AN ECOLOGICAL LIVELIHOODS APPROACH TO STRENGTHEN FOOD SECURITY IN TIGRAY AND THE SOUTHERN NATIONS, NATIONALITIES, & PEOPLES' REGIONS OF ETHIOPIA

By

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ACRONYMS

AGP	Agricultural Growth Plan
Belg	Ethiopia's short rainy season
BoA	Ethiopian Regional Bureau of Agriculture
BoE	Ethiopian Regional Bureau of Education
BoH	Ethiopian Regional Bureau of Health
CFI	Chronically food insecure
CSA	Central Statistics Agency
CIP	International Potato Center
Ekub	Ethiopian traditional financial institution, at the local level
FCS	Food Consumption Score
GTP	Growth and Transformation Plan
MOA	Ethiopian Federal Ministry of Agriculture
MOH	Ethiopian Federal Ministry of Health
FAO	Food and Agriculture Organization
GoE	Government of Ethiopia
Ha	Hectare
HABP	Household Assets Building Programme
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HH	Household
IDDS	Individual Dietary Diversity Score
Idir	Ethiopian traditional social institution, at the local level
IFAD	International Fund for Agricultural Development
Kebele	Ethiopian smallest administrative unit
M4M	Mums for Mums
MDG	Millennium Development Goals
Meher	Long rainy season
MoA	Ethiopia Federal Ministry of Agriculture
MoH	Ethiopia Federal Ministry of Health
OFSP	Orange fleshed sweet potato
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PSNP	Productive Safety Net Programme
n	Number
SARI	Southern Agricultural Research Institute
SNNPR	Southern Nations, Nationalities and Peoples Region
SP	Sweet potato
SDG	Sustainable Development Goals
SLA	Sustainable Livelihoods Approach
TARI	Tigray Agricultural Research Institute
USAID	United States Agency for International Development
UW	University of Wisconsin-Madison
VA	Vitamin A
VAD	Vitamin A Deficiency
WAT	Women's Association of Tigray
WFSP	White fleshed sweet potato
Woreda	Ethiopian administrative district

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I applied to be a doctoral (PhD) candidate at the University of Wisconsin-Madison Nelson Institute for Environmental Studies in order to better prepare myself to be part of and lead efforts to address the question of how to design sustainable and equitable food systems, and contribute to the understanding of the intersections between environmental and human health. My goal and intended research was to improve understanding of community-driven, participatory models for resilient food systems that sustain ecological, economic, and community health. However, in some ways, my entry into the PhD program was also somewhat accidental. After completing my Masters in Public Health in 2012, I was working at the UW's School of Medicine and Public Health, managing medical partnerships with universities in Ethiopia. During one of these partnership trips to Ethiopia, Jonathan Patz and I met with Dirk Hoekstra from the International Livestock Research Institute to learn more about Ethiopia's efforts on food security and nutrition projects. He introduced us to Dr. Steffen Schulz, then country director for the International Potato Center, which led to a subsequent UW partnership with CIP to implement an impact evaluation study of an integrated agriculture and nutrition program. It was out of this chance meeting and ensuing program efforts that I came to learn more about the complexities of designing and evaluating food security interventions, particularly in limited resource settings with diverse stakeholders. Through this collaborative work, the question culminated for me of how to design food security programs to achieve multiple benefits – i.e., economic, ecological, and human health – to improve the health of whole communities. What drove me to the doctoral program was a combined desire to enhance my skills and leadership to improve the quality and rigor of this work, along with the encouragement and mentoring of Steffen and my supervisor, Dr. Girma Tefera.

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ABSTRACT

BACKGROUND: Globally, nearly 1 billion people are food insecure, the majority of whom live in developing countries. One measure of food insecurity, the prevalence of children under-5 years of age that are underweight, is estimated to underlie the deaths of 3.1 million children globally each year, representing nearly 45% of all mortality in this age category. There are multiple underlying causes of food insecurity, including unclean water, political instability, lack of health services, climate change, and low rates of education. These underlying causes require actions by multiple sectors in order to improve food security outcomes. Such interventions, termed "nutrition-sensitive interventions," include food security programs, agricultural development, education, water and sanitation projects, poverty reduction, and women's empowerment. However, indicators for measuring the impact of nutrition-sensitive interventions are often discipline and project specific, and do not address a broad range of multi-sectorial indicators. Thus, current programs miss key elements of drivers and barriers to food security and fail to incorporate these to ensure success of programs.

One framework that has informed the design of multi-sector food security programs in developing countries is the Sustainable Livelihoods Approach (SLA), developed by the United Kingdom's Department for International Development (DFID). Applications of the SLA demonstrate that households most successful in maintaining food security do so in ways that maximize multiple types of assets. This view of food security focuses on households' long-term resilience to external shocks that can disrupt it, and directs intervention activities to multi-sector, participatory processes for solutions that come from within communities rather than providing single-sector, short-term services that are externally driven. The SLA has primarily been applied at the household level; however, food security and livelihoods strategies are multi-dimensional and influenced by community, organizational, and political environments. To address this gap, my research integrates an ecological systems approach to the SLA model to consider the inter-relationships at the different household, community, political, and institutional levels to improve the design and evaluation of food security programs.

AIMS AND METHODS: Evidence suggests that food security interventions can be more effective when they are asset-based and adapted to local contexts, because the drivers and manifestations of food insecurity differ across communities. However, we do not have a good understanding of how food insecurity is experienced in different contexts or how households use local assets to cope with the risk of food insecurity. This limited existing empirical data as well as lack of rigorous and reliable methods limit future program development and intervention work. Recognizing that food security interventions should be adapted to local contexts, this research employs a traditional SLA approach but is expanded and modified to include an ecological systems framework to understand both the magnitude of food insecurity and how rural households in two regions of Ethiopia use household and community assets to cope with the risk of it. The three research aims and methods for achieving them were to:

AIM 1: Quantify the prevalence and magnitude of food insecurity among the study population in two regions of Ethiopia.

METHODS: Primary data were collected from 450 households in the study area using structured questionnaires with trained enumerators in the local language. Enumerators interviewed heads of households, and the survey included questions about household socio-economic characteristics, education, agronomic practices, food security, nutritional status, and health data for women and children between 6-59 months. To assess the different dimensions and extent to which households perceived their food security status, surveys included eight food security questions, each corresponding to a different degree of food insecurity using the Household Food Insecurity Access Scale. The questions collected self-reported experiences within the last 30 days, and a Likert scale to consider the frequency of the event (*i.e.,* frequently, sometimes, rarely). The questionnaire was prepared in English, reviewed and approved by a technical committee comprised of CIP-Ethiopia staff and local stakeholders, and conducted in the local language by trained enumerators.

HHs were selected based on geographic location, demonstrated food gaps, having at least one child under 5 years of age, approval of local administration, and willingness to participate in future nutrition and agriculture trainings. Surveys were conducted in February/March 2014 (Tigray) and June /July 2013 (SNNPR), and analyzed using SAS® version 9.2. Households were then classified into categories of being food secure, having mild food insecurity, or moderate/severe food insecurity according to the Household Food Insecurity Access Scale (HFIAS).

AIM 2: Describe how contextual factors are important for ensuring food security, particularly local institutional processes and policies, using quantitative analysis to identify associated factors and the direction of these relationships, considering similarities and differences between regions.

METHODS: I conducted a literature review of food security interventions that have applied the SLA framework to identify what indicators have defined these domains in other contexts. A comprehensive list of SLA indicators by asset category were generated to consider commonalities and differences across cultural and policy contexts, and identify which ones were found to be effective indicators in relation to enhancing livelihoods and food security. After this list was generated, I drew from interviews with experts from the study population to further refine and add to the list of indicators used in the quantitative analysis. After classifying households by food security status (Aim 1) and identifying context-specific indicators for each of the SLA domains, the SLA indicators were analyzed for association with food security status. Household indicators with continuous variables were compared across the three food security categories (*i.e.*, food secure, mildly food insecure, and moderately/severely food insecure) using Analysis of Variance (ANOVA) to identify potential associations. Household indicators with categorical variables will be compared using Chi-Square to test for significance (p-values <0.05).

AIM 3: Apply participatory methods to evaluate community perspectives regarding the significance of these factors to inform how food security projects can work to enhance local assets to strengthen food security and livelihoods.

METHODS: Narrative inquiry methodology and participatory methods were used to engage communities, first, in describing assets from the traditional SLA capital categories, and, second, in describing their broader community environments, institutions, and policy processes. Qualitative data were managed using NVivo® and coded to evaluate local perspectives of factors that influence food security, and improve understanding of multi-sector, multi-level strategies to strengthen food security and livelihoods. The narrative analysis started with the traditional SLA capitals as deductive categories, but considered unanticipated themes and the frequency of them at different ecological levels.

RESULTS:
***Aim 1*:** In the SNNPR, survey data indicated that 12% of HHs were food secure, 47% were mildly food insecure, and 41% were moderately or severely food insecure at the time the surveys were conducted. In Tigray, 66% of HHs self-reported being food secure, 12% were mildly food insecure, and 22% were moderately or severely food insecure. Findings may have been influenced by seasonality, as they reflected self-reported data within the 30 days prior to when the surveys were conducted.

Aim 2: In both the SNNPR and Tigray, multiple capital categories were associated with food security status, including economic, environmental, and health factors. In the SNNPR, financial assets such as livestock, land holdings, and cell phone ownership, along with education levels had an association with food security. In Tigray, human assets, such as maternal health, and natural assets such as altitude, geographic location, and irrigated landholdings had an association with food security. These differences perhaps partially can be explained by the cultural and policy differences between the two contexts. One measure used to assess national progress toward the Millennium Development Goal of achieving food security for all – the proportion of children under-5 years that are underweight – was not associated with food security status in either the SNNPR or Tigray study populations. The proportion of children under-5 years of age that were classified as underweight was 34.6% in Tigray and 16.1% in the SNNPR.

Aim 3: Certain household and community assets – schools, health care facilities, water infrastructure, religious institutions, trees, and roads – were identified as important by 100% of group discussion participants in both regions. Additionally, participants from both regions emphasized the importance of human assets – health, education, and positive attitudes – for supporting livelihoods and food security in their communities. In the SNNPR, participants emphasized built, natural, and social assets, while in Tigray participants emphasized financial and natural assets. Communities in both regions spoke of the need for food security programs to align with existing government programs at the *kebele*, *woreda*, and national levels rather than work outside of these existing institutional structures.

KEY FINDINGS:

1. Within this study population, households with more assets – and assets from multiple capital categories – are more likely to be food secure.

2. Assets important for ensuring food security are driven by local contextual (i.e., land, demographics, wealth, and environmental) and cultural (i.e., feeding behaviors and practices) factors.
3. Community as well as household assets from multiple capital categories – financial, human, natural, and social – are important for ensuring food security; however, the types of indicators within each capital category and the importance of each overall category differ between regions.
4. The nutrition indicator of child underweight – one measure used to assess national progress toward the Millennium Development Goal of achieving food security for all – is not associated with food security status in either the SNNPR or Tigray study population.
5. The use of an ecological livelihoods framework may help improve selection of contextually relevant indicators and inform the design of multi-sector food security interventions that better enable multiple sectors to work together because, in order to ensure food security, projects enhance the food systems that support it, including: productive agriculture, economic vitality, healthy people and environments, and with consideration to justice and equity.

IMPLICATIONS: First, this study established that multiple factors – both at the household and community levels – are associated with food security status within the study population; "both," suggesting that household assets traditionally the focus of development evaluation may not be sufficient. This also highlights the importance of designing multi-sector interventions – be they food security, agricultural development, or public health – to better address the underlying drivers of food insecurity. Next, it presented a novel methodology to characterize the prevalence and predictive factors of food insecurity by not only combining quantitative and qualitative analyses, but also contributing a novel process for stakeholder engagement. This methodological innovation may improve identification of food insecure households and local factors that inhibit or support food security, which can be used by stakeholders and policy makers to ensure interventions are contextually relevant, work across sectors, and enhance community participation. Most notably, this study's comprehensive approach of including community participation added local perspectives that are often ignored in traditional evaluation methodologies, which either focus solely on quantitative data or collect qualitative data using processes that prioritize the voices of the traditional leaders, those in authority, or who have more assertive voices. Third, this study advanced the use of ecological systems theory into the design and evaluation of multi-sector food security interventions. Integrating an ecological approach to the SLA model may support a more holistic set of actions to build upon local household, community, and organizational assets, which in term may improve program effectiveness and decrease dependence upon external aid. Finally, stakeholder participation – at household, community, and organizational levels – was used to inform the design and selection of program indicators. Food and agricultural policies should set a vision – in collaboration with community and stakeholder feedback – for what kind of impact they want to achieve, and do so in ways that consider the multiple ways that food impacts communities (e.g., economic, health, social, environmental outcomes).

CHAPTER 1: BACKGROUND

1a. Definition of food security:

Food security is commonly defined as existing "at the individual, household, national, regional, and global levels when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life."[1] This definition came out of the 1996 World Food Summit, and introduces the four main dimensions of food security frequently used today:

1. Physical **availability**
2. Economic and physical **access**
3. **Utilization**
4. **Stability** of the other three dimensions over time

These four dimensions illustrate that food security not only requires sufficient caloric intake resulting from strong agricultural production systems, but also functional markets, dietary quality and nutrition, resources and financial capital, cultural appropriateness, and resilience to environmental and social shocks. The ability of families to feed themselves depends on multiple factors beyond food production, such as wealth, gender equity, education, and nutritional status.[2]

The conceptualization that led to this multi-dimensional definition of food security developed over time.[3] In the 1960s, India was experiencing war and widespread famine. Agricultural advisors, including the Nobel laureate Norman Borlaug, were brought into the country to assess the situation and develop a strategy for increasing food production.[4] What the advisors recommended – high yielding varieties of wheat and rice, modern irrigation systems, introduction of synthetic pesticides and fertilizers, and improved planting breeding schemes – became known as the "Green Revolution," a term William Gaud, former United States Agency for International Development (USAID) director, is credited for coining.[5] It was soon expanded to other countries across southern Asia, South America, and sub-Saharan Africa. While the spread of industrial agriculture has been praised by some for increasing crop yields and spreading agricultural technologies globally, by others it has been criticized for decreasing

national food security and being unsustainable.[6] Some of the criticisms against the Green Revolution are that it increased smallholder farmers' dependence on chemical fertilizers which damaged local ecosystems and economies; reduced the variety of indigenous crops that were locally adapted to climate/soil conditions; contributed to new land management and dietary patterns that were less healthy over the long-term, as many farmers changed from polycultures to monocultures (e.g., maize, rice, wheat); increased dependence on high-input agriculture and technology; and widened the wealth gap by forcing smaller farmers into debt as they tried to mechanize and modernize.[7, 8]

Global cereal production yields have steadily increased since 1960, one of the successful outcomes of the Green Revolution. However, it did not resolve the broader question of ensuring global food security, as average per capita availability of cereals and meat have been declining since the mid-1980s.[5] Further, while certain regions have made progress in increasing food production yields, others have not. For example, cereal yields in many African countries have not improved significantly since 1960, while yields in Asia and other developing regions have nearly tripled. One lesson learned from the Green Revolution is that, while barriers to agricultural mechanization and modernization can be overcome, certain pre-conditions must exist for that to happen. Such conditions include an enabling policy environment, basic levels of infrastructure and existing market development, and farmer access to and the human capacity to adopt appropriate agricultural inputs (e.g., fertilizer, improved seed, land, pesticides, and irrigation technology).[4] Increased awareness about these necessary pre-conditions started to shift how food security was conceptualized and how governmental and non-governmental organizations addressed the issue, moving away from solely focusing on supply side issues like food production and availability to consideration of food security's other dimensions.

The first World Food Conference held in Rome in 1974 focused on the **availability of food**, addressing it as a problem of agricultural production, trade, and stocks in line with the goals of the Green Revolution.[9] However, ensuring adequate national and international food supplies was not sufficient to address community- and household-level food security. Despite

international efforts to increase global agricultural production, issues of power and equity were not addressed and households who needed food the most often were unable to access or afford it. Thus, food insecurity rates continued to climb.[10] With this awareness that **food access** is a critical determinant of food security, in the early 1980s food security programs and policies shifted to address the consumer side. In his essay *Poverty and Famines: An Essay on Entitlement and Deprivation*," noted economist Amartya Sen argued this point about demand-side problems.[11] Despite increased availability, many households lacked food due to an inability to access markets, inadequate purchasing power, limited influence to negotiate prices, and other social and political barriers. This brought the food security, food sovereignty, and poverty reduction movements closer together to work toward the shared goal of improving livelihoods.[12] In the 1990s, the dimension of **utilization** entered discussions about how to conceptualize food security, as physical and economic access to food were recognized as necessary but not sufficient to achieve it for multiple reasons. First, factors at the individual level (*e.g.,* age, environmental conditions, and disease status) affect a person's ability to absorb nutrients.[13] Second, within households there may be differences in how food is allocated to members that may prioritize and benefit certain individuals, but not everyone equally.[5] Finally, starting in the 1990s, rates of chronic disease and obesity grew rapidly, becoming a major global public health burden in many countries. Studies found associations between household food insecurity and overweight and obesity, raising attention to not only sufficient caloric intake, but also the *quality* of those calories. Diversified diets, good hygiene and sanitation, food safety, water quality, and health care practices became recognized as determinants of utilization.[13, 14]

1b. Measurement of food security:

As the concept of food security developed over time and in multiple contexts, different measurement tools and indicators were created to assess the dimensions. Initially, measurement reflected the supply side issues of food security, such as national food availability and stocks.[15] Next, measurements attempted to report indirect factors affecting food access, such as income and consumption levels.[16, 17] Increasingly, there has been a shift to collect

direct, experiential indicators of food insecurity and its consequences on individual development and household well-being.[2, 18, 19] Examples of food security metrics, what they measure, and domains captured are found in table 1. These measures are often national- and household-focused, and – the utilization measures in particular – do not often compare well across regions. Also, the HFIAS and another – the *Escala Latinoamericana y Caribena de Seguridad Alimentaria* (ELCSA) – were the only ones that included experiential measures.

Table 1. Examples of food security metrics, types of indicators used, domains and scale they capture. Adapted from Jones et al., 2013.

Metric	Indicators	Dimension	Scale Level
Prevalence of undernourishment	Proportion of population not consuming adequate calories	Availability; access	National
Share of food expenditures by the poor	Average % of total expenditures spent on food by HH from lowest income quintile	Access	National
Domestic price volatility	Observed variation in the FAO's annual food price index	Access	National
Global Hunger Index	Prevalence of undernourishment; Proportion of child underweight; Child under-5 mortality	Availability; Utilization	National
Global Food Security Index	Food costs as proportion of total HH expenditures; food prices; dietary diversity, etc. (30 total)	Availability; access; utilization	National
Dietary Diversity Scores (HH and Individual)	Dietary diversity based on 12 (HH) and 9 (individ.) food groups	Utilization	National, HH
HH Food Insecurity Access Scale (HFIAS)	9 questions based on experiential domains of food security	Availability; access; utilization; time	National, HH

The FAO uses two indirect indicators to estimate global food security rates: **prevalence of undernourishment** (PoU), which is the percentage of the total population estimated to consume fewer than 1800 calories per day, and **prevalence of children under 5-years that are underweight** (CU5).[5] PoU and CU5 were selected because they reveal key information about specific food security dimensions. PoU reflects national availability and access to food. CU5 not only provides information about food utilization, but also some of the underlying drivers of nutrition that other nutrition – e.g., stunting (low height for age) and wasting (low weight for height) – do not. Stunting is indicative of a past episode of chronic undernutrition the child or its mother experienced, while wasting results from rapid weight loss, and is often associated

with famine or disease. Those two indicators usually require immediate and nutrition-specific interventions, such as supplementation or food aid. Underweight, however, is an indicator that reveals inadequate food intake and poor health conditions. When rates of underweight and undernourishment are high, nutrition-specific interventions are not an adequate response. The indicators of PoU and CU5 quantify and compare prevalence of food insecurity at national and international levels and are useful for making cross-national comparisons, highlighting disparities, and monitoring changes over times.[2] However, the data and assumptions used to calculate these rates do not lend themselves well to multi-faceted or localized understanding of the drivers of food insecurity to inform the design of interventions.[20]

Qualitative studies have identified patterns in the ways households experience food insecurity that are consistent across cultural and country contexts.[18] These patterns include feelings of worry about having enough food, a perception that food may be of insufficient quality, reductions in the quantity of food consumed, and harmful physical and cognitive consequences of reduced intake. To better capture localized understanding of households' experiences of food insecurity, direct, experienced-based measurements have been developed and validated to increase their reliability across different cultural contexts. In 2014, the FAO launched the *Voices of the Hungry* project (VOH).[18] The VOH initiative responded to the need for a global reference scale for an evidence- and experience-based data collection metric of food security at the household level. It was modeled upon the Household Food Insecurity Access Scale (HFIAS, developed in the U.S.) and the ELCSA for questions and analytical methods. The questions underwent revisions and field testing to improve the precision in how questions were worded and what they measured, validated by a panel of experts and communities in four countries: Angola, Ethiopia, Malawi, and Niger. The resulting tool – an 8-question Food Insecurity Experience Scale (FIES) – is used to estimate prevalence of household food insecurity. The survey includes questions to capture the different experiential dimensions, which included uncertainty and worry about food, inadequate food quality, insufficient food quantity, and seasonal variations in food access.[18]

What the FIES and other experiential food security assessment tools provide are methods for assessing local experiences of food security within different groups. They can be used to help researchers and policy-makers consider factors that influence local food security status between and within households. Despite the FAO and others' attempts, food security measures are subjective and have multiple limitations when used to compare experiences over time, within and between households, and across countries. Also, in isolation, they fail to capture the political and cultural elements that may also influence the food security experience.

1b.1 Limitations of food security measurements:

Today a multitude of metrics exist for measuring food security at the individual, household, community, and national levels; however, one challenge in assessing food security is selecting which measurement to use and what underlying dimension(s) it reflects.[2] Another challenge is that measurement requires varying levels of inputs, organizational capacity, and intensity to implement, and presents different constraints for data collection.[15, 16] In many contexts, measurement should take into consideration seasonal variables such as employment and income levels, rainfall patterns, harvest times, and even cultural and religious events into the data collection process, analysis, and interpretation; however, that requires significant time and human capacity to implement.[17] Another challenge in measuring food security is that it is a subjective experience. Even though efforts have been made to develop accurate indicators of household food security based on the four experiential domains, *i.e*., access, availability, utilization, and stability over time,[16] surveys rely on a respondent understanding the question the way it was intended and reporting truthfully and accurately. Finally, indicators have been adapted to specific cultures and regions because coping strategies and social norms (*e.g.,* gender roles or dietary preferences) vary by political, geographic, and cultural contexts.[15, 17] Single indicators can vary in significance from region to region, and with respect to implementation across study sites, necessitating careful selection of measurement tools to ensure relevance to the purpose and its intended use.

1b.2 Global and regional magnitude of food insecurity:

Disparities exist in who is most susceptible to food insecurity and where prevalence rates are highest. The majority of food insecure people – 780 million (95%) – live in developing countries, with the highest rates found in sub-Saharan Africa, southern Asia, and Oceania (table 2).[5]

Table 2. Global rates of undernourishment, 1990/92 to 2014/16. FAO, 2015.

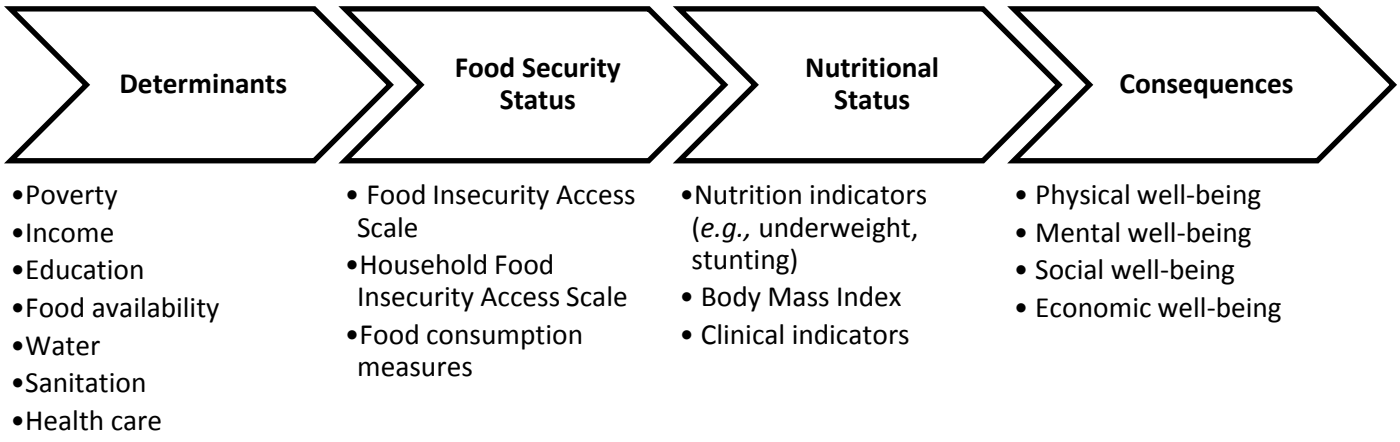
	Number (millions) and prevalence (%) of undernourishment							
	1990-92		2000-02		2010-12		2014-16*	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
WORLD	**1,011**	**18.6**	**930**	**14.9**	**821**	**11.8**	**795**	**10.9**
DEVELOPED REGIONS	**20**	**<5.0**	**21**	**<5.0**	**16**	**<5.0**	**15**	**<5.0**
DEVELOPING REGIONS	**991**	**23.3**	**908**	**18.2**	**805**	**14.1**	**780**	**12.9**
Africa	182	27.6	210	25.4	219	20.7	233	20.5
East Africa	104	47.2	122	43.1	119	33.7	124	31.5
Asia	742	23.6	637	17.6	547	13.5	512	12.1
Latin America & Caribbean Islands	66	14.7	60	11.4	38	6.4	34	5.5
Oceania	1	15.7	1	16.5	1	13.5	1	14.2

Source: FAO. * Data for 2014-16 refer to provisional estimates.

1b.3 Health, social, and economic implications of food insecurity:

Studies show that those who are food insecure have worse health and poorer psycho-social and economic outcomes than those who are food secure,[21, 22, 23] thus limiting the economic and political development of not only the households who experience it, but their communities and entire nations (figure 1).

Figure 1. Determinants, measures, and consequences of individual food insecurity. Adapted from Ballard et al., 2014.[18]



Health Implications:

Food insecurity causes different and serious health problems and illnesses. Many of these problems limit people for their entire lives, and some contribute to early mortality.[13] Food insecurity can lead to malnutrition, and adequate nutrition is important during key stages of physical and cognitive development when individuals are most susceptible to nutritional deficiencies.[24] Child malnutrition, including the period of growth in the womb, has been shown to increase multiple chronic health conditions later in life, such as heart disease, diabetes, and high blood pressure.[25] Undernourished children also have lower resistance to infections, a less resilient immune system, and are more likely to die from common childhood ailments. Multiple studies have identified the synergistic relationship among child undernutrition, infectious diseases, and mortality rates,[13] and found that if undernutrition did not exist, there would not have been deaths from these infectious etiologies. Black et. al. studied 1315 deaths among children younger than 5 years of age, and found all anthropometric measures (*i.e.,* stunting, wasting, and underweight) to be associated with increased rates of death from diarrhea, measles, and pneumonia, though not malaria.[13] Other studies have shown child malnutrition to increase both the susceptibility to and risk of death from measles, diarrhea, malaria, and pneumonia.[26, 27]

Additionally, households that are food insecure are more likely to have micronutrient deficiencies.[28] Micronutrient deficiencies have been shown to contribute to additional poor health outcomes. Globally, 5.17 million preschool age children are estimated to have night blindness and 90 million to have subclinical vitamin A deficiency.[29] In 2011, an estimated 157,000 deaths of children ages 6—59 months were attributed to VAD.[30] Iron deficiency limits the mental capacity of 2 billion children globally and is linked to approximately 25% of maternal deaths in developing countries.[25] Iodine deficiency causes brain damage in almost 18 million newborns per year, and is the primary cause of preventable mental disability.[31] Approximately 150,000 newborns experience acute birth defects annually as a result of folate deficiency. An estimated 33% of the world lives in areas at high-risk for zinc deficiency, which can result in decreased immunity and increased mortality from infections such as diarrhea.[32]

Social Implications:

Food insecurity can negatively impact the well-being of individuals and households through pathways such as psycho-social distress,[33] declines in participation in social and ceremonial activities,[34] and shame.[35] Households that experience food insecurity may resort to negative coping strategies such as spending their savings, liquidating assets, or borrowing.[36] Undernourished adults are less able to work, earn income, and provide and care for themselves and their families.[33] Children who are undernourished will not grow properly and are often too weak or sick to attend school or, when they do, are not able to focus well to learn properly. Conversely, children with improved nutritional status achieve higher schooling levels, higher-paying jobs, and have overall enhanced physical, cognitive, and reproductive performance.[37] For both adults and children, under-nutrition leads to poor health, lost human potential, a lower quality of life, and stress on their families, and contributes to larger impacts on the well-being of communities, nations, and regions.[28]

Economic Implications:

The economic costs of food insecurity and undernutrition include both the direct costs – such as increased burden on the health care system – and the indirect costs of lost productivity. In 2014, the African Union and World Food Programme commissioned a study of the economic and social impacts of child undernutrition and food insecurity in Africa.[38] Data from the first phase of the study were collected from four African countries – Egypt, Ethiopia, Swaziland, and Uganda – and considered the impacts and implications of child undernutrition on multiple sectors: health, education, labor, and the economy. The study found that the total economic impact of child undernutrition varied from 1.9% and 16.5% of gross domestic product (GDP) among the four study countries, and these economic losses were primarily due to increased health costs and loss of productivity.

Because food insecurity negatively impacts individuals, households, and entire countries, multiple agreements have established national and global food security targets, including the Millennium Development Goals (MDGs). In 1990, the MDGs called for the prevalence of hunger

to be cut in half by 2015. And in 1996, the World Food Summit (WFS) set out to halve the number of undernourished people by the same target date. The MDG goal was nearly reached, as the prevalence of undernourishment decreased from 18.6% (1990) to 10.9% (2014).[5] However, achieving the WFS goal would have required bringing the number of undernourished people down to 515 million in 2014, about 265 million fewer than what was reached. In addition, certain populations and regions are disproportionately affected with higher rates of food insecurity. The Food and Agriculture Organization (FAO) estimates that 95% of people who are food insecure live in developing countries. If we know food security is important for human, social, and economic development, then there should be greater and more equitable progress toward achieving it.

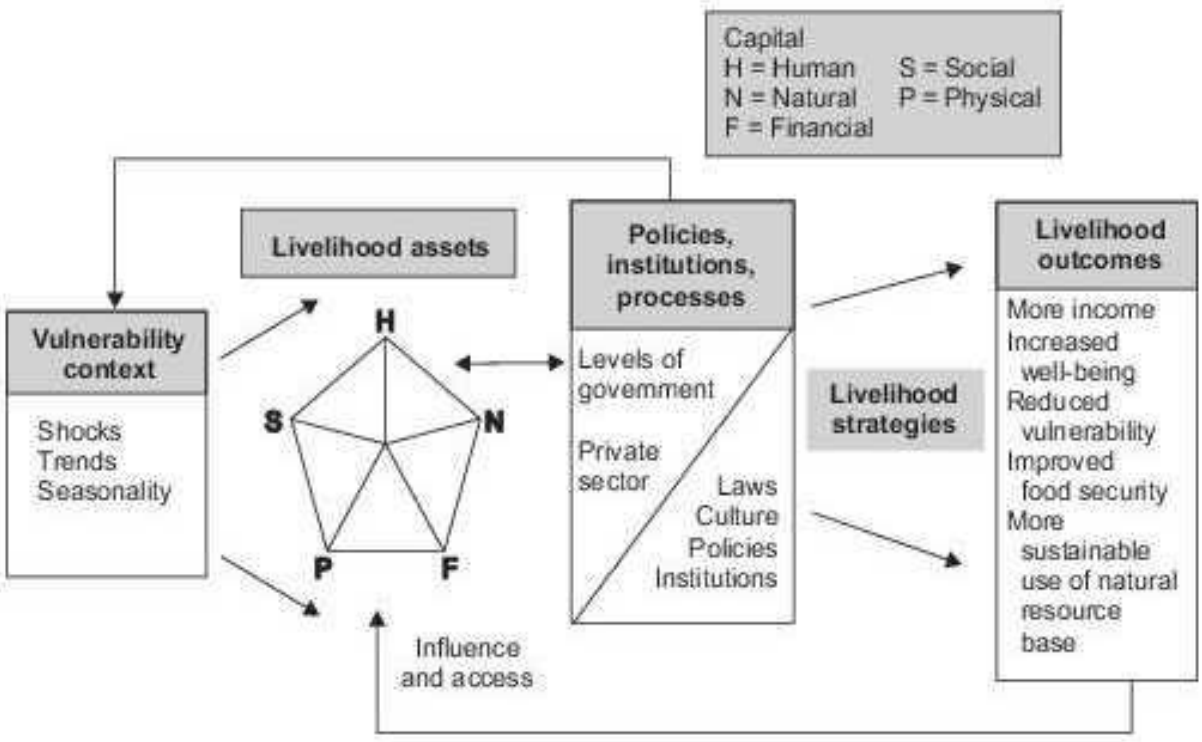
1c. Multi-sector and ecological frameworks:

Understanding the gaps about how food is produced and distributed, accessed, marketed, and consumed is of vital importance for policy-makers at the local, regional, and international levels to ensure the health and well-being of all. Because the underlying causes of food insecurity go beyond food production, it is imperative that indicators for measuring it and interventions for solving it also be drawn from across sectors. Given the complex nature of food security, different frameworks have been produced to help understand linkages among the determinants of food security, indicators used to measure it, and explain relationships.[3] Food security frameworks can help stakeholders identify the many factors that affect households' livelihoods, their relative importance, and the ways in which they interact. Frameworks can also help stakeholders identify appropriate entry points to strengthen food security and nutrition.

One framework used to inform food security program design and analysis in developing countries is the **Sustainable Livelihoods Approach** (figure 2), originally developed by the United Kingdom's Department for International Development (DFID).[39, 40] SLA is a **multi-sector**, livelihoods-centered approach useful for analyzing how households manage risk and make decisions. The SLA is used to understand the root causes of poverty and food insecurity, often employing participatory approaches and analyzing households' livelihoods holistically. Ellis

defines livelihoods as the "natural, physical, human, financial, and social assets, the activities, and the access to these, mediated by institutions and social relations that together determine the living gained by the individual or household."[41] While multiple variables influence decision-making processes, the SLA gives greater agency to individuals to utilize the assets available to them to make decisions that affect their households. This is turn influences and is influenced by the political environment (*i.e.,* policies, institutions, and processes), which shapes the livelihoods strategies a household employs that effect multiple livelihoods outcomes, including food security and health. An SLA perspective assumes that the main objective of a household is to enhance food security and minimize risk.[42] However, exactly how households use assets to manage risk of food insecurity is just one part of a more complex set of decisions family members make, and is frequently determined by localized (*i.e.,* contextual and cultural) factors.

Figure 2. Sustainable Livelihoods Approach framework, DFID.



Key concepts of the SLA include vulnerability, adaptive capacity, and livelihood assets, and the relationships among them.[43] *Vulnerability* refers to the effects that a circumstance (*i.e.,* flood, drought, illness) may have on a household, and the risk of such an event occurring.[44, 45] Different disciplines such as disaster management, emergency preparedness, and climate science have developed tools for assessing vulnerability at the individual, household, community, and society levels, and often describe it as a function of three components: exposure, sensitivity, and adaptive capacity.[43] These components are influenced by a range of environmental, social, and economic factors.[46] *Adaptive capacity* of a household, community, or system refers to its "ability to modify its characteristics or behaviors in order to better cope with existing or anticipate external stresses and changes."[43] This view focuses on the long-term viability and resilience of households, and helps direct program activities toward empowerment and enhancing existing community assets rather than providing short-term services dependent upon external resources. However, it is dependent upon ownership of certain livelihood assets. *Livelihood assets* are the types of assets important for ensuring household food security.[47] Previous studies have found associations between vulnerability and livelihood assets: the more assets households have, the less vulnerable they are.[43, 48-56] Conversely, the fewer assets a household has, the more vulnerable to shocks and stresses it is. Table 3 summarizes the SLA capital categories, types of indicators that have been used to assess them, and whether the indicator was found to show an association with *adaptive capacity*.

Studies that have applied the SLA have developed different tools to characterize the vulnerability context and how this influences the kinds of assets available to households. However, livelihood strategies and outcomes depend on more than just access to assets. Another unique and important aspect the SLA model describes is how these assets are then transformed by policies and institutions, which raises both the social and participatory dimensions of livelihoods strategies. Factors that influence participation in these processes and policy-making contexts, however, can be difficult to understand and require certain processes, time, and relationships to draw out this important and contextually-driven information, both at the local and other ecological levels.

Table 3. Indicators associated with livelihoods strategies from studies of programs employing a Sustainable Livelihoods Approach

SLA Category	Indicator	Location	Data Source
Financial	Credit access	Uganda, Asian Highlands	Howlett, 2000; Xu, 2014
	Savings access	Uganda, Asian Highlands	Howlett, 2000; Xu, 2014
	Livestock ownership	Uganda, Asian Highlands	Howlett, 2000; Xu, 2014
	Commodity prices	Uganda	Howlett, 2000
	Disposable assets	Uganda, South Africa	Howlett, 2000; Gbetibouo et al., 2009
	Property ownership	Uganda	Howlett, 2000
	Annual income	Uganda	Howlett, 2000
	Primary income activity	Uganda	Howlett, 2000
	Off-farm income	South Africa	Gbetibouo et al., 2009
	On-farm income	South Africa	Gbetibouo et al., 2009
	Tax rate	Uganda	Howlett, 2000
	Borrowed money from relative	Asian Highlands	Xu et al., 2015
	Received loan from institution	Asian Highlands	Xu et al., 2015
	Car ownership	Asian Highlands	Xu, 2014
Human	Health and food security	Uganda, Asian Highlands	Howlett, 2000, Xu, 2014
	Education	Uganda, Asian Highlands	Howlett, 2000; Xu, 2014
	Access to health services	Uganda	Howlett, 2000
	Reliance on indigenous knowledge	Uganda	Howlett, 2000
	Family size	Uganda	Howlett, 2000
	Permanent farm workers	Uganda	Howlett, 2000
	Kitchen garden	Uganda	Howlett, 2000
	Participation in workshops	Uganda	Howlett, 2000
	Life expectancy	India	Brenkert et al., 2005; Patnaik 2005
	Child underweight	Africa	Thornton et al., 2006
	GI illness	Asian Highlands	Xu, 2014
	HIV prevalence	Africa	Thornton et al., 2006; Gbetibouo et al., 2009
	Market information	Uganda	Howlett, 2000
Natural	Soil (quality, depth, organic levels)	Uganda, Philippines	Gomez, 1996; Howlett 2000
	Timing of rains	Uganda, South Africa	Howlett 2000; O'Brien et al., 2004
	Distance to water source	Uganda, Africa	Howlett, 2000; Thornton et al., 2006
	Water quality	Asian Highlands	Xu, 2014
	Average time to collect water	Asian Highlands	Xu, 2014
	Months with water scarcity	Asian Highlands	Xu, 2014
	Slope	Uganda	Howlett, 2000
	Cultivation on marginal land	Africa	Thornton et al., 2006

Table 3, Continued.

SLA Category	Indicator	Location	Data Source
Natural	Availability of pasture, trees	Uganda	Howlett, 2000
	Agro-biodiversity	Multiple sites	Woodhouse, 2000
	Conflicts over land access	Multiple sites	Woodhouse, 2000
	Quality of livestock breed	Uganda	Howlett, 2000
	Crop/livestock yields	Uganda	Howlett, 2000
	Irrigated land	South Africa	Gbetibouo et al., 2009
	Land degradation index	India, South Africa	O'Brien, 2004; Thornton et al., 2006
Physical	Tractor ownership/access	Uganda	Howlett, 2000
	Farm tools	Uganda	Howlett, 2000
	Improved seed varieties	Uganda	Howlett, 2000
	Granary/storage	Uganda	Howlett, 2000
	Distance to all-weather road	Uganda, South Africa	Howlett, 2000; Gbetibouo et al., 2009
	Organic fertilizer	Uganda	Howlett, 2000
	Irrigation infrastructure	South Africa	Gbetibouo et al., 2009
	Electricity access	Uganda, South Africa	Howlett, 2000; Gbetibouo et al., 2009
	Telephone ownership	South Africa	Gbetibouo et al., 2009
	Market access	South Africa	Thornton et al., 2006
Social	Funeral attendance	Uganda	Howlett, 2000
	Agricultural fair participation	Uganda	Howlett, 2000
	Farm organization participation	Uganda	Gbetibouo et al., 2009
	Degree of gender equity	India	O'Brien, 2004; TERI, 2003
	Female-headed household	South Africa	Thornton et al., 2006
	# schools per 100,000 people	South Africa	Gbetibouo, et al., 2009
	# hospitals per 100,000 people	South Africa	Gbetibouo et al., 2009
	Alcohol consumption	Uganda	Howlett, 2000

Studies using the SLA have demonstrated that households most successful in maintaining resilience do so in ways that maximize multiple types of capital. However, there are challenges with the original model and the framework has undergone modifications over time.[56, 57] One challenge in defining and describing livelihood assets using the SLA framework is that the types of assets required to ensure strong adaptive capacity are context-specific and may change over time. Additionally, the original framework only presented five capitals, those being financial, human, natural, physical, and social, but researchers have argued the importance of cultural and political capitals in certain settings as well.[56, 58] Subsequent studies have suggested a capitals framework that considers seven categories, and further investigation of the influence of the community-level determinants on household livelihoods.[57, 59] Finally, the SLA has primarily been applied at the household level. However, food security and livelihoods strategies are multi-dimensional and influenced by community, organizational, and political environments. An ecological systems model is needed to consider the inter-relationships of capitals at the different household, community, political, and institutional levels.

The developmental psychologist Urie Bronfenbrenner (1917-2005) was one of the first to conceptualize an **ecological systems theory** to explore and explain the dynamic influences of social, environmental, and economic factors on human development.[60] Ecological systems theory, as conceptualized by Bronfenbrenner, recognizes behavior as being shaped by multiple levels of influence, with each level representing a social influence or environment, and "progressively more complex reciprocal interactions" between an individual and proximal and distal factors in their environments.[60] Social-ecological systems (SES) research has emerged from multiple fields in response to the need for interdisciplinary solutions to complex challenges,[61, 62] in order to "advance understanding of relationships between social and ecological conditions, interactions, and outcomes."[63] In the field of public health, the social ecological model (SEM) is an evidence-based framework frequently used to guide communities in making changes at individual, family, community, and policy levels to support healthier lifestyles.[64] It is used to describe the complex interaction between individual, organization, community, and policy-level factors. The fields of public health and health promotion research recognize that most public health issues (*e.g.,* food insecurity, poor nutrition) are complex and

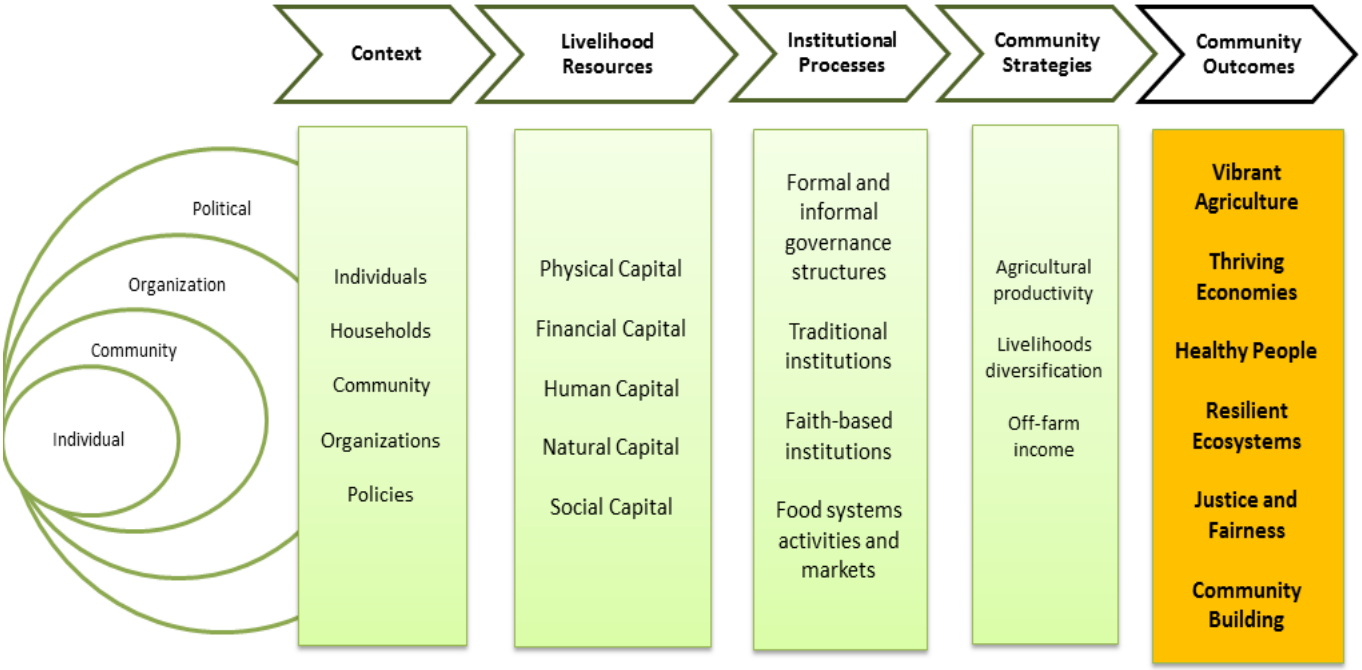
cannot be understood by linear, single-level analysis models, like the SLA.[63] Instead, these fields have shifted from individual- and household-level efforts to community-, environment-, and policy-oriented interventions to enhance supportive conditions and healthy behaviors.[61, 64]

What the model of the SEM provides that has been missing from the SLA when applied to food security research is a model of social utilization of assets that consider levels beyond the individual and household. My research proposes a **conceptual framework** model (figure 3) for integrating SEM with the SLA in order to support a holistic set of actions at multiple levels to advance food security programs and policies that build upon local individual, community, and organizational assets in order to support the health and resilience of individuals, families, and whole communities. My model integrates an ecological approach to the SLA to frame the relationships for each contextual level (*i.e.,* household, community, organization) to consider:

- The **situational context** of households and their communities in the study population. This comes from the SLA but incorporates the addition of the SEM to describe what social structures exist for a given population at multiple levels (*i.e.,* individual, household, *kebele* (village), *woreda* (district), government, etc.).
- How these contexts shape what **livelihood assets** households and communities have, and also how they value and use them. This presents an integration of the SEM/SLA models.
- What localized **institutional processes** operate in the SNNPR and Tigray. This is the "processes, institutions, and policies" section of the SLA model.
- And, finally, how these processes affect the kinds of **strategies** being used or that could be used to enhance ultimate **outcome** of food security. It is not only local processes and institutions that influence outcomes, but also the utilization of assets at the different contextual levels that feed back into different strategies that are important to recognize – and possibly intervene into – in order to positively influence food security outcomes. While improving food security may be a programmatic goal, by taking a multi-sector, multi-level approach, it's likely for multiple outcomes beyond food security to also result, such as those from Whole Measures, a values-driven planning and evaluation tool to help communities frame a process for food systems change (described in Chapter 6). In figure 3, these

potential Whole Measures' effects include vibrant agriculture, thriving economies, healthy people and ecosystems, justice and fairness, and community building.

