higher frequency during the food scarcity period, when food is less available [Table 19]. Agricultural fields and home gardens contribute significantly to the food availability to the households during both seasons, with considerably higher frequencies during the sufficiency season. A great amount of local food plants is also brought from forests and public spaces, especially roadsides, during the sufficiency season.

Table 19. *Number of plant species and sites where they originate from*

Place of origin	Scarcity season		Sufficiency season	
	Number of species	Percentage of species	Number of species	Percentage of species
Agricultural field	19	23%	40	49%
Home garden	27	33%	38	46%
Forest	4	5%	17	21%
Public spaces	5	6%	16	20%
Roadside	3	4%	14	17%
Lake	1	1%	0	0%
Riverside	1	1%	2	2%
Market	50	61%	45	55%
Other	50	61%	19	23%

** The results come out the baseline household survey, in which 333 households participated. In total, the responses of 56 households were missing in the scarcity period (N=277), and 40 during the sufficiency period (N=293). During both the first survey round (scarcity season), 82 plant species were mentioned. During the second survey round (sufficiency season) 82 species were mentioned as well. 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

Baseline survey data showed that women bring home the majority of species during both the scarcity (89%) and sufficiency (89%) seasons, compared to other family members [Table 20]. Men also bring quite a variety of local food plants to their households, without important variations during the two seasons. 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	Scarcity season		Sufficiency season	
	Number of species	Percentage of species	Number of species	Percentage of species
Man	41	50%	50	61%
Woman	73	89%	73	89%
Both genders	26	32%	11	13%
Children	3	4%	0	0%

**The results are based on the baseline household surveys, in which 333 households participated. In total, 56 households were missing in the scarcity period (N=277), and 40 during the sufficiency period (N=293). During both the first survey round (scarcity season), 82 plant species were mentioned. During the second survey round (sufficiency season) 82 species were mentioned as well. The percentages reflect the number of species brought from each family member, divided by the total number of different species mentioned per season.*

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

Individual men (6.6 ± 2.4) listed a higher number of plants than individual women (5.1 ± 1.5). However, as a group men reported a similar total number of different plant species (126 different species/ 222 men), compared to women (111 different species /261 women). Almost all plant species were listed by the two genders with similar frequencies, with pea, mashua, oca, and wheat being mentioned more frequently by men. 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[12].

3.11 Relationships with dietary diversity and food insecurity indicators

A significantly positive relationship was found between the number of crops grown in the past 12 months for consumption and the household food insecurity indicator *HFIAS* ($p<0.001$) during

the food scarcity season. No significant correlation was found for this relationship during the sufficiency season. This suggests that during the scarcity season when food security is threatened, the more food-insecure households grow a larger number of crops for household consumption. This does not appear to happen during the food sufficiency season.

Similarly, a significantly positive relationship was found between the number of local food plants that were acquired and the HFIAS indicator ($p<0.01$), but this time the correlation was significant during both seasons. This might suggest that regardless of the time of the year, the more food-insecure households consume a larger number of local food plants.

A significantly positive relationship was also found between the number of crops grown in the past 12 months for consumption and the micronutrient-sensitive household dietary diversity (MsHDDS), during the food scarcity period ($p<0.001$). This indicates that, when food is less available, the households that grow a larger number of crops for consumption have higher dietary diversity.

Likewise, during both seasons, 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) ($p<0.001$), meaning that the households that acquired more local food plants 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[22]. 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.

Within the participating FFS, 15 responses indicated that mothers are the ones who decide what to eat in the household [Table 22]. Grandmothers (32%) and daughters (8%) were also reported to make such decisions, while fathers were not mentioned at all.