Figure 3. Framework for a social-ecological approach to Sustainable Livelihoods



1d. Research hypothesis and aims:

Despite awareness of the need for food security interventions that engage multiple sectors, there is a lack of evidence about how to effectively design and measure the impacts of such interventions, both across sectors and at multiple levels. Concern about food security and its relationship with chronic undernutrition has increased interest in how agriculture could be used to improve food security and nutritional outcomes.[20, 21] Two recent systematic reviews of agricultural interventions intended to improve nutrition showed little evidence of impact.[65, 66] Another study conducted by the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) analyzed and mapped the gaps for how agriculture research projects can improve nutrition.[67] The authors looked at 151 agriculture projects with a stated intent to impact nutrition outcomes, and found multiple gaps along the pathway, including lack of meaningful measures. This has resulted in a growing emphasis for reliable and effective food insecurity indicators that can be applied to multi-sector food security interventions.

This research contributes to the larger body of knowledge and practice about improved **multi-sector measures** of food security, informing national and international programs to more strategically work across sectors toward achievement of alleviating food insecurity. While efforts have been made to develop methods that reliably and effectively measure individual and household food security, household-specific strategies have not been sufficient to reduce food insecurity. Better understanding of **multi-level efforts** is needed, at the household as well as at the community, organizational, and policy levels.

As shown in the integrated SLA/SEM framework (figure 3), my ***hypothesis*** is that multiple household- and community-level assets are needed to support improved food security, and that these assets will be contextually specific to each region. My overarching research ***goal*** is to utilize a mixed methods approach to describe local experiences of food security in order to identify local assets needed to strengthen it and recommend more contextually-relevant indicators for measuring it using an ecological framework. To meet this goal, I defined and estimated the magnitude of food insecurity in two regions of Ethiopia – the SNNPR and Tigray – that have been the focus of a multi-sector, multi-level collaboration to improve food security in the region. The quantitative data was used to objectively describe what factors might be important in influencing food security, and the qualitative data was used to describe (either confirming or rejecting) what the quantitative findings mean. Taking a mixed methods approach would then result in a more comprehensive picture to improve understanding of how food security interventions can more effectively support improved livelihoods and achieve multi-sector goals, and consider the role that context plays in determining program implementation and evaluation. This has relevance both to the CIP project in the Ethiopia setting, as well as other food security programs and settings.

My **three research aims** are to:

AIM 1: Quantify the prevalence and magnitude of food insecurity among the study population in two regions of Ethiopia.

AIM 2: Describe how contextual factors are important for ensuring food security, using quantitative analysis to identify associated factors and the direction of these relationships, considering similarities and differences between regions.

AIM 3: Apply participatory methods to evaluate community perspectives regarding the significance of these factors to inform how food security projects can work to enhance local assets to strengthen food security and livelihoods.

Dissertation organization

The remainder of the dissertation is organized as follows: Chapter 2 characterizes the issue of food security within the Ethiopia context (the study site for this research), explains my role within the broader impact evaluation study, and describes the political and programmatic contexts for this study. Chapters 3 and 4 quantify the prevalence of food insecurity in two regions of Ethiopia and examine the individual and household level socio-demographic, economic, and environmental factors to evaluate the magnitude and drivers of food insecurity within each study region. Chapter 5 compares the types of associations found in the SNNPR and Tigray, and relates the findings to broader evidence about the pathways linking agriculture with nutrition and food security. Chapter 6 uses qualitative data to identify what contextual factors are important for ensuring food security and livelihoods within the two study regions, considering similarities and differences between regions. Since we now understand that multiple factors are important in both regions and how these factors work based on discussions with communities, I then describe recommendations for adjusting food security program strategies and indicators to better capture and characterize how households and communities utilize assets to protect against food insecurity. Finally, Chapter 7 summarizes the empirical findings and recommends implications for practice and policy, as well as areas for further research.

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CHAPTER 2: CHARACTERIZATION OF THE STUDY POPULATION: POLITICAL AND PROGRAMMATIC CONTEXTS

Despite awareness of the need for food security interventions to use multi-sector approaches, there is a lack of evidence about how to effectively design and measure the impacts of such interventions, both across sectors and at multiple levels. Further, studies have demonstrated that food security is affected by contextual factors, and methods for collecting localized data are needed to improve how food security programs work to help achieve the global target of ensuring food security for all. To study this issue of what contextual factors influence food security and how, and to test a more comprehensive framework for doing so, two regions of Ethiopia were selected for this study. These regions were selected because they were the location for a food security program being implemented by the International Potato Center (CIP) in Ethiopia, and have unique agronomic, health, and demographic characteristics that make them suitable to receive the CIP intervention strategies. This chapter characterizes the issue of food security within the two study regions by presenting results from a formative assessment. Using my proposed new SLA model that integrated an ecological dimension (page 14), the first step in my study design was to consider the situational context of the households in the two regions of Ethiopia, SNNPR and Tigray, where the CIP program was to be implemented. I designed a formative food security assessment which was implemented at the start of the project among the 20 SNNPR and Tigray *woredas*. It utilized Oxfam's livelihoods approach to assessing food security to guide the process, questions, and analysis. The formative food security assessment (Appendix 1) was conducted in each of the participating *woredas* by two local CIP staff and me, and I analyzed, interpreted, and presented the results. The results were used to improve understanding of the political and programmatic contexts to subsequently shape and inform the quantitative and qualitative methodologies, and also framed the overall evaluation framework and methods used to frame them.

2a. Country context: Magnitude and drivers of food insecurity in Ethiopia

Ensuring adequate nutrition and food security for all Ethiopians is a priority of the Federal Government of Ethiopia (GoE). The GoE is working to sustainably reduce hunger and poverty in all regions, a key objective outlined in the country's Plan for Accelerated and Sustained

Development to End Poverty (PASDEP) that covered the period of 2004/05 to 2009/10. During that period, Ethiopia's Gross Domestic Product (GDP) grew by 11% overall, and the agricultural sector grew by 8.4%.[1] The GoE's five-year Growth and Transformation Plan (GTP) launched in 2010 outlined strategies to continue growth at an ambitious rate of 14%, with agriculture playing a major role.[2] Because the agricultural sector represents nearly 50% of Ethiopia's national GDP, 85% of employment, and 90% of exports, food production and rural development are cornerstones of current and future Ethiopian government initiatives.[1] The GTP provides an overarching strategic framework for the country, and comes at a pivotal time as the GoE recognizes the need for equitable distribution of wealth and integrated cross-sectoral programs as strategies for successful rural and national development.

Despite Ethiopia's recent gains in economic development, chronic food insecurity and malnutrition remain as major challenges.[3] Data from the 2014 Ethiopia Mini Demographic and Health Survey indicate that 40% of children ages 6-59 months are stunted, higher in rural areas (42%) than in urban areas (24%), and 25.3% are underweight (figure 4).[4] Moreover, despite Ethiopia's recent growth in economic development, rural communities are not benefiting at the same rate as urban areas, leading to increasing wealth and health disparities.[4, 5] In 2011, more than 5 million Ethiopian children were stunted, even though per capita gross annual income grew from $130 USD to $387 USD.[1] Poor and rich households alike have high rates of stunted and underweight children, highlighting that economic growth alone is not sufficient to reduce food insecurity and improve child nutrition.

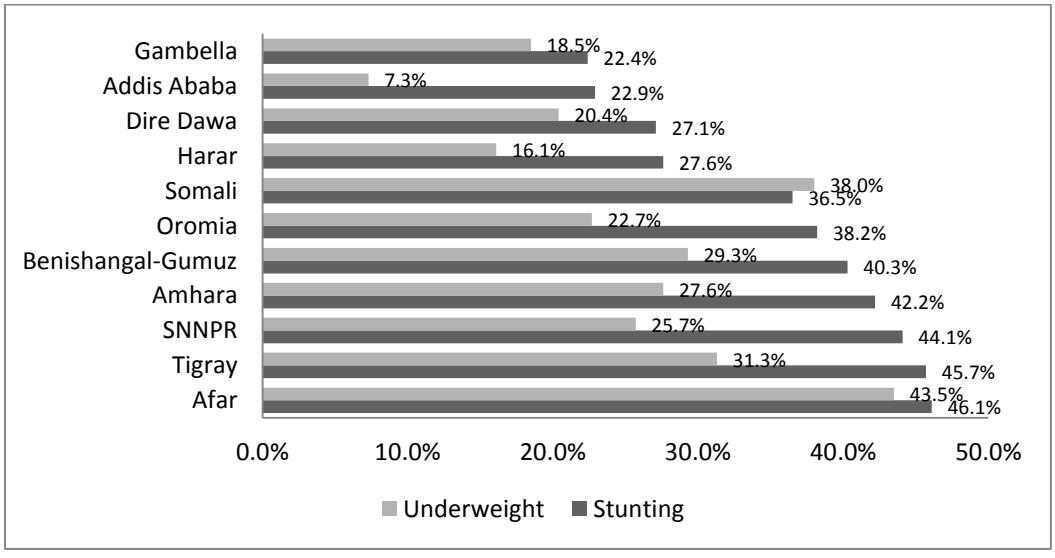


Figure 4. Prevalence of stunting and underweight among child under-5 years, by region of Ethiopia. Ethiopia Mini Demographic and Health Survey, 2014.

Ethiopia include infant and child feeding practices, cultural traditions and feeding behaviors, a high disease burden, low agricultural yields, and limited dietary diversity.[6]

Infant and child feeding practices: The Ethiopian Ministry of Health estimates that only 57% of all children under-6 months are fed according to the recommended Infant and Young Child Feeding (IYCF) practice guidelines, with the percentage of infants fed according to these guidelines decreasing significantly among infants age 0-1 months (70%), age 2-3 months (55%), and age 4-5 months (32%).[7]

Cultural barriers: Ethiopia has a large percentage of the population that reports practicing a religion. Members of the Ethiopian Orthodox church comprise 43.5% of the population, and Muslims 33.9%. Within the Coptic Orthodox tradition, there are 210 days per year of fasting (*i.e.,* no consumption of any animal-based foods). Families may fear judgment from their neighbors for not observing regular or holiday fasting days. Even though "pregnant and lactating women and children younger than seven years are not required to fast, women often fast anyway due to social pressure."[8] Additionally, in some regions of Ethiopia there is a still a strong social expectation that men should eat first and be given the largest portions, restricting women and children's dietary intakes.

Disease burden: Thirteen percent and 18%, respectively, of child under-5 deaths in Ethiopia are attributed to diarrhea and pneumonia.[9] Undernutrition increases the likelihood of childhood morbidity and mortality, and it has been estimated to be the largest single risk factor in the global burden of disease.[10] In a report on child undernutrition, Mason et al report that the total disease burden in developing countries would be "reduced by nearly one-third if undernutrition were eliminated."[11]

Dietary diversity: Dietary diversity has been shown to predict diet quality, particularly among infants and young children.[12] Analysis of dietary diversity scores has shown that increased dietary diversity was positively associated with height-for-age in nine of 11 countries.[13] Further, a study of WHO infant and young child feeding indicators found

that meal frequency with dietary diversity reduced the risk of both stunting and underweight, b2010-ut meal frequency alone was only associated with lower risk of underweight.[14] But in Ethiopia, only 4% of children ages 6-23 months are fed in according with IYCF guidelines, and 5% receive foods from at least four food groups.[15]

2b. Ethiopia: Multi-sector programs and policies to address food insecurity

Because food insecurity and malnutrition remain as major public health challenges in all regions of Ethiopia, multiple sectors include enhancing food security as part of their strategic objectives.[16-18] Ethiopia initiated a comprehensive approach to alleviate food insecurity and poverty in 2005 under its Food Security Program (FSP), administered by the Ministry of Agriculture. A key element of the FSP was to establish the Productive Safety Net Program (PSNP), which provided food and cash transfers to chronically food insecure (CFI) households in exchange for labor on public works projects.[19] The program addressed chronic food insecurity by employing households to engage in productive activities that strengthened community infrastructure and promoted market development by increasing household purchasing power.[19] The amount of food and cash transfers a household would receive was determined by season and need. Vulnerable households could receive six months of assistance each year, while households with able-bodied individuals would be required to participate in productive activities, such as rehabilitating land, constructing water infrastructure, and building schools and roads. A 2011 study by Berhane *et. al.* about the impacts of Ethiopia's PSNP found that the predictable cash and food transfers shortened the time households did not have enough food to feed all family members by over one month. In one region (Amhara), the length of insufficient food was reduced by nearly two months.[19] The FSP worked first to stabilize CFI households' assets to become food sufficient. Then, it helped households increase their resources through a series of integrated development interventions to ensure long-term food security. The GoE made several changes to the FSP from the lessons learned during the first five years of implementation, one of which was to add a new component called the Household Assets Building Programme (HABP). The HABP works to improve "diversified income sources and increased productive assets for food-insecure households" in CFI districts, and was intended to complement the other three FSP components.[20] The GoE's FSP was renewed for

another period from 2010-2014, with the aim of making a "substantial contribution to food security for chronic and transitory food insecure households in rural Ethiopia."[21] This would be achieved by continuing the focus on development and capacity-building activities (as opposed to food aid) and integrating food security into the strategic objectives across different sectors. However, the FSP also made key changes in the 2010-14 period. The first two periods emphasized training numbers and output indicators, and the new period places greater emphasis on what changes are occurring as a result of this capacity-building. Second, the first two periods emphasized investment in household assets, while the new period places greater emphasis on investment in and development of community assets and ensuring structures are in place for all community members to benefit.

In addition to the FSP, the GoE has multiple programs and initiatives working to directly and indirectly reduce undernutrition. These programs include promoting girls' education; increasing agricultural productivity; increasing immunization rates; water, sanitation, and hygiene projects (WASH); family planning; prevention of mother-to-child transmission of HIV; and integrated management of neonatal and childhood illnesses.[22] Recognizing the need for more to be done to strengthen nutrition and health outcomes, in 2008 the GoE launched the National Nutrition Programme (NNP), which combined nutrition activities under one comprehensive strategy that emphasized cross-sector responsibility for improving nutrition. The first stage of the NNP was implemented from 2008-2013. The GoE learned several key lessons during that period, which informed changes to the second NNP period (2013-2015).[23] The strategic objectives of this second NNP include:

1. Improve nutritional status of women (15-49 years) and adolescents (10-19 years)
2. Improve the nutritional status of infants, young children, and children under-5 years
3. Improve the delivery of nutrition services for communicable and non-communicable/lifestyle-related diseases for all ages
4. Strengthen implementation of nutrition sensitive interventions across sectors
5. Improve multi-sectoral coordination and capacity to ensure NNP implementation

The NNP shifted the previous foci of nutrition being a responsibility of any single sector and use of food aid to address nutrition and food insecurity challenges, to more comprehensive

interventions that address the underlying causes of malnutrition. It aligns well with the FSP's emphases on addressing the underlying causes, ensuring long-term food security, and building household assets. In order to strengthen nutrition and food security for all Ethiopians, cross-sector collaboration is necessary from agriculture, health, education, planning, and economic development. In demonstration of their commitment to this, nine Ethiopian Ministries signed onto the NNP, declaring their support and accountability to help achieve shared goals. No comprehensive or rigorous evaluation plan to assess the impact of these programs was available.

2c. Programmatic context: International Potato Center's Nutrition Project

To contribute to these national efforts to alleviate food insecurity and inadequate nutrition in Ethiopia, in 2013 the International Potato Center (CIP) received funding from Irish Aid to work with the University of Wisconsin-Madison (UW) and local partner organizations to implement an integrated agriculture and nutrition program (the "CIP Nutrition Project") in two regions of Ethiopia: Tigray and the Southern Nations, Nationalities, and Peoples' region (SNNPR), see figure 5. The program goal is to improve nutrition and food security among 30,000 vulnerable households through increased production and consumption of vitamin A-rich orange fleshed sweet potato (OFSP) as part of diversified diets, targeting female-headed households and those with at least one child between 6-59 months of age.

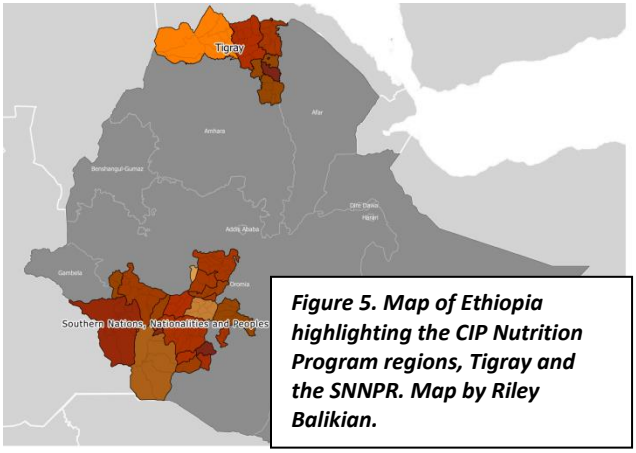
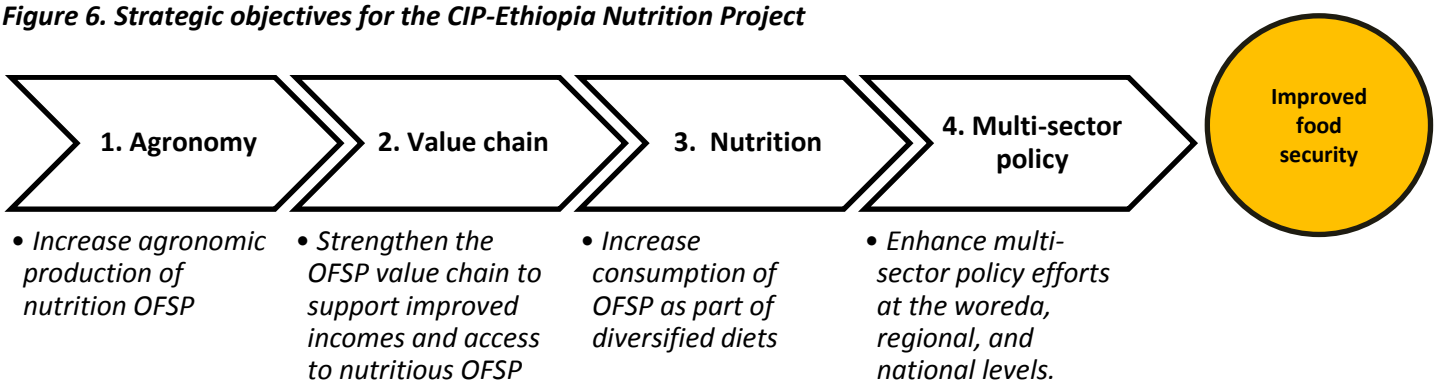


Figure 5. Map of Ethiopia highlighting the CIP Nutrition Program regions, Tigray and the SNNPR. Map by Riley Balikian.

The study population for this research is situated within the organizational context of the CIP Nutrition Project, and the political and cultural contexts of the SNNPR and Tigray regions of Ethiopia. The overarching goal of the CIP project is, through multi-sector collaborations, to improve the nutrition and food security of rural households. Figure 6 shows the four strategic objectives and the anticipated pathway for how the project – an agricultural project aiming to strengthen food security and nutrition – was designed to effect change:

Figure 6. Strategic objectives for the CIP-Ethiopia Nutrition Project



Food security interventions tend to focus on household-level activities and pathways of change. My working hypothesis was that multiple and context-specific household and community level assets are needed to support improved food security. Figure 7 illustrates what this added hypothesis looks like when applied to the program and evaluation design.

Figure 7. Logic model for CIP-Ethiopia Nutrition Project

Change OFSP production and consumption knowledge, attitudes, and practices

Change Level	*Activities*	*Outcomes*	*Impact*
Individual	- Education and behavior change strategies	- Increased OFSP consumption	Improved nutrition & health
Household	- Education and behavior change strategies	- Increased OFSP production and dietary div.	Improved HH food security
Community	- Promotion strategies	- Increased number of beneficiaries	Improved OFSP community access
Organization	- Promotion and collaboration strategies	- Strengthened OFSP value chain	Productive OFSP value chains
Policy	- Alignment with government priorities	- Creation of cross-sector committees	Improved cross-sector coordination

Enhanced livelihoods and food security

2d. Site Selection

Ethiopia is a country with great ecological and cultural diversity and is experiencing rapid development. Analyzing study populations across two regions provides a powerful comparative model to consider how a multi-sector food security intervention should work in different settings within the same national context. This project and study areas build upon previous CIP work in the SNNPR and Tigray regions to deliver integrated agriculture and nutrition programs. The study population reaches a total of 20 *woredas* (districts) across the two regions (table 4).

Table 4. Summary of the zones,* woredas*, and* kebeles *participating in the CIP Nutrition Project

Region	Zone	*Woreda*	*Kebeles*	# of *Kebeles*
SNNPR	**Sidama**	Aleta Chuko	Loko Dama, Chicho Woyamo	2
		Boricha	Fulasa Aldada, Shondolo Leo, Konsore Chefa, Aldada Dela	4
		Dale	Debub Mesenqela, Soyama	2
		Loko Abaya	Chancho, Sala Qebado, Danshe Ganbela, Doya Dao	4
	Wolayta	Bolo Sosore	Weyibo Woga, Yukara	2
		Damot Gale	Bugge, Tabba, Gacheno, Ade Damot	4
		Damot Woyde	Mayo Kote, Kindo Koyo, Ade Dawe, Sura Koye	4
		Duguna Fango	Duguna Offakelecha, Duguna Waresalasho, Duguna Damot Shenka, Duguna Koysha Humbo	4
		Humbo	Gututo Larena, Ampo Koyesha	2
		Sodo Zuriya	Woraz Lasho, Kuto Serfela	2
			Sub-Total SNNPR	**30**
Tigray	**Central**	Mereb Leke	Hadush Adi, Mai Weyni, Medhin	3
		Qoula Temben	Dabano, Dr. Ataklity, Werika Aba	6
		Tanqua Abergelle	Adi Awena, Hadash Tekliy, Limat	6
	Eastern	Ganta Afeshum	Mai Weyni, Simret, Wihidet	6
		Gulo Mekeda	Haben, Mezabir, Sebeya	3
		Hawzen	Dugum, Megab, Suluh	6
	Southern	Raya Azebo	Genetia, Kara Adisho, Tsiga	3
	South Eastern	Enderta	Chelekot, Dedeba, Kedama Weyane	3
		Hintallo Wujirat	Ara Asegeda, Hageraselam, Waza-Adi Awena	6
		Samre Seharti	Chile, Hintsa, Metkel Lineat	3
			Sub-Total Tigray	**45**

The SNNPR and Tigray regions are both predominantly rural, agricultural, have climatic and agronomic conditions suitable for OFSP production, and have high levels of VAD, making them suitable for implementation of a primarily agricultural food security program. They also have unique political, agro-ecologic, socio-economic, and cultural. The *woredas* were selected by CIP in consultation with BoA and other implementing partners according to the following criteria:

- Agro-ecology suitable for OFSP and potato production
- Degree of food insecurity
- Degree of malnutrition
- Drought and moisture stress
- Proximity of *woredas* to one another and access to market, with a possibility of selecting a contiguous block (to reduce transaction costs such as transport).

Specific villages within these *woredas* were selected through a joint planning process with BoA and local implementing partners. Households were selected based on the following criteria: significant annual food gap; at least one child between 6-59 months of age; and interest to participate in the CIP Nutrition project.

Researcher's Role with CIP Nutrition Project:

My role started after the grant funding was secured, and it was to design and implement the impact evaluation methodology. CIP had pre-determined output indicators and targets from their grant proposal, and I discussed these goals and targets with CIP to learn how they envisioned the program, how they were implementing the program, and what they had learned from prior CIP community interventions. Based upon these discussions, my prior experience evaluating public health programs, and a literature review I conducted on impacts of integrated agriculture-nutrition projects on food security status, I proposed to CIP a mixed-methods approach for the impact evaluation that combined quantitative (baseline and endline surveys) with qualitative methods (formative assessment, focus group discussions).

This doctoral research study adds the following contributions to the CIP programming:

1) Broadening the evaluation framework to consider direct and indirect measures on food security (i.e., HFIAS and child nutrition; dietary diversity at the household and individual levels) and potential factors that may be important correlates of food security

2) Addition of questions in the household surveys to consider SLA dimensions important for ensuring sustainable livelihoods

3) Addition of the ecological model, to consider factors that important in influencing food security in the regional contexts

4) Classification of households by food security status and statistical analysis of factors associated with it

5) Addition of the participatory qualitative methodology, including the design, implementation, and analysis of the group discussions and local facilitator training

For the quantitative data, I created the survey tool, CIP hired local enumerators, and I prepared a training manual (see Appendix 2) and co-trained (with CIP) the enumerators to implement the surveys. Surveys were field tested during the enumerator training period, and revisions made to address any issues and improve clarity of questions. During the training, we discussed the overall project goal and design to familiarize the enumerators with the project, general rules of good practice when conducting HH interviews (e.g., issues of privacy, respect in asking questions, and ethics), and then went through each survey question to explains its purpose. Each enumerator practiced asking some questions and "being asked" to give the experience of what it felt like to be interviewed. Descriptions about questions included in the survey tool are found in Chapters 3 and 4.

The surveys for my study were conducted in June 2013 in the SNNPR, and February 2014 in Tigray. The timing of the surveys was selected based on CIP program priorities (i.e., when OFSP crop would be harvested and consumed, so that surveys reflected changes in that specific outcome), not seasonal food security prevalence. Surveys were collected by going to the household – one enumerator, one CIP staff member, and one local *kebele* leader were present. It was not helpful for me to be present during survey implementation, due to language barriers but also my presence drew too much attention/distraction. The surveys were conducted with the household head and mother present. For the maternal and child health surveys, the mother was interviewed separately. I also prepared food albums (for the dietary diversity questions) and color-coded "yes" and "no" cards (color-coded because of illiteracy), so that the mother could hold up a response for the more personal health and food security questions (e.g., "have you experienced GI issues in the last 30 days?"). After the surveys were collected, I brought them back to Madison, entered them into a database (REDCap) that I had designed and built, and cleaned the data before conducting basic descriptive analysis myself and exporting the data to our statistician for the advanced statistical analyses.

2e. Formative assessment

Using my proposed new SLA model that integrated an ecological dimension (page 14), the first step in my study design was to assess the situational context of the households in the two regions of Ethiopia, SNNPR and Tigray, where the CIP program was to be implemented. In the context of my proposed SLA/ecological model, "defining the community" can be viewed partly as the step of describing the context. Despite having previously worked with Ethiopians and having some familiarity with their culture, I had only selective understanding of community, cultural, linguistic, and gender contexts, and from a different area (Addis Ababa) of the country. This awareness partly influenced my rationale to conduct the formative assessment, comes from the broader community development field of the importance of conducting rapid participatory appraisals to improve understanding about defining "community." While the formative assessment results helped characterize CIP's program context, it was also intended to help me better understand important community, social, and cultural factors. I designed a formative food security assessment which was implemented among the 20 SNNPR and Tigray *woredas*. It utilized Oxfam's livelihoods approach to assessing food security to guide the process, questions, and analysis.[24] The goal of the formative assessment was to gather qualitative information about the local community context to improve understanding about:

a) How food security is understood in the local context
b) Whether and to what extent there is food insecurity within the selected *woredas,*
c) Potential causes of and mitigating factors against food insecurity, and
d) Local resources available to support improved community food security

The formative food security assessment was conducted in each of the participating *woredas* by myself and two local CIP staff, and I analyzed, interpreted, and presented the results. The formative assessment helped identify both the situational context of the communities (i.e., assets and challenges), improved understanding of the local factors that affect food security, and was used to design the baseline qualitative survey and assess feasibility of subsequent research questions. Semi-structured interviews were conducted with *woreda* agriculture workers, health workers, and management staff from the local organizations implementing CIP's Nutrition project ("implementing partners"), all with local expertise about their communities. Interviews with the *woreda*-level government agencies were conducted in

Amharic by a CIP staff member who followed a semi-structured questionnaire. Interviews with management staff from local implementing partners were conducted in English. Responses were coded into deductive categories to align with the interview questions and noted for frequency. A summary of key findings for the SNNPR and Tigray regions follows, along with a table under each recording results from the *woreda* interviews (figures 8 and 9).

2e.1 Southern Nations, Nationalities, and Peoples' Region

The SNNPR is located in southern Ethiopia, and its geographic location has resulted in unique political, historical, and cultural perspectives. The SNNPR borders Kenya to the south, South Sudan to the West, the Gambella region to the northwest, and is bounded by Oromia on the north and east. Excluding the regional capital of Hawassa, the SNNPR has 21 administrative zones (including 13 zones and 8 special *woredas*), about 133 *woredas*,[25] and about 4,000 *kebeles*.[26] The land size of the SNNPR is the fourth largest of Ethiopia's nine regions, at about 105,887 square kilometers. The population of the region is 17,359,008, with 90.3% being rural. The estimated population density is 163.9 people per square kilometer, the highest of any region (excluding special urban regions, i.e., Addis Ababa). As suggested by its name, the SNNPR is a diverse region. Fifty-six ethnic groups (each with their own mother tongue) call this region home. Sidama and Wolayta are the most populated zones. Along with Gambella, the SNNPR is the only region in Ethiopia where a majority of the population is Protestant Christian (55%). There are significant Orthodox Christians (20%) and Muslims (14%), and about 6% hold to traditional belief systems.[26]

Agro-ecological factors:

Given the reliance upon rain-fed agriculture in Ethiopia, smallholder farmers have adapted low-input farming strategies to thrive within the bio-physical conditions in which they live. Across the SNNPR, altitude is a key factor in determining agro-ecologies and the kinds of livestock and cropping systems farmers employ. Generally speaking, lower elevation areas are hotter and drier, while higher elevation areas are cooler and wetter.[27] The three main altitude and agro-ecological divisions are: *Kolla,* lowlands that range from 1400-1800 meters with relatively low rainfall and high temperatures; *Woyna dega,* middle highlands that range from 1800-2400

meters with medium rainfall and temperatures; and *Dega,* highlands that range from 2400-3400 meters with relatively higher precipitation and cooler temperatures. An assessment and description of each livelihoods zone from the SNNPR was created by the Ethiopian Ministry of Agriculture and Rural Development in collaboration with USAID. A summary of the livelihoods type found in each CIP Project *woreda* in the SNNPR is summarized in Table 5:

Table 5. Livelihoods Zones of the SNNPR Woredas considered for this study

Zone	*Woreda*	Agricultural Zone	Livelihoods Group*
Wolayta	Bolo Sosore	Woyna Dega, Dega	Wolayta Ginger and Coffee; Wolayta Barley and Wheat
	Damot Gale	Kolla, Woyna Dega, Dega	Wolayta Maize and Root Crops; Wolayta Barley and Wheat
	Damot Woyide	Kolla, Woyna Dega, Dega	Wolayta Maize and Root Crops
	Duguna Fango	Kolla, Woyna Dega	Wolayta Maize and Root Crops
	Humbo	Kolla, Woyna Dega	Wolayta Maize and Root Crops
	Soddo Zuriya	Kolla, Woyna Dega, Dega	Wolayta Maize and Root Crops; Wolayta Barley and Wheat
Sidama	Aleta Chuko	Kolla, Woyna Dega	Sidama Coffee; Sidama Maize
	Boricha	Kolla, Woyna Dega	Sidama Coffee; Sidama Maize
	Dale	Kolla, Woyna Dega, Dega	Sidama Coffee; Sidama Maize; Sidama-Gedeo Highlands
	Loko Abaya	Kolla, Woyna Dega	Sidama Coffee; Sidama Maize

** Livelihoods groups were developed by the Livelihood Integration Unit and funded by USAID.*[27]

Health factors:

The average life expectancy for men in the SNNPR is 53.4 years, and for women it is 55.4 years.[28] The maternal mortality rate is estimated at 673:100,000, and the percentage of children between 6-59 months that receive the full vaccination regimen is 69.9%.[9] According to the 2007 CSA Population and Health Census, 54% of the total SNNPR population accessed safe drinking water.[26] The EDHS 2011 report estimated the neonatal, infant, and under-5 mortality rates are 38, 78, and 116 per 1,000 live births, respectively.[18] The top regional health concerns in descending order of reported cases are malaria, acute febrile illness, pneumonia, diarrhea, typhoid, acute upper respiratory infections, trauma, helminthiasis, urinary tract infections, and skin infections.

Socio-economic factors:

Although there have been some improvements in recent years, chronic food insecurity still is a major issue for smallholder farmers in the SNNPR. One key constraint to food security is land access. Additionally, 31% of inhabitants fall into the poorest wealth quintile for the country, adult literacy for men is 57.0% and for women is 22.4%.[29] An estimated 55% of *woredas* in the

SNNPR are chronically food insecure and are beneficiaries of the Productive Safety Net Program resource transfers. The Ethiopia Central Statistics Agency in collaboration with the World Food Programme recently reported that 68% of rural households in the SNNPR consumed 'less than acceptable' diets, with 34% having 'poor' food consumption, which are diets consisting overwhelmingly of staples/starches.[30]

Figure 8. Food security themes from formative assessment: SNNPR

2e.2 Tigray Region

Tigray is located in northern Ethiopia, and has two international borders, one with Eritrea and the other with Sudan. The border with Eritrea has been closed since 1998, thus restricting options for the flow of trade in livestock, grain, and salt as well as limiting employment opportunities. Tigray contains two major rivers – the Tekeze and Mereb – which eventually flow into the Blue Nile River Basin to Sudan. The Tekeze River originates in Amhara and forms a long part of the border between the two regions. The Mereb River defines Tigray's northern border with Eritrea. Tigray is one of Ethiopia's smaller regions in land area and population: its land comprises about 84,722 square kilometers and the population is estimated at 4,664,071 people, resulting in a population density that is one of the lowest in the country, estimated at 55.1 people per square kilometer. Tigray served as the seat of the armed opposition to the Derg regime until its fall in 1991, resulting in much of the region being closed from the rest of Ethiopia for that period and subsequently impacting its economic, social, and political development. Excluding the regional capital of Mekelle, Tigray has six administrative zones, a total of 46 *woredas* (34 of which are rural), and 688 *kebeles*.[26]

Tigray contains what had been the capital of the Axumite Empire, which pre-dates Christianity. Axumites converted to Christianity in the 4th century, and the Ge'ez language (used by the church and closely associated with the Tigrinya language) remained in political use for another millennium. The rural population of Tigray is still largely comprised of members of the Ethiopian Orthodox Church and speaks Tigrinya, making it a relatively homogenous population. Catholics and Muslims are also represented, but are smaller in number. Other languages spoken in Tigray include Agaw, Irob, and Amharic. Consistent with Ethiopia as a whole, the majority (80.5%) of the Tigray population is rural and depends upon agriculture for their livelihoods. However, recent trends are towards growth in the urban population, particularly women, leading to an increase in the number of women-headed households.[26]

Agro-ecological factors:

Rainfall patterns drive Ethiopian farmers' cropping patterns and yields. Generally speaking, the duration of the main rainy season (*meher*) decreases as one goes north in Ethiopia, so that

Tigray has one of the shortest seasons in the country. Average annual rainfall ranges from 350mm in some lowlands to 800mm in the highlands. Given the impact of inconsistent rainfall on crop yields and food security, the Tigray government has invested heavily in irrigation schemes for smallholder farmers. Farmers in Tigray have developed drought- and heat-tolerant varieties of their most important crops – particularly barley, sorghum, and wheat – one risk-mitigation strategy to rain and climate uncertainty.[31] Tigray contains the 3 traditional divisions of arable land in Ethiopia: *Kolla,* located primarily in the western and northern areas of Tigray, it forms more than half of the region's area but contains less than half the population, and is the region's primary source of grain and cash crops; *Woyna dega,* the middle highlands, are the most populated area; and *Dega,* the highlands with relatively higher precipitation and cooler temperatures, and a smaller variety of crops. A summary of the livelihoods type found in each CIP Project *woreda* in Tigray is summarized in Table 6:

Table 6. Livelihoods Zones of the Tigray* Woredas *considered for this study [31]

Zone	*Woreda*	Agricultural Zone	Livelihoods Group
Central	Mereb Leke	Kolla	Mereb Basin
	Qoula Temben	Kolla	Werie Catchment
	Tanqua Abergelle	Kolla	Middle Tekeze
Eastern	Ganta Afeshum	Dega	Gesho and Wheat Highlands
	Gulo Mekeda	Woyna Dega	Eastern Plateau
	Hawzen	Woyna Dega, Dega	Eastern Plateau
Southern	Raya Azebo	Kolla	Raya Valley
South Eastern	Enderta	Woyna Dega	Enderta Dry Midlands
	Hintallo Wujirat	Woyna Dega, Dega	Alaje Ofla Highlands
	Samre Seharti	Kolla	Middle Tekeze

Health factors:

The average life expectancy for men in Tigray is 52.0 years, and for women it is 54.9 years.[28] The infant mortality rate is 67:1000, lower than the national average, and the under-5 mortality rate is 106:1000, and the percentage of children receiving the full regimen of vaccinations is 73.8%.[9] According to Ethiopia's Central Statistics Agency, 54% of the total population in Tigray could access safe drinking water, of whom 43% were rural and 97% were urban. Additionally, 32% of inhabitants fall into the poorest wealth quintile, adult literacy for men is 68% and for women is 34%. The top regional health concerns in descending order of reported cases are

tuberculosis, malaria, acute upper respiratory infections, injury, gastro-intestinal diseases, parasitic diseases, HIV/AIDS, rabies, typhoid, and skin infections.[18]

Socio-economic factors:

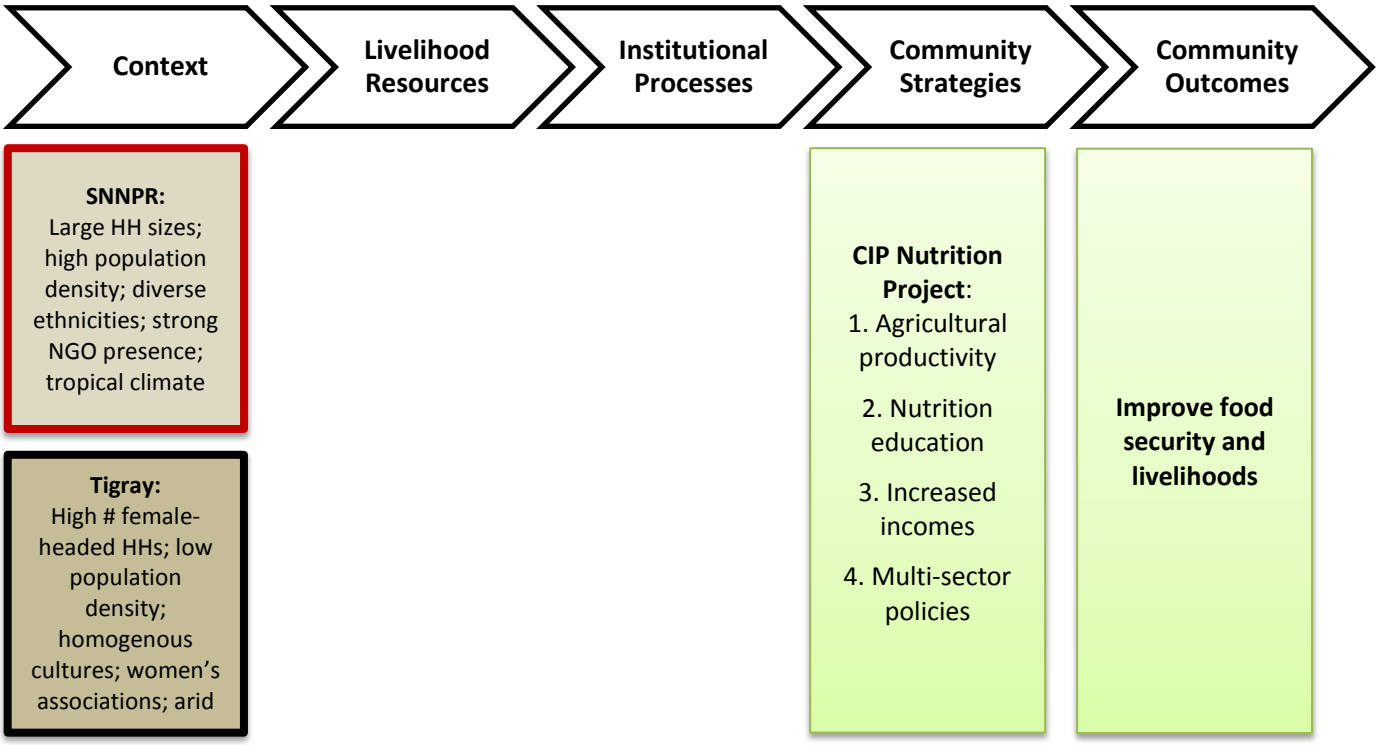
Basic demographic and socio-economic indicators show that chronic poverty, food insecurity and malnutrition impact smallholder farmers in Tigray, although they also indicate improvements. The Ethiopia Ministry of Finance and Economic Development recently reported that approximately 37% of the rural population in Tigray lived below the national poverty line, and Tigray is one of the chronically food insecure regions in Ethiopia.[29] In 2013, almost 1.24 million people did not produce enough food and income to meet their families' nutritional requirements and they have received assistance from the Productive Safety Net Program for a six month period. An additional 283,000 people also received food emergency assistance.

Figure 9. Food security themes from formative assessment: Tigray

2f. Discussion of formative assessment results

Figure 10 summarizes what was learned about the contextual settings of the SNNPR and Tigray regions, fitting it into my integrated SLA/SEM model. The Tigray region – located along Ethiopia's borders with Sudan and Eritrea – is characterized as being more arid, a cereal- and grain-producing region, having a strong centralized government, a lower population density, and being more homogenous in terms of language, religion, and ethnicity. The SNNPR, in contrast, has a more tropical climate, greater emphasis on roots crop and livestock production, very high population densities, and is very diverse in language and ethnicities.

Figure 10. Comparison of SNNPR and Tigray contextual settings from formative assessment, integrated with SLA/SEM model



In both the SNNPR and Tigray regions, respondents identified a number of challenges facing their communities, with food security being just one of multiple issues impacting households. Common in both regions were the issues of population density, education, malaria, drought/lack of irrigation systems, and land ownership/availability. In the SNNPR, community leaders also spoke about the issues of having clean water/sanitation systems, lack of

agricultural productivity, youth unemployment, electricity, crime, nutrition knowledge, and access to credit. While in Tigray, *woreda* leaders reported concerns such as very high prevalence of child malnutrition and border conflicts.

When asked what food security means within their communities, respondents from both regions described it as a concept that affected individuals and households. At the individual level, it was important to have knowledge about and access to nutritious foods; assets to buffer you against seasonal food shortages; and sufficient stores of food to not worry about going hungry. At the household level, it was important to have sufficient and continuous food stocks so that all family members could eat three meals per day throughout the year, and to have diverse foods to ensure for adequate nutrition. Respondents felt most people in their community worried about food security because they were farmers who depended on subsistence agriculture with limited landholdings and other assets. In the SNNPR, community leaders identified those who worried less as being model farmers (because they tend to have larger landholdings and more education), households located near main roads (because they had better access for NGOs to work with them), households that generated off-farm income, and those with certain political affiliations. In Tigray, leaders identified those who worried less about food insecurity as those who generated an off-farm income, had larger land holdings, and owned livestock that they could trade or use for draft power to till larger plots.

Respondents in the SNNPR and Tigray identified multiple causes that lead to food insecurity, and also those they thought were most vulnerable to it. The potential causes included water and sanitation issues (e.g., lack of irrigation, clean water, and sanitation practices), land scarcity, lack of productive agriculture, limited nutrition knowledge, population density, climate change, youth unemployment, malaria, gender roles, and lack of credit services. The formative assessment findings also made the temporal nature of food security clear, and that it was significantly impacted by seasonal rains and the timing of crop harvests. All respondents identified women and children as being most vulnerable to food insecurity. Other characteristics of vulnerable households mentioned include those with small landholdings, limited education, and lack of off-farm employment. Community leaders in both regions

described a few shared factors that could help households not worry about food, including the importance of education, off-farm income, remittances, and equitable intra-household distribution of food sources. In the SNNPR, respondents also noted that having a household member earning income, political affiliation, and access to roads could be helpful to families to provide them with more assets to protect against food insecurity. In Tigray, responses emphasized individual assets like livestock ownership and having larger landholdings. In both regions, there are multiple government initiatives working to address food insecurity. In the SNNPR, responses emphasized government-led programs working to address issues of emergency food relief and assistance. Participants also raised the issue of how programs are shifting away from single-sector, emergency relief initiatives to multi-sector projects that build local capacity for sustainable livelihoods to ensure food security over the long-term. In contrast, in Tigray respondents emphasized the importance of programs that link natural resource management with social and human services, making a very strong case and description of the dependency households have on their natural resource base.

This contextual understanding of the SNNPR and Tigray regions informed my study design in a few ways. Though the regions were different, the survey tools (i.e., household questionnaires and participatory methods) were in both regions. However, I considered regional differences in the survey design and implementation. For example, language is different between regions. I wrote the surveys in English, but the enumerators conducted the surveys in the local language. In the SNNPR, this included the languages of Amharic, Sidamaigna, and Wolaytaigna; in Tigray, the language was Tigrinya. To ensure consistency in how the questions were translated, I developed a training manual and co-facilitated an enumerator training with a CIP staff member. During the training, we described each question, explained the purpose for each, and then discussed how each question would be translated so the enumerators would ask the questions consistently and know their intended meaning. Another difference between regions is crop and dietary diversity. Farmers in Tigray and the SNNPR grow – and, thus, consume – different foods. For the dietary diversity forms, the broad categories remained the same, but I incorporated specific grains, fruits, and vegetables for each region to ensure households could report foods they actually consume. Additional discussion of the survey tools is found in Chapters 3 and 4.

2g. Conclusion

Results from the formative assessment interviews and assessment of local livelihoods strategies helped to characterize a few things about the study populations: food insecurity is a concern in both contexts, and that multiple social, economic, and environmental factors shape it within both the SNNPR and Tigray populations. Additionally, while the issues that influence food security may manifest themselves at the individual level, they may be connected with factors at the household, community, and policy levels. Given that the study population spans two very different regions of Ethiopia, these results highlight the need for improved understanding of similarities and differences between the two contexts, which will be the focus of the subsequent chapters.

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CHAPTER 3: MAGNITUDE AND DETERMINANTS OF FOOD SECURITY IN TIGRAY, ETHIOPIA

3a. Abstract:

Chronic food insecurity and undernutrition are major public health challenges facing Ethiopia. Effective models to identify who is food insecure and local factors that influence food security status can help programs better target the most vulnerable and deliver effective interventions. The Sustainable Livelihoods Approach (SLA) is one framework that considers the underlying drivers of household food insecurity and draws upon local financial, human, natural, physical, and social assets to strengthen it. This study analyzes and characterizes associations between household food security and the five SLA asset categories in Tigray, Ethiopia. Households were classified into three food security levels using a modified Household Food Insecurity Access Scale (HFIAS): food secure, mild food insecurity, and moderate food insecurity. Analysis of variance (ANOVA) and cross-tabulations with Chi-square tests were used to assess associations between food security status and household indicators, and logistic regression models were used to analyze strength of associations. Seventy-nine percent of study households experienced a time in the last twelve months when there was not enough food to feed their families. Indicators in all asset categories except social capital were found to be associated with food security status. Because multiple factors influence food security in the study population, interventions that use multi-sector, multi-level approaches may be more effective in addressing the complex, underlying influencing factors.