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

Decision making member	Number of answers	Percentage of answers
Mother	15	60%
Grandmother	8	32%
Daughter	2	8%
Total	25	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=25) collected from the 15 FFS.*

Fathers (36%) were reported to be the most powerful household members in providing access to food at large, while children (33%) and women (31%) were reported next 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	15	36%
Children	14	33%
Mother	13	31%
Total	42	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=42) collected from the 15 FFS.*

The majority of the FFS participants (87%) reported that no household member is the least powerful in terms of access to food, suggesting an equal power division between the household members [Table 24]. However, this might be an artefact of the way the question was asked to the FFS participants. Mothers were reported twice within the FFS as the least powerful household members in terms of access to food.

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

Weakest members	Number of answers	Percentage of answers
No one	13	87%
Mother	2	13%
Total	15	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=15) collected from the 15 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, men have more power in accessing food from any source and providing it to their household.

The baseline analysis further showed that the length of both men's and women's lists of plants was significantly longer (more plants reported) in households with more women of childbearing age ($p<0.05$). This finding reconfirms the notion that women have a prime role in maintaining knowledge of local food plants and highlights the important role they play in providing food and nutrition security at the household level.

3.13 Evaluation of coping strategies and possible solutions

The main coping strategies that are implemented by the FFS participants to fight food insecurity are the food preservation (52%), and the maintenance of home gardens (48%) [Table 25].

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
Storing food	14	52%	Storage of local foods; exposure to frost of local crops such as potatoes and oca; consumption of stored foods
Having home gardens	13	48%	Having food plant backyard gardens; consuming vegetables and greens that grow in the backyard gardens; having backyard gardens at home
Total	27	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=27) collected from the 15 participating FFS.*

The most popular solutions suggested to combat malnutrition according to FFS participants were the promotion of diverse diets and the increase of nutrition awareness [Table 26]. Activities to improve cooking skills and introduce new ways of food preparation were also reported as possible solutions to malnutrition, eight times within the FFS. The promotion of local food plants and their nutritional benefits was reported seven times by the FFS participants, while the introduction of improved farming and processing practices was also mentioned once. In general, practical demonstrations and promotion of applicable knowledge were mostly reported as a desired contribution to better nutrition, indicating a significant need for knowledge sharing.

Table 26. *Possible solutions to malnutrition by farmers*

Solutions	Number of answers	Percentage of answers
Promote awareness on nutrition, health and diversified diets	17	52%
Improve cooking skills	8	24%
Improve knowledge about local plants (consumption and cultivation)	7	21%
Improve farming practices (including storage and seed saving)	1	3%
Total	33	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=33) collected from the 15 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

Radio and TV are the channels by which most households obtain information, though they are certainly not the most preferred [Table 27]. NGOs (35%), school children (26%) and health facilities (17%) are the channels by which most households would prefer to obtain information on local food plants. It is important to notice that almost no reference is made to agriculture-related information sources. This suggests that support to cope with food scarcity and dietary needs is better received when obtained from NGOs, educators and health providers.

Table 27. *Current and preferred sources of information*

Sources of information	Current sources		Preferred sources	
	N	% Hhs	N	% Hhs
Neighbour	52	7%	28	5%
Health facilities	152	19%	95	17%
Community health	41	5%	2	0%
Support group, farmer group, FFS	1	0%	1	0%
NGOs	2	0%	193	35%
Radio	210	27%	14	3%
School children	32	4%	144	26%
TV	171	22%	5	1%
Pamphlet	22	3%	59	11%
Cell phone	87	11%	8	2%
Governmental programmes	5	1%	2	0%
Other	14	2%	28	5%

* The results come out the first round of baseline household survey, in which 333 household participated and 30 value is missing for the Current sources (N=303), and 32 values were missing for the Preferred source (N=301). 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

In conclusion, the findings of this study shed light on various aspects of household dynamics, agricultural practices, and nutrition in the Junín and Huancavelica regions. The households investigated exhibited a gender disparity in their composition, with a majority being male-headed. Furthermore, a significant portion of household heads lacked formal education, highlighting the need for educational interventions.