3b. Introduction:

Globally, undernutrition underlies the deaths of 3.1 million child under-5 years annually, representing nearly 45% of all mortality in this age category.[1] There are multiple underlying causes of poor nutrition, including food insecurity, poverty, unclean water and sanitation, political instability, inaccessible or ineffective health services, climate change, and lack of education.[2] Analysis published in the second *Lancet* series on Maternal and Child Nutrition identified a set of ten nutrition-specific interventions that, if delivered at scale globally, had potential to reduce stunting by 20% and mortality by 15% among children under-5 years of age.[3] However, nutrition-specific actions have not been sufficient to resolve the global challenges, as the number of undernourished people globally has not been significantly reduced since the 1996 World Food Summit first established the goal of halving the number of hungry people.[4] The underlying causes of malnutrition are locally variable and require actions by multiple sectors in order to make progress towards improved nutrition. These nutrition-sensitive interventions should be intentionally adapted to local contexts, since the drivers and manifestations of malnutrition differ across urban and rural communities, and throughout different regions of the world. Nutrition-sensitive interventions include agricultural development, education, public health promotion efforts, water and sanitation projects, poverty reduction, income generation, and women's education and empowerment.[5-7] However, methods for measuring the impact of nutrition-sensitive interventions vary across sectors.[8] Relevant and reliable indicators are needed for sectors to more effectively work together to achieve the shared goals of improving nutrition and food security status.[9, 10]

In Ethiopia, chronic food insecurity and malnutrition remain major public health challenges. Data from the 2014 Ethiopia Mini Demographic and Health Survey indicate that 40% of children ages 6-59 months are stunted – higher in rural areas (42%) than in urban areas (24%) – and 25.3% are underweight.[11] Even so, Ethiopia has made strong progress in recent decades in reducing its child under-5 mortality rate. In 1990, the national child under-5 mortality rate was 205 for every 1,000 live births, but declined to 64 for every 1,000 live births in 2013.[12]

Recognizing the need for more to be done to strengthen nutrition and health outcomes and that progress cannot be achieved by any one sector alone, in 2008 the Government of Ethiopia (GoE) launched the National Nutrition Programme (NNP). The NNP combined nutrition activities under one comprehensive strategy that emphasizes cross-sector responsibility for improving nutrition.[13] Coordinated under the NNP, the GoE has multiple programs and initiatives working to directly and indirectly reduce undernutrition. These programs include promoting girls' education; increasing agricultural productivity; increasing immunization rates; water, sanitation, and hygiene projects (WASH); family planning; prevention of mother-to-child transmission of HIV; and integrated management of neonatal and childhood illnesses.[14, 15] Recognizing this need for multi-sector collaborations to address the challenges of food insecurity and malnutrition in Ethiopia, in 2013 the International Potato Center (CIP) launched a project ("CIP Nutrition Project") to improve nutrition and food security of rural households in two regions of Ethiopia through increased production and consumption of orange-fleshed sweet potatoes (OFSP) as part of diversified diets. The CIP Nutrition Project considered a Sustainable Livelihoods Approach (SLA)[16-18] in design and implementation. SLA is a people-centered, asset-based approach to poverty analysis and development interventions that considers the multiple dimensions (*i.e.*, assets, strategies, and institutions) that influence how households manage risk and make decisions.[19] Interventions that have applied the SLA have found that households most successful in maintaining food security do so in ways that maximize 5 types of capitals (i.e., human, financial, natural, physical, and social), emphasizing the importance of multi-sector efforts. However, programs that have applied the SLA have learned that the kinds of capitals needed to support resilience are contextually-dependent. Further, the SLA has primarily been applied at the household level. Household-specific strategies have not been sufficient to reduce food insecurity. Better understanding of factors that influence food insecurity is needed, not only at the household but also community, organizational, and policy levels.

While the CIP Nutrition project works in two regions of Ethiopia (Tigray and the Southern Region), this analysis considers only Tigray and has three primary objectives: describe the

prevalence of food insecurity among a representative sample of households in the Tigray region of northern Ethiopia; analyze associations between household food security and SLA asset categories (financial, human, natural, physical, and social); and discuss how identification of local drivers of food insecurity can help inform design of multi-sector, multi-level interventions.

3c. Background:

3c.1 Strategic Context

Ensuring adequate nutrition and food security for all Ethiopians is a priority of the GoE. The GoE is working to sustainably reduce hunger and poverty in all regions, a key objective outlined in the country's Growth and Transformation Plan (GTP).[20] The GTP outlines strategies to continue economic growth at an ambitious rate of nearly ten percent, with agriculture playing a major role. While strengthening food security is a priority for Ethiopia's agricultural sector, evidence from other sub-Saharan African (SSA) countries suggest that cross-sector interventions may be more effective in reaching the most vulnerable populations.[21-23] The GoE recognized the importance of this when launching the NNP, introduced above, which mandated cross-sector strategies to address nutrition and food security priorities.[24] The NNP's strategic objectives are:

1) Improve nutritional status of women (15-49 years) and adolescents (10-19 years)
2) Improve the nutritional status of infants, young children, and children under 5 years
3) Improve the delivery of nutrition services for communicable and non-communicable/lifestyle-related diseases for all ages
4) Strengthen implementation of nutrition-sensitive interventions across sectors
5) Improve multi-sectoral coordination and capacity to ensure NNP implementation

The International Potato Center was founded in 1971 as a research-for-development institution committed to achieving food security, improved well-being, and gender equity for poor people in root and tuber farming and food systems of the developing world. It is a member of the Consultative Group for International Agricultural Research (CGIAR). With offices in thirty countries across Asia, Africa, and Latin America, CIP works with partners from multiple sectors to support integrated approaches to reducing poverty and food insecurity. In recent years, CIP has paid particular attention to improving the production and consumption of OFSP in African countries as a food-based strategy for addressing micronutrient deficiencies and food

insecurity. The use of OFSP, when introduced with nutrition education at the community level, has been shown to effectively reduce Vitamin A deficiency in vulnerable populations.[25, 26]

3c.2 Community Context: Tigray, Ethiopia

CIP has implemented agricultural development projects in Ethiopia since the mid-1980s. In 2010 with funding from Irish Aid, CIP initiated its first integrated agriculture and nutrition program in five *woredas* (districts) in the Tigray region of northern Ethiopia. The goal was to increase the production and consumption of OFSP to reduce vitamin A deficiency and improve nutrition and food security for smallholder farmer households. In 2013, CIP scaled-up their project, adding five *woredas* in Tigray and ten in the Southern Nations, Nationalities, and Peoples' Region (SNNPR). The project works with diverse stakeholders from the sectors of agriculture, education, and health to achieve the shared goal of improved nutrition and food security.

The Tigray region is located in northern Ethiopia, and has two international borders, one with Eritrea and the other with Sudan. Excluding the regional capital of Mekelle, it has six administrative zones, forty-six *woredas* (thirty-four of which are rural), and 688 *kebeles* (local administrative units). The population is relatively homogenous, with the primary language being Tigrinya. Consistent with Ethiopia as a whole, the majority of the Tigray population (80.5%) is rural and depends upon agriculture for their livelihoods. However, recent trends show an increase in the urban population and the number of female-headed households.[27] Tigray is one of Ethiopia's smaller regions in land area and population, resulting in a population density that is one of the lowest in the country at 55 people per square kilometer.[28] A recent poverty analysis conducted by the Ethiopian Ministry of Finance and Economic Development reported that approximately 37% of the rural population in Tigray live below the national poverty line, and it is one of the chronically food insecure regions of the country.[29] In 2013, almost 1.24 million households in Tigray (approximately 25% of the population) did not produce enough food and income to meet their families' nutritional requirements and received

assistance from the government's Productive Safety Net Program for a six-month period, and an additional 283,000 people received food emergency assistance.[30]

3d. Methods:

3d.1 Intervention site selection

The project intervention areas were jointly selected by CIP and regional partners to build upon the pilot project (undertaken from March 2010 to October 2013) by scaling out OFSP interventions to improve food security among smallholder households using this crop as an entry. To enhance the scaling out activities, CIP worked in collaboration with implementing partners including government departments, universities, and non-governmental organizations (NGOs) on agronomy, nutrition promotion, and value chain activities. The project intervention area included 45 *kebeles* (villages) in ten *woredas* in four zones of Tigray (figure 11; table 7).

Figure 11. Map of Tigray Zones and the CIP project intervention areas.

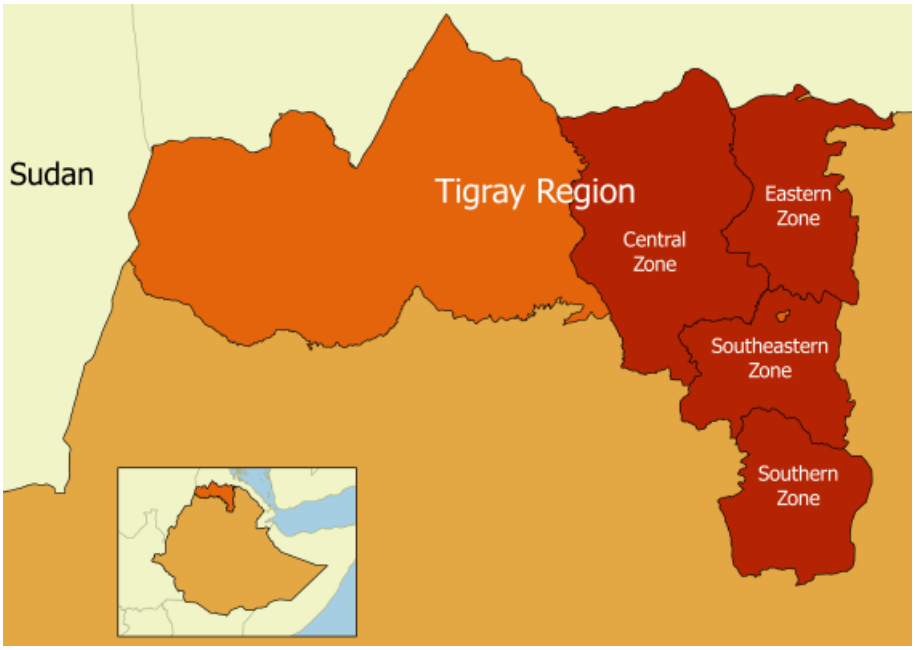

***Table 7. Intervention zones,* woredas *and* kebeles *in Tigray, Ethiopia*.**

Zone	*Woreda*	# of *kebeles*
Central	Qoula Temben	6
	Tanqua Abergelle	6
	Mereb Leke	3
Eastern	Ganta Afeshum	6
	Gulo Mekeda	3
	Hawzen	6
Southern	Raya Azebo	3
South Eastern	Enderta	3
	Hintallo Wujirat	6
	Samre Seharti	3
SUB-TOTAL		**45**

3d.2 Study participants

In consultation with the Ethiopian Bureau of Agriculture (BoA) and other partners, CIP selected *woredas* to participate in this study and subsequent program activities according to the following criteria: agro-ecology suitable for OFSP and potato production; degree of food insecurity; degree of malnutrition; drought and moisture stress; and proximity of *woredas* to one another and markets, with a possibility of selecting a contiguous block to improve program efficiency. After *woreda* selection, specific households were selected based on the following criteria: had a least one child between 6-59 months of age; was vulnerable to food insecurity, as evidenced by annual food gap; was interested and able to participate for the duration (i.e., 3 years) of the project.

3d.3 Survey tool

Baseline data were collected in February – March 2014 from 300 households in the study area using structured questionnaires with trained enumerators in Tigrinya (the local language). The baseline surveys gathered information on household socio-economic characteristics, education levels, agricultural practices, potato and OFSP production and consumption habits, food security, nutritional status, and general health data for women and children between 6-59 months. Questions were adapted from validated survey instruments including the Household Income and Expenditure Survey (for household resources and characteristics),[31] Helen Keller International Nutrition Survey (for nutrition and Vitamin A-related questions),[32] UNICEF (for

maternal and child health questions),[33] and the Household Food Insecurity Access Scale (HFIAS, for food security screening questions).[34] Surveys received an exemption from the Health Sciences Institutional Review Board at the UW. Verbal consent was obtained in the local language and collected from each household head prior to conducting each survey.

From the findings of the formative assessment, we learned that males would be deferred to for answering the household surveys, and it would be uncommon for the men and women to answer together. However, studies have shown the important role that women play in prioritizing household resources for nutrition and health. Thus, the surveys were intentionally designed to collect data about women and children (i.e., health and dietary diversity forms for each) to try to ensure women's voices were heard in the responses. Additionally, because household food security varies in severity and over time, it was important to assess variations in food security status and at different times of year. To capture the different dimensions and extent to which households perceived their food security status, the surveys included eight food security questions, each corresponding to a different degree of food insecurity using the HFIAS.[34] Households were then grouped according to their self-reported responses into the categories of food secure (n=199), mildly food insecure (n=36), and moderately food insecure (n=65) (table 8). Households were classified according to the most severe response (*i.e.,* if one response indicated severely food insecure, that household was classified severely food insecure). Food security status reflected a household's self-reported status over the past 30 days. Data were taken after the *meher* harvest season, a time usually considered as having better food availability.

Table 8. Key and classification categories for assessing degree of food security in last 30 days[a]

Aspect of food security addressed in question	No	Rarely	Sometimes	Often
1. Worry about food				
2. Lack of nutritious food				
3. Limited variety				
4. Smaller meals				
5. Fewer meals				
6. Ran out of food				
7. Went to bed hungry				
8. Went whole day without food				

Table 8 Key	
Food secure	
Mild food insecurity	
Moderate & severe food insecurity	

[a] Questions were adapted from the Household Food Insecurity Access Scale[34]

Several factors have been found to be associated with food security as measured by the HFIAS, including wealth,[35] maternal education,[35] household per capita income,[36] household assets,[37] and dietary diversity.[36, 37] To the researcher's knowledge, no previous studies had identified what factors were associated with food security within the Tigray study area. Using the SLA asset categories to consider multiple household assets, the following indicators were analyzed for association with food security status within the Tigray study population:

- **Financial**: livestock, total owned land, cell phone ownership, radio ownership, bicycle ownership, access to credit, off-farm employment
- **Human**: mother's body mass index (BMI), maternal health, maternal nutrition knowledge, literacy rates
- **Natural**: water source, altitude, irrigated land, kitchen garden
- **Physical:** administrative zone, electricity, roof type, floor type, pit latrine
- **Social**: education of HH head, child dietary diversity score, HH dietary diversity score, family size, HH head age

3d.4 Data analysis:

Data were entered into a RedCAP® database and checked for missing values and outliers. Household socio-economic indicators with continuous variables were compared across the three food security categories (*i.e.*, food secure, mildly food insecure, and moderately food insecure) using analysis of variance (ANOVA) to identify potential associations. And household indicators with categorical variables were compared using Chi-Square tests. Logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) of food insecurity by asset indicators. P-values <0.05 were considered as significant. All tests were performed using SAS® version 9.2 software (SAS Institute, Cary, North Carolina).

Food insecurity is a public health concern in all countries, with certain regions and populations disproportionately affected, which leads to disparities. However, there is limited evidence

about the relationships between food insecurity and local demographic, socio-economic, and environmental factors. This study's statistical analysis had two approaches. First, we wanted to assess whether there were differences among food security classes (secure, mild, and moderate food insecurity) by considering socio-economic status, wealth, geographic location, and health across the three levels of food security as a way to characterize the study population. Results from this univariate analysis are presented in Table 11. From these results, certain factors were found to be associated with food security: livestock, land holdings, administrative zone, cell phone ownership, radio ownership, maternal health, and altitude. From the list of variables found to be associated with food insecurity from these analyses, two separate logistic regression-based models (one for secure versus mild/severe food insecurity, and the other for secure/mild versus severe food insecurity) were run with individual predictors. The variable of household dietary diversity score was added to the model because it was a programmatic indicator of interest to the CIP Nutrition Project. The second part of the analysis used logistic regression to consider which of these factors may be more strongly associated with food security after controlling for all other variables in the model, and also to learn what the odds of experiencing food security for each of them were. To determine if the association between food security and each of the variables known to be associated with it persists after controlling for other factors, we ran two separate multi-variable models including factors that were significant in the univariate analyses, presented in table 11. Because household socio-economic factors (e.g., gender of the head of household, household size, education level, etc.) did not show an association with food security in the univariate analyses, we did not control for this in the models in the subsequent logistic regression models.

A binomial model was used to control for direction of relationship so the dependent variable only had two states. In the first model, households with mild-moderate food insecurity (88 HHs) were compared to food secure households (194 HHs), with eighteen households not included due to missing responses. In the second model, households with moderate food insecurity (65 HHs) were compared to households with food security-mild food insecurity (231), with four households not included due to missing responses. Associations were evaluated using a Chi-

Square distribution with 1 degree of freedom. Table 12 summarizes the odds of experiencing mild or greater food insecurity (Model 1) and moderate or greater food insecurity (Model 2), by SLA asset category.

3e. Results and Discussion:

The mean household size in the study population was 6.4 members and the mean age of the HH head was 40 years (table 9). Fourteen percent of HHs were headed by females, and 80% of HH heads had not completed a primary school education.

Table 9. Basic household demographic characteristics among the Tigray study sample

Household Characteristics (n=300)	
Mean household size (# people)	6.4
Female-headed households (%)	14%
Household head mean age, years (SD)	40.0 (9.8)
Mean age of mother, years (SD)	32.6 (8.0)
Mean number of children (SD)	4.2 (2.0)
Household with a family member who earns an off-farm income (%)	68%
Household head education level (%)	
Illiterate	42%
Read/Write only	38%
Completed primary school	14%
Completed secondary school	4%
Completed vocational school	1%
Attended/Completed college	1%

Seventy-nine percent of households experienced a time in the past twelve months when there was not enough food to feed all household members (table 10). However, there was variation among the four administrative zones in the degree to which they experienced food insecurity. The Southern Zone had the lowest rates of food insecurity, as 20% of households reported mild or moderate food insecurity in the last 30 days. The Eastern Zone had the highest rates of food insecurity, with 53% of surveyed households reporting it in the last 30 days. There was also variation in the number of months households reported food insecurity, with the Southern Zone again reporting the fewest months (2.6 months) and the Eastern Zone the highest (5.0 months) at $p<0.001$.

Table 10. Comparison of self-reported food security among households in the Tigray region

	Overall (n=300)	Eastern (n=90)	Central (n=90)	South East (n=90)	Southern (n=30)	P-value
% food insecure HHs (last 30 days)	34%	53%	28%	24%	20%	<0.0001
% HHs unable to feed family at some time in last 12 mths	79%	89%	84%	69%	63%	0.006
Average # months food insecure	3.6	5.0	3.2	2.9	2.6	<0.001

Table 11 highlights the characteristics of survey respondents by food security status using the HFIAS survey tool to classify households by self-reported food security status in the past 30 days. Households reporting being food secure had on average more livestock holdings, larger parcels of land, lived at a lower altitude, owned a cell phone or radio, off-farm employment, and had access to credit services. Additionally, mothers from food secure reporting households had higher body mass index scores and got married at an earlier age than women from food insecure households. The averages for these variables were found to be significantly different across the three food security groups using ANOVA ($p<0.001$). Table 10 also shows the prevalence of mild and moderate food insecurity for each of the four Tigray zones where the CIP Nutrition project is working. The percentage of households reporting mild food insecurity by Eastern, Central, South Eastern, and Southern Zones, respectively, was 16%, 6%, 12%, and 17%. While the percentage of households reporting moderate food insecurity by Eastern, Central, South Eastern, and Southern Zones, respectively, was 37%, 22%, 12%, and 3%. These differences were statistically significant ($p<0.001$). Having a kitchen garden versus not, dietary diversity score, electricity ownership versus not, the mean age of the household head, household size, and average education level of the household head were not found to have a statistically significant association with food security status.

Table 11. Among Tigray households that reported food security, mild food insecurity, and moderate food insecurity, the following socio-economic factors were indicated.

	Food secure (n=199)	Mild insecurity (n=36)	Moderate insecurity (n=65)	P-value
1. Zone				<0.0001
Eastern Zone	47%	16%	37%	
Central	72%	6%	22%	
South Eastern	76%	12%	12%	
Southern Zone	80%	17%	3%	

2. Livestock holdings				
Average # cattle	1.37	0.96	0.91	<0.0001
Average # goats	2.17	1.09	1.17	<0.0001
Average # draft oxen	1.29	1.10	1.05	<0.0001
3. Land holdings (timad)				
Total owned land	3.57	2.84	2.65	0.0036
Irrigated land	0.34	0.16	0.14	<0.0001
4. Altitude				0.0005
<2000m	76%	10%	14%	
>= 2000m	56%	14%	30%	
5. Maternal indicators				
Mother's BMI	19.86	18.83	18.74	<0.0001
Mother's age at marriage	16.3 years	17.3 years	17.5 years	0.0014
6. Cell phone ownership	76%	8%	16%	0.0002
7. Access to credit services	69%	12%	19%	0.0031
8. Radio ownership	77%	10%	13%	0.0045
9. Off-farm employment	69%	9%	22%	0.0266
10. Kitchen garden	59%	10%	31%	0.1351
11. Dietary diversity score	6.9069	6.6563	6.5692	0.3846
12. Electricity	66%	15%	19%	0.4151
13. HH head age	40.0 years	39.7 years	39.3 years	0.4503
14. HH size (# members)	6.48	6.36	6.31	0.5788
15. Education level				0.696
Illiterate	39%	47%	49%	
Read/Write	42%	28%	32%	
Primary	12%	19%	14%	
Secondary and above	7%	6%	5%	

The results of the logistic regression model examining the relationship between household assets to food security status are presented in Table 12. The odds of experiencing mild and greater food insecurity was 4.5 times higher among households located in the Eastern zone (CI 1.7-12.0), 4.9 times higher among households without access to credit services (CI 1.5-15.8), 3.3 times higher among households that did not own a cell phone (CI 1.4-7.6), and 2.2 times higher among households located at an altitude of 2,000 meters or higher (CI 0.6-7.9). The odds of experiencing moderate food insecurity was 8.4 times higher among households located at an altitude of 2,000 meters or higher (CI 1.4-49.8), 7.0 times higher among households without access to credit services (CI 1.9-25.4), and 6.0 times higher among HHs living in the Central Zone (CI 1.1-33.4). What we learn from this is that – in this study population – there may be benefits to classifying HHs between mild and severe food insecurity because while some factors significant in predicting them are shared, there are also differences.

Table 12. Odds of experiencing mild-moderate food insecurity (Model 1) or moderate-severe food insecurity (Model 2)

	Overall (n=300)	Model 1	Model 2
1. Financial Assets			
Cell phone ownership			
Not owned	38%	3.3 (1.4-7.6)***	2.5 (1.2-5.4)*
Access to credit services			
No credit access	8%	4.9 (1.5-15.8)**	7.0 (1.9-25.4)**
Radio ownership			
Not owned	40%	2.3 (1.3-3.8)**	1.9 (0.9-4.3)
Livestock holdings			
Goats	1.80	0.9 (0.8-1.0)*	-
Cattle	1.24	0.7 (0.6-0.9)*	0.9 (0.6-1.2)
2. Human Assets			
Maternal indicators			
Mother's BMI	19.6	1.0 (0.9-1.1)	-
Mother's age at marriage	16.6 yrs	1.2 (1.1-1.3)**	1.1 (1.0-1.3)
HH Dietary Diversity score (avg)	6.79	0.8 (0.7-1.0)	-
3. Natural Assets			
Altitude (% HHs)			
>= 2000m	49%	2.2 (0.6-7.9)	8.4 (1.4-49.8)*
Land holdings (in *timad*+)			
Irrigated land	0.20	0.5 (0.3-0.9)*	-
Total owned land	3.33	0.9 (0.8-1.0)*	0.8 (0.7-1.0)
4. Physical Assets			
Administrative zone (% survey HHs)			
Eastern	30%	4.5 (1.7-12.0)**	3.6 (1.2-10.9)*
Central	30%	1.6 (0.6-4.4)	6.0 (1.1-33.4)*
South Eastern	30%	1.3 (0.5-3.6)	1.3 (0.08-22.3)
Southern	10%	Ref	Ref

* p<0.05; ** p<0.01; *** p<0.001

+ 4 *timad* = 1 hectare

Within the Tigray study population, food insecurity is experienced seasonally by a majority of the households, with seventy-nine percent identifying a time in the last year when there was not enough food to feed all family members. However, certain geographic zones reported a higher proportion of food insecure households and certain household assets were found to predict food security status and its severity. Household financial assets were important in determining food security status. Households without a cell phone were 3.4 and 2.5 times more likely to experience mild and moderate food insecurity, respectively, than households that owned a cell phone. And households that lacked access to credit services were 4.9 times and 7 times more likely, respectively, to experience mild and moderate food insecurity than households with credit access. Human assets, specifically maternal health, also had an

association with food security status. In households where the mother was sick in the last 30 days, the odds of being mildly and moderately food insecure were 2.9 and 3.9 times greater, respectively, than households where the mother was healthy. Household physical assets had an association with food security status. Households in the Eastern and Central zone were 5.2 and 2.8 times more likely, respectively, to experience food insecurity compared to households in the Southern Zone. Households with a roof made of mud/stones were 17.3 and 7.7 times more likely to experience mild and moderate food insecurity, respectively, than households with a roof made of thatch. Household natural assets also had an association with food security status, as households living at or above 2,000 meters were more likely to experience mild and moderate food insecurity than households below 2,000 meters.

The following factors did not show statistically significant association with mild food insecurity (at $p>0.05$): water source, electricity, age of the head of household, household head's education level, membership in farmer's group, and household size. The indicator of dietary diversity is interesting and important to consider since improving it is a key objective of CIP's project. In Model 1, it did not show an association with food security. This is consistent with the ANOVA results (table 11) where dietary diversity did not differ significantly across the food security classes. All households within this study population have diets primarily based on cereals with limited dietary diversity. There was limited variation in household dietary diversity scores in general, which may have resulted in not enough variability to test for it in the models. Thus, dietary diversity may not be an effective measure of food security in this study population and in other contexts where there is limited dietary diversity and the range of dietary diversity scores is not great. However, there was a trend for household dietary diversity scores to decrease across the three food security categories, getting lower among households with more severe food insecurity. In Model 2, when dietary diversity was adjusted for other factors, it appears there is an association with moderate food insecurity.

Certain variables were found to have an association with food security within the Tigray study population. To help understand the relative importance of these factors, the study included follow-up interviews (n=10) with *woreda*-level agriculture and health workers in February and

March 2014. Interviews were conducted in Tigrinya and transcribed into English. Themes were coded into deductive categories, and aligned with the study question of understanding *woreda*-level factors influencing food security. The predictive indicator of administrative zone provides a good illustration of how complex the underlying drivers of food insecurity can be and the importance of local, qualitative data. The Eastern zone exhibited higher rates of food insecurity than the other three CIP intervention zones. It is located along the border with Eritrea, and issues of security and border conflicts are important concerns affecting these households. Farmers in the Eastern zone tend to have small land holdings, and the specific *kebeles* where CIP works are in the *dega* (highlands). Here, land is not as fertile for productive agriculture and there is limited irrigation infrastructure. There are few off-farm sources of income, and family members often migrate to cities to find work to send back to their families. In contrast, the Southern zone contains part of the Raya Valley, which is known for its flat, fertile lowlands. Most agricultural production takes place in wetlands (*i.e.,* swampy lowlands), which retain moisture during the dry season, allowing farmers to produce crops year-round to contribute to their food stocks. The climate and soils support a more diverse agriculture, and there are good roads and infrastructure linking farmers with markets for income generation. The Southern zone has good potential for crop and livestock agriculture because it has better physical and environmental conditions than surrounding zones. This example of administrative zone helps highlight the complexity of interpreting a single food security predictive variable, and how vital qualitative understanding of the local context can be.

In order to understand how these multiple determinants work together to shape food security in a given community, scholars have emphasized the importance of a food systems approach.[38, 39] A 2015 report by the International Panel of Experts on Sustainable Food Systems drew attention to some of the failures of the global food system, and the resulting unsustainability, rise of negative health outcomes, inefficiencies, and inequalities that have resulted.[40] The report outlined the need for and principles of transdisciplinary science that "must be applied to generate the types of knowledge that can support the transition to sustainable food systems."[40] The IPES expert panel identified five reasons for why transdisciplinary approaches are essential in food systems:

1. Single discipline approaches are inappropriate for social-ecological systems.
2. Normative benchmarks and ethical choices cannot be defined by scientists alone, but requires discourse among farmers, researchers, and other food system actors.
3. Methodologies embody specific assumptions that must be subject to deliberation.
4. Proposals must be based on context-specific and adaptive knowledge to succeed.
5. Social actors hold unique knowledge that can catalyze change.

Results from this study highlight the complexity of understanding the drivers of food insecurity, as many are difficult to categorize into a single sector or category. The CIP Nutrition project is implementing a multi-sector systems approach to address the multi-factorial challenges of nutrition and food insecurity, striving to move beyond just the household level and address broader community and institutional barriers, integrating with regional and national stakeholders. Transdisciplinary approaches have been identified as useful when working on complex issues that more traditional, single discipline approaches have failed to succeed at.[41] When applied to the CIP Nutrition project, ways a transdisciplinary approach can enhance effective implementation responsive to the local conditions are outlined by the four characteristics of transdisciplinary collaborations[42] (table 13):

Table 13. Four characteristics of transdisciplinary food systems collaborations

Characteristic	Description
1. Crosses disciplinary and academic boundaries	Multiple factors are associated with food security in Tigray. In order to effectively address this, it is important to convene diverse food system stakeholders.
2. Common goal-setting	CIP has implemented a joint approach to address food insecurity by engaging stakeholders across the sectors of agriculture, education, and health, using OFSP as an entry point for improving livelihoods.
3. Integration of disciplines and non-academic participants	CIP brings together academic and non-academic partners, as the solution to the problem of food insecurity requires a multi-directional flow of knowledge. Each partner has a unique and differentiated role; however, all efforts are coordinated through local task forces.
4. Development of integrated knowledge and theory among academic stakeholders and the community	Multiple sectors increasingly recognize the risks and dangers of fragmentation between disciplines and the importance of working under unifying processes.[43] CIP is working to foster processes where such integrated knowledge can be co-created, intentionally involving diverse stakeholders and facilitating collaborative spaces.

3e.1 Limitations:

This study attempts to provide a case for the use of transdisciplinary approaches to inform the design and implementation of food security interventions that can address the complex,

underlying drivers of undernutrition and food insecurity within local contexts. However, these findings have several limitations. First, the sample size was limited to districts where BoA was willing to work with CIP and where food insecurity prevalence was known to be high. As a result, the findings may not be applicable in other zones of Tigray or regions of Ethiopia. Second, food security prevalence is known to be seasonal and would likely be different if considered at multiple times throughout the year. These surveys were conducted at the end of the *meher* season, when food insecurity is reportedly lower, so the rates and trends of food insecurity may look different if considered over time. Additionally, the area has a high proportion of Orthodox Christians who were observing the Lenten fasting season at the time the surveys were conducted. Eighty-nine percent of households and 20% of children 6-59 months reported fasting at the time the surveys were implemented. Third, the statistical analysis was attempting to understand relationships among factors that operate in dynamic systems, but analytical models are limited in their ability to fully describe and explain how systems operate. Fourth, the study was originally conceptualized as a program evaluation and findings were intended to inform program improvements rather than research. Finally, given the complex approaches required for food insecurity and poverty alleviation programs, it is important to adopt and adapt evaluation frameworks to measure impact in holistic ways. Such processes take time and trust for data to be collected and ensure equitable representation across all socio-economic and ethnic members of a community.

3f. Conclusion:

Globally, the primary drivers of morbidity and mortality result from nutrition insecurity. Understanding the social and environmental determinants of nutrition-related diseases and the multiple ways in which agriculture impacts nutrition has significant social, economic, and political implications. Models for identifying who is food insecure and their constraints can help programs better target the most vulnerable and deliver interventions that are relevant, work across sectors, and build adaptive capacity. In Tigray, Ethiopia, geographic location, wealth indicators, and maternal health variables are strong predictors of food security status, while socio-economic indicators traditionally associated with food security (e.g., education, income,

family size) did not show an association. Future research should combine quantitative and qualitative data. Using the Sustainable Livelihoods Approach can consider the multidimensional influences from an asset-based approach to improve the monitoring of program impacts. And the use of transdisciplinary approaches may help inform the design and implementation of multi-sector, multi-level food security interventions that address the complex, underlying drivers of undernutrition and food insecurity within local contexts.

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CHAPTER 4: MAGNITUDE AND DETERMINANTS OF FOOD SECURITY IN THE SOUTHERN NATIONS, NATIONALITIES, AND PEOPLES' REGION, ETHIOPIA

4a. Abstract:

Food security is essential for robust economies, political stability, and a resilient environment. Stakeholders from across sectors have a vested interest to ensure all people at all times have access to sufficient, nutritious food. The objectives of this study were to measure magnitude and identify determinants of food security among rural households in two districts of southern Ethiopia. The study population consisted of 150 households in the Sidama and Wolayta zones in the Southern Nations, Nationalities, and Peoples Region (SNNPR). Data were collected using structured questionnaires by trained enumerators in the local language, and analyzed using SAS® version 9.2. The following factors were found to have association with food insecurity: total livestock, total landholdings, cell phone ownership, educational attainment, radio ownership, and type of roof. Localized studies can help improve understanding of the local drivers of food insecurity in order to design more effective programs and policies to enhance the livelihoods of individuals, families, and whole communities.

4b. Introduction:

Food insecurity and malnutrition are major public health problems facing Ethiopia. According to the 2011 Ethiopia Demographic and Health Survey, 44% of children under five are stunted, 29% are underweight, and 9% are severely underweight.[1] An estimated one in eleven Ethiopian children die before their fifth birthday,[1] and more than 50 percent of these deaths are due to malnutrition.[2] The majority of households depends on a few staple foods, and do not consume sufficient amounts of meat, fish and vegetables needed to meet daily protein and nutrition requirements,[3] resulting in micronutrient deficiencies including vitamin A, zinc and iron.[4-7] The Federal Government of Ethiopia has recognized the goal of improving and food security as a national priority, particularly for women and children, to reduce child mortality and improve overall human nutrition and health.[2, 8]

Alleviating malnutrition and enhancing food security is a global priority for humanitarian, political, and security reasons. Food security not only impacts the health of individuals and whole communities, but is also essential for robust local and regional economies, political stability, effective education, and a resilient environment.[9-14] Consequently, measuring food security and understanding its influencing factors are important tasks for stakeholders from across sectors. In 2010, an estimated $11.7 billion USD was spent globally on food security and nutrition programs, with 41 percent going to sub-Saharan African countries.[15] Despite many resources invested in enhancing global food security, the problems of chronic malnutrition persist. More effective measures are needed to assess not only the effects of this spending, but also what kinds of food security programs make the greatest positive impacts on individual and community well-being. With this kind of information, more relevant and targeted programs and policies can be created to achieve the international goal outlined in the Millennium Development Goals (MDGs) of reducing hunger and food insecurity for all.

In 2013, the International Potato Center (CIP), its funder Irish Aid, and regional partners were implementing two separate nutrition-focused projects in the Tigray and the SNNPR regions of Ethiopia. The project in Tigray was called “Alleviation of Food Insecurity and Malnutrition in Tigray, Ethiopia through Promotion of Potato and Sweetpotato,” and the project in the SNNPR was titled, “Linking Agriculture and Health: Alleviation of Food Insecurity and Malnutrition in SNNPR, Ethiopia, through Promotion of Potato and Sweetpotato.” The Tigray project started in 2010 and ran through October 2013, while the SNNPR project started in 2012 and ran through October 2014. A new project combined the Tigray and the SNNPR projects into one common funding agreement, which ran from November 2013 to December 2016. The overall program goal is to improve nutrition and food security among 30,000 vulnerable households through increased production and consumption of OFSP as part of diversified diets, targeting female-headed households and those with a child between 6-59 months of age.

This chapter summarizes the prevalence of household food insecurity among five *woredas* from the Southern Nations, Nationalities and Peoples Region (SNNPR), Ethiopia, and evaluates the

potential predictive factors specific to this region, which have implications for the design of community nutrition and agriculture programs, monitoring and evaluation, and policies.

Background:

Food security is a multi-dimensional concept, and understanding about it has evolved over time.[16, 17] The first World Food Conference held in 1974 focused on the supply side and availability of food, addressing it as a problem of agricultural production, trade, and stocks.[18] However, ensuring adequate national and international supplies of food did not address household level food security. Despite international efforts to increase global agricultural production with improved seeds, farm technology, irrigation, and chemical fertilizers, households who needed food the most were not able to access it and food insecurity rates continued to climb.[19] Recognizing that food access is a critical determinant of food security, development programs and policies shifted to address the demand-side starting in the early 1980s. In "Poverty and Famines" (1981), noted economist Amartya Sen called greater attention to this issue and argued that, despite greater availability, many households lacked food due to an inability to access markets, inadequate purchasing power, and other social and political barriers.[20] This brought the food security and poverty reduction movements closer together to work toward the shared goal of improving livelihoods.[21] In the 1990s, the dimension of utilization entered the food security discussion, as sufficient energy and nutrient intake is vital to ensure health and well-being.[21] Diversified diets, good hygiene and sanitation, food safety, water quality, and health care practices are all determinants of good utilization. Today, food security is commonly defined as existing when "all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life."[18] This definition came out of the 1996 World Food Summit, and introduces the four main dimensions of food security frequently used today: physical availability, economic and physical access, utilization, and stability of the other three dimensions over time.

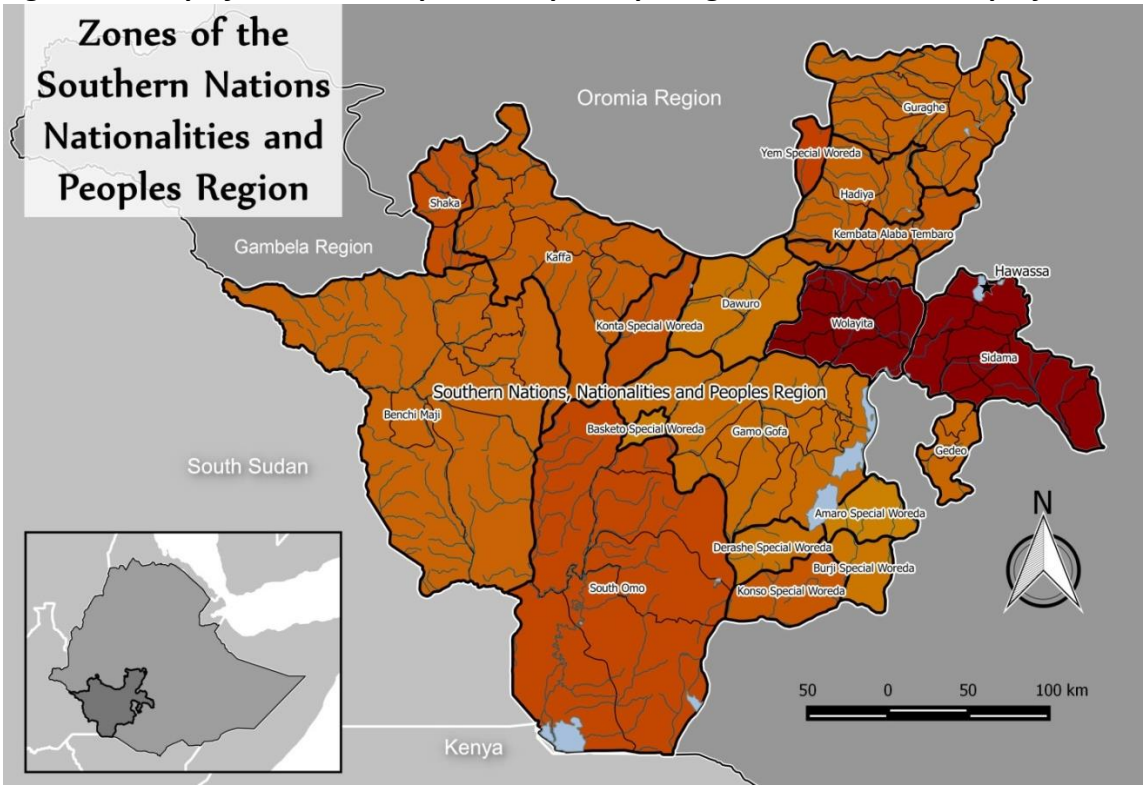
The International Potato Center was founded in 1971 as a research-for-development institution. It is an example of an international organization committed to "achieving food

security, improved well-being, and gender equity for poor people in root and tuber farming and food systems of the developing world."[22] It is a member of the Consultative Group for International Agricultural Research (CGIAR), with offices in 30 countries across Asia, Africa, and Latin America. CIP works with interdisciplinary partners from agriculture, nutrition, the social sciences, economics, the health sciences, and policy to support multi-sectoral approaches to poverty and food insecurity reduction. CIP has implemented projects emphasizing improved agricultural production of root and tuber crops in Ethiopia since the mid-1980s. In 2013, CIP partnered with the University of Wisconsin-Madison and local stakeholders from agriculture, nutrition and health in the SNNPR to strengthen food security for smallholder farmers and their households by improving the production and consumption of potato and OFSP as part of nutritious, diversified diets. The project worked in five *woredas* (districts) in two SNNPR zones, Sidama and Wolayta. The five *woredas* are Boricha (Sidama), Damot Gale (Wolayta), Damot Woyide (Wolayta), Duguna Fango (Wolayta), and Loko Abaya (Sidama).

4c. Methods:

The study population consisted of 150 households in the Sidama and Wolayta zones in the SNNPR (figure 12). Data were collected using structured questionnaires with household heads and their wives that were implemented in April-May 2013 by trained enumerators in the local language. Households were selected as part of the study having met the following criteria: located within study area; proximity to a main road to enable enumerators access to the household; contained primary targets of food security interventions (i.e., mothers of children aged 6-59 months and at least one child aged 6-59 months); and approval of the elders and local government offices. Ethical approval was obtained from the Institutional Review Board at the University of Wisconsin-Madison. Verbal consent was obtained in the local language and collected from each household prior to conducting the surveys. Questionnaires were adapted from the following: Household Income and Expenditure Survey (for household resources and characteristics),[23] Helen Keller International Nutrition Survey (for nutrition and Vitamin A-related questions),[24] and UNICEF (for maternal and child health questions).[25]

Figure 12. Map of SNNPR, Ethiopia zones participating in the CIP Nutrition project.



Food security questions were based upon validated tools developed by the Food Nutrition and Technical Assistance Project (FANTA).[26] Questions captured households' experience of food security over the past 30 days in the areas of uncertainty/worry, inadequate quality, insufficient quantity, and social unacceptability. Because households and people within households are food secure to varying degrees, it is important to assess variations in food security status between different groups of people, to varying degrees, and at different times of year. In order to attempt to capture these multiple dimensions, each food security question corresponded to a different degree of food insecurity within the past 30 days: mild, moderate, or severe (table 14).[26] Households were then grouped according to their self-reported responses into the categories of severely food insecure (n=61), mildly food insecure (n=71), and food secure (n=18).

Table 14. Example questions for assessing severity of food insecurity, based on the Household Food Insecurity Access Scale

Degree of Food Insecurity	Example Questions
Mild	In the past 30 days, did you worry that your household would not have enough food?
Moderate	In the past 30 days, have you reduced the variety of food you or any household member ate because there was not enough money or food? In the past 30 days, have you or any household member ever had to eat a smaller meal because of not enough to eat?
Severe	In the past 30 days, have you ever gone to bed hungry because there was not enough food to eat?

Several factors are important for ensuring food security, including economic and income growth, agricultural productivity, markets, and social protections.[27] Given that the majority of smallholder farmers from the SNNPR earn little if any off-farm income, proxies for wealth were used that were relevant to the local context and resources.[28] The asset categories and wealth proxies used include:

1. *Agriculture holdings*: Total livestock, total cattle, total land holdings
2. *Household assets:* Bicycle, cart, cell phone*, r*adio
3. *Housing conditions:* Latrine, type of flooring*, t*ype of roof, water source
4. *Services:* Education, electricity, health care facility access

A model was developed for a single baseline measure for each of the food insecurity dimensions. Household socio-economic indicators with continuous variables were compared across the three food security categories (*i.e.*, severely food insecure, mildly food insecure, and food secure) using analysis of variance (ANOVA) in to identify potential associations. Household socio-economic indicators with categorical variables were compared using Chi-Square test. P-values <0.05 were considered as significant. All tests were performed using SAS® version 9.2.

4d. Results and Discussion:

The mean participant HH size was 6.9 members and the mean age of the HH head was 44 years (table 15). Five percent of households were headed by females. Thirty-two percent of HH heads were illiterate, and 25 percent had completed secondary school. Forty-four percent of

households reported any family member who earned an income, and the primary occupation classification among HH heads was farmer (96%), followed by merchant/petty trader (2%) and student (2%).

Table 15. Basic household demographics of the SNNPR study sample

Household Characteristics (n=150)	
Mean household size (# people)	6.9
Female-headed households (%)	<1%
Household head mean age, years (SD)	44 (10.2)
Mean age of mother, years (SD)	36.4 (8.4)
Mean number of children (SD)	6.1 (2.6)
Household with a family member who earns an off-farm income (%)	43%
Household head education level (%)	
Illiterate	32%
Read/Write only	4%
Completed primary school	33%
Completed secondary school	26%
Completed vocational school	2%
Attended/Completed college	3%

Mean total land holdings were 0.975 hectare, and mean total livestock holdings was 9 head (raw sum of cattle, chickens, oxen, and goats) (table 16). Forty-three percent of households owned a cell phone. A majority of households owned a pit latrine (93%), had a tin roof (64%), and had a dirt floor. All households had access to a health care facility (local health post), and 10% of households had electricity.

Table 16. Socio-economic characteristics of the SNNPR households

Wealth Indicators	
Agriculture Holdings	
Mean cattle head, number (SD)	2.9 (2.64)
Mean total livestock holdings, number (SD)	8.9 (10.66)
Mean owned land, in hectare (SD)	0.975 (0.76)
Household Assets	
Owns bicycle	3%
Owns cart	8%
Owns cell phone	43%
Owns radio	31%

Housing Conditions	
Has private latrine	93%
Has tin roof	64%
Has concrete floor	9%
Services	
Has electricity	10%
Health care facility access	100%

All households experienced time in the past 12 months when there was not enough food to feed all household members. There was variation among the five *woredas* in how they experienced the different food security domains (table 17). The two food insecurity domains with statistically significant differences were worry (self-reported uncertainty about having enough to eat) (p=0.01) and inadequate quantity (whether children have enough to eat) at (p=0.04).

Table 17. Comparison among SNNPR* woredas *of food security status, by domain (%)

	Boricha (n=30)	**Damot Gale (n=30)**	**Damot Woyde (n=30)**	**Duguna Fango (n=30)**	**Loko Abaya (n=30)**	**P-value**
In the past 12 months, have you experienced:						
A time when your HH did not have enough to eat?	100	100	100	100	100	n/s
In the past 30 days, have you experienced:						
Worry about food?	90	86	100	73	83	0.01
Shortage of food or money?	47	46	59	57	33	0.27
Limited variety of foods?	90	71	94	80	70	0.05
Your children not having enough to eat?	73	64	75	60	40	0.04
Asking a neighbor for food or money for food?	73	68	59	63	53	0.56
Going to bed hungry?	43	32	44	50	33	0.59

Certain socio-economic and wealth indicators were found to be individually significant in predicting food security. A model was developed for a single baseline measure for each of the food insecurity dimensions. The p-values for each socio-economic and wealth factors were determined using a chi-square distribution with 1 degree of freedom. Table 18 summarizes the order of relationships, in descending strength of association, of the indicators found to be predictive of food security within this study population. The top 3 predictive indicators for food

security were:

1. **Livestock and cattle ownership:** among food secure HHs, the mean number of total livestock owned (converted to Tropical Livestock Units) was 9.91, among HHs with reported mild food insecurity it was 4.53, and among HHs with reported severe food insecurity it was 3.73 ($p<0.0001$).
2. **Total land holdings:** among food secure HHs, mean total landholdings in *timad* (4 *timad* = approximately 1 hectare in the SNNPR) was 11.22, among HHs with reported mild food insecurity it was 4.67, and among HHs with reported severe food insecurity it was 3.34 ($p<0.0001$).
3. **Cell phone ownership:** among food secure HHs, 100% owned cell phones, while only 44% and 25% of HHs with mild and severe food insecurity, respectively, owned cell phones ($p<0.0001$).

Table 18. Socio-economic factors indicated by SNNPR households that reported food security, mild food insecurity, or severe food insecurity

	Food secure	Mild insecurity	Moderate insecurity	P-value
1. Livestock holdings				
Average total livestock (TLU)*	9.9	4.5	3.7	<0.0001
Average # cattle	8.1	3.7	2.7	<0.0001
2. Landholdings				
Total landholdings (timad)	11.22	4.67	3.34	<0.0001
3. Cell phone ownership (%)	100%	44%	25%	<0.0001
4. Education level				<0.0001
Illiterate	0%	24%	51%	
Read and write	17%	1%	3%	
Primary	33%	44%	20%	
Secondary	50%	31%	26%	
5. Radio ownership (%)	67%	32%	20%	0.0011
6. Tin roof (%)	90%	68%	52%	0.0113
7. Concrete floor (%)	22%	8%	5%	0.0631
8. Bicycle ownership (%)	11%	3%	2%	0.187
9. Cart ownership (%)	17%	8%	5%	0.2368
10. Electricity ownership (%)	5%	8%	13%	0.633
11. Latrine ownership (%)	100%	92%	92%	0.66
12. Health facility access (%)	100%	100%	100%	1.0

* TLU = Tropical Livestock Unit conversation, where cattle/oxen=0.7, pigs=0.4, and goats, sheep, chickens=0.1 (FAO 2009).