Agriculture played a pivotal role in the livelihoods of these households, with a majority engaged in farming activities. Crop diversification emerged as a key factor influencing dietary diversity, contributing to enhanced food security. Notably, the study identified low consumption of fruits and vegetables and a preference for unhealthy food as major contributors to malnutrition, emphasizing the importance of nutrition education.

The impact of food scarcity on household food security was evident, with a higher prevalence of severe hunger during scarcity seasons. Crop diversification, home gardens, and the collection of local food plants from diverse sources proved crucial in mitigating the effects of food scarcity, emphasizing the need for sustainable agricultural practices and conservation of biodiversity.

Gender dynamics played a significant role in the acquisition and utilization of local food plants, underscoring the importance of considering gender-specific approaches in interventions. The study encourages the promotion of local food plants and nutritional awareness, with a focus on engaging local communities, NGOs, educators, and health providers.

The findings also suggest that interventions addressing malnutrition should be culturally and environmentally sensitive, building upon local knowledge and traditions. Strategies involving key stakeholders such as agriculture and nutrition departments, alongside NGOs, educators, and health providers, are crucial for the success of initiatives aimed at improving nutrition outcomes.

While radio and TV were identified as popular sources of information, the study emphasizes the need for targeted and culturally relevant communication strategies. Collaborative efforts from multiple stakeholders are recommended to maximize the impact of knowledge-sharing initiatives, particularly during times of food scarcity.

In conclusion, this study provides valuable insights into the challenges faced by indigenous households in Junín and Huancavelica, offering a foundation for the development of holistic and community-driven strategies to address malnutrition and enhance food security through the use of local food plants.

5 References

1. Fact sheets - Malnutrition. https://www.who.int/news-room/fact-sheets/detail/malnutrition.
2. International Bank for Reconstruction and Development / World Bank. *Rising Strong: Peru Poverty and Equity Assessment*. https://documents1.worldbank.org/curated/en/099042523145533834/pdf/P17673806236d70120a8920886c1651ceea.pdf (2023).
3. WFP Peru Country Brief, April 2023 - Peru | ReliefWeb. https://reliefweb.int/report/peru/wfp-peru-country-brief-april-2023.
4. Poder La Juventud En La Creación De Sistemas Alimentarios, E. DE. Informe Perú: Global Hunger Index 2023.
5. Coates, J., Swindale, A. & Bilinsky, P. Food and Nutrition Technical Assistance Project (FANTA) Academy for Educational Development 1825 Connecticut Ave. (2000).
6. Coates, J., Swindale, A. & Bilinsky, P. Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide: Version 3. (2007).
7. 24-hour Dietary Recall (24HR) At a Glance | Dietary Assessment Primer. https://dietassessmentprimer.cancer.gov/profiles/recall/.
8. Fao. Guidelines for measuring household and individual dietary diversity.
9. Aberman, N.-L., Meerman, J. & Benson, T. MAPPING THE LINKAGES BETWEEN AGRICULTURE, FOOD SECURITY & NUTRITION IN MALAWI.
10. NP, S., JH, N., G, N., G, K. & D, L. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? *Public Health Nutr* **9**, 644–650 (2006).
11. Lachat, C. *et al.* Dietary species richness as a measure of food biodiversity and nutritional quality of diets. *Proc Natl Acad Sci U S A* **115**, 127–132 (2018).
12. Sutrop, U. List Task and a Cognitive Salience Index. *http://dx.doi.org/10.1177/1525822X010130030*3 **13**, 263–276 (2001).
13. Ocho, D. L., Struik, P. C., Price, L. L., Kelbessa, E. & Kolo, K. Assessing the levels of food shortage using the traffic light metaphor by analyzing the gathering and consumption of wild food plants, crop parts and crop residues in Konso, Ethiopia. *J Ethnobiol Ethnomed* **8**, 1–17 (2012).
14. Bilinsky, P. & Swindale, A. Months of Adequate Household Food Provisioning (MAHFP) for Measurement of Household Food Access: Indicator Guide (Version 4). (2010).
15. Galagarza, O. A. *et al.* Occurrence of chemical contaminants in peruvian produce: a food-safety perspective. *Foods* **10**, (2021).
16. Peru - Climatology | Climate Change Knowledge Portal. https://climateknowledgeportal.worldbank.org/country/peru/climate-data-historical.
17. Jungkunst, H. F., Goepel, J., Horvath, T., Ott, S. & Brunn, M. New uses for old tools: Reviving Holdridge Life Zones in soil carbon persistence research. *Journal of Plant Nutrition and Soil Science* **184**, 5–11 (2021).
18. Post, W. M., Emanuel, W. R., Zinke, P. J. & Stangenberger, A. G. Soil carbon pools and world life zones. *Nature 1982 298:5870* **298**, 156–159 (1982).
19. Peel, M. C., Finlayson, B. L. & Mcmahon, T. A. Hydrology and Earth System Sciences Updated world map of the Köppen-Geiger climate classification. *Hydrol. Earth Syst. Sci* **11**, 1633–1644 (2007).
20. NP, S., JH, N., G, N., G, K. & D, L. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? *Public Health Nutr* **9**, 644–650 (2006).
21. Lachat, C. *et al.* Dietary species richness as a measure of food biodiversity and nutritional quality of diets. *Proc Natl Acad Sci U S A* **115**, 127–132 (2018).
22. Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L. & Martorell, R. The Importance of Women's Status for Child Nutrition in Developing Countries About This Report. (2002).

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			2%	3%	2%	0.01	0.01	29%	86%	0%	0%	100%	0%	83%	17%	0%
ajenjo			1%	3%	0%	0.01	0.00	67%	33%	0%	0%	0%	0%			
ají			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	100%	0%			
ají rocoto			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	100%			
ajo			1%	2%	0%	0.00	0.00	25%	100%	0%	100%	0%	0%	0%	100%	0%
alcaparra			0%	0%	1%	0.00	0.00	0%	0%	0%	50%	50%	0%			
aliso			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
amargón			0%	0%	1%	0.00	0.00	0%	0%	0%	0%	100%	0%			
anis			3%	3%	3%	0.01	0.01	14%	57%	29%	13%	25%	63%			
apio	celery	Apium graveolens	4%	4%	4%	0.01	0.02	0%	100%	0%	82%	55%	9%	29%	71%	0%
arnica			1%	0%	1%	0.00	0.00	100%	0%	0%	100%	0%	0%			
arroz														40%	20%	40%
artea			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	100%	0%			
arveja	pea	Pisum sativum	27%	31%	23%	0.05	0.06	30%	36%	35%	43%	37%	20%	11%	85%	4%
atajo			1%	0%	2%	0.00	0.01	100%	0%	0%	75%	0%	25%			
avena	oats	Avena sativa	21%	25%	18%	0.06	0.05	64%	25%	9%	70%	11%	20%	78%	16%	4%
berros			7%	7%	8%	0.02	0.03	19%	31%	50%	5%	65%	30%	38%	33%	29%
berros pacha			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
beterraga	beetroot	Beta vulgaris	4%	5%	4%	0.01	0.01	20%	80%	10%	40%	50%	10%	8%	92%	0%
borraja			2%	3%	1%	0.01	0.00	33%	67%	0%	0%	100%	0%	0%	100%	0%
brocoli			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
cacho cacho			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
capuli			2%	0%	3%	0.00	0.01	0%	100%	0%	0%	71%	29%	0%	33%	67%
capuli de campo			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
ceb			1%	1%	0%	0.00	0.00	67%	33%	0%	0%	0%	0%			
cebada	barley	Hordeum vulgare	40%	40%	40%	0.11	0.12	74%	25%	3%	74%	30%	4%	56%	42%	2%
cebolla			7%	11%	4%	0.03	0.01	36%	60%	4%	55%	36%	9%	52%	48%	0%
cebolla china			1%	1%	1%	0.00	0.00	0%	50%	50%	67%	67%	0%			
cedron			3%	4%	2%	0.01	0.01	22%	78%	0%	60%	40%	0%	0%	100%	0%
chicargua														0%	0%	100%
chicoria/ achicoria/ diente de león	chicory	Cichorium intybus	3%	4%	2%	0.02	0.01	0%	89%	11%	20%	80%	0%	0%	100%	0%
chilca	chilca	Baccharis latifolia	4%	2%	5%	0.01	0.01	0%	80%	20%	8%	67%	25%	7%	0%	93%
chinche			3%	2%	3%	0.01	0.01	0%	75%	25%	44%	44%	11%	67%	33%	0%
chinche de campo			0%	0%	1%	0.00	0.00	0%	0%	0%	100%	0%	0%			
chujitallo			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
chupa sangre	pink evening primrose	Oenothera Rosea	4%	6%	3%	0.03	0.01	15%	0%	85%	0%	13%	88%			