Food secure HHs had 2.2 times as many head of livestock, twice as many cattle, and twice as much land than HHs that exhibited mild food insecurity. The level of education of HH heads was significantly higher in food secure HHs compared to both mildly and severely food insecure HHs, as were the wealth proxies of cell phone, radio, and tin roof. The following socio-economic factors did not show statistically significant association with food security (at $p>0.05$): health care facility access, electricity, latrine, bicycle, concrete floor, and cart ownership.

Efforts have been made to develop methods to accurately and efficiently measure household food security based on the domains of uncertainty/worry, inadequate quality, insufficient quantity, and social unacceptability, with growing emphasis given to individual health outcomes, nutritional status, risk management, secure livelihoods, and subjective perceptions over objective indicators.[29] Within these four domains, however, survey measures must be adapted to specific cultural and ecological landscapes because coping strategies and social norms (*e.g.,* gender roles or dietary preferences) vary widely from one area to another.[30-32]

Given the complex nature of food security, different frameworks have been produced to help understand linkages among food security determinants and to explain connections.[33] Food security frameworks can help stakeholders identify the many factors that affect livelihoods, household food security and nutrition, along with their relative importance and the way in which they interact.[34] They can also help stakeholders identify appropriate entry points to strengthen livelihoods, household food security, and nutrition. One framework that has been used to analyze food security programs in developing countries is the Sustainable Livelihoods Approach (SLA), originally developed by the United Kingdom's Department for International Development (DFID).[35, 36] The SLA is people-centered and attempts to analyze individuals' livelihoods holistically. It stresses the inter-relationships between community-level activities, political, and institutional environments. It acknowledges that food security encompasses economic, environmental, institutional and social parameters.[37] While multiple variables influence decision-making processes, the SLA gives greater agency to individuals to make decisions that affect themselves and their households.

Among the households that participated in this survey, the prevalence and ways in food security was experienced was generally similar across all *woredas,* suggesting that place (i.e., one's village location) is not a significant factor in predicting food insecurity. Multiple socio-economic and wealth-related indicators, however, were associated with both mild and severe experiences of food insecurity. This is consistent with the literature, where wealth can buffer against food shortages in a number of ways. Previous studies have shown a strong predictive value between a HH's socio-economic status (SES) and a range of health outcomes, including food security status.[38-40] While relationships between SES and food security have been established, debates exist over which indicators are most meaningful in global and local contexts.[41] An even greater challenge exists in measuring SES in developing countries such as the SNNPR, Ethiopia study site because indicators of education, wealth proxies, and access to services may be unreliable and irrelevant in the local context.[42] Further, these measurements may not adequately incorporate social support networks and other intangible assets that contribute to individual and household well-being and security.

Limitations exist when assessing only quantitative measures of food insecurity, as the issues of seasonal variation, coping strategies, social norms (such as gender roles or dietary preferences), and food consumption are dependent upon cultural preferences, weather patterns, and agro-ecological zones, and can vary widely from one area to another.[29-31] Thus, the findings of this survey may not be applicable in other regions and food security prevalence would likely be different if considered at multiple times during the year. Data from these surveys were collected at the end of the *belg* season (February-May), which is the secondary harvest season in the SNNPR. Food stocks tend to be lower at this time of year as households wait for seasonal rains (June-September) to irrigate their main *meher* harvests. In order to enhance understanding of the preliminary results from the SNNPR *woredas*, semi-annual surveys were to be conducted at 6-month intervals to capture seasonal food security and dietary diversity patterns. Additionally, follow-up qualitative surveys may help capture how HH's define food security, how they experience it, and what wealth indicators are valued most in the community. Having this kind of data would shift food security measures away from only capturing

prevalence toward an understanding of the local conditions, factors, and experiences of the community to tailor programs and policies that meet their concerns. Such in-depth, local assessments often require considerable human and financial resources, knowledge and capacity to implement qualitative research methodologies, and trust from communities, and therefore are less commonly used.[43] Despite the time and resource investment needed to conduct these types of assessments and collect qualitative data, they return multiple benefits to the community and the resulting food security program and policy solutions may be more sustainable than that which relies upon quantitative data alone. Finally, given the complex, interdisciplinary approaches required for food insecurity and poverty alleviation programs, adapting evaluation frameworks that measure impact in holistic ways so that social, economic, and environmental outcomes are considered in relation to each other is critical. This may present opportunities for programs implemented in low-resource settings to share lessons with communities in high-resource settings, leading to bi-directional learning and innovations in food security partnerships.

4e. Conclusion:

Among the participating SNNPR *woredas*, wealth measures were found to be the strongest predictors of food insecurity. Further qualitative analysis with community members is needed to assess whether these wealth indicators align with local values and to improve understanding of the direction of the relationship. More localized studies such as this are needed to help inform the design of programs and policies that integrate the sectors of agriculture, nutrition, health at the regional level in order to enhance the health and livelihoods of individuals, families, and whole communities.

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CHAPTER 5: ASSOCIATIONS BETWEEN HOUSEHOLD ASSETS AND FOOD SECURITY INDICATORS: COMPARISON OF FINDINGS FROM TIGRAY AND THE SNNPR, ETHIOPIA

5a. Abstract

Households with more financial, social, and human assets have better livelihood outcomes, including food security, health, and incomes, than households with fewer assets. This paper compares similarities and differences between food security status and associated factors based on household surveys from Tigray and the SNNPR regions of Ethiopia. Food security was measured using an adapted Household Food Insecurity Access Scale (HFIAS). Household indicators were classified into the following categories: financial, human, natural, physical, and social. Analysis of variance (ANOVA) and cross-tabulations with significant tests were used to assess associations between household food security status and socio-economic, demographic, health, and environmental indicators. Prevalence of household food insecurity in the last 30 days when the surveys were taken was 59% and 34%, respectively, among the SNNPR and Tigray households. Prevalence of food insecurity in the last 12 months was 100% and 79%, respectively, among SNNPR and Tigray households. The months of reported food insecurity differed between regions, as did the factors associated with food insecurity. In the SNNPR, households with greater financial assets (i.e., livestock holdings, cell phone ownership, roof type) tended to be more food secure than others ($p<0.001$). In Tigray, households with greater human (i.e., maternal health) and natural assets (location, altitude) tended to be more food secure than others ($p<0.001$). Multiple economic, environmental, health, and social factors were associated with food security status in both regions. One measure used to assess national progress toward the Millennium Development Goal of achieving food security for all – the proportion of children under-5 years that are underweight (CU5) – was not associated with food security status in either region. Determining which food security indicators to use, local prevalence, and determinants can help ensure the chosen strategies are coordinated and responsive to contextual and cultural conditions. Given the multiple factors associated with food insecurity within this study population, nutrition-sensitive approaches may offer a more effective solution than single-sector approaches.

5b. Introduction:

Food security is a multi-dimensional concept which manifests itself in multiple conditions and is determined by numerous causes.[1, 2] In 1990, the Millennium Development Goals included objectives to address and improve global food security, with the target of halving the proportion of chronically undernourished people by 2015.[3] Two indicators were used to measure progress toward this goal, prevalence of undernourishment (POU) and the proportion of underweight children under-5 years of age (CU5).[4] POU measures the proportion of the population not consuming sufficient food to meet their dietary energy requirements. CU5 measures a child's weight for age, and reflects an individual's current conditions. Underweight can be caused by multiple factors, including inadequate food intake, poor hygiene, disease, or poor health conditions.[5] Between 1990 and 2015, both indicators declined.[4] The prevalence of undernourished people globally fell by 23.4% from 1.01 billion to 795 million people. However, progress toward the MDGs has varied among countries and within different populations. In sub Saharan Africa, one in four people are still estimated to be undernourished, and the number of undernourished people has actually increased by 44 million. Further, an estimated 1 in 5 children are underweight.[4] Better understanding of local contributing factors is needed to achieve the food security for all.

Progress towards global food security targets requires that food is available, accessible and of sufficient quantity and nutritional quality to ensure good developmental outcomes.[6--8] Nutrition contributes to human development: it helps individuals, their families, and whole communities realize their full potential, but the underlying drivers are complex. Conducive political, economic, social, and human environments are all required to ensure food and nutrition security. Despite some progress

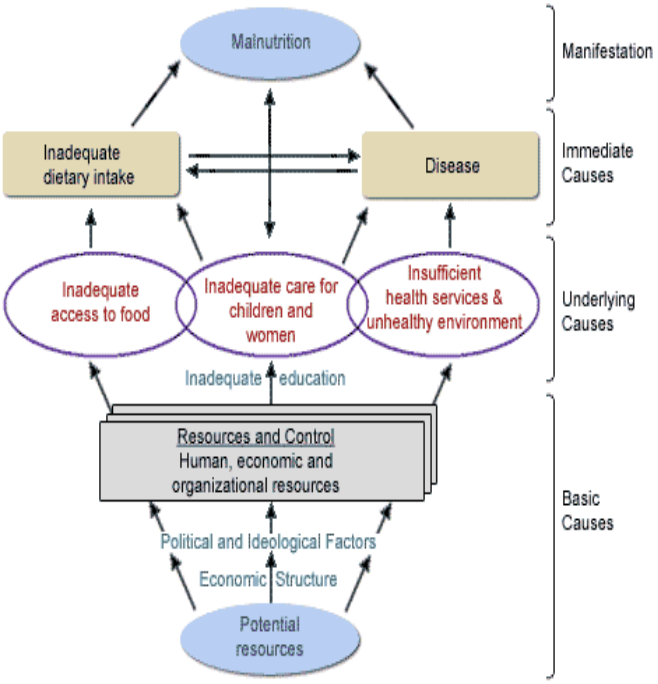


Figure 13. Multi-sector framework for undernutrition. UNICEF, 1990.

toward the MDGs, globally rates of undernourishment and child underweight remain high. The inability of nutrition-specific actions to resolve this global problem has been understood for years,[9] and was clearly outlined in 1990 in the UNICEF framework on undernutrition (figure 13).[5]

One challenge for achieving food and nutrition security is that nutrition-specific actions – such as vitamin supplementation, biofortification, breastfeeding and complementary feeding, and treatment of acute malnutrition – are essential but not sufficient to resolve the problem. The underlying causes may be most successfully addressed by complimentary actions across sectors to have indirect effects on food security and nutritional outcomes.[9] Food security and nutrition programs recognize this and increasingly are shifting from addressing single issues to multidisciplinary approaches that build resilience.[10-13]

Despite awareness of the need for approaches that engage multiple sectors, there is a lack of evidence about how to effectively design and measure the impacts of such interventions.[14] In particular, concern about food security and its relationship with chronic undernutrition has increased interest in how agriculture could be used to improve nutritional outcomes.[15, 16] Two recent systematic reviews of agricultural interventions intended to improve nutrition showed little evidence of impact.[17, 18] Another study conducted by the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) analyzed and mapped the gaps for how agriculture research projects can improve nutrition.[19] The authors looked at 151 agriculture projects with a stated intent to impact nutrition outcomes, and found multiple gaps along the pathway, including lack of meaningful measures. This has resulted in a growing emphasis for reliable and effective food insecurity indicators that can be applied to multi-sector food security interventions. Understanding the gaps for how food is produced and distributed, accessed, marketed, and consumed is of vital importance for policy-makers at the local, regional, and international levels to ensure the health and well-being of all. Because the underlying causes of food insecurity go beyond food production, it is important that indicators for measuring it and interventions for solving it also be drawn from across sectors.

5b.1 Multi-sector frameworks

Households with improved access to financial, social, and human assets have improved livelihood outcomes, including food security, health, and incomes. However, the types of assets required to ensure food security are context-specific and may change over time.[20,21] Additionally, most studies have analyzed household assets, and not given as much attention to community, organizational, and policy-level assets. Studies using the Sustainable Livelihoods framework have used the following categories to consider different types of assets that enhance liveihoods:[22, 23]

> **Financial capital:** includes forms of wealth, both money and other wealth indicators, such as material possessions, livestock, and landholdings. Investments in financial capital can lead to increases in profits, jobs and businesses.
>
> **Human capital:** refers to health, knowledge, skills and understanding. It also can also include confidence, capacity, and self-efficacy.
>
> **Natural capital:** includes natural resources such as water, land, air, forests, and animals
>
> **Physical capital:** includes infrastructure, such as roads, homes, and telecommunications.
>
> **Social capital:** includes connections, networks, participation, and relationships.

This study compares the prevalence of household food insecurity from two regions of Ethiopia – the Southern Nations, Nationalities, and Peoples' region (SNNPR) and Tigray; analyzes and compares determinants between regions and at different levels of influence; and presents implications for designing localized, multi-sector programs to address food insecurity.

5c. Methods:

Quantitative household data were collect from 450 households from 20 *woredas*: 300 households in Tigray; and 150 households from the SNNPR (figure 14). Structured questionnaires with household heads and their wives were implemented by trained enumerators in the local language. Households were selected as part of the study having met the following criteria: located within study area; proximity to a main road to enable enumerators access to the household; contained primary targets of food security interventions

(*i.e.,* mothers of children aged 6-59 months and at least one child aged 6-59 months); and approval of the elders and local government offices. Ethical approval was obtained from the Institutional Review Board at the University of Wisconsin-Madison. Verbal consent was obtained in the local language and collected from each household prior to conducting the surveys.

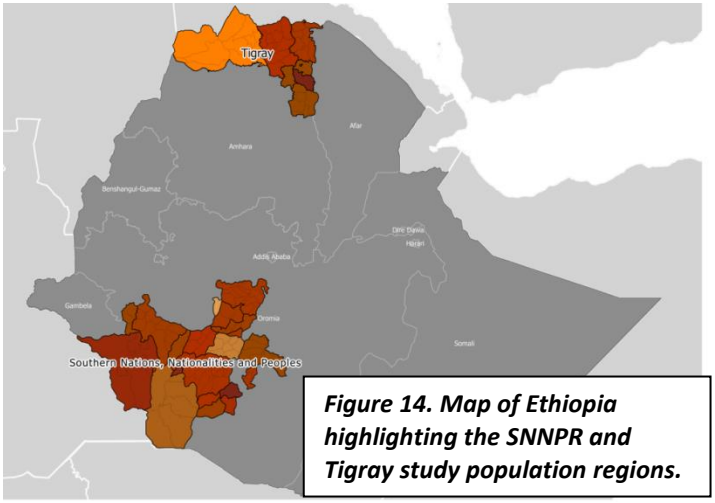


Figure 14. Map of Ethiopia highlighting the SNNPR and Tigray study population regions.

The questionnaires were designed to record household socio-economic and socio-demographic status; agricultural production practices; OFSP production practices; access to health services; food security; and nutritional status of children 6-59 months and their mothers. The questionnaire was prepared in English, reviewed and approved by a technical committee comprised of CIP-Ethiopia staff and local stakeholders, and conducted in the local language by trained enumerators. Food security questions were based upon the validated Household Food Insecurity Access Scale (HFIAS) developed by the Food Nutrition and Technical Assistance Project (FANTA).[24] Questions captured households' experience of food security over the past 30 days in the areas of uncertainty/worry, inadequate quality, insufficient quantity, and social unacceptability. Because households and people within households are food secure to varying degrees, it is important to assess variations in food security status between different groups of people, to varying degrees, and at different times of year. In order to attempt to capture these multiple dimensions, each food security question corresponded to a different degree of food insecurity within the past 30 days: mild, moderate, or severe (table 13).[24] Households were then grouped according to their self-reported responses.

5d. Results:

5d.1 Household characteristics from baseline quantitative surveys

Results indicate that Tigray and SNNPR households share similarities in terms of household size, the age of the head of household, membership on farmer committees, and having at least one member earning an income (table 19). However, households from Tigray and the SNNPR differed in the percentage that were female-headed, education levels, off-farm income, access to credit, livestock and landholdings, and OFSP production.

Table 19. Comparison of select socio-economic indicators between SNNPR and Tigray HHs

	SNNPR (n=150)	Tigray (n=300)
Average HH size (# people)	6.5	6.5
Female-headed HHs (%)	<1%	14%
HH Head mean age, years (SD)	38 (8.2)	40 (9.4)
HH Head education (highest level)		
Illiterate	14%	42%
Read/Write	<1%	40%
Primary	37%	12%
Secondary	39%	4%
Vocational/College	9%	2%
HH with source of off-farm income (%)	26%	66%
Mean number of cattle owned (SD)	2.1 (1.6)	1.3 (1.2)
Mean number of oxen owned (SD)	0.6 (0.7)	1.3 (1.2)
Mean total livestock owned (SD)	6.9 (6.6)	10.7 (10.3)
Mean owned land, in *timad* (SD)	2.3 (1.9)	3.4 (2.3)
HH has access to credit (%)	61%	91%

5d.2 Prevalence of food insecurity, by region

Measuring food security has posed challenges due to the difficulties of defining it, and a multitude of indicators have been used to evaluate it.[25, 26] Single indicators can vary in significance from region to region, necessitating selection of indicators for specific sites to ensure relevance to the context. This study used the HFIAS to food security status based upon the following experiential domains:[27] 1) uncertainty and worry; 2) inadequate food quality; 3) insufficient food intake; 4) and social unacceptability; and seasonal variation.

To assess whether a household experienced food insecurity, questions were asked within each domain category bound to the past 30 days. Households were also asked about food security in the last 12 months by inquiring about food stock levels and whether there was any time when the household experienced a shortage of food. A summary comparing responses between SNNPR and Tigray regions is presented in Table 20.

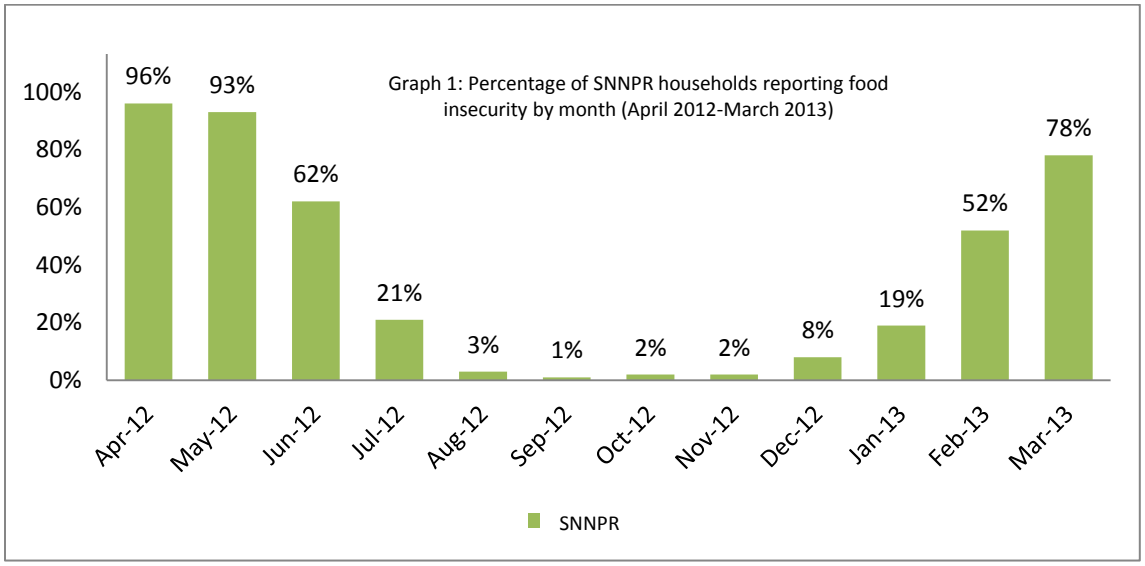
Table 20. Comparison of household food security status between SNNPR and Tigray, self-reported responses in last 30 days

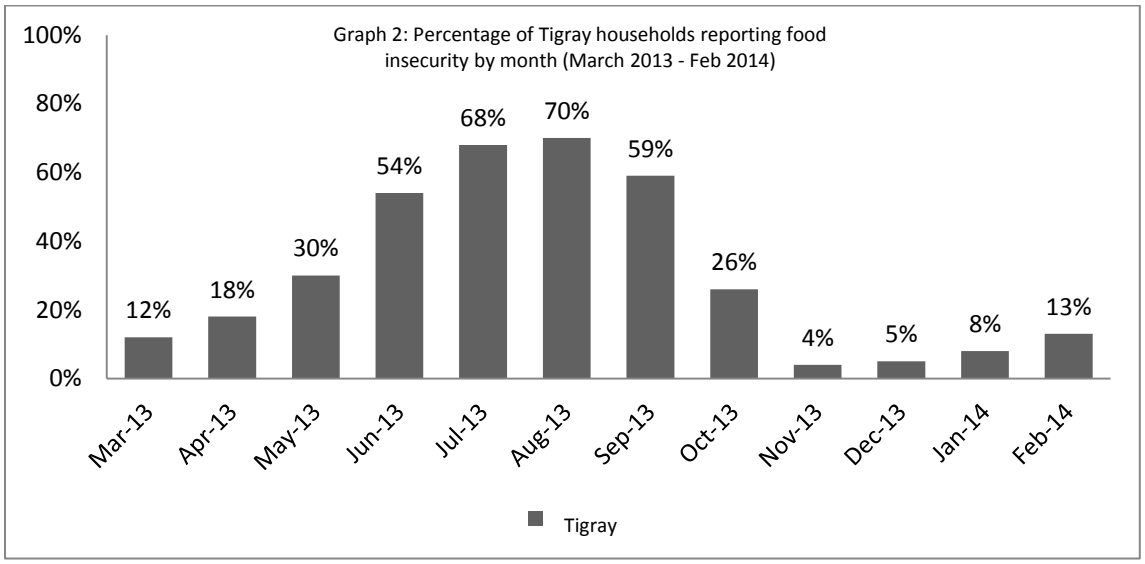
	SNNPR (n=150)	Tigray (n=300)
Food secure	12.0%	66.3%
Mild food insecurity	47.3%	12.0%
Moderate-severe food insecurity	40.7%	21.7%
Food insecure at some time in last 12 months	100%	79%

Food security status varied between regions. In both regions, a majority of households (100% in the SNNPR and 79% in Tigray) had experienced a time in the last 12 months when there was not enough food to feed all household members. In the SNNPR, a majority of HHs were food insecure, with 47.3% classified as having mild food insecurity 40.7% as moderate or severe food insecurity. In Tigray, the majority of households were classified as food secure, with only 12% and 21.7%, respectively, being classified as experiencing mild and moderate/severe food insecurity. Tigray surveys were conducted after the harvest season, a time when households are known to have greater food stocks so food insecurity may have been under-reported. However, as mentioned in Chapter 2, the timing of the surveys was not selected based on seasonal food security prevalence. Rather, the timing was determined based on CIP program priorities (i.e., when OFSP crop would be harvested and consumed) so that surveys at endline could reflect changes (or not) in those specific agronomic and nutrition program outcomes.

A household's food security status can change over time, fluctuating over the course of a year due to seasonal food production seasons, and also varying year to year based on changing climate and other forces that impact food availability (*e.g.,* pricing). Having adequate food intake in the past 30 days may not recognize an individual's or household's vulnerability to food

insecurity in the coming month, so it is vital to consider seasonal variation. To understand this, on the household questions I included the question: "In the last 12 months, did you or anyone in your household worry about not having enough food to feed all family members?" If yes, households were to report which month(s) in the last year this occurred. From this, we could learn whether the timing of the SNNPR and Tigray household surveys coincided with seasonal insecurity high/low patterns. Graphs 1 and 2 consider seasonal distribution in the SNNPR and Tigray of self-reported household food insecurity, and illustrate different times of the year when households faced food shortages.





In the SNNPR, all households reported at least one month between April 2012 – March 2013 when there was not enough food to feed all family members. Months representing the highest rates of household food insecurity were April 2012 (96%), May 2012 (93%), and March 2013 (78%). In Tigray, 79% of households reported that they experienced at least one month between March 2013 – February 2014 when there was not enough food to feed all family members. Months representing the highest rates of household food insecurity were August 2013 (70%), July 2013 (68%), and September 2013 (59%). These periods of improved food security coincide with the main harvest seasons in both regions. One interpretation of this data is that it reflects how much these communities – which are still primarily subsistence farmers – depend upon environmental factors and seasonal harvests patterns for their livelihoods.

5d.3 Comparison of household factors associated with food security status, by region

Several factors have been found to be associated with food security as measured by the HFIAS, including wealth,[28] maternal education,[28] household per capita income,[29] household assets,[30] and dietary diversity.[29, 30] Using the SLA asset categories to consider multiple household assets, the following indicators were analyzed for association with food security status within the SNNPR and Tigray study populations:

- **Financial**: livestock, total owned land, cell phone ownership, radio ownership, bicycle ownership, access to credit, off-farm employment
- **Human**: mother's body mass index (BMI), maternal health, maternal nutrition knowledge, household size
- **Natural**: water source, altitude, irrigated land, kitchen garden
- **Physical:** administrative zone, electricity, roof type, floor type, pit latrine
- **Social**: education of HH head, child dietary diversity score, HH dietary diversity score, family size, HH head age

Household socio-economic indicators with continuous variables were analyzed for association with food security status using analysis of variance (ANOVA) in to identify associations. Household socio-economic indicators with categorical variables were compared using Chi-

Square test. All tests were performed using SAS® version 9.2. Table 21 compares the factors from the univariate analyses and their associations between SNNPR and Tigray regions at $p<0.05$, $p<0.01$, and $p<0.001$.

Table 21. Comparison of assets associated with food insecurity among SNNPR and Tigray HHs

	SNNPR	Tigray
1. Financial Assets		
Cell phone ownership	***	***
Access to credit services		**
Radio ownership	***	**
Cattle ownership	**	**
Oxen ownership		***
2. Human Assets		
Mother's BMI	*	***
Mother sick in last 30 days	**	***
Mother's age at marriage	***	***
HH dietary diversity score		
3. Natural Assets		
Altitude (>=2000 m)		***
Total owned land	***	**
Total Irrigated land		***
Drinking water source		**
4. Physical Assets		
Administrative zone	**	***
Roof type	**	
5. Social Assets		
HH head age		
Total HH members		
HH education level	***	

* p<0.05; **p<0.01; ***p<0.001

Multiple economic, environmental, and health factors were associated with food security status in both regions. In the SNNPR, households with greater financial assets (i.e., livestock holdings, cell phone ownership, roof type) were more likely to self-report being food secure than not ($p<0.001$). In Tigray, households with greater human (i.e., maternal health) and natural assets (location, altitude) were more likely to report being food secure than not ($p<0.001$).

5d.4 Prevalence and predictors of child underweight, by region

Nutrition impacts an individual's health over the life course. Undernutrition is a global problem that impacts child morbidity and mortality, and the economic productivity of individuals, their households, and societies.[13] In communities with high rates of food insecurity and insufficient food resources, children are not able to achieve their full potential. This impacts not just the cognitive, physical, and social development of individuals, but has consequences on families, communities, and national development.[2]

Child undernutrition is assessed by measuring height and weight and screening for clinical manifestations and biochemical markers. Indicators based on weight, height, and age are compared to international growth references to assess the nutritional status of a population.[5] This includes the indicators of stunting (inadequate height for age), wasting (inadequate weight for height), and underweight (inadequate weight for age). Prevalence of children under-5 years that are underweight (CU5) is defined as weight for age Z-score more than two standard deviations below normal on the WHO growth chart. The proportion CU5 in the study population was calculated in both regions (table 22).

Table 22. Comparison of child-5 undernutrition status between SNNPR and Tigray

	SNNPR (n=150)	Tigray (n=292)
Stunting, %	39.4%	40.0%
Underweight, %	16.1%	34.6%
Wasting, %	5.8%	10.7%

Analysis was conducted to determine if there were associations between household assets and CU5, just like with food security status. This was done to compare against the two variables of food security and CU5 since CU5 has been used to estimate progress toward improved food security at the national level (table 23).

Table 23. Comparison of associations with child under-5 underweight in SNNPR and Tigray

	SNNPR (n=150)	Tigray (n=292)
1. Financial Assets		
Cell phone ownership		
Access to credit services		
Radio ownership		
Cattle ownership		
Oxen ownership		
2. Human Assets		
Mother's BMI		
Mother hx of eye disease		*
Mother sick in last 30 days	*	
Mother's age at marriage		
HH dietary diversity score	**	
Complementary food, age		
3. Natural Assets		
Altitude (>=2000 m)		
Total owned land		
Total Irrigated land		
Drinking water source	*	
4. Physical Assets		
Administrative zone		***
Roof type		
5. Social Assets		
HH head age		
Total HH members		
HH education level		
Food insecure in last 30 days		

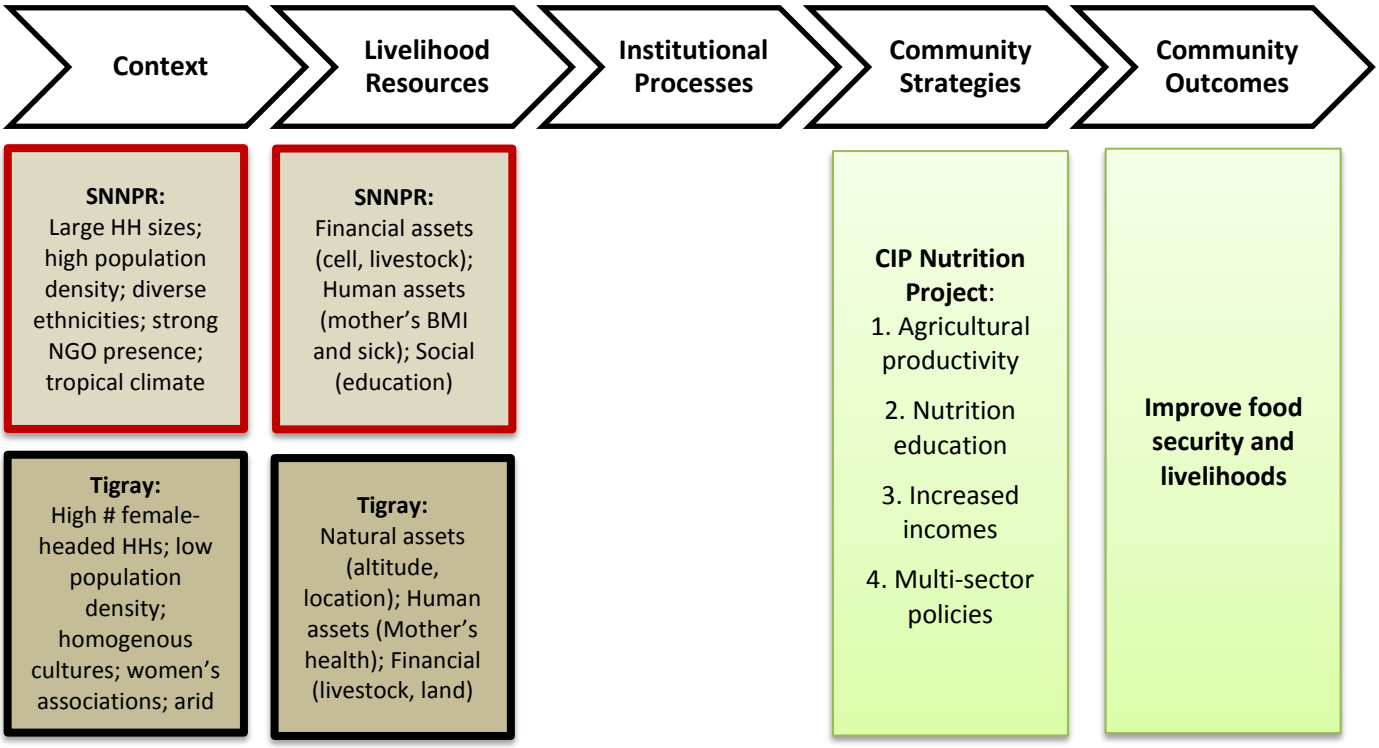
* p<0.05; **p<0.01; ***p<0.001

Among children under-5 years of age, prevalence of stunting and underweight was 39% and 16% in the SNNPR, and 40% and 35% in Tigray. Factors associated with it in the SNNPR were water source, maternal health, and age at which the child was first fed complementary foods. In Tigray, factors associated with CU5 were geographic location and maternal eye health.

5e. Discussion:

Figure 10 adds the quantitative results to the integrated SLA/SEM model to illustrate what kinds of household level factors were associated with food security in the SNNPR and Tigray regions.

Figure 10. Comparison of SNNPR and Tigray context, livelihood resources, and institutional processes, integrated with SLA/SEM model



Among SNNPR and Tigray households participating in these surveys, prevalence of food insecurity in 30 days prior was taken was 59% and 34%, respectively. In the SNNPR, households with greater financial assets (*i.e.,* livestock holdings, cell phone ownership, roof type) were more likely to self-report being food secure than not ($p<0.001$). In Tigray, households with greater human (*i.e.,* maternal health) and natural assets (*i.e.,* location, altitude) were more likely to self-report being food secure than not ($p<0.001$). Factors not associated with food security in Tigray were dietary diversity, education level of HH head, household size, and CU5. And in the SNNPR, access to credit services, dietary diversity, household size, CU5, and drinking water source were not associated with food security. Consistent with other studies, within this study population multiple economic, environmental, and health factors were associated with

food security status. Suggesting that households with more assets have improved food security status, and perhaps indicating the importance of multi-sector approaches to address the challenge of food insecurity within the study population.

The seasonal variation in food security shows a near mirror image between the SNNPR and Tigray: months when food insecurity is lowest in the SNNPR are times of harvest and better food security in Tigray, and vice versa. This reflects a broader issue of national food production and distribution issues, bringing into question not only food supply but also what kinds of food processing and storage facilities, distribution, and transportation infrastructure exist. Within the CIP project specifically, this finding provides an opportunity to discuss how to create a national OFSP value chain strategy to ensure adequate, year-round supplies of OFSP for all regions. Recognizing that regions differ in the timing of seasonal production, CIP and its stakeholders should consider how to ensure sufficient, year-round production of OFSP and value-added products to meet market demand in both regions and other regions of Ethiopia, as well as the greater Horn of Africa.

This issue of seasonality presented a larger challenge to the impact evaluation, which was to select a time of year for when to administer the baseline and endline surveys in order to capture multiple important targets. Those targets being not only food security rates, but also harvest yields of OFSP, consumption of OFSP, general dietary diversity, and maternal/child health indicators, all of which have associations with seasonal weather patterns, all the while also keeping in mind fasting seasons and political factors (e.g., elections). For the broader impact evaluation, the timing of the endline surveys would be critical, and was determined more to coincide with OFSP harvest and consumption cycles than times of the year when there was known food insecurity. I handled this impact evaluation limitation by making additional adjustments and expanding the evaluation framework so that important impacts/positive changes the CIP Nutrition Project was making could be captured, even if the ultimate outcome of reducing food insecurity (which is obviously impacted by much larger factors than just CIP's single intervention) was not changed.

The results from my study's statistical analyses indicate that there are relationships between multiple variables and food security in this study population, and that those variables and strength of relationships differ between regions. However, the relationships are not necessarily causal and I cannot infer that evaluating correlates can substantiate the indicators. Nor can I make the case that any of the variables found to be associated with food security (e.g., in Tigray, administrative zone being an example) can be used as surrogates for food security. My findings do indicate a couple things about evaluating localized correlates with food security. First, multiple factors are important for ensuring food security, and no single indicator alone can be a good surrogate across multiple contexts and settings; rather, identifying specific assets with the broader categories of assets that are contextually specific is important to identify and develop effective program and evaluation plans. Second, the significance tests across the three categories show the direction of relationships, with some being not surprising (e.g., more secure HHs had more cattle) and others, surprising (e.g., more secure HHs had more children, while other studies from Ethiopia have the found opposite to be true). From their own descriptions and what we know about Ethiopia as a country, these communities are changing. So variables that are associated with food security this year may not be next year (or in 3 years). Trends in how indicators are associated with food security status will be interesting to compare over time.

Additionally, what we learn from these findings is that it not only is difficult – if not impossible – to identify localized surrogate measures for food security, but we really need to rethink what the goal of food security interventions should be. How can we transform the capitals that communities have to result in positive outcomes on entire food systems? This is one my study's key contributions to broader program and policy efforts that are calling for shifts towards diversified food systems that can deliver simultaneous benefits for productivity, the environment, and society, which I discuss in greater detail in my conclusion.

The indicator of the proportion of children under-5 years that are underweight is used to measure progress toward MDG 1 and the Global Hunger Index as indicators of progress toward food security for all.[32] In the SNNPR, child under-5 stunting, underweight, and wasting rates were 39%, 16%, and 6%, respectively. CU5 in the SNNPR was found to be associated with the mother's age at marriage and the household's drinking water source ($p<0.05$). The Tigray child under-5 stunting, underweight, and wasting rates were 40%, 35%, and 11%, respectively. CU5 in Tigray was found to be associated with a household's geographic location ($p<0.001$). Child nutrition indicators in neither region were associated with food security status. The lack of association between household indicators and CU5 was surprising given the multitude of factors associated with food security in both regions. This may suggest certain food security indicators may not be contextually relevant. Thus, when they are used, they may be over- or under-reporting localized prevalence of food insecurity. Second, even among households that report food security, there may be disparities within households in who (*e.g.,* mothers or young children) has access to adequate and quality foods. Third, even if households report adequate food security, the quality of foods consumed may be poor leading to nutritional deficiencies and subsequent poor child nutrition status. While multiple household assets influence food security status, nutrition may be more greatly influenced by proximal environmental and political factors beyond the household level. Thus, in order for food security interventions in this population to impact nutrition, it will be important to identify and be able to influence such factors.

Given these high rates of food insecurity and child undernutrition within the study population, what can and should be done to address the challenges in the Ethiopia context? Examples of approaches to combat undernutrition in developing regions include a natural, food-based method, biofortification, and direct supplementation.[32] Studies have reported cases in which each approach has proven successful. For example, a Cochrane review showed that vitamin A supplementation reduced all-cause mortality by 24%, diarrhea-related mortality by 28%, and measles incidence by 50% in children ages 6-59 months.[33] However, high dose supplements may increase risk of diarrhea and respiratory tract infections, and continued supplementation is

costly.[34] While supplementation remains necessary for high-risk populations, especially when used as a short-term emergency measure, it does not adequately address the root causes of micronutrient deficiencies and more sustainable options exist. Strategies to reduce undernutrition and micronutrient deficiencies should consider co-related factors such as resource availability, cost, access, and long-term sustainability in relation to social and cultural systems, issues a supplementation-only approach cannot deliver.[13]

Other studies have confirmed the importance of enhancing multiple assets to ensure for improved livelihoods. A meta-analysis published by Berti *et. al.*[35] reviewed and analyzed the characteristics and impacts of thirty agricultural interventions on nutritional status. The study analysis took into account five types of capital using the Sustainable Livelihoods framework: natural, physical, human, social, and financial. Nine of the 17 studies showed improvement in at least one agricultural factor, and all nine of these cases used a food-based approach (kitchen gardens). Food-based interventions enhanced more capital categories than the other approaches, including women's empowerment, which may have been responsible for the positive effect on child nutrition, vitamin A status, and morbidity. Nineteen interventions had a positive effect on nutrition. Of these, the majority (14) were interventions that enhanced four or more types of capital. Conversely, of the nine interventions that had a negative or no effect on nutrition, only one invested in four or more types of capital. The findings suggest that when multiple capitals are strengthened with a focus on education and gender considerations, there is greater likelihood of improved food security and nutrition outcomes and for interventions to have longer-term, positive effects.

Increasingly, agricultural interventions and food-based approaches are encouraged because of the potential to support sustainable livelihoods by increasing income and assets, promoting environmental stewardship, increasing social capital, and addressing issues of gender equity and empowerment combined with improvements in nutrition and food security.[36] Findings from two reports, "Seven Key Pathways between Agriculture and Nutrition" (Gillespie et al, 2012) and "Guiding Principles for Linking Agriculture and Nutrition (FAO, 2013), have proposed

a set of guiding principles on how agriculture programs could improve nutrition. The principles represent an emerging global consensus on how to link agriculture and nutrition. The United States Agency for International Development adapted these principles into a framework for how their programs can integrate agriculture, health, and water and sanitation interventions in order to align with the UNICEF conceptual framework of the determinants of undernutrition (table 24), along with potential monitoring indicators for each.[37]

Table 24. Pathways and potential indicators for measuring the impacts of agricultural interventions on nutrition, adapted from Du, 2014[37]

Nutrition – Agriculture Pathway	Potential Monitoring Indicators
1. Agriculture as a source of food	Crop yield, # livestock for home consumption, HH garden diversity, quality of foods stored at home, dietary diversity
2. Agriculture as a source of income to affect food purchases	Market access
3. Agriculture as a source of income to affect health care purchases	Availability of and access to HC facility, community health services, types of services provided, care-seeking behaviors, demand for preventive services
4. Link between agricultural policies and food prices	Supply and demand statistics, food price information
5. Women's nutritional status due to workload changes	BMI, micronutrient status, weight gain, resting time during pregnancy, birthweights
6. Women's ability to manage the care, feeding, and health of young children	Time spent on farm/non-farm labor, child care (hygiene), IYCFP (breastfeeding, complementary foods, child DD), contribution of other caregivers
7. Women's SES and ability to influence HH decision-making and food allocation	Income controlled by women, food intakes of women and children, dietary diversity scores

5f. Conclusion

Multiple economic, environmental, health, and social factors were associated with food security status within the study population in both the SNNPR and Tigray regions. However, few factors were associated with the prevalence of rates of child under-5 underweight. While multiple household assets influence food security status, nutrition may be more greatly influenced by environmental and political factors beyond the household level. Thus, in order for agricultural interventions in this population to impact both food security and nutrition status, it may be important to understand and be able to influence those factors. Determining which indicators to use, local prevalence, and determinants can help ensure the chosen strategies are coordinated and responsive to contextual and cultural conditions. Multi-sector, multi-level nutrition-sensitive approaches may offer a more effective solution than single-sector approaches within this study population.

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CHAPTER 6: TRANSFORMING MINDS, TRANSFORMING COMMUNITIES: COMPARATIVE ANALYSIS OF HOW RURAL COMMUNITIES USE ASSETS TO MITIGATE THE RISK OF FOOD INSECURITY IN TIGRAY AND THE SNNPR, ETHIOPIA

6a. Abstract:

Background: The drivers and magnitude of food insecurity differ within households, across communities, and over time. However, there is limited localized understanding of how food insecurity is experienced and assets used to cope in different contexts. The purpose of this qualitative comparative analysis study was to utilize participatory methods to understand how rural communities in two regions of Ethiopia use assets to cope with the risk of food insecurity and ways these assets can be used to strengthen livelihoods. **Methods**: Narrative inquiry was used to collect and analyze data. Twelve community discussions were conducted in six rural districts of Ethiopia (3 in Tigray; 3 in SNNPR) in June-July 2015. Within each district, two sessions were held – one for men and one for women – with a total of 98 participants (52% women). Trained facilitators followed a semi-structured script to collect feedback using community asset maps, small group discussion, and ripple mapping. Sessions were conducted in the local language, with verbal consent given by participants. Field notes and audio recordings were translated and transcribed into English. The transcriptions were manually coded into five deductive categories, and the asset maps were analyzed for category frequency and characterizations. **Results:** All focus groups identified the following assets as important to their communities: schools, health care facilities, water infrastructure, religious institutions, trees, and roads. In the SNNPR, groups identified land, local markets, and communal spaces as important assets. In Tigray, groups identified crop/livestock sales, knowledge, women's associations, health, and savings. The most frequently cited category improved by the project was human assets, followed by financial and social assets. **Conclusion**: How households use assets is influenced by diverse and changing social, institutional, and ecological landscapes. Understanding both the assets and contexts can inform the design and evaluation of more contextually-relevant food security programs. Participatory approaches to increase assets – ownership, voice, and empowerment at the household and community levels – may present a novel approach to adapt in other contexts to gain feedback about how projects can address complex issues in holistic, integrated ways.

6b. Introduction:

One factor associated with food insecurity is poverty: people who are poor are more likely to be food insecure.[1] Poverty can be defined as the lack of wealth and material possessions, and is often measured by gross annual income or other wealth indices (actual or relative).[2, 3] However, the impacts of poverty go beyond financial assets. The poor tend to have worse health outcomes, are less well nourished, access fewer social, economic, and educational resources, and are exposed to greater environmental risks, thereby perpetuating or even increasing poverty and contributing to social and health disparities.[4-7] Developmental and ecological systems theories[8, 9] both hold that mutually beneficial relations between a developing individual and community resources that support health are necessary for positive, healthy trajectories across the lifespan: people with better access to assets experience better human, social, and financial outcomes.[10-12] Interventions aiming to reduce poverty and food insecurity have been more successful when they support building assets, self-efficacy, and empowerment.[13-15] In order to effectively reduce food insecurity and poverty, intervention strategies should consider culturally- and contextually-relevant ways to build assets, self-efficacy, and capacity, particularly among women and vulnerable households.

In 2010, an estimated $11.7 billion USD was spent globally on food security programs, with 41% going to sub-Saharan Africa.[16] The majority of funds were allocated to agriculture (61%), as well as food aid (22%), agricultural education/research/extension (11%), and nutrition (3%). Despite significant resources invested in addressing food insecurity, the problem persists.[17] One criticism of prior food security programs is that they have been driven by outside interests and do not reflect the values, priorities, or assets within the communities they are trying to help, limiting their potential to do more good.[18, 19] One framework to help communities identify assets important for livelihoods is the Community Capitals Framework (table 25),[20] an adaptation of the Sustainable Livelihoods Approach.[21] The Community Capitals Framework considers seven types of capital (*i.e.,* cultural, financial, human, natural, physical, political, and social) and how they interact with households and communities to support positive household and community outcomes.[22] Applications of this framework can help improve understanding of

the impacts of food insecurity experiences and program efforts on communities, particularly ways in which different capitals function within communities.

Table 25. Community Capitals Framework

1. Physical Capital	Infrastructure that supports the community
2. Cultural Capital	How creativity and innovation are nurtured and identity is created
3. Financial Capital	Monetary resources available to invest in a community
4. Human Capital	Knowledge, skills, and abilities of people
5. Natural Capital	Natural resources, including soil, water, flora, fauna, and biodiversity
6. Political Capital	Access to power and power brokers
7. Social Capital	Connections among people, networks, and leadership

Understanding barriers to food security requires knowledge of not only the community's situational context, but also the governance structures, local leadership, privilege, and decision-making contexts.[23, 24] Participatory Action Research (PAR) is a "collaborative, reflective, experiential, and participatory mode of research in which all individuals… – researcher and subjects alike – are deliberate and contributing actors."[25] PAR comes out of multiple intellectual traditions and practice, and has been linked to critical theory to identify and challenge assumed power structures and relations.[26] It brings together diverse stakeholders – *e.g.,* community members, researchers – to examine a problem or issue and collectively act to make change for the better.[27] Brazilian educator Paolo Freire wrote about the value of critical inquiry and consciousness-raising as tools for building social capital and political empowerment, particularly within communities faced with poverty and food insecurity.[28] When applied to food security programs, this process starts with developing consciousness about one's lived experiences of food insecurity, engaging in dialogue with others about collective experiences, and then applying this deeper self- and collective-awareness for positive change.

Background:

To help address food insecurity in Ethiopia, in 2013 the International Potato Center (CIP) implemented an integrated agriculture and nutrition program in two regions, Tigray and the Southern Nations, Nationalities, and Peoples' Region (SNNPR), to promote orange fleshed sweet potatoes (OFSP). Baseline quantitative data collected from communities participating in

the CIP project revealed that 90% and 34% of households in the SNNPR and Tigray, respectively, had experienced food insecurity in the last 30 days. And 100% and 79% of households in the SNNPR and Tigray, respectively, had experienced food insecurity in the last year. These quantitative measures helped confirm community members' and project stakeholders' identification that food security is an issue of concern within the study population, and informed the process of convening stakeholders to come together to address it.