			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
col	cabbage	Brassica oleracea	13%	15%	11%	0.04	0.04	15%	85%	12%	40%	73%	3%	62%	38%	0%
col pacha			0%	0%	0%	0.00	0.00	0%	100%	0%	100%	0%	0%			
cola de caballo			3%	5%	1%	0.01	0.00	45%	55%	0%	33%	67%	0%			
coliflor			1%	1%	0%	0.00	0.00	50%	50%	0%	0%	100%	0%	100%	0%	0%
condor condor			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
congona			1%	0%	1%	0.00	0.00	0%	100%	0%	0%	100%	0%			
culantro			3%	3%	3%	0.01	0.01	33%	67%	0%	43%	29%	29%	0%	100%	0%
culen			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	0%	100%			
cumulluc			1%	1%	0%	0.00	0.00	0%	50%	50%	0%	100%	0%			
cushuro	Andan caviar	Nostoc spaericum	7%	8%	7%	0.04	0.02	0%	67%	33%	0%	88%	18%	11%	26%	63%
cuturrumaza			1%	1%	1%	0.00	0.00	67%	33%	0%	50%	50%	0%			
diente de león			3%	5%	2%	0.02	0.00	25%	67%	8%	50%	25%	25%	60%	40%	0%
discosonera			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
durazno			0%	1%	0%	0.00	0.00	50%	50%	0%	0%	0%	0%			
espinaca			2%	2%	2%	0.01	0.01	50%	75%	0%	50%	50%	17%	0%	100%	0%
eucalipto	eucalyptus	Eucaliptus globulus	5%	6%	4%	0.01	0.01	57%	43%	0%	50%	50%	0%	0%	100%	0%
flores			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
frambuesa			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%	0%	100%	0%
frambuesa pacha			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	100%	0%			
fresa serrana			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	0%	100%			
granadilla			3%	4%	2%	0.01	0.01	0%	100%	0%	0%	100%	0%	0%	100%	0%
guagualla			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
guinda			1%	2%	0%	0.00	0.00	50%	25%	25%	0%	0%	0%			
haba	faba bean	Vicia faba	36%	40%	33%	0.08	0.10	49%	42%	8%	54%	40%	6%	51%	44%	4%
harina														0%	0%	100%
hazhua			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
hierba buena	mint	Clinopodium douglasii	10%	12%	8%	0.04	0.02	78%	22%	0%	52%	43%	5%			
hierba luisa			2%	3%	1%	0.01	0.00	0%	100%	0%	0%	100%	0%			
hierba santa			0%	0%	1%	0.00	0.00	0%	0%	0%	0%	100%	0%			
hinojo			1%	0%	2%	0.00	0.00	100%	0%	0%	20%	80%	0%	0%	100%	0%
huacasha			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
huacatay			4%	4%	5%	0.01	0.01	33%	67%	0%	8%	75%	17%	33%	67%	0%
huajuro			1%	1%	1%	0.00	0.00	0%	100%	0%	0%	100%	0%	17%	17%	67%
huamanpinta			2%	4%	1%	0.01	0.00	75%	25%	0%	67%	33%	0%			
huamanripa			1%	1%	0%	0.00	0.00	50%	0%	50%	100%	0%	0%			
isanda blanco			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
jarjancha			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	100%	0%	20%	0%	80%
jawi			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			
lavano														0%	100%	0%