The intent of this study was to create a participatory process for reflection, discussion, and action by households participating in the CIP Nutrition Project. The objectives of this comparative qualitative analysis study were to utilize participatory methods to understand a) what assets households in CIP's project areas use to strengthen livelihoods, b) how these assets are used (by individuals, households, and communities), and the factors that impede or facilitate their use, and c) what subsequent changes result.

6c. Methods:

Narrative analysis, one type of qualitative methodology,[31] informed the design of the survey instruments and data collection, analysis, and reporting processes. Narrative analysis starts with thematic categories and then looks for storied descriptions to inform understanding of these categories. The categories used for this research were the original SLA categories of financial, human, natural, physical, and social capitals. The categories of cultural and political capitals were not incorporated into the discussion guide script, a decision made during the facilitator training sessions. Cultural capital was not distinguished as a separate category due the challenge of using the concept in the Ethiopian context: there are multiple ethnic groups and we did not want to bring ethnicity into the discussions to avoid conflict or perpetuate any discrimination. Political capital was not distinguished as a separate category due to the potential safety risks posed to the study participants in discussing political beliefs and affiliations.

Site Selection: The target audience was smallholder farmer households in selected zones in rural Tigray and SNNPR with high levels of food insecurity, demonstrated by rates of participation in the GoE's Productive Safety Net Programme (PSNP). In consultation with BoA and other implementing partners, *woredas* were selected according to the following criteria:

- Agro-ecology suitable for OFSP and potato production
- Degree of food insecurity
- Degree of malnutrition
- Drought and moisture stress
- Proximity of *woredas* to one another and access to market, with a possibility of selecting a contiguous block (to reduce transaction costs such as transport).

Recruitment of Study Participants: Participants in the community discussions were recruited from among households participating in the CIP Nutrition Project. Local program staff communicated with the BoA administrative office to inform them about the proposed community discussions and request their approval to conduct them. Then, local development agents and Health Extension Workers recruited men and women from among active participant households based on their availability and interest. Twelve group discussions were conducted in six districts (3 in Tigray; 3 in SNNPR) in June-July 2015 (table 26). In each district, two focus groups were held – one for men and one for women – with a total of 98 participants (52% women). Participation was capped at 12 participants per group in order to keep sessions small enough to be more conductive to full participation by everyone. No per diem or other incentive was provided to participants, but snacks were provided. On the day of the community discussions, trained facilitators described the goals and purpose of the discussion session, and obtained verbal informed consent from participants before beginning discussion.

Table 26. Interview participants by category of interview, data collection method, and region

Category of Interviews	**Data Collection Method**	**Interview Participants by Region and *Woreda***	
		SNNPR	Tigray
Beneficiary households	Focus Group Discussion	• Damot Gale • Damot Woyide • Duguna Fango	• Enderta • Hawzen • Raya Azebo

Data Collection: In rural communities in the SNNPR and Tigray regions of Ethiopia, there are low levels of literacy. Story-telling and oral traditions are frequently used. The data collection methods reflected this awareness as well as an effort to respect Ethiopian positions of authority to foster group discourse. Methods included structured **focus group discussions (termed "community discussions" in this manuscript)**, **community asset maps**, and **ripple mapping** (to identify how the CIP project is enhancing important assets in the community), along with field notes and personal observations. Community asset maps and ripple mapping (sometimes termed "ripple effect mapping") are participatory methods used to engage communities in describing their environments, institutions, and assets, and – in doing so – learn more about communities and draw out perspectives that can sometimes be ignored in traditional group discussion settings where more assertive voices can take precedence. Community mapping consists of participants drawing their community, which can raise discourse about how community is defined and physical, social, and political spaces in the community. Ripple mapping shows concentric circles of impact from a central project goal or activity, the resulting changes that occur, and people involved (or not involved) in the process. It is a helpful tool to facilitate civic engagement, voice, and dialogue. In the context of the CIP Nutrition Project, ripple mapping was also used to help the program understand what activities were actually occurring and who was participating in each community to learn if there were gaps in delivery of the project activities, or innovations that were working well in one community that could be shared with others.

Survey Instrument: For the group discussions, trained facilitators followed a semi-structured script that emphasized participatory processes to collect community feedback, including asset maps, pictures, and group discussion. The script was developed by the UW researcher, edited with feedback from CIP, and then implemented by trained facilitators in the local language in the SNNPR and Tigray communities. See Appendix 3 for the script.

Facilitators: Group discussions were conducted in the local language (Sidamaigna and Wolaytaigna in the Southern region; and Tigrinya in the Tigray region). Local facilitators with a college education, fluency in English and the local language, and prior qualitative interview

experience were recruited and hired by CIP, and trained in participatory methods and discussion protocols by the UW researcher. The training was conducted over 1.5 days, and included a training manual, didactic and discussion sessions, and role playing to practice interview techniques. These trained facilitators – in total, four men and two women –followed a semi-structured script that emphasized participatory processes.

Consent: Due to low levels of literacy within the participating communities, participants were asked for oral rather than written consent. For all community discussions, information about the study design and purpose of the discussion was provided at the start of each session. Participants were informed that their participation was voluntary and that the sessions were being conducted on behalf of CIP and/or a local organization. Participants were informed that their decision to participate would not impact the services or resources they received from the program, and that the primary purpose of the discussion was to inform program improvements.

Ethical Considerations: Participating in the study was not viewed as presenting any immediate risks to participants; however, discussing food insecurity can be a sensitive issue. It required trust between the research team and participants as well as among participants so that they felt safe and could be guaranteed their responses would be kept confidential and not be linked back to them. At the start of the community discussions, the facilitators established "ground rules" for participating: all responses would be kept confidential, the information would be used primarily for program evaluation, and information shared should be kept confidential and not discussed after leaving the room. To maintain confidentiality of responses, each individual was given a different number to designate them in the group. This was so the facilitator could refer to them as that number (rather than their name) so the audio recording and subsequent transcriptions will not have personal identifiers. If anyone reverted back to using personal names in the discussions, the translator and transcriber coded the transcriptions with the individuals' assigned number and removed the name from the record. Finally, study participants could refuse to answer any question and were able to leave the discussion at any time. While there were no monetary or other individual incentives to participate, the results

were intended to benefit the communities by informing program improvements to ensure activities were more responsive to community-identified needs and suggestions.

Focus Group Discussion Outline: For the group discussions, facilitators followed a semi-structured script to collect community feedback, including asset maps, pictures, and stories. Table 27 outlines an abbreviated script, and Appendix 3 provides a detailed script. Appendix 4 provides the consent form that was used for facilitators to frame the verbal consent, and Appendix 5 provides the interview schedule.

Table 27. Outline for community discussions in the SNNPR and Tigray

	Outline of Questions and Activities
Part 1: Introductions	• Name and role in community • Tell me why food security is an important topic in your community. • Are there households who experience food insecurity? If yes, how do know? • Are there households who do not experience food insecurity? What protects them?
Part 2: Asset Mapping	• Discuss concept of "assets" • Create community maps that identify places where different types of assets exist: Built*: infrastructure* Financial*: monetary resources or other wealth indicators* Human*: individual knowledge, skills, and abilities* Natural*: environmental* Social*: connections and influence among people, networks, and leadership* • Debrief which assets are most important and who does/not have access to them
Part 3: Ripple Mapping	• Ring 1: What does the CIP Project do in your community? [Activities, Participation] • Ring 2: What change has occurred from these activities? [Impact] • Ring 3: What changes do you want to see in the way the project works? [Feedback]

Data Analysis

Each community discussion was audio-recorded and led by one facilitator, and the second facilitator took detailed notes. Multiple forms of data were collected, including digital audio recordings, field notes, and photographs of the maps made by the communities. At the end of each day, materials (*i.e.,* notes and maps) were stored in envelops numbered by event, recorded in a spreadsheet, and the audio files were transferred from the audio equipment to a digital database. Before leaving, the research team asked the participants if they wanted to keep their community maps. Photos were taken of all maps, and in communities that wanted to keep them, the maps were left as a resource.

At the end of the field data collection period, facilitators translated and transcribed the audio recordings and sent them to the researcher. The transcriptions were read and discussed via email to clarify accuracy and completeness before analysis. The transcriptions were uploaded into NVivo® as a data management tool, but coded manually by two researchers. The analysis started with an overall reading of the transcriptions. Then, categories were generated relevant to the study objectives, using the *a priori* thematic categories of the SLA capitals. The final stage established categories linked to each theme. Responses were analyzed using primarily deductive processes to inform interpretations, exploring where themes aligned and diverged. From these themes, additional sub-themes were coded. For the community asset maps, frequency the categories and types of assets within each category were identified (table 28).

Table 28. Objectives, themes, and axial categories of the study

Study objectives	Themes	Axial codes/categories
Assets used to support livelihoods	Physical	Transportation; infrastructure; market access
	Financial	Livestock; landholdings; employment; savings
	Human	Education; health; risk-taking; innovation
	Natural	Water quality; land quality; biodiversity
	Social	Family structure; types of social institutions
	Political	Participation; decision-making processes
Factors that impede or facilitate use of assets	Individual level	Attitudes; education; health; empowerment
	Household level	Food shortages; size; traditions; gender roles
	Community level	Land scarcity; climate change; leadership;
	Policy level	Collaborations; communication; transparency
Livelihoods changes that result from assets	Stewardship	HH and community resources; distribution
	Economic development	Income; jobs creation; poverty reduction
	Human development	Health services; food security; diets; education
	Environments	Clean drinking water; sanitation; ag practices
	Community building	Schools; public spaces; cultural traditions
	Leadership	Decision-making; governance; gender roles

6d. Results:

6d.1. Defining Assets:

The focus group discussion started with a conversation about assets. Among most of the facilitators, the term “assets” was a familiar concept, as they each had prior government or NGO employment experience with asset-building programs. However, at the community level, it was important introduce the concept and provide a common definition. Recognizing that how a community defines assets reflects their values, relationships, and available resources, the

facilitators probed to understand how communities defined assets. Rather than seeing assets as only individual possessions, communities in both the SNNPR and Tigray tended to see assets in the context of community and interpersonal relationships (table 29).

Table 29. Quotes defining assets from community discussions in the SNNPR and Tigray

Quotes from SNNPR community discussions
"In Sidama, there is a word for asset. It is jiru. A person with a lot of land and cattle is considered 'rich.' But a person is considered jiru if they are generous with others." *"Assets are not what someone has, but what the community owns. The biggest asset is when the community has awareness and knowledge. If the community does not have [these], it can't develop assets. If the attitudes of society change, changes in terms of money and capacity will follow."*

Quotes from Tigray community discussions
"*Life is sustained by assets. To be a good citizen and to have better ideas, you should make use of your assets."* *"Asset means knowledge. There are trainings provided to the farmers, and putting this knowledge into practice is asset. When OFSP was first introduced, [we were told] to plant it. I rejected the idea, but later was convinced to devote a small plot of land to [it]. I then saw change and expanded it."* *"You get an asset or wealth through work. You set a plan and direction. Therefore, an asset is a current direction that leads to change."*

In the SNNPR, definitions of assets tended to emphasize relationships and being able to share generously with others beyond one's own household. In Tigray, definitions of assets emphasized human assets such as knowledge, attitudes, and health as the building blocks for community and national development. Both definitions and views about assets emphasize strengthening not just household but also community and institutional systems.

6d.2. Examples of Assets:

Facilitators explained that one way to classify different types of assets were the categories of built, financial, human, natural, and social. Then, participants were asked to identify examples for each category to ensure they understood the concept, and also to select which asset category they thought was most important to ensure livelihoods in their communities. Quotes from community discussions in the SNNPR and Tigray are listed by SLA category in Table 30:

Table 30. Quotes describing examples of assets from SNNPR and Tigray discussions

Asset Category	Quotes describing examples of assets
1. Physical	*"All [assets] are necessary, but built assets are crucial in a society. We cannot survive if there is no road or health center or school in our village."*
2. Financial	*"Assets are wealth. In old times, camels were assets. But now assets are cows, goats, and sheep. The focus has shifted from number to quality, because new varieties of cattle give more milk and butter, and people are changing."* *"Men and women are getting better incomes and changing their livelihoods. Houses are changing from thatch to tin roofs. We are sending our kids to school."*
3. Human	*"A healthy diet is the [most important asset]. It is the cornerstone for a healthy community and country. It is the source of development for our country. A healthy diet requires balanced foods and clean water."* *"Health itself is an asset. If you have health, it is possible to reach anything. After you ensure health, the cash or livestock you get as a result of work are also assets."* *"The biggest asset is when the community [has knowledge]. If the community does not know, then it can't develop assets. It also needs some entity to let it know [teach it]."*
4. Natural	*"The permanent plants [e.g., trees and* enset*] and vegetables are assets."* *"Water is life. In any place, for a human to lead a healthy life, the availability of clean water is necessary."*
5. Social	*"If the attitude of the society is changed, there will be a change in the social life of the community."* *"A person's way of thinking is the biggest asset. If you develop good thinking, then assets will be accumulated."* *"Challenging ideas presented in public gatherings is an asset."*

Participants did not struggle to come up with examples of assets. However, participants did at times wrestle with categorizing an asset into a single category. Participants from both regions gave examples of how human assets (e.g., health or knowledge) would in turn lead to improved social connections, work productivity, and income generation. Additionally, there was seldom

consensus within groups about which asset category was most important, perhaps signifying the importance to communities of having assets from all categories and no single category being sufficient on its own.

6d.3. Mapping Assets:

Next, participants were asked to work in small groups to draw maps of their communities, first identifying key landmarks. To gain a better understanding of specific assets in their communities and how they were used and accessed, groups were tasked with drawing what assets exist and where they are located. Figures 15a-15d are photos of community maps from men's and women's group discussion. Table 31 summarizes the assets identified by all groups.

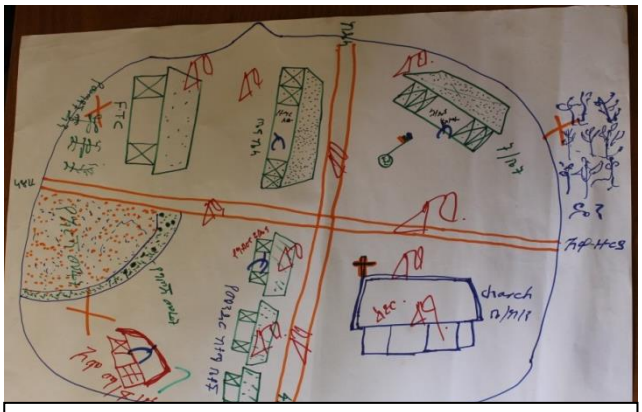


Figure 15a. Community asset map drawn by women. Damot Gale, SNNPR. *Photo: CIP/UW*

Figure 15b. Community asset map drawn by men. Chelekot, Tigray. *Photo: CIP/UW*

Figure 15c. Community asset map drawn by men. Debre Berhan, Tigray. *Photo: CIP/UW*

Figure 15d. Community asset map drawn by women. Debre Berhan, Tigray. *Photo: CIP/UW*

Table 31. Summary of capitals and examples identified by any community discussion in the SNNPR and Tigray, respectively, by SLA category.

Asset Category	SNNPR	Tigray	Examples identified by discussion groups on community maps
PHYSICAL ASSETS	X	X	School
	X	X	Road
	X	X	Churches and Mosques
	X		Market places
	X	X	Health center
	X	X	Farmer Training Center
	X	X	*Kebele* administrative office
	X		Cemetery
	X	X	Mill
	X		Shops (tea, butcher, firewood)
	X	X	Water infrastructure (dams, tanks)
FINANCIAL ASSETS	X		Microfinance institutions
	X	X	Crops (*enset*, maize, *chat)*
	X	X	Trees (fruit and eucalyptus)
		X	Livestock (mules, cattle, oxen, bees)
		X	Livestock products (milk, honey, butter)
	X	X	Money (cash and savings)
		X	Gold
		X	Household possessions (TV, bed, sofa, refrigerator)
		X	Electricity
HUMAN ASSETS		X	Education
	X		Religion
	X		Children's vaccinations
	X		Educated people in community (HEWs, DAs, teachers, pastors/priests)
	X		Community sports
	X	X	Ability to work
	X	X	Attitude/outlook (positive thinking, self-discipline, hope)
		X	Skills/training
		X	Experience
	X	X	Homes
NATURAL ASSETS	X	X	Water (rivers, rain, ponds, natural springs)
	X	X	Trees/forest (indigenous trees, fruit trees, government-protected lands)
	X	X	Land (for grazing, crops, permanent crops, and soil quality)
	X	X	Crops (fruits, maize, coffee, *chat*, *enset*)
	X	X	Stones
		X	Mountains
		X	Wild animals
SOCIAL ASSETS	X	X	Religion
	X	X	Traditional community institutions (*idir, ekub,* women's associations)
	X	X	Marketplaces
		X	Weddings
	X		Shops
		X	Communal grazing land
		X	Farmer associations

Regional Assets: Commonalities

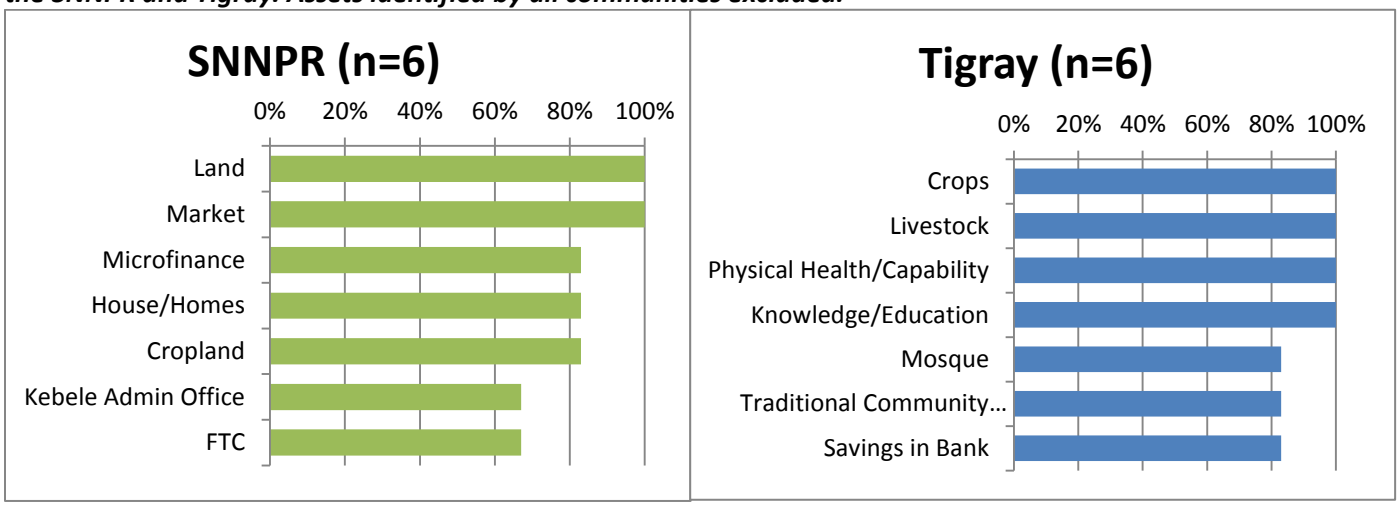
Common assets were identified in both the SNNPR and Tigray. Assets that all focus groups drew and described as important included schools, health care facilities, water infrastructure, religious institutions (*i.e.,* churches and mosques), traditional community institutions (*ekub*, a financial lending system; *idir,* a social support system; and women's groups), trees/forests, and roads. Responses from communities in the SNNPR and Tigray spoke to the importance of health, community infrastructure, and certain social institutions. Community members described what assets were important in these ways:

> *"Built [physical] assets are the basis for the development of the country."*
>
> *"Water is a natural asset. We mentioned earlier that our assets or wealth diminish due to lack of water, because water is life."*
>
> *"We can achieve all other assets if we have human assets. We need to be healthy and educated."*

Regional Assets: Differences

Despite many similarities, there were also regional differences in how communities mapped and described assets (figure 16). Results were also stratified by gender, with no significant differences found between men and women.

Figure 16. Charts describing the most commonly cited assets identified from community discussions in the SNNPR and Tigray. Assets identified by all communities excluded.



Since communities in both regions identified the importance of enhancing assets for individual and community development, it is worth consideration how each region characterized assets. While individual- and household-level factors influence the responses, the different political, historical, cultural, environmental, and economic contexts of each region may also shape this understanding and subsequent responses.

SNNPR: Assets in the regional context

In the SNNPR, unique assets reported include land holdings in general; local markets where crops and food products (*e.g.,* coffee, tea, *tej* (Ethiopian honey wine)) where sold and social interactions happened; microfinance institutions; *kebele* administrative offices; and the BoA's Farmer Training Center (FTC). The SNNPR has a strong root crop culture, and households are familiar with production and consumption of a variety of these crops including WFSP, taro, cassava, and Irish potato. Undernutrition and food security is a challenge in these communities, but it is often driven by lack of nutrition knowledge, seasonal fluctuations in food production and rainfall patterns, a dependence on rain-fed agriculture, and high population densities. Agricultural production yields are constrained by small landholdings, lack of irrigation, and limited technologies. Finally, even though the average household size (6.5 members) is consistent between the SNNPR and Tigray participant households, the majority of SNNPR households have a husband and wife (or multiple wives), which influences labor availability.

One SNNPR community member defined assets as *jiru*, or being generous with others beyond your household. This definition provides some insight into the communal nature of assets in the SNNPR, and how aspects of trust, participation, and enhancing the collective commons are valued and important to supporting livelihoods. Quotes from SNNPR interviews that reflect this:

> *"[We] trust someone who is part of the community, someone who speaks the language. For example, [we] have a close daily relationship with the HEWs, so when they [train], we accept [their teachings]. Kebele leaders and agriculture professionals are all trusted because they are members of the community."*
>
> *"We [i.e., HEWs and DAs] go jointly to the field to teach farmers. People believe what [is taught] because they see it. They participate in demonstrations and taste [the OFSP]. So,*

> *for the second time, they believe what we bring to them. They accept the message and, based on our message, they practice."*
>
> *"We first give training to people that are respected within the society."*

The SNNPR, particularly Wolayta, has a history of innovative, participatory, community-based development initiatives to address food insecurity. In this region, enhancing local governance structures (formal or informal) and building collective capacity of "people the community trusts" and "members of the community" are important for effective and relevant action.

Tigray: Assets in the regional context

In Tigray, unique assets reported include crops and livestock that can be sold for income; individual health and well-being; knowledge and education; mosques; traditional community institutions such as *ekub, idir,* and women's associations*;* and having savings. The Tigray region is known for cereal and livestock production. Production of OFSP and other root crops is low, and consumption of it and other root crops has a negative stigma attached to it as being "poor man's food." In Tigray, factors driving undernutrition and food insecurity are attributed to the following: first, the land has been depleted of nutrients as it has been cultivated for generations. Second, households' labor supply and landholdings have been affected by political instability and conflict with Eritrea. Third, farmers have limited resources and low levels of modernization. Fourth, there are unhealthy cultural traditions and feeding practices, such as numerous fasting days to observe Orthodox holidays and the preferential feeding of men before women/children. Finally, households tend to sell their crops for cash income first rather than consume their produce. While the average household size is the same as that in CIP's SNNPR study population, a much larger proportion (15%) of Tigray households are female-headed. Women's development groups figure prominently in community outreach and mobilization efforts in Tigray, as does integration and coordination with the local *kebele* administration office in order to ensure activities are harmonized with the regional government. Quotes from the Tigray discussions highlight the importance of working within these formal institutions:

> *"Our region is highly resistant to change, especially in food behaviors. Changing the food behavior is highly, highly difficult."*
>
> *"The government now needs a strategy to bring changes in feeding practices. The productivity, between now and old times, is incomparable. But we didn't bring similar changes in nutrition. The gap is in using local resources (foods) to prepare balanced diets. We should improve this."*
>
> *"If we supply [OFSP vines] to the male farmer, it's going to be a cash crop. But if we divert the empowerment to the mother, [it becomes] food."*

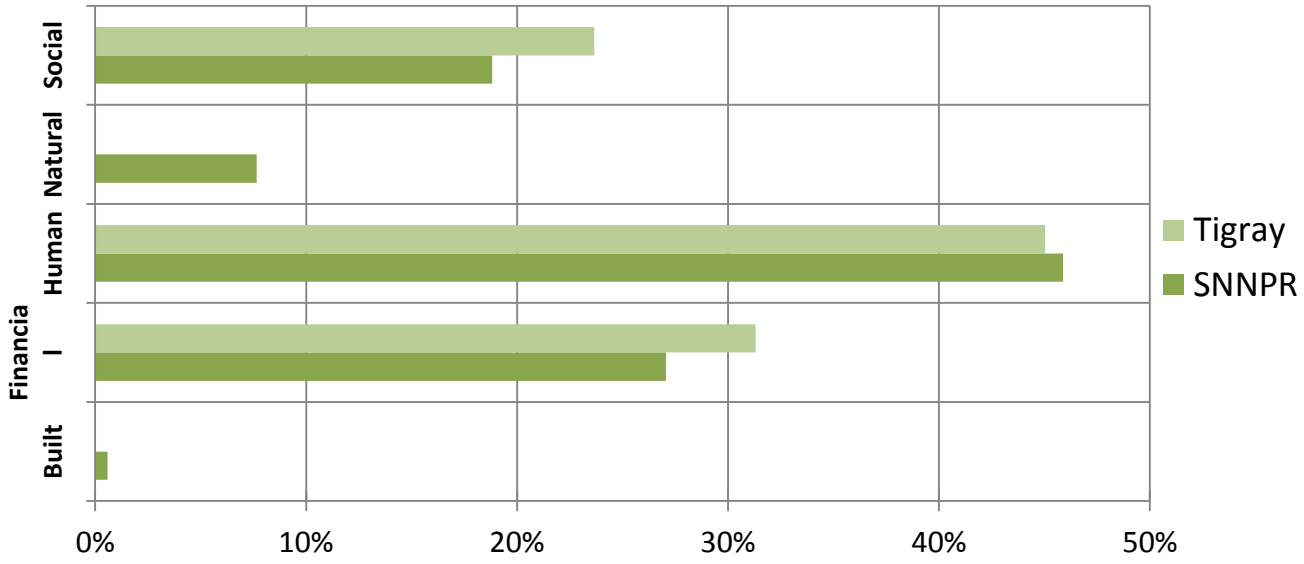
In Tigray, the regional government has invested in irrigation systems to support increased regional food production and, in general, has a strong and influential role in individual and community life. In this region, working in alignment with formal governance structures, strengthening women's empowerment, and enhancing individual assets that "lead to change" are seen as necessary for effective action.

6d.4. Changes in Assets:

The final activity community groups completed was a "ripple mapping" activity. The purpose of this activity was to get community feedback about what kinds of activities the CIP Nutrition Project was doing in their community, who was participating, and the results. By starting with discussion about assets and characterizing the community context, this final activity built both the trust and common language for community members to describe intended and unintended change from a holistic perspective (as opposed to simply reporting what the project was doing).

Communities from both regions spoke about the changes in human assets they were seeing: improved knowledge and awareness about nutrition that led to changes in dietary practices and health outcomes, which in turn led to impacts in the other capital categories. The types of changes reported from community discussions are listed by SLA category in Table 32. Participants reported change in all asset categories except "built," and the category with the most examples of change was "human."

Table 32. Types of change reported as a result of the CIP Nutrition Project from SNNPR (n=6) and Tigray (n=6) community discussions, depicted on the community maps



Quotes from the community discussions describing the kinds of changes, by SLA asset category, they experienced as a result of the CIP Nutrition Project:

Financial *"We have generated income by selling OFSP vines."*
"We cook OFSP as injera, dabo *(bread), and* sauces *and* ***sell*** *them in the market."*
"We are able to ***shorten the food insecurity gap****."*

Human *"A* ***new generation*** *with sharp minds and strong bodies is being created."*
"Our ***children's weight*** *is taken by health workers, and changed for the better."*
*"****Rates of malnutrition and diseases*** *have gone down."*

Natural *"We are planting OFSP next to our homes."*

Social *"We are sharing our experiences with households that are not part of this project."*
"We serve OFSP to guests in our homes."
"Because of these trainings, our community started to eat ***balanced diets****."*

6e. Discussion

One objective of the participatory approach taken by this qualitative study was to allow the SNNPR and Tigray communities to discuss what assets existed in their communities and consider which were most important to them (tables 23 and 24). Notably, when asked how they defined assets and which were important for ensuring adequate nutrition and food security, participants in both the SNNPR and Tigray identified assets that spanned **different**

capital categories and sectors. When asked to identify which category of assets was most important, there was seldom consensus within groups about which asset category was most important, signifying the importance of communities having access to assets from all categories, and no single category is sufficient on its own. Additionally, community groups identified assets at **multiple levels**: individual health and knowledge; household food stocks, landholdings, and livestock; community infrastructure and networks; and government and NGO programs. These descriptions emphasized strengthening not just household but also community and institutional systems. Based on this qualitative characterization of factors influencing community livelihoods, in order to positively influence food security outcomes in these communities, it may be important to consider how interventions impact individuals, households, communities, and influential local institutions.

Another objective of this study was to improve understanding about how households and communities access and utilize assets and, when they do, what kinds of change result. In the past, food security interventions have been criticized for often being driven by outside funding interests and objectives rather than working to respond to and build contextually- and culturally-relevant values, priorities, and assets. By approaching communities as if they need "help," development organizations have not supported local leadership, assuming that effective solutions come from "the outside" and bringing pre-determined goals. Understanding barriers to community food security requires internal knowledge of not only the food security situational context, but also local leadership, decision-making contexts, and priorities.[23, 24] Consideration of a PAR approach – which is grounded in processes that value local expertise – community members and researchers alike can both act as "critical thinkers engaged in a transformative process of identifying relevant issues for reflection and critical analysis."[29] One teacher of action research methodology, Susan Smith, described its transformative potential this way: "when people form a group with a common purpose, investigate their situation, and make decisions to take actions that re-form power and create justice, their reality is transformed. In doing so, they also are transformed."[30]

Working with communities to deliberately foster individual and collective assets can help communities see their surroundings as assets to others, which in turn can inspire recognition about and transformation of the resources and leadership that exist within themselves and their communities.[32] One participant commented about the responsibility each person has to improve themselves and their community:

> *"What should we do in the future? We each have a responsibility. As head of the youth association, I will be role model by planting OFSP… and will also organize youth to grow it. Agricultural experts should continue strengthening their follow-up and technical assistance. Health experts should show us how to prepare foods for healthy families."*

When taking a multi-sector, multi-level approach that draws upon multiple community assets, it's important to expect different types of change to result. (table 33). The question remains then of what kinds of change do communities **want**? Whole Measures is a values-driven planning and evaluation tool designed to help communities and organizations frame and facilitate a collaborative process for food systems community change.[33, 34] It starts with the question, "what do we want our community to look like?" and guides stakeholders through a process of considering the multiple impacts programs can have. This builds ownership and recognizes capacity for creating healthy communities resides in the hands of local leaders[35] rather than perpetuate reliance on external demands. Whole Measures' six fields of practice are justice and fairness, thriving local economies, healthy people, sustainable ecosystems, justice and fairness, and resilience.

Table 33. Transforming community capitals into holistic community impact: recommended indicator categories from SNNPR and Tigray discussions

Characterizing SNNPR and Tigray Communities by Asset Categories		Household and Community Indicators	Impact
PHYSICAL	School; Road; Church/Mosque; Markets; Health centers; Mill; Cemetery; Shop	Irrigation systems Market linkages Improved transit systems Processing facilities for OFSP	**Vibrant Agriculture**
FINANCIAL	Microfinance; Crops; Trees; Livestock; Money; Gold Possessions; Electricity	Income from OFSP sales Farmers selling OFSP at mkts New OFSP products Buyers of OFSP Linkages to credit institutions	**Thriving Local Economies**
HUMAN	Education; Religion; Sports; Vaccinations; Ability to work; Attitude; Homes	Improved diets Improved school attendance Reduced mortality rates Reduced diarrhea rates	**Healthy People**
NATURAL	Water; Forests; Land; Crops; Stones; Mountains; Wild animals	Number of vines distributed Increased production area Training in climate resilient agriculture techniques Water quality	**Sustainable Ecosystems**
POLITICAL	Government offices; farmer groups; women's groups; traditional inst.	Cross-sector steering committees OFSP as GoE priority crop Women's associations	**Justice and Fairness**
SOCIAL	Religion; Marketplaces; Weddings; Shop; Grazing land; Associations	School gardens School feeding programs Women making decisions Farmers share experiences with others	**Resilient Communities**

GOAL: Food security

When considering the community responses of change they have seen (table 32) through the lens of Whole Measures, we can see both **how** the community – combined with coordinated efforts of the CIP Nutrition Project – is transforming local assets into healthy community outcomes, and also **what future impact** communities want to work toward. This can help direct future program efforts toward measuring program impacts in more holistic ways, going beyond the agronomic and nutrition outputs and considering broader community systems (table 26).

The theme of **healthy communities** – healthy people, households, and communities – was described by communities in both regions. As one SNNPR farmer said:

> *"Like getting honey from bees is inevitable, an awakened mind comes from enhanced human health. This can be achieved by accessing and eating a more balanced diet. That is why supporting health is essential."*

All communities have assets, and how they are used brings about multiple outcomes. Granted, some communities have more assets available to them, and issues of equity cannot be ignored. However, even when communities are intentional about how they want to use assets, their health, economic, and environmental outcomes can look very different. One outcome from this study is to use the SLA categories to discuss community assets and how they are used. And to apply Whole Measures as a visioning tool to discuss what kind of food system (and communities, livelihoods, etc.) do communities want. This can help direct food security interventions towards helping communities utilize capitals in ways that lead to resilience and food security, rather than vulnerability and insecurity. One Tigray community member spoke about the value of the participatory methods applied in this way:

> *"Today's discussion was so important that it should continue to help us change our lives. We now know location of our assets and can develop plans."*

The participatory methods used in this study supported community members and researchers being able to speak with a common language about concepts raised during the discussions. It also placed the participants as experts with respect to what was occurring in their communities. The CIP Nutrition project was intentionally designed to be flexible to the different regional contexts, and the benefits of this model are evidenced in the common changes seen across both regions. However, this study provided additional context to how the project was working in response to community priorities. For example, communities in both regions emphasized the importance of ensuring basic needs be met (*i.e.,* health, water, education), but the SNNPR and Tigray groups differed in strategies that could be used to achieve this. In the SNNPR, emphasis was on working at the local/district level through trusted individuals and networks. In Tigray, groups emphasized alignment with government and women's associations. Finally, this participatory approach enhanced understanding about concepts that are difficult to translate

across cultures and languages. When participants can explain important assets within their own communities for promoting health, self-efficacy, and agency, they hopefully can identify ways they themselves can improve their assets and food security status, rather than be the recipients of interventions.

Limitations:

Due to time and resource constraints, not all of the CIP Nutrition Project participant communities were involved in this study. Different communities may have responded differently and having more community input would enhance the data. Additionally, there were six different facilitators. While the same UW researcher trained the facilitators in qualitative research methods and participatory approaches for the group discussions, each facilitator had a different style and perspective, which influenced the consistency of the questions asked. Community members were not randomly selected to participate; rather, a convenience sample was taken based on geographic areas where CIP had worked for a longer period of time and at sites that were willing to participate. All community members were welcome to participate, so the responses may reflect a bias towards those who wanted to offer feedback rather than being representative of the total population. Errors may have occurred both during translation and transcription of the interview and focus group discussion audio recordings. Some of the questions raised – particularly about health and food security status during the focus group discussions – reflect sensitive topics with social stigmas attached. Not all participants may have felt comfortable sharing their thoughts and what was captured may reflect only certain individuals and not the sentiments of the entire group.

6f. Conclusion

Food security interventions that support self-efficacy, foster empowerment, and build social capital have proven successful in reducing poverty and food insecurity. Social capital is just one type of capital communities must mobilize to ensure for food security and well-being. The assets households use to cope and how they are used are influenced by diverse and changing social, institutional, and ecological landscapes; thus, understanding both the assets and environmental contexts can shape the design and evaluation of more contextually-relevant

food security programs. The capacity to solve challenges needs to come from within local communities and be informed by improved awareness of relationships among environmental, social, and economic systems. Participatory approaches to increase assets – ownership, voice, and empowerment at the household and community levels – may present a novel approach that can be adapted to other contexts to gain feedback about how projects can address complex issues in holistic, integrated ways.

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CHAPTER 7: CONCLUSIONS AND IMPLICATIONS

7a. Summary of key findings

Globally, while there has been progress toward Millennium Development Goal targets of reducing hunger and poverty, the change has been uneven between countries and in different regions of the world. Even within countries that met their goals, certain populations are still disproportionately affected by food insecurity and undernourishment persists. Ethiopia is one developing country that achieved its MDG of halving the proportion of undernourished people; however, it is still a long way from reducing the total number of undernourished people and reducing the percentage of households that experience food insecurity on a daily basis. The fragile state of Ethiopia's food security situation was made especially clear in 2015, when vast parts of the country experienced prolonged drought. In a country where more than 80% of the population still depends on subsistence agriculture for their livelihoods, this meant a high proportion of households were unable to feed themselves and their families. The Ethiopian government estimated that 10.2 million people would need food assistance, on top of 8 million people already chronically food insecure. In March 2016, the United Nations estimated that as many as 15 million Ethiopians could suffer acute malnutrition – or worse – in 2016.

When severe drought hits communities, obviously the immediate response needs to be to bring in emergency food aid to help people. While there will likely always be a need for humanitarian efforts to support communities food and nutrition needs in times of crisis, what can be done to ensure communities – in Ethiopia and globally – are more resilient and able to ensure the food security of all in the first place? Numerous studies have highlighted the multidimensional nature of food insecurity: determinants from multiple sectors shape the ability of individuals and households to meet their daily dietary needs to lead full and active lives, and ensuring long-term food security cannot be achieved by any one sector alone. In particular, the question of how agricultural interventions can support improved nutrition has been raised by policy makers and researchers as a priority for the past couple decades. However, how sectors can more effectively work together and what kinds of indicators they can use to measure shared progress is lacking. This study aimed to contribute to this body of knowledge, and more. I also argue that

we don't just need improved and contextually-relevant measures for food security, but we need to rethink what the goal of food security interventions should be. This is why Whole Measures was introduced to consider how the capitals that communities have can be transformed to result in positive outcomes on entire food systems. This is one of the key contributions I hope my study makes to broader program and policy efforts that are calling there to be a "fundamental shift towards diversified agro-ecological farming" that can deliver simultaneous benefits for productivity, the environment, and society (IPES, 2016). This section highlights some of the key findings from this study:

1. ***Households with more assets – and assets from multiple capital categories – are more likely to be food secure***

Households in the SNNPR and Tigray that accessed and utilized greater assets were more likely to be food secure. Prevalence of household food insecurity in the 30 days prior to when the surveys were taken was 59% and 34%, respectively, among the SNNPR and Tigray households. Prevalence of household food insecurity in the last 12 months was 100% and 79%, respectively, among SNNPR and Tigray households. In the SNNPR, households with greater financial assets (i.e., livestock holdings, cell phone ownership, roof type) and a household head with higher education tended to be more food secure than other households ($p<0.001$). In Tigray, households with greater human (i.e., maternal health) and natural assets (location, altitude) tended to be more food secure than other households ($p<0.001$). Multiple economic, environmental, and social factors were associated with food security in both regions. Determining which food security indicators to use, local prevalence, and determinants can help ensure chosen strategies are coordinated and responsive to contextual and cultural conditions.

2. ***Assets important for ensuring food security are driven by local contextual (i.e., land, demographics, wealth, and environmental) and cultural (i.e., feeding behaviors and practices) factors.***

While multiple household assets were associated with food security status, the types of assets and ways in which they were used differed. In the SNNPR, assets important for food security clustered in the capital category of financial assets. In Tigray, assets tended to cluster in the categories of human and natural capitals. Qualitative data were used to help understand the

meaning of assets in the local contexts. One example of this came out of the community discussions, as participants described how assets that previously were important to their households (i.e., camels) no longer were. Rural communities in the SNNPR and Tigray are changing. In the SNNPR, the pressures of population density and lack of available land are forcing family members to migrate for employment in order to earn income to purchase food to sustain their families. In Tigray, the population density is much lower; however, changing rainfall and climate patterns and a fragile environment make the issue of dealing with resource (i.e., water) scarcity a continual challenge to ensure productive agriculture and household food stocks. Additionally, it is a region with strong cultural and religious traditions that affect feeding behaviors/practices and well-being. Prescriptive food security interventions driven by external interests may not recognize these household, community, and environmental factors and how they affect local livelihoods. In contrast, recognizing and adapting programs to respond to these situational contexts may inform more effective action.

3. ***Community as well as household assets from multiple capital categories – financial, human, natural, and social – are important for ensuring food security; however, the types of indicators within each capital category and the importance of each overall category differ between regions.***

Results from the quantitative and qualitative analyses indicate multiple social, economic, and environmental factors shape food security within both the SNNPR and Tigray populations. While the issues that influence food security may manifest themselves at the individual level, they are closely connected with factors at the household, community, and policy levels. Respondents in the SNNPR and Tigray identified both drivers of food insecurity and those most vulnerable to it. The potential causes included water and sanitation issues (e.g., lack of irrigation, clean water, and sanitation practices), land scarcity, lack of productive agriculture, limited nutrition knowledge, population density, climate change, youth unemployment, malaria, gender roles, and lack of credit services. All respondents identified women and children as being most vulnerable to food insecurity. Other characteristics of vulnerable households mentioned include those with small landholdings, limited education, and lack of off-farm employment. Community leaders in both regions described a few shared factors that could help households not worry about food, including the importance of nutrition knowledge,

education, off-farm income, remittances, and equitable intra-household distribution of food sources. In the SNNPR, respondents also noted that having a household member earning income, political affiliation, and access to roads could be helpful to families to provide them with more assets to protect against food insecurity. In Tigray, responses emphasized individual assets like livestock ownership and having larger landholdings. In order to create better nutrition and food security outcomes, food security interventions must confront the multiple social, economic, and environmental factors that influence food security.

4. ***The nutrition indicator of child underweight – one measure used to assess national progress toward the Millennium Development Goal of achieving food security for all – is not associated with food security status in either the SNNPR or Tigray study population.***

Multiple indicators for food security exist, and it is acknowledged that the selection of appropriate indicators should be determined by the research question, resources available, and population of study. Different indicators present different benefits and challenges in terms of application and interpretation, and a couple recent articles (Coates 2013; Jones et al 2013) have noted there may even be potential benefits in using multiple indicators to complement one another. The proportion of children under-5 years of age (CU5) that are underweight is defined as having a weight-for-age Z score greater than two standard deviations below normal on the WHO growth chart. This indicator is used both as a measure of the MDG 1 and also the Global Hunger Index as a way to assess national prevalence and progress towards reduction of food insecurity. This measure is used because it is caused by a range of factors, including insufficient or inadequate food intake, poor hygiene, disease conditions, and sanitation/access to clean water. Child undernourishment and other anthropometric measures provide helpful information regarding the nutritional status of individuals and for making national and cross-national comparisons. However, they require additional resources and expertise for data collection and analysis. Additionally, they necessitate certain information and assumptions about a population.

From my study, we learned that rates of child underweight (34.6%) and HH food insecurity (33.7%) are nearly matched in Tigray; however, in the SNNPR, rates of child underweight (16.1%) and food insecurity (88.0%) do not match. In the SNNPR, the use of child underweight measures would grossly underestimate household food insecurity, and possibly also do the same in Tigray, as households conveyed that they felt rates of food insecurity were underreported at the time of the surveys. Additionally, while underweight can be one potential outcome of food insecurity, it can result from circumstances other than food insecurity. Finally, there is a time lag that occurs between a household's food security status and it impacting a child's nutrition status. Using the measure of food security for both assessing prevalence and evaluating program impact presents multiple methodological challenges.

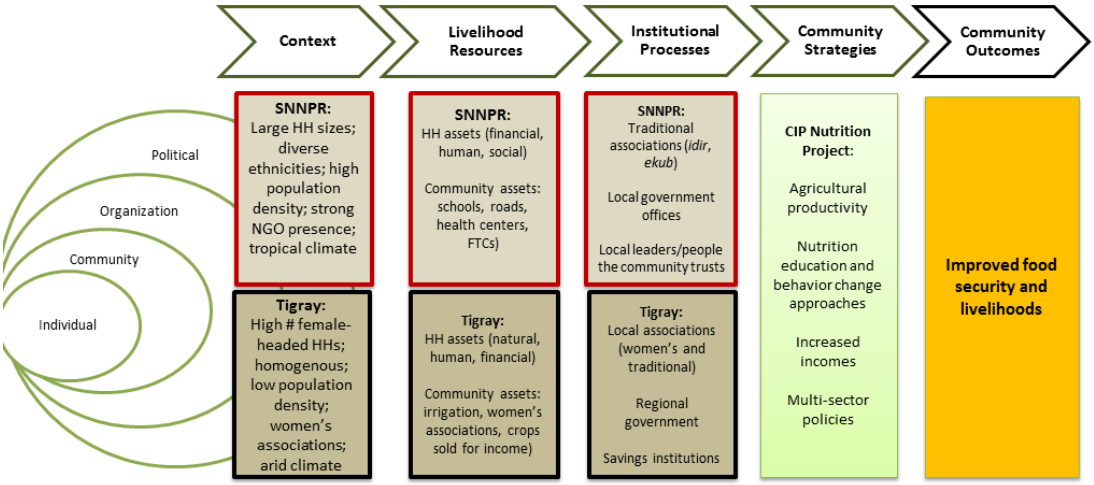
Given the complex relationship between food security status and nutrition outcomes, direct and experience-based measures (like the HFIAS, used in this study) provide certain benefits. First, they provide current or time-bound measures of food security status in order to more quickly identify the most vulnerable rather than waiting for the effects of malnutrition to manifest in nutritional status. Second, they are seen as more simple and a less costly method than other measures (e.g., calculations of prevalence of undernourishment, household expenditure surveys, etc.). Additionally, there are more upstream determinants of food insecurity that show the underlying aspects of it that cannot be measuring using outcome-based measures. Experience-based scales such as the HFIAS were designed to understand specific dimensions of food insecurity, and can inform how it is experienced in a more localized (rather than national or regional) context. It is not that either experiential/direct measures of food security or indirect measures (like CU5) are better than another, but that when to use each measure must be considered in light of what each means and how the information is to be used.

5. ***Use of an ecological livelihoods framework may help improve selection of contextually relevant indicators and inform the design of food security interventions that better enable multiple sectors to work together because, in order to ensure food security, projects must enhance the food systems that support it, which include: productive agriculture, economic vitality, healthy people and environments, and with consideration to justice and equity***

Community members from both regions described multiple government initiatives working to address food insecurity. In the SNNPR, community members described most of these efforts being directed toward emergency food relief and assistance. However, they noted how programs are shifting away from single-sector, emergency relief initiatives to multi-sector projects that build local capacity for sustainable livelihoods to ensure long-term food security. In contrast, in Tigray respondents emphasized the importance of programs that link natural resource management with social and human services, making a very strong case and description of the dependency households have on their natural resource base. These circumstances in both the SNNPR and Tigray provide examples of the importance of cross-sector efforts when designing food security interventions.

Determining which indicators to use, local prevalence, and determinants can help ensure the chosen strategies are coordinated and responsive to contextual and cultural conditions. The SLA is one framework for defining and describing assets important for ensuring sustainable livelihoods. However, the SNNPR and Tigray regions of Ethiopia have unique and diverse agro-ecologies, demographics, and institutions. The integrated SLA/SEM framework (figure 10) that I proposed can improve understanding for how to design and evaluate integrated food security programs. Figure 10 summarizes what was learned about the contextual settings of the SNNPR and Tigray regions, and the next section describes in detail my recommendations to CIP.