			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
layan			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
lechuga	lettuce		11%	11%	10%	0.04	0.04	17%	75%	8%	30%	70%	4%	68%	32%	0%
lenteja			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%	0%	50%	50%
lima lima			0%	1%	0%	0.00	0.00	50%	0%	50%	0%	0%	0%			
linaza			2%	2%	1%	0.00	0.00	40%	40%	20%	67%	33%	0%	0%	0%	100%
linlish			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
llamapaankoj			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
llancahuasa			1%	2%	1%	0.01	0.00	100%	0%	0%	50%	50%	0%			
llanten	llantén	Plantago major	6%	8%	5%	0.02	0.02	41%	59%	0%	43%	57%	0%			
llinllicosh			0%	1%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
machamacha														0%	0%	100%
maiz			5%	5%	5%	0.01	0.01	75%	17%	8%	50%	50%	0%	71%	29%	0%
malva	mallow	Malva silvestrys	4%	3%	5%	0.01	0.02	86%	14%	0%	93%	7%	0%			
manzana			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
manzanilla			6%	8%	3%	0.02	0.01	28%	67%	6%	33%	56%	11%			
maraymaray			1%	1%	0%	0.00	0.00	0%	67%	33%	0%	100%	0%			
marco			1%	1%	0%	0.00	0.00	100%	0%	0%	100%	0%	0%			
mashua	mashua	Tropaeolum tuberosum	23%	27%	19%	0.05	0.05	10%	33%	57%	28%	32%	40%	63%	32%	5%
matico			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
matico pacha			0%	1%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
menta			7%	8%	6%	0.04	0.02	94%	0%	6%	87%	13%	0%	0%	100%	0%
muña	Peruvian mint	Minthostachys setosa	12%	16%	10%	0.05	0.03	20%	77%	3%	52%	48%	0%	20%	80%	0%
muña pacha			5%	6%	4%	0.01	0.01	15%	38%	46%	18%	45%	36%			
nabo			2%	1%	2%	0.00	0.01	100%	0%	0%	50%	33%	17%	0%	75%	25%
oca	yam	Oxalis tuberosa	23%	30%	18%	0.05	0.04	8%	38%	56%	30%	30%	39%	38%	57%	5%
olluco	olluco	Ullucus tuberosus	29%	32%	26%	0.07	0.06	15%	42%	42%	23%	49%	28%	35%	60%	5%
oregano			5%	5%	5%	0.01	0.02	42%	58%	0%	77%	23%	0%	50%	50%	0%
ortiga			2%	1%	3%	0.00	0.01	50%	0%	50%	14%	0%	86%			
ortiga colorada	nettle	Urera chlorocarpa	12%	13%	11%	0.05	0.04	7%	61%	32%	14%	24%	62%			
ortiga crespa			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
ortiga mula guanuche			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
ortiga negra			1%	1%	0%	0.01	0.00	0%	50%	50%	0%	0%	100%			
ortiga oregano			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
paico			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
papa	potato	Solanum tuberosum	53%	54%	52%	0.22	0.28	58%	46%	7%	65%	40%	4%	79%	24%	4%
parajaccsho			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
payco			0%	0%	0%	0.00	0.00	0%	0%	0%	0%	100%	0%			