Figure 10. Comparison of SNNPR and Tigray context, livelihood resources, and institutional processes, integrated with SLA/SEM model



7b. CIP Nutrition Project: impact and recommendations

Impact:

CIP's activities have brought about change for SNNPR and Tigray communities in multiple ways and at multiple levels. There are various ways to qualitatively consider change, not only changes in terms of SLA assets (as presented on pp 107-8), but also changes in knowledge, attitudes, and practice, in order to work toward the intended outcomes of improved nutrition and food security. I summarized the changes communities have experienced in table 35. In addition to changes in health and nutrition, the CIP Nutrition Project is supporting other positive livelihood changes. For example, many people in both regions reported an increase in income as a result of growing OFSP. To capture these positive changes that are indirectly related to the nutrition goals of the project, my study utilized the SLA framework both because it reflect my study design but also to give communities shared terms for articulating changes they see in themselves, their households, and communities. Change most frequently cited in both regions included increased preparation of OFSP foods, increased income (primarily through the sale of OFSP roots), improved health, and increased dietary diversity. The greatest differences between the two regions were the type and variety of OFSP foods prepared, the reported change in dietary diversity (emphasized in Tigray), and the sale of OFSP vines (SNNPR emphasized use of the leaves). Also, from the participatory feedback from my study and

considering a multi-sector approach, I was able to transform these lessons into specific recommendations for each of CIP's programmatic areas (table 36).

Recommendations:

Given the scope of the CIP Nutrition Project, effective coordination, communication, and mobilization of partner organizations is critical to success. The CIP Nutrition Project has made a difference in the lives of rural Ethiopian communities and, as described from this study's qualitative findings, it is creating positive change in multiple asset categories. From community discussions, there was strong support not only to continue the project, but also expand it to involve additional people within existing communities, reach broader geographic areas, and include urban areas. Despite much progress, there were also challenges in how the project worked, which are important to consider if the project were to be scaled-up. Table 34 outlines suggested changes, and this section concludes with a brief summary of recommendations for CIP.

Table 34. Recommendations for improving the CIP Nutrition Project activities

Capacity building - Within implementing partners (agronomy, nutrition, leadership) - Increase resources to implementing partners - Labs and tissue culture facilities - Cross-sector trainings; increase frequency and length of trainings - Within CIP
Expand project - Involve more men; Urban areas; PLWHA; Youth - Establish geographically distributed seed producers - Better involvement from BoH and BoE
Improve coordination
Strengthen value chains
Incorporate integrated model with kebele-level institutions
Improved M&E system and processes

A. Continue to Build Capacity and at Multiple Project Levels

The CIP Nutrition Project already places a strong emphasis on capacity building. Community discussions highlighted the importance of continuing to build capacity – particularly human and financial assets – both at multiple levels and among different stakeholders within communities. Having this more complete picture of the regional contexts that my study contributed can help CIP adapt its strategies to be more responsive, and engage local leadership toward the goal of

improving food security. However, some responses questioned whether local organizations had the necessary skills and staff capacity to deliver the expected project activities, not to mention the capacity to scale-up if the project were expanded to additional areas. CIP should also continue its focus on capacitating government research facilities with the equipment and resources needed to perform their roles. Finally, there is a need for more capacity for cross-sector collaboration and specific ways for agriculture, health, and education partners to work together (e.g., food policy planning councils).

B. Expand the Project – geographically and scope – but in ways response to local contexts

Despite certain implementation challenges, all communities wished to expand the project because they were already seeing changes in their households: increased agronomic production, improved nutrition, decreased food gaps, income generation, and supportive social networks. The CIP Nutrition Project has made a difference in these communities, and more change could be realized if the project expanded its reach to include new demographics (e.g., men, youth, people living with HIV/AIDS, and urban areas); emphasize geographically distributed seed producers to meet the farmers' production demand; and involve government agencies beyond agriculture (e.g., Bureau of Health and Bureau of Education). However, importantly, before moving into new communities, it is important for the CIP Nutrition Project to ensure the work it started in the original communities has been achieved. This could include adding a "next generation" of trainings that address contextual community constraints to food security – e.g., feeding behaviors, dietary diversity, irrigation, business and cooperative development. Additionally, during the community discussions, I learned that communities recognize they have learned much from CIP about agronomy and sustainable agricultural practices, the importance of dietary diversity, and how nutrition and what foods people consume impact their health, and want to share this knowledge with others. CIP should tap this community leadership and find ways to further incentivize community leaders to have voice and increased ownership in implementing and shaping activities. Activities that communities reported being most impactful and should be expanded include: agronomic activities (i.e., OFSP vine distribution, on-farm workshops, and training about seed multiplication and preservation systems); nutrition activities (i.e., cooking demonstrations, school gardens, mobile kitchens, and

promotional activities and demonstrations at local harvest festivals); and cross-sector collaborations (i.e., local nutrition committees comprised of agriculture, nutrition, and education government staff).

While there was consistency across regions in their desire to expand the project, my study contributed better contextual understanding to know how CIP can make adapt its program regionally to increase effectiveness. In Tigray, the regional government has invested in irrigation systems to support increased regional food production and, in general, has a strong and influential role in individual and community life. Here, it is important to work in alignment with formal governance structures and local women's associations. The CIP Nutrition Project should prioritize capacity-building of government staff, engagement with women's associations and women's cooperatives, and enhancing individual assets (e.g., knowledge and wealth) in Tigray. In the SNNPR, local markets for sales and social interactions, traditional institutions (e.g., *idir* and *ekub),* microfinance institutions, and the village administrative offices were important institutions communities identified. One of the zones where CIP works, Wolayta, has a history of participatory and community-based development initiatives to address food insecurity, and both zones (Wolayta and Sidama) have strong root crop cultures. So in the SNNPR, CIP should work with local governance structures (formal or informal) and build collective capacity of people the community trusts to deliver trainings and education about the importance of OFSP production and consumption, and incorporate behavior strategies where information is disseminated by members of the local community.

C. Improve Coordination and Foster Experience-Sharing Workshops

Overall, most aspects of the CIP Nutrition Project are well managed and coordinated, largely due to strong communication between CIP and community partners, integration with GoE priorities, and an implementation strategy that emphasizes community-level participation. One of CIP's strengths is their ability to facilitate better processes and regular engagement across regions and different actors of the value chain to foster sharing of lessons/failures learned, as well as innovative practices between districts within and across regions. Additionally, continued coordination with the GoE is vital, as participants from both the SNNPR and Tigray could attest.

This might include more multi-sector capacity-building workshops for government staff, involvement at annual work plan meetings, and coordination to get OFSP as a national priority crop (for value chain development).

D. Strengthen Value Chains

One of the weakest aspects of the CIP Nutrition Project is the "food system activities and markets" component of my SLA/SEM model, under the "institutional processes" heading. There are multiple OFSP production constraints and limited market linkages for OFSP growers. OFSP is a relatively new crop in Ethiopia, and lacks an existing value chain and markets for farmers to sell to. Thus, they experience risk and uncertainty in growing OFSP as there are not established buyers and markets. Awareness about OFSP and nutrition needs to go beyond the community level to the regional and national levels, and CIP can play a vital role in bringing together and facilitating discussions among value chain stakeholders. Additionally, farmers need to be able to access sufficient quantity of OFSP vines, at the right planting times, and of good quality; and buyers and markets need to have consistent and reliable supplies of OFSP. This aspect of value chains is also important in light of the quantitative findings. Households from the SNNPR and Tigray experience higher rates of food insecurity at different times of year: months when food insecurity is lowest in the SNNPR are times of harvest and better food security in Tigray, and vice versa. This reflects a broader issue of national food production and distribution issues, bringing into question not only food supply but also what kinds of food processing and storage facilities, distribution, and transportation infrastructure exist. Within the CIP project specifically, this provides an opportunity to discuss how to create a national OFSP value chain strategy to ensure adequate, year-round supplies of OFSP for all regions. Recognizing that regions differ in the timing of seasonal production, CIP and its stakeholders should consider how to build a nutrition-focused OFSP value-chain that can produce sufficient, year-round production and also create value-added products to meet market demand in both regions and other regions of Ethiopia, as well as the greater Horn of Africa.

E. Incorporate Integrated Model with *Kebele*-Level Institutions

Community members – particularly from *kebeles* in Tigray – identified the importance of aligning and better integrating CIP Nutrition Project efforts within existing institutional structures. What those institutional structures are may vary by community, but include organizations such as government offices, women's association, schools, and model farmer networks ("1-to-5", where 1 model farmer is expected to pass on training to 5 additional households). One innovation of the CIP Nutrition Project was to integrate agriculture and nutrition trainings, where agriculture and health extension workers together learn about OFSP. This has helped them learn holistically about the crop but also fostered conversations about ways to work together. This cross-sector training continues in how they pass on their training to community members, as they are empowered to talk about both agronomy and nutrition.

F. Enhance the Monitoring and Evaluation to Reflect Community-Level Impacts

Much positive change has occurred from the CIP Nutrition Project; however, traditional project output measures (e.g., number of people trained) fail to capture what the communities felt to be the most important impacts the project have made. In fact, the traditional output measures were identified as key gaps in implementation (e.g., timing when OFSP vines are delivered). Further, gaps exist between when these output indicators happened (or failed to happen) and when data were collected, leading to delays for when CIP could address them. Improving evaluation methods and processes could ensure improved progress toward nutrition and food security. My recommendations for potential changes include: a) identify a lead monitoring and evaluation field person to relieve some of the burden and responsibility of field reporting; b) incorporate qualitative methods (e.g., case studies) to help capture change and barriers to change that are not captured in quantitative data; and c) train local staff about monitoring indicators to explain and get their feedback on the meaning and value of different indicators.

Table 35. CIP Nutrition Project outcomes and impacts, with participant quotes

Knowledge	Attitudes	Practices	Impacts
Importance of nutrition *The farmer used to sell milk, honey, and meat… due to poor attitudes toward nutrition. They only focused on getting money. Now they understand that nutrition will bring holistic change to their livelihoods.*	**Food taboos** *We had a negative attitude towards eating OFSP in general; it was not recommended for men. It was thought that consuming OFSP could make a man physically weak and lose [sexual] energy.*	**Distribution of OFSP vines** *I observed many trained women promoting growing OFSP in the community, and engaging in OFSP vine distribution.* *We will continue promoting how farmers can preserve the planting material for next year by themselves and share with their neighbors.*	**Improved maternal and child health** *In the past, it was common in our village for many pregnant women to be sick and have health-related problems during delivery. But I have witnessed such problems are drastically reduced. Now they deliver healthy children without problems. One of the possible contributors could be the nutrition education and eating OFSP.* *My children become healthy when I feed them OFSP. We hope the change will continue.*
Health benefits of OFSP *We know that eating OFSP is useful to protect us from night blindness and good for our mental development.* *OFSP is good as food and good for health. It provides Vitamin A to children and mothers*	**Eating behaviors** *There has been a change in the attitude which, previously, was to wait for the husband or father to eat. Now they [women] are eating on time [with the family]. It is a big change.*	**Increased OFSP production** *When this project started, we [farmers] received training. Through this training, we learned [the OFSP] production system.* **Increased OFSP consumption** *I learned the cooking process from [the focal person] and apply it in my house.*	**Improved built infrastructure** *When the income gained from OFSP is spent on infrastructure, we developed built assets.* *From CIP, we have received much assistance, starting from chemicals, sometimes water, and the establishment of net tunnels.*
Agronomy of OFSP *When this project started, we received training [about the OFSP] production system. The agricultural experts explained how to plant OFSP, the depth of the OFSP vine, and so on."*	**Practical, hands-on training** *They promote using different mechanisms, which are really effective in changing people's minds. Now, OFSP is popular in our project* woredas.	**HHs consume more diverse foods** *In the past, there were problems [like] deaths due to the absence of nutrition or balanced diets. Now there are at least no child deaths.* *When we see what changes have come as a result of the project, we identified [one as] the society started to eat a balanced diet.*	**Established OFSP quality seed system** *Areka's tissue culture lab has gained very good experience. [They] will help us commit more activities to community development.*
Value of multidisciplinary approach *Our HEWs and DAs go jointly to the field to teach farmers.* *Starting from the regional level, there is a committee that collaborates: the Bureau of Agriculture, the women's association, and women' affairs*.	**Sharing OFSP benefits** *It's considered more common to find farmers talking about OFSP.* **Consumer demand for OFSP** *Demand for OFSP – and its vines – has increased.*	**HHs generate income** *We are benefitting. We sell it and earn money.* **Formation of nutrition task force committees** *The purpose of the task force is to avoid duplication, share [who] is implementing in which district, and what types of activities.*	**Improved food security** *These [CIP] activities have helped the society be self-reliant and the number of food secure households is increasing.* **OFSP helped HHs bridge food security gaps** *[OFSP] matures in a short period of time. We use both the OFSP root and leaves for our consumption as well as for animal feeding.*

	Lessons Learned	Recommendations
Agronomy and Farming Systems	• OFSP is valued for nutrition and health, but it's uncertain if OFSP's **economic potential** is valued enough **to scale-up production** • Multiple **farming challenges** exist: lack of irrigation; small land-holdings; risk of planting OFSP without markets • Women plant OFSP in **kitchen gardens** for nutrition and sales • **Schools** plant OFSP for meals, education, and distribution	• Improve understanding of costs/benefits to farmers to grow OFSP • Support regional steering committees to coordinate OFSP supply and demand issues • Build capacity of DAs/BoA to deliver OFSP trainings on agronomy, irrigation, and financial topics; enhance cross-sector approach
Nutrition	• **Food behaviors and customs differ** between the SNNPR and Tigray region, and reported changes also differ • Communities like the **participatory implementation strategies**, • Communities now know benefits of **dietary diversity** • OFSP is popular among **youth**, and perhaps will lead to change for the next generation	• Compare qualitative feedback with quantitative survey data to confirm if reported dietary patterns are indeed changing • Consider expanding OFSP model to other crops (dietary diversity) • Explore how to address seasonal availability issues, and cross-regional and value-added opportunities • Support school gardens and feeding programs
Value Chain Develop-ment	• The CIP Nutrition Project works at each step of OFSP value chain • Stakeholders are involved at each staep; however, **capacity gaps** exist at stages of transportation, processing and packaging, and markets • Farmers are currently **unwilling to buy OFSP vines** so there is not adequate demand for DVMs to supply OFSP planting materials	• Facilitate experience-sharing along the entire OFSP value chain, taking lessons from within and outside of Ethiopia • Continue working to ensure OFSP is a priority crop of the GoE among all regions • Support women's microenterprise groups
Cross-Sector Partnerships	• Alignment with multiple levels of the **Government of Ethiopia and other governance institutions is** important • Cross-sector partnersrhips have a shared vision for change, but **need processes for planning and implementing joint strategies** • Shared and integrated processes are happening at **local levels**	• Facilitate greater regional and national GoE awareness and support for OFSP; highlight multiple benefits (i.e., nutrition, health, social) • Foster woreda- and regional-leval steering committees • Continue utilizing FTCs as demonstration and training sites • Explore traditional and non-traditional (e.g., private sector) partnerships to address key constraints (i.e., irrigation)
Scaling-Up	• **Activities are integrated across sectors** and disseminated using local, **trusted** experts • **Participatory methods and action research** can help identify contextual issues with local solutions, helping level power between farmers/research • Need improved **communication mechanisms** among stakeholders • Improve evaluation methods and processes	•Better assess and manage implementing partner capacity and staff turnover to ensure consistency and qualiity • Increase CIP involvement in local monitoring and evaluation • Expand and diversify program activities, building food systems activities and livelihoods •Continue participatory methods for collecting community feedback

7c. Study implications – food security programs and policies

Effective measures are needed to assess not only the prevalence and determinants of food insecurity, but also to guide design of programs and policies that ensure more effective programs. Traditional indicators for food security are often discipline- and project-specific, and do not address a broad range of multi-sectorial indicators. Thus, programs often miss key elements of drivers and barriers to food security and fail to incorporate these to ensure success of programs. Additionally, agricultural policies are often driven by goals that do not consider community contexts or multi-sector outcomes. However, creating more responsive policies would require intention (e.g., informed knowledge about systems' interactions) and additional resources (e.g., funding mechanisms) to do so. My study contributes to improved understanding of the local factors that influence food security status in two regions of Ethiopia to inform a specific food security project working to address nutrition and food insecurity; however, it has impact and application for national policies in Ethiopia and other countries and development contexts as well.

First, my research employed a traditional SLA approach – to consider multiple livelihoods factors that influence household food security – but expanded and modified it to include and ecological systems framework to better understand the contextual factors and local institutional processes. One of the strengths of this model is that it allows programs to visualize how a program is working within a broader set of contextual and environmental settings, and brings in a more comprehensive and descriptive understanding to see potential gaps in how a program is working. Second, I presented a novel methodology to characterize the prevalence and predictive factors of food insecurity by not only combining quantitative and qualitative analyses, but also contributing an innovative approach for stakeholder engagement. This innovation may improve identification of food insecure households and local factors that inhibit or support food security, which can be used by stakeholders and policy makers to ensure interventions are contextually relevant, work across sectors, and enhance community participation. Third, this study's comprehensive approach of including community participation added local perspectives that are often ignored in traditional evaluation methodologies, which

either focus solely on quantitative data or collect qualitative data using processes that prioritize the voices of the traditional leaders, those in authority, or who have more assertive voices. Fourth, my study advanced the use of ecological systems theory into the design and evaluation of multi-sector food security interventions. Integrating an ecological approach to the SLA model may support a more holistic set of actions to build upon local household, community, and organizational assets, which in term may improve program effectiveness and decrease dependence upon external aid. Finally, stakeholder participation – at household, community, and organizational levels – was used to inform the design and selection of program indicators. Food and agricultural policies should set a vision – in collaboration with community and stakeholder feedback – for what kind of impact they want to achieve, and do so in ways that consider the multiple ways that food impacts communities (e.g., economic, health, social, environmental outcomes).

I next highlight important implications from this study, first in the context of the CIP Nutrition Project and, second, to national policy efforts.

Implications for the CIP Nutrition Project

1. ***Select and monitor indicators of food security that reflect local factors that influence it and at multiple levels***

It is recognized that measuring food security is challenging for multiple reasons, including selection of meaningful indicators, methodologies, and implementation constraints. When evaluating the CIP Nutrition Project intervention, two specific evaluation challenges emerged: first, there are multiple factors that influence food security, and it is unrealistic for a single project to address all of those issues. Second, there is limited impact that can feasibly be achieved within a 3-year time period. Given time and attribution constraints, the CIP Nutrition Project and other interventions must reflect upon and consider what kind of indicators may be most meaningful to determine whether project goals were accomplished. In addition to monitoring project outcomes, another contribution of my ecological SLA model is improved characterization of the “local drivers of change” that contributed to program impact to know

whether findings can be generalizable to other settings and the intervention strategies should be scaled up to other contexts. From the quantitative findings, we learn that multiple factors – some shared, some different – are associated with food security in the SNNPR and Tigray regions. This could indicate a couple things: first, multiple factors are important for ensuring food security, and no single asset alone makes a difference. Second, the significance tests across the three categories show the direction of relationships, with some being not surprising (e.g., more secure HHs had more cattle) and others, surprising (e.g., more secure HHs had more children, while other studies have the found opposite to be true). This was also important for me to characterize because these communities – from their own descriptions and what we know about Ethiopia as a country – are changing. These trends in how indicators are associated with food security status will be important to compare over time. While these factors are beyond the scope of the CIP project and therefore any change would be difficult to attribute to the project intervention, they are helpful contextual factors to inform program design.

What my study also contributed was important descriptive contextual information that the household surveys missed entirely. Qualitative findings revealed key local behavioral (feeding practices; nutrition knowledge), environmental (limitations to expanding land size), and cultural (religious fasting requirements) factors that shaped food security. Additionally, communities described important factors at multiple levels that were affecting food security, information also not available from the quantitative data alone. These included individual knowledge, innovation, and health; community infrastructure and networks; and government and NGO programs (see Chapter 6). What my study contributed was not only contextual understanding of individual and household assets important at a single point in time for ensuring food security, but also community and cultural factors that are important over time.

After completing this study and having improved understanding of the local factors that influence food security status at multiple levels, I created a revised logic model for the CIP Nutrition Program (figure 18). This logic model indicates the kinds of activities, intended outcomes, and impacts occurring at multiple levels. This logic model still employs a linear

pathway of change, while incorporating multi-tier (i.e., first column, "change level") and multi-sector outcomes (i.e., last column, "impact"), which includes improved agricultural outputs, health and nutrition, economic gains, improved ecological systems, and cross-sector policy initiatives.

Figure 18. Multi-level logic model for CIP-Ethiopia Nutrition Project

Change OFSP production and consumption knowledge, attitudes, and practices

Change Level	*Activities*	*Outcome Indicators*	*Impact*
Individual	- Education and trainings - Consumption habits	- % increase OFSP growers - % increase diverse diets	Improved nutrition & health
Household	- Production area - HH gardens	- % OFSP yield increase - # HH gardens - % increase IYCF practices	Improved HH food security
Community	- Field days - School gardens - Markets selling OFSP - Health post vouchers	- # participants - # school gardens - # markets - # radio broadcasts	Improved OFSP access within community
Organization	- Demonstration sites - DVMs and Processors - Promotion - Stakeholder workshops	- # sites - # multipliers/*woreda* - # processor partners - # OFSP products	Productive OFSP value chains
Environment	- Biophysical conditions - Climatic conditions - Action research	- # farms rotating crops - % HHs with irrigated plots - Increase irrigated land	Enhanced environment & crop yields
Policy	- Regional nutrition TF - OFSP as priority crop - Cross-sector priorities	- # policy roundtables - # sectors represented at stakeholder meetings	Improved cross-sector coordination

Enhanced livelihoods and food security

2. ***Adapt evaluation tools to be more responsive to the kinds of data that should be collected to determine whether food security interventions are contributing to positive community outcomes***

At the start of my study, both CIP staff and I understood that food security varied across regions and was frequently shaped by seasonal rainfall and harvest patterns. My study was able to describe this variation to characterize food insecurity prevalence for specific times in the last 12 months (Chapter 5). Initially, I had planned to collect seasonal household data to evaluate changes in OFSP production, dietary diversity, and experiences of food insecurity. However, the resource requirements and time commitment this would have placed on households were too

burdensome to realistically carry out, a common constraint of development organizations. What my study offered to the CIP Nutrition Project was a local solution to this challenge that also expanded the evaluation framework in ways that were responsive to contextual factors. First, the quantitative analysis was able to determine specific indicators that showed association with food security status. This information was used to design shortened annual surveys (rather than semi-annual) that targeted key household information, reducing page length from 30 to 10 pages. This way, we could still capture specific and annual quantitative measures of change between baseline and endline, but reduce the burden on households. . Second, to collect changes that were occurring in communities and organizations, I created a semi-annual qualitative questionnaire. This feedback was collected every six months from local health extension workers, agriculture extension agents, and implementing partner staff (i.e., Enga le Enga, Mums 4 Mums, etc.) to learn what was (or was not) happening at the village and district levels in terms of program activities broadly, and market and environmental factors (e.g., rainfall patterns) specifically. Third, I created a school garden survey. From the formative assessment and community discussions, I came to realize how important schools were seen to the communities. CIP was already distributing vines to schools, but did not have evaluation tools or ways for capturing outcomes and impact from the school garden program.

3. ***Incorporate methods and measures that collect qualitative data to capture impact, particularly at the household and community levels***

The CIP Nutrition Project – like other food security interventions – needed to balance the demands of their funding agency with community and stakeholder priorities. While the funder had a set of pre-determined targets and outcome measures important for them to capture, these measures were not necessarily important to communities or of shared importance across communities. Methods for collecting qualitative data are needed to better capture change that quantitative methods cannot, particularly during time intervals between larger and more comprehensive baseline and endline questionnaires. While quantitative approaches may provide relevant and important data, they can fail to explain why a food security intervention is (or is not) working. As mentioned in the previous section, I created new qualitative tools for the

CIP Nutrition Project in order to capture changes occurring at household and community levels, and with consideration to the SLA categories. The quantitative analysis of my study took an empirical approach for quantifying the prevalence and drivers of household food security across two regions of Ethiopia. However, multiple demographic, social, and community characteristics are important in influencing household food security. One unique contribution of my study was to create the ecological SLA model to collect descriptive information about demographic, social, and community characteristics to consider how these factors might explain some of the quantitative findings and apply this information to inform how the CIP Nutrition Project may be adapted to each context.

For example, the Tigray region is characterized as being more arid, a cereal- and grain-producing region, having a strong centralized government, and being more homogenous in terms of language, religion, and ethnicity. About 81% of the population is rural and depends on subsistence agriculture. What the participatory analysis helped us better understand was how these broader contextual factors were influencing and shaping household nutrition and food security. For example, we know Tigray has a large number of Orthodox believers, and this impacts nutrition and food security by the Church's fasting requirements (over 200 days/year). Additionally, Tigray has strong, hierarchical structures tied to the government, and this impacts nutrition and food security because community members felt it important that those teaching them about nutrition be recognized by these government channels (e.g., development agents, health extension workers). The SNNPR, in contrast, is more tropical, has greater emphasis on root crops and livestock production, and is very diverse in language and ethnicities. Excluding urban regions, the SNNPR has the highest population density in the country, estimated at over 160 people per square kilometer, but with rates estimated to be as high as 800 people per square kilometer in one zone. Like Tigray, the majority of the population (nearly 90%) is rural and depends on subsistence agriculture. Unlike Tigray, the environment is somewhat more conducive to agriculture because of two rainy season cycles and somewhat better soil conditions. The SNNPR has an environment conductive for growing root crops, but with this tradition comes resistance to change and consume OFSP to diversify diets because households

are familiar with the white-fleshed variety. Additionally, there are large households in the SNNPR, and the land tenure system is set up in such a way that parcels are continually divided into smaller plots to the male son, thus reducing households' production of household food stocks and leading to other strategies (e.g., off-farm employment) to provide food for families.

4. ***Engage stakeholders – community members, organizations, and policymakers – in the entire process of program planning, implementation, and evaluation***

Understanding barriers to food security requires knowledge of not only the community's situational context, but also the governance structures, local leadership, privilege, and decision-making contexts. Participatory Action Research (PAR) is a collaborative process that involves participants and research in the study process. Using a PAR approach – which is grounded in processes that value local expertise – community members and researchers alike can work together to identify relevant issues, the local factors that facilitate and inhibit processes, and evaluation of efforts. When applied to the CIP Nutrition Project, PAR and other participatory approaches have the added benefit of helping ensure stakeholder investment in the process over the long-term, and that voices sometimes excluded from intervention and decision-making processes can be heard.

In my field of public health, defining the community is a key and initial step in designing program and evaluation plans, because programs designed with community input and involvement are more effective. However, when community participation becomes part of program design and evaluation, issues of how to define a community, stakeholder participation and representation, local leadership/power structures, and decision-making processes must also be considered. I continually had to reflect upon my own assumptions about community, culture, and social norms throughout the design, implementation, and analysis of this study, as well as those of the community members and other CIP project stakeholders. In the context of my proposed SLA/ecological model, "defining the community" can be viewed partly as the step of describing the context. Despite having previously worked with Ethiopians and having some familiarity with their culture, I had only selective understanding of community, cultural,

linguistic, and gender contexts, and from a different area (Addis Ababa) of the country. This awareness influenced my rationale to conduct the formative assessment, as I had implemented similar rapid appraisals during my Peace Corps service to improve understanding about defining "community." While the formative assessment results helped characterize CIP's programmatic context, it also helped me better understand important community (e.g., cash income society, migration patterns) and gender (e.g., maternal health and nutrition) factors. During the quantitative study design, I included processes to ensure the methods used were respectful of and responsive to these contexts (e.g., avoid implementation of HH surveys during fasting season). It also meant adapting (e.g., wealth proxies rather than income) or removing altogether (e.g., ethnicity, religion) questions that would provide helpful information from a scientific study perspective, but would make respondents uncomfortable or possibly put them at risk. Finally, I learned that males would be deferred to for answering the household surveys and it would be uncommon for men/women to answer together. But studies have shown the important role women play in prioritizing household resources for nutrition and health. So I intentionally designed the individual surveys to collect data about women and children to try to ensure women's voices were heard in the responses.

For the qualitative methods, I had additional community considerations to keep in mind. The qualitative methods I used for my study reflected my awareness and respect for Ethiopians' traditions of story-telling coupled with the challenges of fostering group discourse. In the rural communities of the SNNPR and Tigray regions of Ethiopia, there are low levels of literacy and people tend to identify themselves strongly with their ethnic affiliation. Groups in these regions tend to employ story-telling and the use oral tradition to communicate ideas. Additionally, issues of power and privilege exist within the community and between the community and researcher, and it was important to be aware of this; however, an in-depth analysis of power roles and dynamics were beyond the scope of this study. Finally, I wanted to better understand the lived experiences of food insecure households, a vulnerable population with past experiences of being removed from decision-making processes. The methods for collecting research data can be intrusive, requiring trust, confidentiality, and vigilance to ensure no risks were assumed by participants. It required effective relationships – like the ones already

established by CIP – with the participants and local community members and empowered and competent facilitators to ensure accurate and quality data were collected. I ensured this by working with CIP to train the facilitators, giving them role play exercises and discussing issues of how to employ respectful methods and approaches to engage community members to support confidential and open spaces for the community discussions.

5. ***Build community and institutional assets, rather than solely focus on conducting household-level activities***

When SNNPR and Tigray communities were asked how they defined assets and which were important for ensuring adequate nutrition and food security, participants in both regions identified assets that spanned different capital categories and sectors. When asked to identify which category of assets was most important, there was seldom consensus within groups about which asset category was most important, signifying the importance of communities having access to assets from all categories, and no single category is sufficient on its own. Additionally, community groups identified assets at multiple levels: individual health and knowledge; household food stocks, landholdings, and livestock; community infrastructure and networks; and government and NGO programs. These descriptions emphasized strengthening not just household but also community and institutional systems. Based on this qualitative characterization of factors influencing community livelihoods, in order to positively influence food security outcomes in these communities, it may be important to consider how interventions are affecting and enhancing assets for individuals, households, communities, and local institutions. This requires a detailed understanding of the local context, processes and time spent understanding different types of localized assets within each capital category, and effective relationships and trust built to be able to facilitate a process for communities to come together and articulate their thoughts and vision for what they want their communities to look like. Certainly, these issues of time, resource capacity, trust, and relationship-building are significant and not all organizations with have the human or cultural capacity to implement this. Table 33 presented a table for what this might look like, using the CIP Nutrition project as an example, and a detailed list of CIP Project indicators using this framework is included as Appendix 6.

Implications for Policy Initiatives

National priorities and policies have direct and indirect impacts on decisions made by citizens, and this is especially the case in Ethiopia given the strong and centralized role of the GoE. One of the challenges faced by food security interventions – particularly the CIP Nutrition Project – is how to design a program that is both responsive to the priorities set by the political governing structure while also considering the interests and concerns of local stakeholders, especially under circumstances where the two groups' interests may conflict. In consideration of this, this section highlights important implications from this study as they relate to national policy efforts.

1. ***Support multi-sector, multi-level food security initiatives***

The FAO's 2015 *State of the World* report recognizes that economic growth is not enough to ensure improved and equitable progress towards global food security targets. Diverse stakeholders influence food security, and the relationship between national economic development and food security still needs to consider issues of behavioral and cultural practices, women's participation, social and economic disparities, food quality, environmental conditions, and political stability. Determinants of food security are diverse and interconnected, requiring multi-sector strategies, just like those already being promoted by Ethiopia's National Nutrition Program. Approaches should also be multi-level, working at the local, regional, and policy levels to enhance assets at each level. Multi-sector, multi-level approaches to respond to the challenges of food and nutrition insecurity may offer a more effective solution than single-sector approaches. A multi-sector, multi-level approach may help ensure efforts are both responsive to the community context, and work with local leadership so that change can be coordinated across multiple projects and continue beyond the timeline of single projects.

How can the GoE support improved collective impact from multi-sector, multi-level food security interventions? Potential considerations include the following: the GoE has already established ensuring nutrition and food security as a federal policy that spans sectors and works from the federal down to the village levels. One lesson from this study's qualitative analysis of

how the CIP Nutrition Project is working was that, while regional and federal levels of government are critical for establishing strategic goals and objectives, their staff are often too removed from contextual circumstances to effect change. Instead, what was important was building human assets and the capacity of local institutions, both local government (be they development agents (DAs) or health extension workers (HEWs)) and traditional institutions. In the SNNPR, these local institutions include traditional savings and funeral groups (*ekub* and *idir*), as well as FTCs and health posts. While in Tigray, local institutions include women's associations, district government offices, and savings associations. It may be helpful for the GoE to consider enhancing capacity of these institutions to improve coordination and help ensure community change continues beyond the timeline of single, short-term projects (like CIP). Additionally, the GoE has created structures starting at the regional down to the district levels to address the challenge of nutrition, but require more capacity to improve their ability to coordinate and lead community efforts. One key constraint government offices face is frequent turnover of staff – from the BoA and BoH in particular, and from the regional down to the village levels. This results in inefficiencies, as it limits institutional knowledge about what has (and has not) worked and the ability of GoE to be integrated into program activities. Additionally, there are inter-institutional communication and rivalry barriers that can limit communication and coordination of activities at all levels. How can the GoE address this? In Central America, *Sistema de la Integracion Centroamericana* (SICA), through its Regional Food Security and Nutrition Programme for Central America (PRESANCA), has come up with a local solution to this constraint of enhancing capacity of rural community and government leadership in food security programs. They are collaborating with regional universities to offer a practical graduate degree program that focuses on training local leaders in designing, implementing, and evaluating food security interventions that are targeted to their communities. While still relatively new and – to my understanding – not yet analyzed, this program highlights the importance of finding innovative solutions for building local leadership capacity across institutions to address complex, multi-sector issues, rather than focusing solely on external organizations to fill that gap and leave perpetual gaps when they are done. Consideration of such a capacity building training program for the Ethiopia context might offer the dual benefit

of not only graduating better trained government staff, but also enhancing their professional development to incentive them to stay for longer periods of time in rural regions.

2. ***Strengthen stakeholder participation – from the community to the policy levels – in the design and evaluation of food security policies and programs***

Brazilian educator Paolo Freire wrote about the value of community participation and consciousness-raising as tools for building empowerment, particularly within communities faced with poverty and food insecurity. When applied to food security programs, this process starts with developing consciousness about one's lived experiences, engaging in dialogue with others about collective experiences, and then applying this deeper self- and collective-awareness for positive change. Including stakeholders in the design, implementation, and evaluation process – using participatory methods – can improve contextual awareness of local and national governance and decision-making processes.

My study findings indicate how contextual the drivers of food insecurity are in Ethiopia, and national policies and priorities may not be as effective in addressing the true drivers of food security as regional and localized policies could be. In Ethiopia – as in most if not all countries – no single sector handles all programs and regulations related to food and its multiple effects on communities and nations. In part due to growing awareness of this gap, there is greater recognition of the importance of improved coordination of food-related policies. However, such policy initiatives that are both coordinated across sectors and driven by participatory, community feedback come at both a financial and human resource cost. One solution employed in the U.S. to address this is the food policy audit. The food policy audit is a tool used by cities and other municipalities to aggregate information about food programs and initiatives, often involving stakeholder participation from diverse perspectives (e.g., agriculture, health, business, transportation, etc.). It is also used to identify gaps and opportunities to design future activities that can be managed by a local coordinating body, such as government. While the audit tool has primarily been used in the U.S., the broad categories of equitable food access, zoning and land use, economic development, and public health offer some broad categories

and structure for consideration of how to improve what the government and other agencies are going to strengthen not just food security, but local food systems.

3. ***Set expectations for food security interventions to be responsible for achieving multiple outcomes that support the systems important for ensuring food security, such as productive agriculture, economic vitality, healthy people and environments, and with consideration to justice and equity***

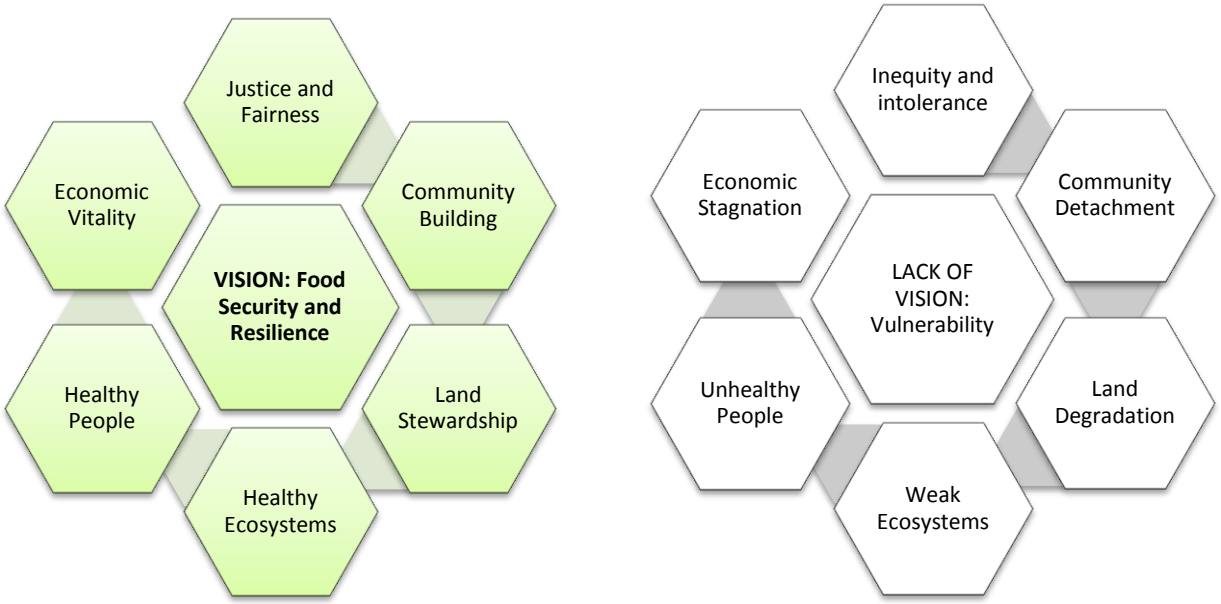
Some countries have been successful in addressing and reducing rates of food insecurity. The FAO attributes these successes because countries not only improved incomes and reduce poverty rates. Rather, investments and efforts were made across sectors toward a larger, shared vision for improving national food security and nutrition. Additionally, for agriculture to positively impact nutrition, agricultural interventions may need to consider measures of success beyond agricultural productivity and income generation, and move into other areas of impact. The SNNPR and Tigray communities identified food security as a challenge driven by multiple factors in their communities. However, they also described it as just one set of challenges they face. Issues of clean and adequate water, education, employment, family planning, land access, and productive agriculture were also all raised as important. One planning and evaluation used to design food security projects in the United States is called Whole Measures. Whole Measures has been used to frame and facilitate a collaborative process for community change, guiding participants through the multiple impacts food security interventions can have. All communities have assets, and how they are used brings about multiple outcomes. Granted, some communities have more assets available to them, and issues of equity cannot be ignored. However, even when communities are intentional about how they want to use assets, their health, economic, and environmental outcomes can look very different. One outcome from this study is to use the SLA categories to discuss community assets and how they are used. And to apply Whole Measures as a visioning tool to discuss what kind of food system (and communities, livelihoods, etc.) do communities want. When applied to Whole Measures' six fields of practice, Table 33 presented a model for how identification of capitals at multiple tiers

of influence can be transformed to thinking about how to use these assets to support strengthened community outcomes. This can help direct food security interventions towards helping communities utilize capitals in ways that lead to resilience and food security, rather than vulnerability and insecurity. One Tigray community member spoke about the value of the participatory methods applied in this way:

> *"Today's discussion was so important that it should continue to help us change our lives. We now know location of our assets and can develop plans."*

Figure 17 presents another way to visualize how to apply Whole Measures to inform the design of food security programs by contrasting two models of food systems: the one on the left is where community capitals are transformed into positive Whole Measures outcomes, and the one on the right is where they are not.

Figure 17. A Whole Measures framework for transforming community capitals to improve livelihoods



7d. Areas for further research

One question I wanted to explore when I started this research was whether agricultural interventions could be used to not only improve food security, but contribute to other community benefits as well (e.g., environmental, economic, and social). While this study presents data arguing a case for how agricultural interventions can improve multiple community livelihoods, further research is needed to build better evidence and understanding of how agricultural interventions can improve nutrition outcomes. This has significant impacts not only in LMICs to address issues of undernutrition, but also in high income countries where food insecurity and poor nutrition environments are leading to epidemic rates of chronic disease and obesity. One of the surprising findings from this study was the limited number of factors associated with the prevalence of child underweight in both the SNNPR and Tigray regions. Additionally, statistical analysis revealed that this measure was not associated with food security status in either region. This was surprising given that child under-5 underweight is one indicator used to assess progress toward improving national and global food security. One interpretation is that, perhaps, factors beyond the household have a greater influence child nutrition status in this study population. Further research is needed to understand the determinants of child undernutrition and the relationships between food security and nutrition. Questions might include:

- Is food security status associated with prevalence of children that are underweight?
- Is child underweight an effective indicator for assessing food security progress?
- Since the statistical analysis from the SNNPR and Tigray regions found very few factors associated with child underweight, what factors are most important for determining child nutritional status? And are agricultural and food-based interventions effective strategies to address these determinants?

This study established the importance of multiple capitals in determining food security status, and improved a localized understanding of how communities use assets to support livelihoods. . This led to proposing the design of multi-sector, multi-level interventions to achieve the goal of solving food insecurity challenges. However, results from the CIP Nutrition project and other programs designed with multi-sector, multi-level strategies are needed to determine whether such interventions are, indeed, more effective and what kinds of change (intended and unintended) can occur from these intentionally-designed interdisciplinary studies.

7e. Study limitations and strengths

Multiple factors both beyond the control of the researcher and attributed to the selected methods had the potential to impact study findings. Some of these factors included the selected methods; the multi-dimensional definition and temporal nature of food security; and demographic, social, and community characteristics. Key strengths and limitations of this study include the following:

Limitations in Quantitative Methods: Semi-structured questionnaires are inadequate for fully understanding respondents' lived experiences, opinions, and feedback. What is captured on the household questionnaires reflects a single form of data and a single point in time, and is likely incomplete (Appendix 7). Non-response to specific questions can distort the sample when individuals preferred not to respond or did not answer the question that was asked. Respondents may interpret the questions differently than the evaluation team intended and also differently than other respondents. Therefore, responses may reflect personal interpretations. Some of the questions that participants are asked – particularly about health and food security status –are sensitive topics with the potential of having social stigma attached. This can lead to social desirability bias, in which respondents will answer based on what they think perceive the interviewer or society says they should respond rather than responding based on facts. For example, in the Ethiopia context, it is not unusual for families to borrow money or food across households both, not just in times of need but to be generous with others. Thus, the HFIAS question of "did you need to borrow food or money from another household in the last 30 days" may be over-reported in the context of describing food insecurity in this population because it is not seen as socially undesirable, and, in fact can reflect strong social ties. Participants were not selected randomly, but through a discussion-based process at the district and village levels based on households determined to have significant food gaps and food security challenges, which may have introduced bias in determining participants and/or their geographic location, but was intended to limit the study audience to the most food insecure within each study region. Finally, significant resources, existing community relationships, and survey and statistical expertise were required to conduct

this study, which not all communities or food security interventions may have available to them. As a result, the approach I employed may not be replicable by single organizations or under all circumstances (e.g., if the duration of an intervention is less than 3 years). Development organizations and policy-makers need to balance their resources available with intervention goals and outcomes to determine how much of such a rigorous, mixed-methods study is feasible given time and resource constraints. Given the multiple potential applications and audiences that such descriptive community information could benefit, it may be advantageous for organizations to discuss ways to collaborate and invest in shared, contextually-driven studies to collect rich data that could enhance multiple types of programs (e.g., food security, nutrition, health, water and sanitation).

Strengths: Rates of undernutrition and food insecurity are high in both the SNNPR and Tigray regions, which were known before this study. However, this study's quantitative analyses contributed to localized characterization of these rates, their magnitude, and associated factors. Additionally, the data are being used to consider seasonal and longitudinal trends within this specific study population. Finally, the comparative model can enhance understanding of common and unique variables and how they vary between regions.

Limitations in Qualitative Methods: For all interviews, information about the study design and purpose was provided, and individuals were asked for their consent to participate. Community participants were informed that this is a voluntary discussion conducted on behalf of CIP and/or the local implementing organization. Whether or not they participated would not impact the services or resources they received from CIP, and the information was intended to inform program improvements. Despite attempts to ensure the interviews were not delivered in a manner that could be seen as coercive, I recognize that issues of ethics and privilege still remain and must be taken into consideration because it impacts who participates and their responses. Language and cultural barriers were also significant, and impacted the study in multiple ways. First, due to my language limitations, I did not conduct the interviews directly. Instead, I trained and relied upon local facilitators to conduct the sessions. Additionally, due to time and resource

constraints, not all of the CIP Nutrition Project participant communities were involved in this study. Different communities may have responded differently and having more community input would enhance or change the data. Also, there were six facilitators. While I trained the facilitators in qualitative research methods and participatory approaches, each facilitator had a different style and perspective, which influenced the consistency of the questions asked and subsequent participant responses. In reading and coding the interview transcripts, I needed to consider this bias that may have been introduced but tried to triangulate responses with the additional data from community maps to compile a more complete interpretation. Also, community members were not randomly selected to participate; rather, we did a convenience sample based on geographic areas where CIP had worked for a longer period of time and at sites that were willing to participate. All community members were welcome to participate, so the responses may reflect a bias towards those who wanted to submit feedback rather than being representative of the total population. Language impacts this study in that some of the concepts (especially food security and different asset categories), as they are not easy to translate and have nuanced interpretations. With qualitative data, interpretation and analysis is limited by time, capacity, and the biases and assumptions that the researcher brings to the process. I tried to reduce my interpretation bias by coding data with one other team member, and also by sharing results back with my broader team members for feedback and input during the interpreting process. Finally, the small sample size of this study may make it difficult to generalize findings to the broader regional population or other sites.

Strengths: Given high rates of food insecurity generally in these communities, the qualitative and participatory components may improve identification of those most vulnerable to food insecurity. More importantly, the qualitative methods helped explain and interpret the quantitative findings to identify local factors that inhibit or support food security, which can be used by stakeholders and policy makers to ensure interventions are contextually relevant, work across sectors, and enhance community participation. Additionally, the qualitative findings highlighted a number of important behavioral, community, and social factors that shaped food security in the local context that were missed entirely by the quantitative household

questionnaires. Finally, this study's comprehensive approach of including community participation added local perspectives that are often ignored in traditional evaluation methodologies, which tend to either focus solely on quantitative data or collect qualitative data using processes that prioritize the voices of the traditional leaders, those in authority, or who have more assertive voices.

Mixed Methods

A final strength of my study was the use of mixed methods. Having both quantitative and qualitative data allowed for triangulation to check the consistency and quality of findings; allowed for multiple (and sometimes neglected) voices to be heard, which both could help improve interpretation of results while also allow for multiple co-existing interpretations; considered drivers and effects at multiple levels, including the individual, household, community, and policy levels; and made it possible to build in intentional feedback loops into the program, so that results can be used to more rapidly inform program changes.

In conclusion, my proposed integration of the SLA framework with an ecological design combined with a participatory, mixed methods approach helped identify what types of assets were important in the local context for ensuring food security. Then, applying this innovative evaluation methodology to the CIP Nutrition Project's multi-sector intervention, this study enhanced understanding of how households and communities are harnessing local assets to make changes that are resulting in multiple outcomes. This information can be used to enhance the selection of more relevant program indicators, but also to make adaptations to how the CIP Nutrition Project is working in two very different regions in the same national context. When taking a multi-sector approach, it's likely (and hoped) that outcomes beyond improved food security could result. Policies should set expectations for food security interventions to be responsible for achieving multiple outcomes that support the systems important for ensuring food security, such as productive agriculture, economic vitality, healthy people and environments, and also consideration to justice and equity.

APPENDIX 1: FORMATIVE ASSESSMENT SURVEY INSTRUMENT

The purpose of the formative assessment was to identify the needs of the communities and improve understanding of the context and dynamics that affect local food security. A livelihoods approach was used as the model because it helps consider both the severity of food insecurity and its impacts on households, along with the underlying factors and conditions of food insecurity (i.e., vulnerability, risk and coping) that have a long-term impact on livelihoods. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A "sustainable livelihood" is one which can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1992).

There were two components of the baseline formative assessment: *woreda* profiles and qualitative interviews.

Part A. *Woreda* profiles

Local information about communities' assets, needs, and concerns was collected at baseline and, from this data, profiles were made for each *woreda* in which the CIP project was implemented. This was done for three reasons. First, as a method for helping CIP and the researcher engage with communities and get community participation in the research process. Second, collecting only quantitative household data to characterize the study population could lead to incomplete interpretations of the data. Third, there was limited local and updated surveillance data about the study population's demographics with which to inform the program design. So the data collected were help both to the program but also were shared back with communities. *Woreda* profiles were completed by the UW researcher and CIP staff among five SNNPR *woredas* in May 2013, the ten Tigray *woredas* in February 2014, and the remaining 5 SNNPR *woredas* in June 2014. Data were collected by observation and semi-structured interviews to collect profile indicators. Observational data were collected by walking through the villages, having informal conversations with local leaders, and household visits.

Table 1. Observational data collected within each *woreda*

Information collected by OBSERVATION
1. General impressions Where are people living? What are their living conditions?
2. Condition of livestock and crops Have crops grown to normal size? Are crops being planted, growing, or being harvested? Are some areas not harvested and/or are there empty fields? What are the cropping patterns (e.g., are there intercrops? Any signs of crop-livestock integration, such as crop residue being dried and fed to livestock?)? What animals can you see and do they appear healthy?
3. Condition of infrastructure What is the condition of the roads, water sources, wells, important buildings/schools, irrigation systems, etc.?
4. Transportation Do you see many vehicles available for transportation and/or picking up produce/livestock for market? Are trucks carrying food?
5. Presence of other agencies Do you see other organizations (e.g., buildings, staff, cars, logos)? If yes, what kind/s of organizations are working locally and what assistance are they providing?
6. Security and safety Do people appear safe and do you see community members walking freely on streets?

7. Environment Do you see any indications that arable land is scarce? Are there many trees? Are there trees recently cut down (deforestation)? What kind of vegetation, landscapes, and soils do you see? Do you see any dead animals? Are there any flooded and/or dry areas? Do you see many insects/mosquitoes? Is there much garbage? Are people burning it?
8. Condition of food markets What types of markets do you see? What is the condition of marketplaces and shops? What is being sold and in what quantity in the markets? Do you see any P/SP/OFSP? Are there multiple varieties, and do they appear healthy and fungus-free? Are there any P/SP products, and if so what types of markets are selling these items? Is there scarcity? Are people shopping?
9. People's activities What are people doing? Are they working? Can you see many ill or wounded people? Are people lining up anywhere for services or resources? If yes, for what? Are any people moving with their family and belongings?
10. Condition of people's homes and family Are people preparing food? What kind/s of food, and what kind of fuel are they using? What kind/s of assets do people have in and around their homes? Are there many family members home? What age/s? What are they doing? Are families growing food around their homes? Are there animals nearby?

Semi-structured interviews were conducted with agriculture and the woreda Health Officer or staff member. The following indicators were collected from each *woreda* as a way to quantify and compare community characteristics across *woredas* within regions. Because data were collected as part of the CIP Nutrition project intervention, specific questions related to potato, WFSP, and OFSP production were included to help inform understanding of those crops' production and marketing systems.

Table 2. Key *woreda* profile indicators

Indicator
1. Total population
2. Total number of households
3. Average household size
4. Number of female-headed households
5. Area (in square kilometers)
6. Number of primary schools
7. Number of secondary schools
8. Number of high schools
9. Number of post-secondary schools (vocational and college)
10. Five (5) most important cash/agricultural crops produced
11. Three (3) more important household (food security) crops
12. Number of health posts
13. Number of health centers
14. Top health concerns overall
15. Top health concerns among children under 5 years of age
16. Number and types of markets (e.g., shops, merchants, OFSP sales) and days of week operated.
17. Infrastructure for OFSP and women's participation: seed OFSP/P producers; vine multipliers; processors
18. Access to transportation (bus, taxi, etc.)
19. Food security and nutrition interventions: other NGOs and/or government programs
20. Technology access (e.g., internet services, # internet cafes, etc.)
21. Top 3 community concerns overall (e.g., employment, food security, health)
22. What are the 3 most pressing constraints to agriculture in the *woreda*?

Part B. Food Security Formative Assessment
Qualitative interviews with local agriculture and health experts were conducted in each *woreda* in the Tigray and the SNNPR. The interviews were conducted in the local language, and later translated and transcribed into English before analysis. The semi-structured interview guide follows.

Welcome and Purpose: Thank you for your time today. You were asked to participate in this interview because your community is participating in the International Potato Center's (CIP) Nutrition Project. I am _____ from _____. I am here on behalf of CIP to learn about your community and the work you do. The information you provide will help us understand your community's priorities and needs, and will be used to inform how the program is designed. Here with me is _____ from _____. S/He will be helping by taking notes during the interview. I will be asking the questions. This will take about 20-30 minutes of your time.

Confidentiality: All comments are confidential. Nothing you say will affect the services you will receive from CIP. You are free to stop the interview and decline to answer any question.

Voluntary Consent*:* By agreeing to participate in this interview, you are giving us consent to document and use information shared today for program learning and improvement. Do you understand what that means or have any questions? Do you agree to participate? If yes, let's begin with the first question.

Interview Questions*:*

1. In terms of health and well-being, what are the major issues facing your *woreda*?
   - Probe on concerns related to food security
   - Probe on concerns, if broader community issues come up

2. What does food security mean to you and your community?

Before proceeding with the next questions, read this definition of food security: When we talk about food security, we refer to households who have access to enough food or money to buy food for all members of the household at all times. Food secure households are those who do not worry about having enough food to eat.

3. Are there people in your community who do not worry about hunger? Can you describe these people to me?

4. What are some things that you think help these families not to worry about food compared to households who do worry?
   - Probe separately on wealth and other assets such as money, education, # family members, land, livestock, family member abroad who sends money home, technical assistance, etc.

5. Are there people in your community who worry about hunger? Can you describe these people to me?

6. What are some things that influence families' ability to feed themselves and lead them to worry about enough food?
   - Probe separately on wealth and other assets such as money, education, # family members, land, livestock, family member abroad who sends money home, technical assistance, etc.

7. What is currently being done in your *woreda* or neighboring *woredas* to deal with the issue of food security?
   - Probe separately on programs for both health and agriculture
8. What programs or services would help your community deal with food security issues?
   - Probe separately on programs and both health and agriculture
9. What is your role as an agriculture/health leader in helping your community deal with the issue of food security?
10. Is there anything else that you think is important for us to know about food security?

APPENDIX 2: ENUMERATOR GUIDELINES AND TRAINING MANUAL

Scaling Out Sweet Potato and Potato-Led Interventions to Improve Nutrition and Food Security in Tigray and SNNPR, Ethiopia

Enumerator Training Guidelines

Prepared for enumerators conducting baseline questionnaires
the Tigray Region for the International Potato Center

Tigray Enumerator TOT: February 21-22, 2014
Held at Mekelle University, Mekelle, Ethiopia

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International Potato Center-Ethiopia
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Section 1: Introduction

This is a guidance document was prepared by the University of Wisconsin-Madison in partnership with the International Potato Center (Ethiopia) in order to document and clarify issues often raised when community surveys are undertaken. The medical history section was reviewed by Girma Tefera, MD, and the Amharic translations were prepared by him.

A. About the project

The International Potato Center-Ethiopia (CIP), in collaboration with the University of Wisconsin-Madison (UW) and other implementing partners, is conducting an impact evaluation to assess the outcomes of a 38-month integrated agriculture, nutrition, and health project in 20 *woredas* in Ethiopia (10 from the Tigray region, and 10 from the Southern Nations, Nationalities and Peoples' Region). During the first six months of the project, baseline surveys will be conducted to gather household- and individual level information related to agricultural production of potatoes and sweet potatoes, socio-economic indicators, food security, nutrition, and health. The findings will be used to guide the development of project activities over the course of the program. An endline survey will be conducted at 38-months, with shorter annual surveys to be implemented. Findings from the endline surveys will be analyzed against baseline data to assess program impact, and a summary report of these findings will be shared among stakeholders at the program conclusion.

Goal:
The overall goal of the project is to contribute to improved nutrition and food security in vulnerable households with young children in Tigray and the SNNPR through increased production and consumption of micronutrient-rich sweet potato and potato varieties as part of diversified diets.

Expected Results:

- Expanded smallholder production of nutritious sweet potato and potato varieties.
- Increased consumption of OFSP and potato as part of more nutritious diets.
- Improved and diversified market chains for OFSP and nutritious potato.
- Increased institutional and policy support for nutrition-focused agriculture.

B. Goals of the Enumerator TOT

1. Enumerators will have understanding of both technical information and practical tools to implement surveys.

2. Enumerators will have time to ask questions and practice the surveys.

3. The training will be conducted in an open, interactive learning environment.

4. Enumerators will demonstrate competency and understanding of training expectations by the end of the session, as indicated by successful completion of a pre- and post-test.

5. Enumerators will know what additional resources and materials are available to them to ensure quality field data is collected.

C. General Survey Guidelines

1. Successful Surveying Techniques

- Before asking any questions, be sure to discuss and obtain permission from the household for you to conduct the survey.
- Build a connection with the respondent, both the household head and his spouse. The respondent's first impressions of you will affect their willingness to cooperate and answer truthfully.
- Give the respondent opportunities to ask questions and answer them honestly. This means saying "I don't know" or "I will have to ask and get back to you" if you do not know an answer. Do not make up information you do not know to be true.
- Be positive, friendly, and do not show expressions when people respond, even if an answer seems hard to believe.
- Stress confidentiality and explain how the data will be used.
- Stay calm and relaxed. Conduct the survey in privacy when at all possible, and create a comfortable and open atmosphere.
- Probe in a neutral way. Examples include:
  "Can you explain a little more?"
  "I did not quite hear you, can you tell me again?"
  "Take a moment and think about your answer. There is no hurry."
- Avoid rewording the question. If the respondent is unclear, read it again, slowly and clearly, as it is written to avoid changing the question's meaning. If it is still unclear, carefully reword it but keep the question as close to its original meaning as possible.
- Deal tactfully with non-response. Explain again that all responders will be asked the survey questions and reiterate why the survey is important. If they still refuse, write "refused" next to the question and move on.

2. Practice Sessions

It is a useful exercise to have enumerators "role play" portions of the survey to give them experience asking questions and understand the process from a respondent's point of view. As a facilitator of the practice session, keep the following tips in mind:

- Most of the CIP enumerators will have had prior household survey experience. They bring professional experience, and be open to their suggestions and feedback to improve the quality of the process. However, be careful about any one person dominating the discussion, and ask questions of the entire group to ensure everyone has an opportunity to ask questions and share their input.
- Role play in teams before the field work begins
- Be sure all enumerators understand the questions and the questionnaire
- Intentionally introduce a few possible mistakes and/or common errors so they can be dealt with before the field work begins
- Have enumerators who are not engaged in role play write down their observations, thoughts, comments, etc. and discuss as a group. This will keep them engaged, and hopefully foster an open atmosphere of peer feedback.
- Have enumerators practice filling out the questionnaires in a standardized manner – all numbers, dates, ages, etc. recorded consistently.

3. Equipment Needed to Conduct Survey

- Equipment checklist
- Project summary sheets
- Informed consent forms
- Questionnaires
- Plastic bags to keep survey questionnaires in (one for blank surveys and one for completed surveys)
- Clip board
- Pencils with erasers
- Pencil sharpeners
- Measuring tape (for measuring height/length)
- Weight scale (for adults and children under 5 years)
- Personal identification
- Backpack/briefcase
- GPS coordinate recorder

4. Additional Field Tips for Enumerators

- *Labeling*: Label forms correctly and review with the team a standardized labeling format. Remember to label each page with the HH number and personal ID Number (when relevant).
- *Time*: Allow sufficient time for completing the entire questionnaire.
- *Reschedule Visit, if needed*: Complete all the questions on the survey or make sure to arrange a time for a return if the family member needed to respond to a questionnaire is not present.
- *Recheck:* Review each questionnaire to make sure it is properly filled in before leaving the household.
- *Professionalism:* Personal conduct and clothing is important. Be polite and professional.
- *Cultural appropriateness*: Consider who should conduct the survey based on gender, age, and other cultural expectations.
- *Sensitivity*: Consider how questions about goods and food availability might be sensitive.

Section 2: Surveys

A. General Household Survey

HH ID Number is a household identification number that would help us identify one household from the other. Each household will be given a number from 001 to 300. Please make sure this 3-digit number is written down on the survey sheet, as it is the only way to connect survey answers to the household. The HH ID Number must also be recorded at the top of each additional survey sheet, again for the purpose of ensuring accurate data collection.

Be sure to ask all questions listed and record information legibly. Questions included on this sheet include:

- Name of the Enumerator (your full name, first and last)
- Indicate whether household is a participant or non-participant in CIP activities

A0. Household identification number
A1. Administrative Zone
    1: Central
    2: Eastern
    3: Southern
    4: South Eastern

A1a. Woreda
    Central Zone
    Tanqua Abergelle
    Qoula Temben
    Mereb Leke

    Eastern Zone
    Ganta Afeshum
    Hawzen
    Gulo Mekeda

    Southern Zone
    Raya Azebo

    South Eastern Zone
    Hintallo Wujirat
    Samre Seharti
    Enderta

A1b. Kebele/Tabia
A1c. Village
A2. Name of the head of household
    * Enter first name and second (father's) name
A3. Date of the interview
    * Enter the date in the following format: MM/DD/YYYY

* Enter date using the Ethiopian calendar year.

A3a-A3b. Start and end times of interview

* Use Ethiopian time

(e.g., 00:00 Ethiopia time = 06:00 Western time)

A4-A5. Latitude and Longitude

* Use GPS coordinates

A6. Altitude

* Use altimeter recorder to measure altitude in meters. This has implications in understanding agro-ecological climate and health factors.

A7. Describe any problem or observations. If you need to schedule a call-back visit, the date for this visit and reason why should be recorded here.

B. Household Resources Survey

1. Household Assets

This section contains questions about **household assets, livestock and land holdings** which are used to assess household socio-economic status. Since economic status and health outcomes are directly related, recording this information is important as it will be used for analyzing data and learning what kinds of relationships exist between SES and health/well-being in the communities in Tigray.

Questions B1-B5. Current number of livestock

Questions B6-15. Land holdings over the past 12 months

Questions B16-27. Household assets

2. Food Security

The **general food security** questions are used to identify the household's food security status and, when aggregated, help us understand food security trends in the community. There is no single measure of food security. Thus, asking "are you food insecure" is not a reliable measure. Instead, these questions are based on the idea that the food insecurity is experienced in different ways and differently over time. The following areas of food insecurity are captured in these surveys:

1. Feelings of *uncertainty* or *anxiety* over food (situation, resources, or supply);
2. Perceptions that food is of insufficient *quantity* (for adults and children);
3. Perceptions that food is of insufficient *quality* (includes aspects of dietary diversity, nutritional adequacy, preference); and
4. Reported *consequences* of reduced food intake (for adults and children), such as socially unacceptable means to obtain food resources or hunger.

In addition to these domains, we are assessing the **frequency** that a household experiences food insecurity, and will be used as part of the data analysis to determine proportion of households with mild, moderate, and severe food security. Frequency is measured on the following scale: <u>rarely, sometimes, often.</u>

These questions aim to capture information about how the <u>entire household</u> experiences food insecurity. Thus, the respondent should answer on behalf of all household members unless otherwise instructed differently.

Instructions about food security questions:
B28: Comparing the past 12 months against previous years, how are current food stocks? This question helps us understand whether the food insecurity reported in this survey year is normal or abnormal (and in what direction) from previous year's.

B29. Worried about food
This question asks the respondent to report their personal experience with uncertainty and anxiety about acquiring food.
Instructions about food security questions, continued:

B30: Reduced variety
Eating a variety of foods helps ensure people consume sufficient vitamins and minerals for health. This question asks about the variety of foods a household eats to understand whether the household had to eat an undesired, monotonous diet due to a lack of resources (food or money).

B31. Ate smaller meals
This question asks whether the amount of food that any household member ate in any meal during the past four weeks was smaller than they felt they needed due to a lack of resources. The respondent can answer according to his or her perception of what constitutes enough food for the needs of the household.

B32. Fewer meals in a day
This question asks whether any household member, due to a lack of food, had to eat fewer meals than the number typically eaten in a day.

B33. No food in the household
This question asks whether if at any time in past 4 weeks there was no food of any kind inside the home. This indicates a situation where food was not available to household members through the usual means (e.g., from garden, storage, or the means to purchase food).

B34. Go to sleep hungry
This question asks whether the respondent felt hungry at bedtime because of lack of food or whether the respondent was aware of other household members who were hungry at bedtime because of lack of food.

B35. Ask for food or money outside the home
This question refers to social support networks that the household may turn to when resources are limited.

B36. Children gone to bed hungry
This question ask about making choices in terms of who in their family may or may not go without food, when funding/food is limited.

B37. Period of hunger in the last 12 months
This question considers seasonality of food insecurity over the past year, and will indicate seasons of the year when there is greater food insecurity.

C. Household Characteristics Survey

For this survey, a household includes anyone (related by blood or not) who lives with the family now or who depends upon the family resources (e.g., college students). Household composition information is important for understanding family size, which includes both temporary and permanent residents in the household. Please complete all required information in the page. When it comes to age, individuals might not know their exact birthdate and month. Please record whatever information they provide, even if it is year of birth alone.

C1. Individual ID Number

* You do not need to write anything in this column. It is automatically assigned based on the name you write in Column C2. The Individual ID Number will be used and referred to in the Medical History and Nutrition Surveys.

C2. Name

* Insert first name and father's name

C3. Sex

C4. Relationship to HH

C5. Age

* Be sure to indicate whether age is in years or months. For children 6-59 months, please specify their age in MONTHS and not years.

C6. Marital status

* Options include Married, Unmarried (this includes both children who are too young and adults who have not been married), Divorced, and Widowed.

C7. Major occupation

C8. Highest level of education completed

* Education level refers to highest **completed** level of education achieved. Entries should use the codes listed below and not insert a year of school. For example, if a youth is in Grade 6, the code entered would be "3" indicating their highest level of completed education was a primary grade. Similarly, a youth who is in Grade 1 would also be entered as "3." If a youth/adult only attended but did not complete a grade, technical school, or college, the code entered should be for the actual grade **completed**, and not the grade attended.

C9. Farmer Group member

C10. Generate income

D. Crop Activities Survey - *Meher*

Answers to this set of questions will help us understand crop production practices by season: land access, land acquisition, crop diversity, decision-making/management, yields and uses.

When completing the table that begins with Question D3 (Plot), be sure to ask the farmer for his five largest plots. Then, when you complete the table enter those plots by starting with the biggest one (#1) to the smallest (#5 or however many plots there are). Under Question D6 (Crop Produced), list the top 3 crops grown on each plot from greatest to least yield.

Question D11: the sum of the crop uses (e.g., amount sold, used as seed, consumed, or other) should total the yield listed in Question D9 (or D10).

E. Crop Activities Survey - *Belg*

Answers to this set of questions will help us understand crop production practices by season: land access, land acquisition, crop diversity, decision-making/management, yields and uses.

When completing the table that begins with Question E3 (Plot), be sure to ask the farmer for his five largest plots. Then, when you complete the table enter those plots by starting with the biggest one (#1) to the smallest (#5 or however many plots there are). Under Question E6 (Crop Produced), list the top 3 crops grown on each plot from greatest to least yield.

Question E11: the sum of the crop uses (e.g., amount sold, used as seed, consumed, or other) should total the yield listed in Question E9 (or E10).

F. Household Potato, WFSP, and OFSP Production Survey

The primary goal of the project is to contribute to improved nutrition and food security in vulnerable households through increased production and consumption of micronutrient-rich sweet potato and potato varieties as part of diversified diets. Thus, understanding baseline production practices for P, WFSP, and OFSP is very important to assess whether the program was able to meet its stated objective and resulted in impact. These questions will establish baseline production levels for P, WFSP, and OFSP.

F1. Did you grow Potatoes during the last 12 months?

- If no, ask whether the HH has ever grown potatoes and why they stopped growing. Then, continue on to Question F2.

- If yes, continue with the next set of questions through F1k.

F2. Did you grow WFSP during the last 12 months?

- If no, ask whether the HH has ever grown WFSP and why they stopped growing. Then, continue on to Question F3.

- If yes, continue with the next set of questions through F2k.

F3. Did you grow OFSP during the last 12 months?

- If no, ask whether the HH has ever grown potatoes and why they stopped growing. Then, continue on to Question F4.

- If yes, continue with the next set of questions through F3k.

F4. Does your HH have a kitchen garden?

- A kitchen garden refers to crops that are grown near to the house and are primarily consumed by HH members rather than sold.

F5. Received agricultural technical assistance and/or services for WFSP/OFSP

- Assistance refers to any agricultural technical assistance from extension, an NGO, or other agricultural professional. It is not limited to participation in CIP-Ethiopia trainings.

F6. Received agricultural technical assistance and/or services for Irish Potatoes

- Assistance refers to any agricultural technical assistance from extension, an NGO, or other agricultural professional. It is not limited to participation in CIP-Ethiopia trainings.

G. Potato, WFSP, and OFSP Seed and Vine Production Systems Survey

CIP has already worked to establish and expand a decentralized seed systems linked to high quality found seed in Tigray, and one of this project's aims is to continue building capacity and ensure sustainability through in order to improve cost-effective linkages to technologies, markets, and training programs. These questions will establish baseline levels about P, WFSP, and OFSP seed/vine production systems.

G1. Do you specialize in seed/vine production and multiplication for P, WFSP, or OFSP?

- Check "Yes" if respondent participates for at least 1 crop
- If "No," please skip ahead to Question G2.

G2. Have you ever received training on quality maintenance and storage of seeds/vines?

G3. Do you have any problems with seed quality or storage issues?

G4. Do you have access to storage facilities for potato seeds?

G5-G6. Do you preserve WFSP or OFSP vines?

G7. Do you produce any P or WFSP/OFSP processed products?

- If no, please skip ahead to next form.

Surveys H through L collect information about individuals (mothers and the oldest child between 6-59 months) within a household. For these forms, make sure to complete the household **and** individual identification numbers at the top of the survey sheet.

H. Medical History – Mother Survey

Health and nutrition are closely tied. Understanding health of the mother during pregnancy and beyond will give us a snapshot of her and her child's health and nutrition status during different life stages. Health information can be sensitive and not easy to share. Remember to assure the mother that her answers are confidential and that she can choose not to respond to any question she feels uncomfortable answering.

Question H3: Measure the height of the mother using the measuring tape and record in centimeters. Measure the weight of mother using the scale and record in kg with two decimal units.

Question H4: Age of mother. If the woman does not remember her exact age, you can estimate her age using timeline of events or based on known ages of other family members. Then indicate in Question H5 how age was estimated.

Question H6: If woman does not remember the year she got married, ask how many years ago she was married. If year of birth is known, it can be calculated by subtracting the number of years married from her current age to estimate her age at marriage.

Question H7: Like H6, if a woman does not know her age when she first got pregnant it can be calculated by subtracting the age of her eldest children from her current age.

Question H8: Mothers may be uncomfortable/sensitive to Questions H8a and H8b if there was a child death in the family. Take your time with this question but also give mothers the option to opt out.

Question H11: Asking mothers about the knowledge of problems that may arise during childbirth may require medical terminology and sensitivity when asking. The purpose of this question is to understand what mothers' knowledge about health problems before, during, and after labor which may impact health outcomes for themselves and their children. Translations of these terms into Amharic follow:

Severe vaginal bleeding: ከፍተኛ የማህፀን መድማት
Swollen hands or face: የፊትና የእድ ማበጥ
Blurred vision: የአይን ብዥታ
Prolonged labor (greater than 12 hours): የተራዘመ ምጥ (ከ ፩፪ ሰአት በላይ)
Foul smelling vaginal discharge: ሽታ ያለው የማህጸን ፈሳሽ
Convulsions: የሚጥልና የሚያንቀጠቅጥ በሽታ
Retained placenta: የእንግዴ ልጅ አለመዉጣት
Fever: ትኩሳት

Question H12: Antenatal care refers to the regular medical care recommended for women during pregnancy. It includes recording medical history, individual health assessments, advice on pregnancy and delivery, screening tests, education on nutrition and self-care during pregnancy, and first-line management and referral if necessary.

Question H12c and H14: A birth attendant refers to a person who helped a women give birth. A **skilled birth attendant** is an accredited health professional – such as a licensed midwife, doctor or nurse – who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns. A **traditional birth attendant** provide basic health care, support, and advice during and after pregnancy and childbirth, based primarily on experience and knowledge acquired informally through the traditions and practices of their communities.

Question H18: Night blindness is a condition making it difficult or nearly impossible to see in relatively low or dim light.

Question H19: Eye disorders and/or diseases can include but are not limited to the following:

- Cataracts: fuzzy over the eye
- Glaucoma: able to see central vision but peripheral appears darker
- Strabismus: cross-eyed
- Conjunctivitis: Pink-eye
- Near-sightedness: ability to only see objects within an arm's length away
- Far-sightedness: ability to only objects at a distance
- Macular degeneration: difficulty seeing sharp central vision or points
- Lazy eye

Question H21: Mothers may not know if they had measles or not. If they are unsure what it is, describe illness symptoms to prompt their memory:

> Measles is a viral infection and is spread by contact with droplets from the nose, mouth, or throat of an infected person. Sneezing and coughing can put contaminated droplets into the air. Symptoms include: Bloodshot eyes, cough, fever, light sensitivity, muscle pain, rash (starts on head and spreads to other places), runny nose, sore throat and tiny white spots inside the mouth.[1]

Question H22: Mothers may not know if they had malaria or not. If they are unsure what it is, describe illness symptoms to prompt their memory:

> Malaria results when parasites enter the blood stream and infect and destroy red blood cells. This leads to fever and flu-like symptoms, such as chills, headache, muscle aches, tiredness, nausea, vomiting, and diarrhea.

Question H23: Gastrointestinal problems can include consistent or intermittent but ongoing diarrhea, cramping, and bloating.

Questions H25 and H26: Chronic disease is a long-lasting condition that can be controlled but not cured. Examples of chronic diseases include: asthma, diabetes, heart disease, kidney disease, and lung disease.

Question H27: An injury is damage or physical harm to a person, both intentional (e.g., violence) and unintentional. Examples include: broken bones, serious wounds, severe burn, head trauma, and poisoning.

J. Medical History –Child Survey

Question J7: When asking mothers about their children's immunizations, be sure to read each of the immunization options and have her respond as Yes or No. If the family has the children's immunization record, as to see this to confirm that the immunizations reported are accurately.

Question J8: Children's height and weight measures. If the child is an infant, it helps to lay him/her down to get accurate height (length) measurement. If child is unable to be weighed on his/her own, weigh the mother first on her own. Then, have her step off the scale and get back on holding the child. Subtract mother's weight from mother and child weight to get child's weight ([Mother & child]-[mother]=child). Be patient with a fussy baby.

[1] Measles. http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002536/ Accessed March 8th, 2013

Questions J9-12: If the respondent is not the child's biological mother, skip ahead to Question J13.

Questions J14-15: Night blindness is a condition making it difficult or nearly impossible to see in relatively low or dim light. Make sure that if the mother reported eye problems for herself or the family, that the child's responses are consistent with hers.

Eye disorders and/or diseases can include but are not limited to the following:

- Cataracts: fuzzy over the eye
- Glaucoma: able to see central vision but peripheral appears darker
- Strabismus: cross-eyed
- Conjunctivitis: Pink-eye
- Near-sightedness: ability to only see objects within an arm's length away
- Far-sightedness: ability to only objects at a distance
- Macular degeneration: difficulty seeing sharp central vision or points
- Lazy eye

Question J16: Mothers may not know if their children have had measles. If they are unsure what it is, describe illness symptoms to prompt their memory:

> Measles is a viral infection and is spread by contact with droplets from the nose, mouth, or throat of an infected person. Sneezing and coughing can put contaminated droplets into the air. Symptoms include: Bloodshot eyes, cough, fever, light sensitivity, muscle pain, rash (starts on head and spreads to other places), runny nose, sore throat and tiny white spots inside the mouth.

Question J17: Mothers may not know if their children had malaria or not. If they are unsure what it is, describe illness symptoms to prompt their memory:

> Malaria results when parasites enter the blood stream and infect and destroy red blood cells. This leads to fever and flu-like symptoms, such as chills, headache, muscle aches, tiredness, nausea, vomiting, and diarrhea.

Question J18: Gastrointestinal problems can include consistent or intermittent but ongoing diarrhea, cramping, and bloating.

Question J20: Chronic disease is a long-lasting condition that can be controlled but not cured. Examples of chronic diseases include: asthma, diabetes, heart disease, kidney disease, and lung disease.

K. Food Frequency – Mother Survey

Make sure you complete individual and household identification numbers on top of the survey sheet. For the adult nutrition surveys, only mothers of children aged 0-59 months will be interviewed.

Questions K7-K11

The food frequency portion of this survey is to gather information from mothers on their general nutritional habits and, in particular, on OFSP and P consumption, knowledge of vitamin A rich foods and

consumption patterns. This information will be compared again post-surveys to see if there are changes in knowledge and consumption of VA-rich foods at the end of the program.

Question K12

The household dietary diversity portion of this survey assesses dietary diversity on a **household level**. Please be sure the respondent is sharing information based on what the household has consumed. Dietary diversity is defined as the number of unique foods consumed over a given period of time, provides information on household food security.[2] Food diversification helps in direct or indirect acquisition of micronutrients and thus improved nutrition outcomes.

Monotonous diets that are high in carbohydrates and low in nutrient-rich foods may be common, even among households who can afford to eat better. Diets high in carbohydrates but low in protein, fat, and micronutrients will result in malnutrition even if one's daily energy supply is adequate. The result is malnourishment in the form of hidden hunger, and may contribute to stunting, nutrition-related anemia, and various micro-nutrient deficiencies. To measure nutritional quality we are measuring and comparing food frequency and dietary diversity at individual and household levels.

Reference period: We are using a reference period of the previous 24 hours, as recommended by the FAO. Using one 24-hour recall period does not provide an indication of an individual's regular diet, but it does provide an assessment of the diet at the population level and can be useful to monitor progress or target interventions. Additionally, the recall period of 24 hours was chosen as it is less subject to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many dietary diversity studies.

Atypical consumption: Consumption patterns can be atypical during festive periods or other observances, either lower than normal or higher. If someone is fasting for any reason or there was a holiday, please ask them to refer to the last "typical" 24-hour day.

You can assess whether the past 24 hours was typical by starting this survey with, "Was yesterday a celebration or feast day where you ate special foods or where you ate differently?" If the respondent indicates no, proceed.

Mixed Dishes (e.g., doro wot): If a composite dish (e.g., doro wot, when meat and vegetables are mixed) is eat, all of the individual components should be recorded in their respective food groups (e.g., chicken, onion, garlic, berbere, quibbe or oil, etc.).

As a rule, some basic foods are listed only under their main ingredient. For example, bread is put into the cereals group even if oil, eggs or sugar are added in small amounts during the making.

However, if a casserole or dish with a sauce that accompanies a staple is eaten, be sure to include all composite parts. Particular attention should be given to certain ingredients that may not be spontaneously recalled, such as added fats or oils, or secondary ingredients such as small amounts of meat or vegetables.

Additional suggestions for administering nutrition surveys:

[2] "Dietary Diversity As A Food Security Indicator". International Food Policy Research Institute. http://www.ifpri.org/sites/default/files/pubs/divs/fcnd/dp/papers/fcndp136.pdf Accessed March 9, 2013.

➔ Ask the respondent to mention all the foods (meals and snacks) eaten yesterday during the day and night. Start with the first food/drink consumed the previous morning. Record these items in the spaces provided at the top of the questionnaire, and then proceed to checking the appropriate boxes below.

➔ After the respondent recalls all the foods and beverages consumed, underline the corresponding foods in the list under the appropriate food group and write
"1" in the column next to the food group if at least one food in this group has been underlined. If the food is not listed in any group, write it in the margin and discuss it with the supervisor.

➔ Probe for snacks eaten between main meals.

➔ Probe for special foods given to children or lactating/pregnant women.

➔ Probe for added foods such as sugar in tea, oil in mixed dishes or fried foods.

Portion size: See portion size guide.
Photo album: See photo album for picture examples of the foods.

L. Food Frequency – Child Survey

Make sure you complete individual and household identification numbers on top of the survey sheet. For the infant/child nutrition surveys, be sure to survey the oldest child between 6-59 months in the household. Their mothers or other adult should respond for them. This survey includes infant OFSP consumption, dietary diversity questions for infants, and other general demographic questions.

Questions L8-9
The food frequency portion of this survey is to gather information from children on general OFSP and P consumption, knowledge of vitamin A rich foods and consumption patterns during infancy/early childhood. This information will be compared again post-surveys to see if there are changes in knowledge and consumption of VA-rich foods at the end of the program.

Question L10
The infant/child dietary diversity portion of this survey assesses dietary diversity on an **individual level**. Please be sure the mother is sharing information based on what the individual child has consumed. Dietary diversity is defined as the number of unique foods consumed over a given period of time, provides information on household food security.[3] Food diversification helps in direct or indirect acquisition of micronutrients and thus improved nutrition outcomes.

As stated in the information on the mother's dietary diversity, diets that are high in carbohydrates and low in nutrient-rich foods may be common, even among households who can afford to eat better. Diets high in carbohydrates but low in protein, fat, and micronutrients will result in malnutrition even if one's daily energy supply is adequate. The result is malnourishment in the form of hidden hunger, and may contribute to stunting, nutrition-related anemia, and various micro-nutrient deficiencies. To measure nutritional quality we are measuring and comparing food frequency and dietary diversity at individual and household levels.

[3] "Dietary Diversity As A Food Security Indicator". International Food Policy Research Institute. http://www.ifpri.org/sites/default/files/pubs/divs/fcnd/dp/papers/fcndp136.pdf Accessed March 9, 2013.

Reference period: We are using a reference period of the previous 24 hours, as recommended by the FAO. Using one 24-hour recall period does not provide an indication of an individual's regular diet, but it does provide an assessment of the diet at the population level and can be useful to monitor progress or target interventions. Additionally, the recall period of 24 hours was chosen as it is less subject to recall error, less cumbersome for the respondent and also conforms to the recall time period used in many dietary diversity studies.

Atypical consumption: Consumption patterns can be atypical during festive periods or other observances, either lower than normal or higher. If someone is fasting for any reason or there was a holiday, please ask them to refer to the last "typical" 24-hour day.

Portion size: See portion size guide.
Photo album: See photo album for picture examples of the foods.

On the dietary diversity questions for infants, the same methods apply for HDDS scoring and calculating. Please ask and complete all questions. Keep in mind that wheat and other food items might be consumed in a processed form such as bread.

Section 3: Additional Resources

Arimound M et al. Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse resource-poor settings. Journal of Nutrition. 2013.

BBS/UNICEF. Child and Mother Nutrition Survey of Bangladesh 2005. Bangladesh Bureau of Statistics and UNICER. Dhaka. 2007.

CARE. Infant and Young Child Feed Practices: Collecting and Using Data, a Step-by-Step Guide. Cooperative for Assistance and Relief Everywhere, Inc. 2010.

Coates J, et al. Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3). Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development. 2007.

Devereaux S et al. Improving the analysis of food insecurity: Food insecurity measurement, livelihoods approaches, and policy: Applications in FIVIMS. September 2004.

Frize J and Berger S. Integrating Food Security and Nutrition in Emergency Needs Assessments: A Review of Emergency Assessments Combining Food Security and Nutrition. World Food Programme: Rome, Italy. April 2007.

Kennedy G, Ballard T and Dop MC. Guidelines for Measuring Household and Individual Dietary Diversity. Food and Agricultural Organization. 2010.

Lorenzana, PA and Sanjur, D. Abbreviated measures of food sufficiency validly estimate the food security level of poor households: measuring household food security. Journal of Nutrition 129:687-92. 1999.

Ruel MT. Is Dietary Diversity an Indicator of Food Security or Dietary Quality? A Review of Measurement Issues and Research Needs. International Food Policy Research Institute. Washington, DC. 2002.

Swindale A and Bilinsky P. Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (v. 2). Washington, DC: Food and Nutrition Technical Assistance, Academy for Educational Development. 2006.

WHO. Indicators for assessing infant and young child feeding practices. Part 2 Measurement. Geneva, Switzerland. 2010.

APPENDIX 3: FOCUS GROUP DISCUSSION SCRIPT

Welcome: Thank you for coming! Today we are going to talk about CIP's Nutrition Project – the kinds of work it does, the impact it has had, and your suggestions for how to make it better. You are here because you participate in CIP's Nutrition Project, and will have helpful feedback for us.

Criteria: Each participant should have received technical assistance from at least one CIP workshop (agriculture and/or nutrition) between October 2013 and present date.

Materials: Tape recorder; Notebooks and pens/pencils; Flip chart paper; Markers; Placards with letters on them (placed in front of each participant to track who said what; protect anonymity).

Welcome and Purpose: Thank you for being here today. You were asked to participate in this discussion because you have received assistance from the International Potato Center and their Nutrition Project at some point over the past year. I am _____ from the University of Wisconsin in the United States. I am here on behalf of the International Potato Center to learn about your experiences with their Nutrition Project. The information you provide will help us understand how the program is working so far, and to make any improvements, if necessary. Here with me is _____ from _____. S/He will be helping to take notes during the discussion. I will be asking the questions. Neither of us will participate in the discussion. We ask that you direct your responses to one another rather than to us.

Ground Rules: Everyone's ideas are important, everyone is encouraged to speak. There are no right or wrong answers. Negative comments are useful. Please feel free to disagree with one another, as we would like to have different points of view. I want this to be a group discussion, so you don't have to wait for me to call on you. Please speak one at a time so that we can hear what everyone has to say. We have a lot of issues to cover, but please stop me if you want to add something at any time.

Time Required*:* This will take approximately 2 to 2.5 hours of your time.

Confidentiality: You've probably noticed we have a tape recorder. We will be recording the discussion because we don't want to miss any of your comments. Often people say important things in these discussions and we can't write fast enough to get them all down. **Specific names will NOT be used.** You will notice a letter in front of you. This letter will be used to keep track of who said what, but will not be linked to your name. All comments are **confidential;** nothing you say will affect the services you currently receive from CIP. Whatever is said in the circle MUST remain in the circle. You are free to drop out of the discussion at any time but may not discuss information shared by others after you leave the group.

Voluntary Consent*:* By agreeing to participate in this discussion, you are giving us consent to document, record, and use information shared today for program learning and improvement.

- Does anyone have any questions before we begin?

- Does everyone feel comfortable with the use of the tape recorder?
- Does everyone agree to participate? If yes, let's begin with the first question.

Introductions: Let's start with introductions (*If everyone already knows each other, still have them do introductions as a way to talk about their role within the organization/community)*. We'll go around the circle, and when we come to you please state the following:

- Your name
- Your role within your organization/community
- Why you think nutrition is an important topic in your community
- An example of an activity in your community that is working to address malnutrition (e.g., by an NGO or DAs/HEWs).

If you do not think nutrition is important in your community, please tell us what you think is an important topic, and share an example of a community activity that is working to address it.

Allow 10-15 minutes for each person to introduce her/himself.

Activity 1: Before talking about the nutrition activities, we first want to learn more about your community and the kinds of resources and assets that exist. The overall goal of CIP's project is to improve production and consumption of OFSP to strengthen food security. However, if it is working well, it should be supporting community empowerment and enhancing assets that already exist. The Community Assets Framework is one tool to look at multiple assets within a community.

What are assets? *Resources invested to create new resources over the long-term; something you can draw upon when future needs require it; can be tangible or intangible.*

In your community, are sheep considered assets? What about camels? What about children? What about mosquito nets? *Point: each community has assets that are important, but the assets important to one community may not be the same assets another community values. We want to learn more about the assets that are important to your community.*

There are 6 asset categories that all communities possess. These are listed at the front of the room:

Built: infrastructure to support households and the community (e.g., roads, places where people meet for meetings or church, materials used to construct homes, electricity access)
Financial: monetary resources or other indicators of wealth (e.g., number of livestock, off-farm employment)
Human: knowledge, skills, and abilities of people (e.g., education levels, health, willingness to take risks)
Natural: environmental assets (e.g., irrigated land, land quality, water quality, landholding size)
Political: access to power and those who hold it (e.g., membership in farmer organizations)
Social: connections among people and how to make things happen (e.g., groups people belong to, female-headed households, labor sources)

Pair:Share: Turn to the person next to you, and first draw your community and key features in it. Be sure to identify the roads and walking paths, school, water resources, health services (government and traditional), markets, shops, meeting places, churches, crop lands, grazing lands, etc. Then, identify where in the community they see the assets and label them on their maps with the corresponding color (e.g., Built Assets = purple, Human Assets = blue, etc.). After you create your maps, we'll ask each group to come to the front of the room and describe their maps.

Reflect: Which category had the most examples? Which category had the least? Are there individuals who have better access to these assets in your community? Who are they and what makes them able to access assets? Are there individuals who have little access to assets? Who are they are what prevents them from accessing it? What do you think is your community's most important asset? In the context of CIP's nutrition project, why is it important to focus on assets?

Activity (Ripple Mapping): Next, we're going to do a group activity to look at the how CIP's nutrition project is working in your community. In front of you is a large sheet of paper. Around the edges of the paper, write the first initial for each capital: B, F, H, N, P, and S. In the middle of the paper, write "CIP Nutrition Project" and circle it. Around it, create the following rings, with Ring 1 being closest to the center and Ring 3 being closest to the edges, and each ring in a different color:

Ring 1: What does the CIP Nutrition Project do in your community? What activities are happening?
Ring 2: What is your community doing differently because of each of the activities? Think about what changes you have seen and who is participating in or benefitting from the change. Next to each, identify what assets are being built by writing the letter (i.e., B, F, H, etc.) next to it.
Ring 3: What changes do you want to see in the way the CIP project and other community groups do things in the future? What kinds of additional assets do you want to see enhanced/supported?

Debrief: Go around and ask each group share their ripple map. Questions to ask each group:

Ring 1: **[Promotion]**

- What kinds of activities are happening with the CIP Nutrition Project?
- Any activities that were supposed to happen that are NOT happening?
- Who participates in these activities (be sure to clarify which organizations are DELIVERING nutrition promotion, and which individuals are RECEIVING info)?

DELIVERING ORGANIZATIONS
- Which of these groups talks about nutrition?
- What messages does each provide? Does the NGOs, DAs, HEWs use any special materials to talk about nutrition? Please describe.
- Has anyone had contact with an organization (NGO, HEW, DA) about OFSP, P and nutrition in the last 12 months? If yes, please describe what you talked about (LISTEN for dietary diversity; nutrition; OFSP, food-based nutrition).

RECIPIENT INDIVIDUALS/HHS
- Who do these actors target with their OFSP/P nutrition messages?
- Are the OFSP and P messages relevant and understandable to you?
- Have you learned anything new from the OFSP/P actors? If yes, please describe.

Ring 2: **[Change & Asset-building]**

- In terms of Ring 2 and changes you see, which asset(s) does CIP support?
- Are there any asset categories not being supported? Why is that?
- Who benefits most from CIP's project? Who else could be benefitting?

OFSP/P KNOWLEDGE
- What have you learned about OFSP? Describe.
- If not, what are the barriers to learning about OFSP?
- If yes, what if any benefits did you see from learning about OFSP?

OFSP/P CONSUMPTION/NUTRITION
- Has anyone changed OFSP consumption because of CIP? Describe.
- If not, what are the barriers to OFSP consumption?
- If yes, what if any benefits did you see from making these changes?

DIETARY DIVERSITY
- Has anyone changed nutrition practices? Describe.
- If not, what are barriers to changing nutritional practices?
- If yes, what if any benefits did you see from making these changes?

OFSP PRODUCTION
- Has anyone changed OFSP/P production? Describe
- If not, what are the barriers to increasing OFSP/P production?
- If yes, what if any benefits did you see from producing OFSP/P?

GENERAL
- Are there other benefits the community is receiving from the OFSP/P nutrition project by CIP and partners (ELE, GOAL, BoA, BoH, M4M, WAT, etc.)? Please describe

Ring 3: [Future Success]

- In terms of future change you want to see, what BARRIERS might stop that change from happening?
- In terms of future change, what is needed to make that change happen by:
1. You as an individual
2. The organization you work with
3. Other groups/people from your community
4. Other partner organizations
5. CIP

- What do you think are the most important changes you would like to see result from the CIP project or other community nutrition activities?
- Are there other livelihoods/assets changes you would like to see result from CIP's or project other nutrition activities?

Reflect: To wrap-up, we want to revisit the 6 Community Asset categories. We are going to go category by category and read you an example of how the CIP project intended to impact your community. For each item, we'd like you to comment whether you agree or disagree if this is a good indicator. Before moving the next category, we also want you to comment if – based on the discussion we had today – you would add any new indicators to that category. *Facilitators: see Appendix 5 for list of CIP Project Indicators, the items in red should be read.*

CONCLUSION

- What did you learn from this activity? *(Some of the reasons we focus on assets is it highlights the following: importance of place; interdependency and relationships; intended and unintended impact; and balance.)*
- How can what we learned today inform future work to enhance the 6 community assets?
- Are there other comments or ideas you would like to share with us?

APPENDIX 4: INTERVIEW CONSENT FORM

Interview Consent Form

Title of the Project: Scaling Out Sweet Potatoes to Improve Nutrition and Food Security in Tigray and the Southern Nations, Nationalities, and Peoples Region (SNNPR), Ethiopia
CIP Project Director: Wellington Jogo, PhD, Email: w.jogo@cgiar.org
UW Project Investigator: Heidi Busse, MPH, Email: busse@surgery.wisc.edu

What is the purpose of this interview?
The International Potato Center (CIP), in partnership with multiple implementing partners and community organizations, is implementing a nutrition project in Tigray and the Southern Nations, Nationalities, and Peoples' Region (SNNPR) that is working to increase production and consumption of orange-fleshed sweet potato (OFSP) and potato varieties among smallholder farmers. In partnership with CIP, the University of Wisconsin-Madison (UW) is seeking to understand how the project is performing, what kinds of change (if any) are occurring as a result of the project, and whether any changes should be made to how the project is implemented. You are invited to participate in an interview because of your role within the CIP Nutrition Project. The interview will include questions about your role and responsibilities with the CIP Nutrition Project, and your feedback on how the program is (or is not) working.

What will my participation involve?
If you decide to participate in this interview, you will be asked to respond to a series of open-ended questions. You can pass/chose not to respond to any question. The interview will take approximately 1 hour, and will be recorded to ensure we accurately capture your responses.

How will my confidentiality be protected?
Your name and personal identification (e.g., organization you work with) will be kept confidential and will not be affiliated with the answers you provide.

Whom should I contact if I have questions?
You may ask questions about the study at any time. If you have questions about the study after we leave today, you can contact the CIP Project Director, Dr. Wellington Jogo, at w.jogo@cgiar.org. You may also contact the UW Project Investigator, Heidi Busse, at busse@surgery.wisc.edu or +1 608-263-0327.

By signing the consent form below, the individual being interviewed certifies that s/he has read this document (or it has been read to him/her) and agrees to the terms set forth herein. S/he understands that any and all comments may be used for both program evaluation and summarized (without personal identification) in public documents. Participation is completely voluntary.

Consent

I agree to take part in this interview. I know my comments may be published in public documents.