			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
pepinillo			1%	1%	0%	0.01	0.00	0%	100%	0%	0%	0%	0%			
pepino			2%	2%	2%	0.01	0.00	0%	80%	20%	25%	50%	25%	0%	50%	50%
perejil			1%	1%	2%	0.00	0.01	50%	50%	0%	20%	80%	0%			
piedra chancada			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
pipiriche			0%	1%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
poro			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	100%	0%			
puna puna			3%	4%	2%	0.01	0.02	100%	0%	0%	60%	20%	20%			
putaja			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
putuputu														0%	0%	100%
quinua	quinoa	Chenopodium quinoa	16%	19%	14%	0.04	0.04	40%	14%	40%	54%	30%	22%	47%	33%	20%
rabanito			1%	0%	1%	0.00	0.00	0%	100%	0%	0%	100%	0%	0%	100%	0%
retama			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
rosa verde			1%	1%	0%	0.00	0.00	0%	100%	0%	0%	100%	0%			
ruda			3%	3%	3%	0.01	0.01	0%	100%	0%	25%	75%	0%			
rupacancha			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
salvia pacha			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
sanco														0%	100%	0%
shushuyhuayta			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
tarwi	tarwi	Lupinus mutabilis	11%	14%	8%	0.02	0.02	26%	35%	39%	9%	45%	41%			
taya			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
tomate			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%	100%	0%	0%
toronjil	balm	Melissa officinalis	4%	5%	3%	0.01	0.01	27%	73%	0%	38%	63%	0%	0%	100%	0%
trigo	wheat	Tritium vulgare	26%	30%	22%	0.05	0.05	32%	18%	47%	52%	19%	29%	75%	23%	1%
tumbo			5%	5%	5%	0.01	0.01	8%	92%	0%	0%	100%	0%	0%	89%	11%
turpo turpo			1%	3%	0%	0.01	0.00	83%	17%	0%	0%	100%	0%			
uchpor			0%	0%	0%	0.00	0.00	0%	0%	100%	0%	0%	0%			
umacasha			1%	0%	1%	0.00	0.00	0%	100%	0%	0%	100%	0%			
urpash			1%	1%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
vainita			0%	0%	0%	0.00	0.00	100%	0%	0%	0%	0%	0%			
valeriana			4%	5%	3%	0.01	0.01	73%	27%	0%	38%	50%	13%			
verbena			2%	3%	2%	0.01	0.01	33%	50%	17%	25%	25%	50%			
verdura														0%	0%	100%
huaguro	huaguro	Cactus spp.	5%	5%	5%	0.02	0.02	9%	82%	9%	0%	100%	0%			
wichacc			0%	1%	0%	0.01	0.00	100%	0%	0%	0%	0%	0%			
yahuarshunja			0%	0%	0%	0.00	0.00	0%	0%	0%	100%	0%	0%			
yalan			1%	0%	1%	0.00	0.00	0%	0%	100%	0%	0%	100%	0%	100%	0%
yanacancha			0%	0%	0%	0.00	0.00	0%	100%	0%	0%	0%	0%			
yanajara			2%	3%	2%	0.01	0.01	0%	86%	14%	20%	80%	0%	0%	0%	100%
yuyo	yuyo	Amaranthus quitensis	11%	11%	11%	0.05	0.04	0%	71%	29%	4%	54%	43%	24%	43%	34%

			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
zanahoria	carrot	Daucus carota	10%	11%	9%	0.03	0.03	13%	58%	42%	54%	50%	29%	42%	58%	0%
zapallo			1%	0%	2%	0.00	0.01	0%	0%	0%	100%	40%	0%	50%	50%	0%

**The table presents the results of the 'free listing' module, and the 'plants in food scarcity' module of the baseline analysis; In total, 222 men and 261 women out of 333 participating households, responded to the 'free listing' module and listed 126 (men) and 111 (women) species; Regarding the 'plants in food scarcity' module, out of the 333 households, 35 were missing and 298 did actually participate and listed a total of 66 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.*