_____ _____
Signature Date

APPENDIX 5: INTERVIEW SCHEDULE

Location	Date	Time	Organization and staff
Addis Ababa	Thurs 18 Jun	PM	Heidi/Riley arrive in Ethiopia
	Fri 19 Jun	AM	CIP/UW meeting to review methods
			- Finalize questionnaires and code book
			- Obtain information for document review
		PM	KII: CIP (Wellington, Frezer)
	Sat 20 Jun	-	UW team: revise/finalize questionnaires
	Sun 21 Jun	-	Sunday – Heidi/Riley prepare SNNPR materials
SNNPR	Mon 22 Jun	AM	Depart for Hawassa/SNNPR Noon: Meet with CIP-SNNPR staff and review methods
		PM	KII: CIP (Abiot)
	Tue 23 Jun	AM	KII: GOAL (Ato Mateus)
			KII: GOAL (Ato Tesfay)
		PM	KII: Enga le Enga (Ferew)
			KII: Enga le Enga (Fetele)
	Wed 24 Jun	AM	KII: SARI (Ato Fekadu)
		PM	*Planning meeting with local staff for FGDs*
	Thu 25 Jun	**WOLAYTA Community Interviews: Damot Gale**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Fri 26 Jun	**Areka Ag. Institute**	
		AM	KII: Ato Genene
			KII: DVM/multipliers
		WOLAYTA Community Interviews: Damot Woyide	
		PM	KII: DAs, HEWs
			FGD: Men
			FGD: Women
	Sat 27 Jun	**WOLAYTA Community Interviews: Duguna Fango**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Sun 28 Jun	-	Sunday – rest day
	Mon 29 Jun	**SIDAMA Community Interviews: Boricha**	
		AM	KII: DAs, HEWs
		PM	FGD: Men

			FGD: Women
	Tue 30 Jun	**SIDAMA Community Interviews: Loko Abaya**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Wed 1 Jul	AM	KII: Hawassa University (Dr. Henok)
		PM	Travel back to Addis
Addis Ababa	Wed 1 Jul	-	CIP/UW Mtg: Debrief SNNPR; document review
	Thu 2 Jul	-	Fly to Tigray
Tigray	Fri 3 Jul	AM	*Meet with local Tigray staff and review methods*
		PM	KII: CIP (Dr. Haile)
			KII: Mums 4 Mums
			KII: Women's Association of Tigray
	Sat 4 Jul	**CENTRAL ZONE: Tanqua Abergelle Community Interviews**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Sun 5 Jul	-	Sunday – rest day
	Mon 6 Jul	**EASTERN ZONE: Hawzen Community Interviews**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Tue 7 Jul	**SOUTHERN ZONE:Raya Azebo Community Interviews**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
	Wed 8 Jul	**SOUTH-EASTERN ZONE: Hintallo Wujirat Community Interviews**	
		AM	KII: DAs, HEWs
		PM	FGD: Men
			FGD: Women
		Evening	Fly back to Addis Ababa
Addis Ababa	Thu 9 Jul	AM	CIP/UW Meeting: Debrief Tigray
		PM	Local Staff: Complete School Garden Interview (Damino Elementary School)
			Heidi depart Ethiopia

APPENDIX 6: WHOLE MEASURES INDICATORS FOR THE CIP NUTRITION PROJECT

Context of the SNNPR and Tigray Communities by Livelihoods	
PHYSICAL	School; Road; Church/Mosque; Markets; Health centers; Mill; Cemetery; Shop
FINANCIAL	Microfinance; Crops; Trees; Livestock; Money; Gold Possessions; Electricity
HUMAN	Education; Religion; Sports; Vaccinations; Ability to work; Attitude; Homes
NATURAL	Water; Forests; Land; Crops; Stones; Mountains; Wild animals
POLITICAL	Government offices; farmer groups; women's groups; traditional inst.
SOCIAL	Religion; Marketplaces; Weddings; Shop; Grazing land; Associations

Multi-level Strategies
Policy: formal and informal governance structures
Organizations: institutions (faith-based, traditional, NGO)
Community: School gardens, women's associations, FTC and HEW workshops
Households: diversify livelihoods; off-farm income; productive agriculture; nutrition education

Community Outcome Indicators	Community Impact
- # OFSP buyers - # new OFSP products - Increased average size of irrigated land - #processors using OFSP - # new processing technologies	**Vibrant Agriculture**
- # OFSP growers - Increased income from OFSP sales - # of farmers selling OFSP to urban markets - # farmers using formal credit institutions	**Thriving Local Economies**
- # HH growing OFSP - Improved HH and child dietary diversity scores - Improved school attendance - Reduced mortality rates - Reduced diarrhea rates	**Healthy People**
- # of OFSP vines distributed - Increased OFSP production area - # training in climate/sustainable agriculture techniques - # drought resistant OFSP varieties developed	**Sustainable Ecosystems**
- # woreda-level nutrition steering committees - # regional nutrition steering committees - OFSP made as a GoE priority crop - # of women's associations involved	**Justice and Fairness**
- # of in school gardens - # OFSP vines distributed to schools - # school feeding programs - % of HHs with women making OFSP crop decisions - # farmers sharing experiences with others (new HHs)	**Resilient Communities**

APPENDIX 7: BASELINE HOUSEHOLD SURVEY INSTRUMENT

A. Household: General *HH ID Number:* ___ ___ ___

Notice: Your participation in this survey is completely voluntary. You have the right not to participate. However, if you decide to participate, your information and identity will be kept confidential and your name and identification will never be affiliated with the answers you provide.

HOUSEHOLD IDENTIFICATION		
A1. Administrative Zone		
A1a. Woreda		
A1b. Kebele/Tabia		
A1c. Village		
A2. Name of the Head of the Household		
QUALITY CONTROL		
A3. Date of the Interview	MONTH ☐☐ DAY ☐☐ YEAR ☐☐☐☐	
A3a. START Time of Interview	___ ___ : ___ ___	
A3b. END Time of Interview	___ ___ : ___ ___	
GPS MEASUREMENTS		
A4. Latitude	__ __ __ __ __ __	☐ N ☐ S
A5. Longitude	__ __ __ __ __ __	☐ E ☐ W
A6. Altitude	_____ Meters	

Name of the Enumerator: _____

Participant ☐
Non-participant ☐

A7. Describe Problems or Observations Encountered:

HOUSEHOLD RESOURCES		
Current Livestock Holdings:	**# of Animals**	
B1. ☐ Dairy and/or Beef Cattle		
B2. ☐ Sheep		
B3. ☐ Goats		
B4. ☐ Draft Oxen		
B5. ☐ Chickens		
Land Holdings (over past 12 months):	**Units of Land: Timad (1 hectare= 4 Timad)**	**Units of Land: Timad (1 hectare= 6 Timad)**
B6. ☐ Rented Out Land	*timad*	*timad*
B7. ☐ Share Cropped Out Land	*timad*	*timad*
B8. ☐ Rented In Land	*timad*	*timad*
B9. ☐ Share Cropped In Land	*timad*	*timad*
B10. ☐ Annual Crop Land	*timad*	*timad*
B11. ☐ Permanent Crops	*timad*	*timad*
B12. ☐ Grazing Land	*timad*	*timad*
B13. ☐ Homestead	*timad*	*timad*
B14. ☐ Irrigated Land	*timad*	*timad*
B15. ☐ Fallow Land	*timad*	*timad*
B16. ☐ Total Owned Land (sum B8 through B14)	*timad*	*timad*
HOUSEHOLD ASSETS		
B17. In the past 12 months, did you use communal grazing land?	☐ Yes ☐ No	
B18. Do you wish you had more land available to farm?	☐ Yes ☐ No	
B18a. If yes to B18, what prevents this (check all that apply)?	☐ Lack of money ☐ Available land is not arable ☐ Lack of available land ☐ Other: _____	
B19. Does anyone in your household generate income?	☐ Yes ☐ No	
B19a. If yes to B19, what are the sources of income (check all that apply)?	☐ Off-farm employment ☐ Agricultural production – crops ☐ Agricultural production – livestock ☐ Agricultural production – eggs ☐ Agricultural production – P, WFSP, OFSP ☐ Cottage industry (e.g., butter or cheese) ☐ Rent out land ☐ Other: _____	
B20. Do you have access to credit?	☐ Yes ☐ No	
B20a. If yes to B20, what is the source?	☐ *Ekub* ☐ Microfinance NGO ☐ Bank/Lender ☐ Other: _____	
B21. Do you have electricity?	☐ Yes ☐ No	
B21a. If yes to B21, what is the electricity source?	☐ Solar ☐ Government/Grid ☐ Other: _____	

B. Household: Resources

B22. Do you have a latrine?	☐ Yes ☐ No
B22a. If yes to B22, what kind of latrine?	☐ Pit ☐ Flush ☐ Other: _____
B23. Does your household own a radio?	☐ Yes ☐ No
B24. Does your household own a bicycle?	☐ Yes ☐ No
B25. Does your household own a cell phone?	☐ Yes ☐ No
B26. What is your house roof made from?	☐ Thatch ☐ Tin ☐ Other: _____
B27. What is your house floor made from?	☐ Dirt ☐ Concrete ☐ Tile ☐ Other: _____
B28. Where does your drinking water come from?	☐ Community Water/Pond ☐ Private well ☐ River ☐ Natural Spring ☐ Other: _____
B29. Do you have access to a health care facility?	☐ Yes ☐ No
B29a. If yes to B29, how far is the health facility?	☐ _____ km ☐ Do not know
B29b. If yes to B29, how long does it take to get to the health facility?	☐ _____ minutes ☐ Do not know
B29c. If yes to B29, what kind of health facility is it?	☐ Government health center ☐ Government health post ☐ Private clinic ☐ Other: _____

Baseline Survey
B. Household: Resources

FOOD SECURITY			
B30. Comparing the past 12 months against previous years, how are your current food stocks?	☐ Less than average ☐ Average ☐ Greater than average ☐ Do not know		
B31. In the past 4 weeks, did you worry that your household would not have enough food?	☐ Yes ☐ No	B31a. If yes to B31, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B32. In the past 4 weeks, have you reduced the variety of food you or any HH member ate because there was not enough food or money?	☐ Yes ☐ No	B32a. If yes to B33, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B33. In the past 4 weeks, have you or any HH member ever had to eat a smaller meal because of not enough food?	☐ Yes ☐ No	B33a. If yes to B33, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B34. In the past 4 weeks, have you or any HH member eaten fewer meals in a day because of food or money shortages?	☐ Yes ☐ No	B34a. If yes to B34, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B35. In the past 4 weeks, was there ever no food to eat in your HH because of lack of food or resources?	☐ Yes ☐ No	B35a. If yes to B35, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B36. In the past 4 weeks, have you ever felt or gone to bed hungry because there was not enough to eat?	☐ Yes ☐ No	B36a. If yes to B36, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B37. In the past 4 weeks, have you asked for money or food from a neighbor or someone outside of the home?	☐ Yes ☐ No	B37a. If yes to B37, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B38. In the past 4 weeks, have any of your children ever not had enough to eat?	☐ Yes ☐ No	B38a. If yes to B38, how often did this happen?	☐ Rarely ☐ Sometimes ☐ Often
B39. Was there a period in the <u>Last 12 months</u> when you did not have enough food for your household?	☐ Yes ☐ No		
B39a. If yes, which months were you insecure (Check all that apply)? ☐ February 2014 ☐ August 2013 ☐ January 2014 ☐ July 2013 ☐ December 2013 ☐ June 2013 ☐ November 2013 ☐ May 2013 ☐ October 2013 ☐ April 2013 ☐ September 2013 ☐ March 2013			

Baseline Survey
C. Household: Family and Household Composition

***A household consists of any member who lives with the family now or who depends upon the family resources (e.g., college students)**

C1. ID #	C2. Name	C3. Sex	[1]C4. Relationship to HH	C5. Age	[2]C6. Marital Status	[3]C7. Major Occupation	[4]C8. Highest Education Completed	C9. Farmer Group Member?	C10. Generate Off-farm Income?
01		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
02		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
03		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
04		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
05		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
06		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
07		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
08		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
09		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
10		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
11		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No
12		☐ M ☐ F		____ ____ ☐ Years ☐ Months				☐ Yes ☐ No	☐ Yes ☐ No

[1]C4. Relationship to HH:	0. Head	1.Spouse	2.Son	3.Daughter	4.Parent	5.Brother/Sister	6.Brother/Sister-in-law	7.Parent-in-law	8.Grandchild	9.Other	10.Hired Labor
[2]C6. Marital Status:	1.Married	2.Unmarried	3.Divorced	4.Widowed	5. Separated						
[3]C7. Major Occupation:	0. N/A (child)	1.Farmer	2. Student	3.Cottage Industry	4.Merchant/Petty Trader	5.Teacher	6. Civil servant	7. Seasonal Worker	8.Herder	9.HHMaid	10. Housewife	11. Not working – Disabled	12. Not working – Grandparent
[4]C8. Education:	1.Illiterate	2.Read/Write	3.Primary (1-6)	4.Secondary (7-10)	5.Vocational (11-12)	6.College or Above							

Baseline Survey

D. Household: *Meher* Crop Activities

GENERAL CROP ACTIVITIES: *Meher*	
D1. Do you have access to swamps/marshy areas during the *Meher* season?	☐ Yes ☐ No
D2. How many total plots to you have access to during the *Meher* season?	☐ 0 ☐ 2 ☐ 4 ☐ 6 ☐ 1 ☐ 3 ☐ 5 ☐ 7 or more

Ask for 5 largest plots. Start with biggest plot of household and rank crops by greatest yield within the plot.

D3. Plot	**[1]D4. Location of plot**	**[2]D5. How plot was acquired**	**[3]D6. Crop Produced**	**[4]D7. Who Decides on Crop Production?**	**D8. Crop Production Area**	**[5]D9. Crop Yield *(in quintal)***	**[6]D10a. Yield Unit *(leave blank if quintal)***	**D11. Uses of Crops Produced, by Yield**			
								D11a. Sold	**D11b. Seed**	**D11c. Consumed**	**D11d. Other**
1			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
2			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
3			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
4			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
5			A.		*timad*						
			B.		*timad*						
			C.		*timad*						

KEY:

[1]D4. Location of plot	*1. Homestead*	*2. Wetland*	*3. Dryland*	*4. Irrigated land*	*5. Other (specify)*		
[2]D5. How plot was acquired	*1. Purchase*	*2. Resettled by govt program*	*3. Inherited*	*4.Communal land*	*5. Rented*	*6.Other (specify)*	
[3]D6. Crops Produced	*1. Irish Potatoes*	*2. OFSP*	*3. WFSP*	*4. Wheat*	*5. Maize*	*6. Taro*	*7. Teff*
	8. Cassava	*9. Millet*	*10. Barley*	*11. Oats*	*12. Sorghum*	*13. Cabbage*	*14. Carrots*
	15. Haricot Beans	*16. Chick Peas*	*17. Enset*	*18. Sugar Cane*	*19. Chilies*	*20. Other: _____*	
[4]D7. Who Decides on Crop Production:	*1. Husband*	*2. Wife*	*3. Son*	*4. Daughter*	*5. Other: _____*		
[5]D9. If crop yield is zero, enter code to explain:	*96. Drought*	*97. Flood*	*98. Pest*	*99. Other: _____*			
[6]D10a. Unit code	*1. Jumb __ kg*	*2. Shekim __ kg*	*3. Donkey load _kg*	*4. Other __ kg*			

Baseline Survey
E. Household: *Belg* Crop Activities

GENERAL CROP ACTIVITIES: *Belg*	
E1. Do you have access to swamps/marshy areas during the *Belg* season?	☐ Yes ☐ No
E2. How many total plots to you have access to during the *Belg* season?	☐ 0 ☐ 2 ☐ 4 ☐ 6 ☐ 1 ☐ 3 ☐ 5 ☐ 7 or more

Ask for 5 largest plots. Start with biggest plot of household and rank crops by importance within the plot.

E3. Plot	**[1]E4. Location of plot**	**[2]E5. How plot was acquired**	**[3]E6. Crop Produced**	**[4]E7. Who Decides on Crop Production?**	**E8. Crop Production Area**	**[5]E9. Crop Yield *(in quintal)***	**[6]E10a. Yield Unit *(leave blank if quintal)***	**E11. Uses of Crops Produced, by Yield**			
								E11a. Sold	**E11b. Seed**	**E11c. Consumed**	**E11d. Other**
1			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
2			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
3			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
4			A.		*timad*						
			B.		*timad*						
			C.		*timad*						
5			A.		*timad*						
			B.		*timad*						
			C.		*timad*						

KEY:

[1]E4. Location of plot	*1. Homestead*	*2. Wetland*	*3. Dryland*	*4. Irrigated land*	*5. Other (specify)*		
[2] E5. How plot was acquired	*1. Purchase*	*2. Resettled by govt program*	*3. Inherited*	*4.Communal land*	*5. Rented*	*6.Other (specify)*	
[3]E6. Crops Produced	*1. Irish Potatoes*	*2. OFSP*	*3. WFSP*	*4. Wheat*	*5. Maize*	*6. Taro*	*7. Teff*
	8. Cassava	*9. Millet*	*10. Barley*	*11. Oats*	*12. Sorghum*	*13. Cabbage*	*14. Carrots*
	15. Haricot Beans	*16. Chick Peas*	*17. Enset*	*18. Sugar Cane*	*19. Chilies*	*20. Other: _____*	
[4]E7. Who Decides on Crop Production:	*1. Husband*	*2. Wife*	*3. Son*	*4. Daughter*	*5. Other: _____*		
[5]E9. If crop yield is zero, enter code to explain:	*96. Drought*	*97. Flood*	*98. Pest*	*99. Other: _____*			
[6]E10a. Unit code	*1. Jumb __ kg*	*2. Shekim __ kg*	*3. Donkey load _kg*	*4. Other __ kg*			

Baseline Survey

F. Household: Potato, WFSP and Orange Fleshed Sweet Potato Production

F1. Did you grow <u>Potatoes</u> (P) during the last 12 months?	☐ Yes ☐ No
F1a. If no to F1, how you ever grown potatoes before?	☐ Yes ☐ No
F1a1. If Yes to F1a, why did you stop growing P?	
If you answered NO to Question F1, please skip to Question F2.	
F1b. Did you grow potatoes during *belg*?	☐ Yes ☐ No
F1b1. If yes to F1b, how many *belg* plots did you grow?	_____ plots
F1c. Did you grow potatoes during *meher*?	☐ Yes ☐ No
F1c1. If yes to F1c, how many *meher* plots did you grow?	_____ plots
F1d. Combined total plots of potato production:	_____ plots
F1e. Which potato varieties did you grow?	☐ Do not know ☐ Jalene ☐ Gudene ☐ Wechecha ☐ Gera ☐ Menegesha ☐ Digemegn ☐ Guassa ☐ Bulle ☐ Tolcha ☐ Other: ____
F1f. Reason(s) for selecting potato varieties (select all that apply)?	☐ Readily available ☐ Suitable to climate/soil ☐ Better taste ☐ High yielding ☐ Resistant to pests/disease ☐ Market demand ☐ Have always grown/familiar with P ☐ Other (specify):
F1g. Who selected the potato varieties (check all that apply)?	☐ Husband ☐ Son ☐ Other: _____ ☐ Wife ☐ Daughter
F1h. What was the quantity of potato seed used?	☐ _____ Quintal ☐ Do not know
F1i. What was the source of potato seed (check all that apply)?	☐ Own production ☐ Free from farmer/neighbor ☐ Free from individual outside village ☐ Free from NGO ☐ Bought from <u>individual farmer</u> specializing in seed production ☐ Bought from cooperative/farmer group specializing in seed production <u>within district</u> ☐ Bought from cooperative/farmer group specializing in seed production <u>outside district</u>
F1i1. What was the distance to the seed source?	☐ _____ km ☐ Do not know
F1i2. If seed was **purchased** under F1i, what was the price per unit:	☐ _____ *birr* per ☐ Quintal or ☐ kg ☐ Do not know
F1j. What was your total income from potatoes in the past 12 months (if none, write "0")?	☐ _____ b*irr* ☐ Do not know
F1k. What was your total potato production in the past 12 months?	☐ _____ Quintal ☐ Do not know
F1k1. Of the total potatoes produced, what did you do with them?	☐ Seed: _____ Quintal ☐ Consumed: _____ Quintal ☐ Sold: _____ Quintal
F1k1a. If you sold potatoes, to whom did you sell (check all that apply)?	☐ End consumers ☐ Wholesaler ☐ Agent/broker ☐ Small traders/middlemen ☐ Roadside processor ☐ Retailer ☐ Large processor (e.g., bakery, restaurant, hotel) ☐ Other (specify):
F1j1b. What was the location/s of your buyer/s (check all that apply)?	☐ Within the kebele ☐ From neighboring district ☐ From neighbor kebele ☐ From distant district ☐ From kebele within district
F1k1c. Average distance to buyer?	☐ _____ km ☐ Do not know
F1k1d. Average price per unit?	☐ _____ *birr* per Quintal ☐ Do not know
F1k1e. What was your marketing strategy (check all that apply)?	☐ Sell as individual farmer ☐ Sell collectively as cooperative/farmer group

Baseline Survey

F. Household: Potato, WFSP and Orange Fleshed Sweet Potato Production

F2. Did you grow <u>WFSP</u> during the last 12 months?	☐ Yes ☐ No
F2a. If no to F2, how you ever grown WFSP before?	☐ Yes ☐ No
F2a1. If Yes to F2a, why did you stop growing it?	
If you answered NO to Question F2, please skip to Question F3.	
F2b. Did you grow WFSP during *belg*?	☐ Yes ☐ No
F2b1. If yes to F2b, how many *belg* plots did you grow?	_____ plots
F2c. Did you grow WFSP during *meher*?	☐ Yes ☐ No
F2c1. If yes to F2c, how many *meher* plots did you grow?	_____ plots
F2d. Combined total plots of WFSP production:	_____ plots
F2e. Which WFSP varieties did you grow?	☐ Do not know ☐ If known, please specify: ____
F2f. Reason(s) for selecting WFSP varieties (select all that apply)?	☐ Readily available ☐ Suitable to climate/soil ☐ Better taste ☐ High yielding ☐ Resistant to pests/disease ☐ Market demand ☐ Have always grown/familiar with P ☐ Other (specify):
F2g. Who selected the WFSP varieties (check all that apply)?	☐ Husband ☐ Son ☐ Other: _____ ☐ Wife ☐ Daughter
F2h. What was the quantity of WFSP vines used (specify quantity)?	☐ _____ Vines ☐ Do not know
F2i. What was the source of WFSP vines?	☐ Own production ☐ Free from farmer/neighbor ☐ Free from individual outside village ☐ Free from NGO ☐ Bought from <u>individual farmer</u> specializing in seed production ☐ Bought from cooperative/farmer group specializing in seed production <u>within district</u> ☐ Bought from cooperative/farmer group specializing in seed production <u>outside district</u>
F2i1. What was the distance of vine source?	☐ _____ km ☐ Do not know
F2i2. If vines were **purchased** under F2i, what was the price per unit:	☐ _____ *birr* per vine ☐ Do not know
F2j. What was your total income from WFSP in the past 12 months?	☐ _____ *birr* ☐ Do not know
F2k. What was your total WFSP production from the past 12 months?	☐ _____ vines ☐ Do not know
F2k1. Of the total WFSP produced, what did you do with it?	☐ Seed: _____ Vines ☐ Consumed: _____ ☐ Quintal ☐ Kg ☐ Sold: _____ ☐ Quintal ☐ Kg
F2k1a. If you sold WFSP, to whom did you sell (check all that apply)?	☐ End consumers ☐ Wholesaler ☐ Agent/broker ☐ Small traders/middlemen ☐ Roadside processor ☐ Retailer ☐ Large processor (e.g., bakery, restaurant, hotel) ☐ Other (specify):
F2k1b. What was the location/s of your buyer/s (check all that apply)?	☐ Within the kebele ☐ From neighbor kebele ☐ From kebele within district ☐ From neighboring district ☐ From distant district
F2k1c. Average distance to buyer?	☐ _____ km ☐ Do not know
F2k1d. Average price per unit?	☐ _____ *birr* per vine ☐ Do not know
F2k1e. What was your marketing strategy (check all that apply)?	☐ Sell as individual farmer ☐ Sell collectively as cooperative/farmer group

F. Household: Potato, WFSP and Orange Fleshed Sweet Potato Production

F3. Did you grow <u>OFSP</u> during the last 12 months?	☐ Yes ☐ No
F3a. If no to F3, how you ever grown OFSP before?	☐ Yes ☐ No
F3a1. If Yes to F3a, why did you stop growing it?	
If you answered NO to Question F3, please skip to Question F4.	
F3b. Did you grow OFSP during *belg*?	☐ Yes ☐ No
F3b1. If yes to F3b, how many *belg* plots?	_____ plots
F3c. Did you grow OFSP during *meher*?	☐ Yes ☐ No
F3c1. If yes to F3c, how many *meher* plots?	_____ plots
F3d. Combined total plots of OFSP production:	_____ plots
F3e. Which OFSP varieties did you grow?	☐ Do not know ☐ Gadisia ☐ Guntute ☐ Tulla ☐ Koka 6 ☐ Other: ☐ Kulfo ☐ Koka 12
F3f. Reason(s) for selecting OFSP varieties (select all that apply)?	☐ Readily available ☐ Suitable to climate/soil ☐ Better taste ☐ High yielding ☐ Resistant to pests/disease ☐ Market demand ☐ Have always grown/familiar with P ☐ Other (specify):
F3g. Who selected the OFSP varieties (check all that apply)?	☐ Husband ☐ Son ☐ Other: _____ ☐ Wife ☐ Daughter
F3h. What was the quantity of OFSP vines used (specify quantity)?	☐ _____ Vines ☐ Do not know
F3i. What was the source of OFSP vines?	☐ Own production ☐ Free from farmer/neighbor ☐ Free from individual outside village ☐ Free from NGO ☐ Bought from <u>individual farmer</u> specializing in seed production ☐ Bought from cooperative/farmer group specializing in seed production <u>within district</u> ☐ Bought from cooperative/farmer group specializing in seed production <u>outside district</u>
F3i1. What was the distance of vine source?	☐ _____ km ☐ Do not know
F3i2. If vines were **purchased** under F3i, what was the price per unit:	☐ _____ *birr* per vine ☐ Do not know
F3j. What was your total income from OFSP in the past 12 months?	☐ _____ *birr* ☐ Do not know
F3k. What was your total OFSP production from the past 12 months?	☐ _____ Vines ☐ Do not know
F3k1. Of the total OFSP produced, what did you do with it?	☐ Seed: _____ Vines ☐ Consumed: _____ ☐ Quintal ☐ Kg ☐ Sold: _____ ☐ Quintal ☐ Kg
F3k1a. If you sold OFSP, to whom did you sell (check all that apply)?	☐ End consumers ☐ Wholesaler ☐ Agent/broker ☐ Small traders/middlemen ☐ Roadside processor ☐ Retailer ☐ Large processor (e.g., bakery, restaurant, hotel) ☐ Other (specify): _____
F3k1b. What was the location/s of your buyer/s (check all that apply)?	☐ Within the kebele ☐ From neighbor kebele ☐ From kebele within district ☐ From neighboring district ☐ From distant district
F3k1c. Average distance to buyer?	☐ _____ km ☐ Do not know
F3k1d. Average price per unit?	☐ _____ *birr* per vine ☐ Do not know
F3k1e. What was your marketing strategy (check all that apply)?	☐ Sell as individual farmer ☐ Sell collectively as cooperative/farmer group

F. Household: Potato and Orange Flesh Sweet Potato Production

F4. In the past 12 months, have you/your family received agricultural technical assistance for WFSP or OFSP?	☐ Yes ☐ No
F4a. If no to F4, do you have access to WFSP/OFSP technical assistance?	☐ Yes ☐ No
F4b. If yes to F4, was this assistance conducted in your kebele?	☐ Yes ☐ No
F4c. If yes to F4, who provided the technical assistance?	☐ Primary farmer cooperative ☐ Cooperative union ☐ Women's group ☐ NGO ☐ Government ☐ Other (specify):
F4d. If yes to F4, who in the household has direct access to this technical assistance?	☐ Husband ☐ Wife ☐ Daughter ☐ Son ☐ Other (specify):
F4e. If yes to F4, how many times have you used/accessed this service in the last 3 seasons?	☐ 1 ☐ 2 ☐ 3 or more
F4f. If yes to F4, how many providers of this service are there in your kebele/locality?	☐ 1 ☐ 2 ☐ 3 or more
F4g. If yes to F4, what is the distance to the nearest technical assistance provider?	_____ km
F5. In the past 12 months, have you/your family received agricultural technical assistance for Irish Potatoes?	☐ Yes ☐ No
F5a. If no to F5, do you have access to technical assistance for P?	☐ Yes ☐ No
F5b. If yes to F5, what kinds of assistance did you receive (check all that apply)?	☐ Technical/production assistance ☐ Training on potato product development and marketing ☐ Potato seed production/multiplication ☐ Ware potato and seed markets ☐ Market information (e.g., price, market opportunities, demand, and sources of supplies) ☐ Credit ☐ Potato processing (e.g., flour milling, crisp making) ☐ Other (specify):
F5b1. If yes to any services/interventions checked in F5b, where was the assistance conducted?	☐ On-farm/At the household ☐ Within kebele ☐ Outside of kebele
F5b1a. If assistance was provided within or outside of kebele, what was the distance?	_____ km
F5c. If yes to F5, who provided the technical assistance/services?	☐ Primary farmer cooperative ☐ Cooperative union ☐ Women's group ☐ NGO ☐ Government ☐ Other (specify):

Baseline Survey

F. Household: Potato and Orange Flesh Sweet Potato Production

F5d. If yes to F5, who in the household had direct access to technical assistance/services?	☐ Husband ☐ Wife ☐ Daughter ☐ Son ☐ Other (specify):
F5e. If yes to F5, how many times have you used/accessed assistance/services in the last 3 seasons?	☐ 1 ☐ 2 ☐ 3 or more
F5f. If yes to F5, how many providers of these services/assistance are there in your kebele/locality?	☐ 1 ☐ 2 ☐ 3 or more
F6. Does your household have a kitchen garden?	☐ Yes ☐ No
F6a. If yes to F6, did you grow any of the following in your kitchen garden in the past 12 months?	☐ Irish potatoes ☐ WFSP ☐ OFSP ☐ Did not grow any potato crops

Baseline Survey

G. Household: Seed/Vine Production, Storage, and Marketing Systems

Potato and Sweet Potato Seed/Vine Production Systems	
G1. Do you specialize in seed/vine production and multiplication for P, WFSP, or OFSP?	☐ Yes ☐ No
If you answered NO to Question G1, please skip to Question G2.	
G1a. If yes to G1, for which crops (check all that apply)?	☐ Irish potatoes ☐ WFSP ☐ OFSP
G1b. If yes to G1, what type of seed/vine producer are you?	☐ Individual farmer ☐ Primary farmer cooperative ☐ Cooperative union ☐ Other (specify):
G1c. If yes to G1, what varieties do you produce?	☐ Bulle ☐ Gadisia ☐ Jalene ☐ Tulla ☐ Gudene ☐ Kulfo ☐ Wechecha ☐ Koka 6 ☐ Gera ☐ Koka 12 ☐ Menegesha ☐ Guntute ☐ Digemegn ☐ Other: ☐ Guassa ☐ Do not know
G1d. Do you or any members of the seed producer group receive training in seed/vine production and management?	☐ Yes ☐ No
G1d1. If yes to G1d, who provided the training?	☐ Individual farmer ☐ Government (research centre, BoA) ☐ Primary cooperative ☐ Private company ☐ Cooperative union ☐ NGO ☐ International research centre ☐ Other:
G1d2. If yes to G1d, when did you receive the training (year)?	
G1e. If yes to G1, what is your source of foundation/basic seed?	☐ Own production (saved seeds) ☐ Government (BoA, etc.) ☐ Primary cooperative ☐ Private company ☐ Cooperative union ☐ NGO ☐ International research centre ☐ Other:
G1e1. What is the location of your foundation seed source?	☐ Within the kebele ☐ From neighboring district ☐ From neighbor kebele ☐ From distant district ☐ From kebele within district
G1e2. What is the average quantity of foundation seed/vines purchased per season?	☐ Irish potato seed: _____ Quintal ☐ WFSP: _____ Vines ☐ OFSP: _____ Vines
G1f. To whom do you sell the seeds/vines?	☐ Neighbor farmers ☐ Individual farmers w/in kebele ☐ Individual farmers in distant kebeles/districts ☐ Primary cooperative w/in kebele ☐ Primary cooperative in distant kebele/districts ☐ Other farmer groups ☐ Cooperative unions ☐ Government (research centre, BoA) ☐ NGO ☐ Retailer ☐ Trader (middleman, aggregator) ☐ Wholesaler ☐ Other (specify):

Baseline Survey

G. Household: Seed/Vine Production, Storage, and Marketing Systems

G1f1. When you sell, what is your means of transport?	☐ Own motor vehicle ☐ No vehicle used ☐ Hired vehicle ☐ Animal-powered vehicle ☐ Public transport ☐ Supplier delivers product ☐ Motor bike ☐ Non-motorized vehicle (e.g., bike, wheelbarrow, etc.) ☐ Other (specify):
G1g. What is your average seed/vine production volume per year?	☐ Irish potato seed: _____ Quintal ☐ WFSP: _____ Vines ☐ OFSP: _____ Vines
G1g1. Of the total seed/vine production, what did you do with it?	☐ Stored/Kept for own planting next season: _____ ☐ Sold: _____ Quintal
G1h. What was your average price per unit?	_____ *birr* per Quintal of P seed _____ *birr* per WFSP vine _____ *birr* per OFSP vine
G1i. Do you verify the quality of seed or vine planting material?	☐ Yes ☐ No
G1i1. If yes to G1i, how do you verify quality?	☐ Self/Visual appearance ☐ Government certification ☐ Private certifiers ☐ Group/Association/Cooperative certifiers ☐ Other (specify):
G1j. Beside producing and/or selling seed/vine materials, do you provider farmers/buyers any other services?	☐ Yes ☐ No
G1j1. If yes to G1j, which services do you provide?	☐ Advice on correct varieties ☐ Training other farmers in seed P/SP production ☐ Giving technical assistance to farmers on P/SP production ☐ Other (specify):
Potato and Sweet Potato Seed Storage	
G2. Have you ever received training on quality maintenance and storage of seeds/vines?	☐ Yes ☐ No
G2a. If yes to G2, when did you last receive Training (specify year)?	
G3. Do you have any problems with seed quality or storage issues?	☐ Yes ☐ No
G3a. If yes to G3, what are the problems (check all that apply)?	☐ Seed Quality ☐ Rot ☐ Sprouting ☐ Drying/Shriveling ☐ Disease ☐ No problem with quality ☐ Other quality issue: _____ ☐ Storage ☐ Post-harvest loss ☐ Lack of markets ☐ Lack of equipment for harvesting and/or processing ☐ Lack of knowledge about storage options ☐ No problem with storage ☐ Other storage issue: _____
G4. Do you have access to storage facilities for potato seeds?	☐ Yes ☐ No
G4a. If yes to G4, what type of storage?	☐ Open air ☐ Diffused light storage ☐ Kept underground/in soil ☐ Put in sack/enhance sprouting
G4b. If yes to G4, what is the store capacity?	_____ Quintal

Baseline Survey
G. Household: Seed/Vine Production, Storage, and Marketing Systems

G4c. If yes to G4, what type of ownership do you have?	☐ Own it as an individual ☐ Rent ☐ Collectively own with a farmer cooperative/association ☐ Other (specify):
G4d. If yes to G4, who uses the storage facility?	☐ Use it individually ☐ Share with another farmer ☐ Used collectively by the farmer cooperative
G5. Do you preserve your WFSP vines?	☐ Yes ☐ No
G5a. If yes to G5, how do you preserve your WFSP vines?	☐ Kept in shade area ☐ Other (specify):
G6. Do you preserve your OFSP vines?	☐ Yes ☐ No
G6a. If yes to G6, how do you preserve your OFSP vines?	☐ Kept in shade area ☐ Other (specify):
Production and Sale of Potato and Sweet Potato Products	
G7. Do you produce any P or OFSP processed products?	☐ Yes ☐ No
G7a. If yes to G7, do you produce P products?	☐ Yes ☐ No
G7a1. If no to G7a, does anyone in your kebele make P products?	☐ Yes ☐ No
G7a2. If yes to G7a, what P products do you make?	☐ Potato crisps ☐ Boiled potatoes ☐ Potato flour ☐ Other (specify):
G7a3. If yes to G7a, what is your average annual quantity produced?	_____ Quintal
G7a4. If yes to G7a, what is your average price per unit?	_____ *birr* per Quintal
G7a5. If yes to G7a, to whom to do you sell P products?	☐ End consumers ☐ Wholesaler ☐ Small traders/middlemen ☐ Roadside processors ☐ Agent/broker ☐ Large processors ☐ Retailers ☐ Other (specify):
G7b. If yes to G7, do you produce OFSP products?	☐ Yes ☐ No
G7b1. If no to G7b, does anyone in your kebele make OFSP products?	☐ Yes ☐ No
G7b2. If yes to G7b, what OFSP products do you make?	☐ OFSP crisps ☐ Boiled OFSP ☐ OFSP flour ☐ Other (specify):
G7b3. If yes to G7b, what is your average annual quantity produced?	_____ Quintal
G7b4. If yes to G7b, what is your average price per unit?	_____ *birr* per Quintal
G7b5. If yes to G7b, to whom to do you sell OFSP products?	☐ End consumers ☐ Retailers ☐ Small traders/middlemen ☐ Wholesaler ☐ Agent/broker ☐ Roadside processors ☐ Large processors (e.g., bakery, restaurant, hotel) ☐ Other (specify):

H. Individual: Medical History – Mother
Individual ID Number: ___ ___

GENERAL QUESTIONS	
H1. Were you born in this *woreda*?	☐ Yes ☐ No
H1a. If no to H1, where were you born?	
H2. Were you born at home?	☐ Yes ☐ Do not know ☐ No
H2a. If no to H2, where were you born?	
H3. Measurements:	
H4a. Height of mother	____ ____ ____ cm
H4b. Weight of mother	____ ____ , ____ ____ kg
H4. Age of the mother:	☐☐ years
H5. What is the source of your birth date?	☐ Document (clinic or home record) ☐ Stated and confirmed by other family member/s ☐ Estimated (used calendar of events)
H6. At what age did you first get married?	☐☐ years
H7. At what age did you first get pregnant?	☐☐ years
H8. How many times have you been pregnant (including if currently pregnant)?	☐☐
H8a. How many children have you given birth to that are still alive?	☐☐
H8b. Was there a death of a mother or child between the ages of 0-5 years in the past 5 years?	☐ Yes ☐ No ☐ Decline to answer
H8b1. If yes to H8b, what was the cause?	
H9. Were any of your children born in a health facility?	☐ Yes ☐ No
H9a. If yes to H9, where was your child/ren born (check all that apply)?	☐ Health Center ☐ Health Post ☐ Hospital ☐ Other: _____
H9b. If yes to H9, why was your child/ren not born at home?	☐ Emergency labor ☐ Early term birth ☐ Health professional recommended it ☐ Other: _____
H10. Have you ever taken an ambulance to a hospital to give birth to a child?	☐ Yes ☐ No
H10a. If yes to H10, how many times?	☐☐
H10b. If yes to H10, what hospital did the ambulance take you to?	

Individual ID Number: ___ ___

H11. In your opinion, what are the serious health problems that can occur during pregnancy, childbirth, and the first 2 days after birth to endanger the life of a mother (check all that apply)?	☐ Severe vaginal bleeding ☐ Convulsions ☐ Swollen hands/face ☐ Retained placenta ☐ Blurred vision ☐ Fever ☐ Prolonged labor (greater than 12 hours) ☐ Foul smelling vaginal discharge ☐ Other (specify):
H11a. Have you ever experienced any of these problems?	☐ Yes ☐ Decline to answer ☐ No
H12. Did you receive antenatal care when you were pregnant?	☐ Yes ☐ No
H12a. If yes to H12, how many visits did you have?	☐ 1 ☐ 2 ☐ 3 ☐ 4 or more
H12b. If yes to H12, did you receive antenatal care during the first trimester?	☐ Yes ☐ No
H12c. If yes to H12, from whom did you receive the antenatal care?	☐ Doctor, nurse, or licensed midwife ☐ Health Extension Worker ☐ Untrained birth attendant ☐ Traditional Birth Attendant/Traditional Healer ☐ Other: _____
H13. When you were pregnant, did you eat as much food as you usually ate before the pregnancy, or did you eat more or less food?	☐ Less than before ☐ Same as before ☐ More than before
H13a. If "less than before" to H13, why did you eat less?	☐ Food was not available/HH lacked resources ☐ Ate smaller meals, but more frequently ☐ Eating made her feel sick ☐ Cultural expectation ☐ Other: _____
H14. When you gave birth, did you ever have a birth attendant to help you?	☐ Yes ☐ No
H14a. If yes to H14, who was the birth attendant?	☐ Doctor, nurse, or licensed midwife ☐ Health Extension Worker ☐ Untrained birth attendant (e.g., neighbor, relative) ☐ Traditional Birth Attendant/Traditional healer ☐ Other: _____
H15. After giving birth, have you ever received post-natal care within 6 days from a health worker?	☐ Yes ☐ No
H16. After you gave birth, were any of your children weighed within 3 days of delivery?	☐ Yes ☐ No
H17. Have you or your husband ever used modern contraception?	☐ Yes ☐ Decline to answer ☐ No
H17a. If no to H17, why not?	☐ No access to contraceptive supplies ☐ Other: ☐ Husband refused ☐ Religion
H17b. If yes to H17, what kind/s of contraception have you used (check all that apply)?	☐ Condoms ☐ Injection ☐ Birth control pills ☐ Implant in the arm ☐ Other:
H18. Do you have a history of night-blindness?	☐ Yes ☐ No ☐ Do not know
H19. Do you have a history of any eye	☐ Yes

disorder/disease?	☐ No ☐ Do not know
H20. Does anyone in your family have a history of eye problems/blindness?	☐ Yes ☐ No ☐ Do not know
H21. Have you had measles?	☐ Yes ☐ No ☐ Do not know
H22. Have you had malaria?	☐ Yes ☐ No ☐ Do not know
H23. In the past 30 days, have you had any diarrhea or gastrointestinal problems?	☐ Yes ☐ No ☐ Do not know
H24. In the past 30 days, have you been sick (e.g., fever, severe cough, flu)?	☐ Yes ☐ No ☐ Do not know
H25. Do <u>you</u> have any chronic health issues (e.g., diabetes, heart disease, lung disease, HIV, etc.)?	☐ Yes ☐ No ☐ Do not know
H25a. If yes to H25, specify issue/s:	☐ Diabetes ☐ Heart disease ☐ HIV ☐ Lung disease ☐ Kidney disease ☐ Stroke ☐ Decline to answer
H26. Does anyone in <u>your household</u> have any chronic health issues?	☐ Yes ☐ No ☐ Do not know
H26a. If yes to H26, specify issue/s:	☐ Diabetes ☐ Heart disease ☐ HIV ☐ Lung disease ☐ Kidney disease ☐ Stroke ☐ Decline to answer
H26b. If yes to H26, has there been a death in the household in the past 12 months from any of these illnesses?	☐ Yes ☐ No
H27. Has there been an injury in the household in the past 12 months?	☐ Yes ☐ No
H27a. If yes to H27, how many people have been injured?	☐ 1 ☐ 2 ☐ 3 ☐ 4 or more
H27b. If yes to H27, what caused the injury/ies (check all that apply)?	☐ Farming accident ☐ Motor vehicle/road accident ☐ Assault ☐ Other: _____
H27c. If yes to H27, did anyone in your household die as a result of an injury?	☐ Yes ☐ No
H27c1. If no to H27c, what happened to the injured person/people?	☐ Alive and well ☐ Alive and disabled ☐ Other:

Baseline Survey
J. Individual: Medical History – Child
Individual ID Number: ___ ___

Reported By: ☐ 6-59 months old = Mother reported. Mother's ID Number: ___ ___ ☐ 6-59 months old = Father/other caretaker reported. Father/other caretaker's ID Number: ___ ___	
GENERAL QUESTIONS	
J1. What is the sex of the child?	☐ Male ☐ Female
J2. Age of the child:	☐☐ months
J3. What is the source of the birth date?	☐ Document (clinic or home record) ☐ Stated and confirmed by other family member/s ☐ Estimated (used calendar of events)
J4. What is the birth order of the child among his/her mother's live births?	☐☐ 01 = 1st child 02 = 2nd child 03 = 3rd child, etc.
J5. Was child born in this *woreda*?	☐ Yes ☐ No
J5a. If no to J5, where was the child born?	
J6. Was child born at home?	☐ Yes ☐ No
J6a. If no to J6, where was child born?	
J6b. If no to J6, why not born at home?	
J7. Has child been vaccinated?	☐ Yes ☐ No
J7a. If yes to J7, which immunizations has the child received (check all that apply)?	At birth: ☐ BCG ☐ OPV-0 ☐ Vitamin K At 6 weeks: ☐ PCV-1 ☐ OPV-1 ☐ Pentavalent 1 At 10 weeks ☐ PCV-2 ☐ OPV-2 ☐ Pentavalent 2 At 14 weeks: ☐ PCV-3 ☐ OPV-3 ☐ Pentavalent 3 At 9 months: ☐ Measles ☐ Vitamin A ☐ Other: _____
J7a1. If yes to J7, what is the source of the immunization record?	☐ Certificate (clinic record) ☐ Stated and confirmed by other family member/s ☐ Other: _____
J7b. If no to J7, why not?	
J8. Measurements:	
J8a. Height of child	____ ____ cm
J8b. Weight of child	____ ____ , ____ ____ kg

If the respondent is not the biological mother of the survey child, please skip ahead to Question J13.

J9. Did anyone weigh your newborn infant within 3 days of delivery?	☐ Yes ☐ No ☐ Don't remember
J9a. If yes to J9, what was the weight?	____ , ____ ____ kg
J10. Did you take a Vitamin A capsule within 6 weeks of delivery of your child?	☐ Yes ☐ No ☐ Don't remember
J11. Was this child breastfed?	☐ Yes ☐ No ☐ Don't remember

Individual ID Number: ___ ___

J11a. If yes to J11, for how long was s/he breastfed?	☐☐ months
J12. Does this child eat solid or complimentary foods?	☐ Yes ☐ No
J12a. If yes to J12, at what age was the child when you first gave him/her solid food?	☐☐ months

Resume Survey from Question J8 if respondent is not the biological mother:	
J13. Has this child ever taken Vitamin A supplement capsules?	☐ Yes ☐ No ☐ Don't remember
J14. Does the child have any experiences of night-blindness (difficulty seeing when the sun is down) or eye troubles?*	☐ Yes ☐ No ☐ Don't remember
J15. Does anyone in your family have a history of eye problems/blindness? **	☐ Yes ☐ No ☐ Don't remember
J16. Has the child had measles?	☐ Yes ☐ No ☐ Don't remember
J17. Has the child has malaria?	☐ Yes ☐ No ☐ Don't remember
J18. In the past 30 days, has the child had Gastro-intestinal issues or diarrhea (at least 3 loose stools in 24 hours)?* **	☐ Yes ☐ No ☐ Don't remember
J19. In the past 30 days, has the child had fever or severe cough?	☐ Yes ☐ No ☐ Don't remember
J20. Does anyone in your household have any chronic health issues (e.g., diabetes, HIV, heart disease, lung disease, stroke, etc.)?	☐ Yes ☐ No ☐ Don't remember
FOOD SECURITY QUESTIONS	
J21. In general, how would you rate the child's health today?	☐ Very Good ☐ Good ☐ Moderate ☐ Poor
J22. In the last 30 days, has the child appeared tired or not had enough energy to act normally?	☐ Yes ☐ No ☐ Don't remember
J23. In the past 30 days, did you only breast feed this child because there was no money for food?	☐ Yes ☐ No ☐ Don't remember
J24. In the past 30 days, has this child had to reduce food intake or go without food because of shortage of food or money?	☐ Yes ☐ No ☐ Don't remember
J25. In the last 30 days, did you have to borrow food or money from outside the home for this child?	☐ Yes ☐ No ☐ Don't remember

Baseline Survey
K. Individual: Food Frequency Survey – Mother
Individual ID Number: ___ ___

K1. Woreda	☐ Hintallo Wujirat ☐ Qoula Temben ☐ Ganta Afeshum ☐ Gulo Mekeda ☐ Hawzen ☐ Samre Seharti ☐ Tanqua Abergelle ☐ Raya Azebo ☐ Enderta ☐ Mereb Leke
K2. Are you breastfeeding a child?	☐ Yes ☐ No
K2a. If yes to K2, how many children?	☐☐
K2b. If yes to K2, how often do you breastfeed?	____ times/day
K3. Are you pregnant?	☐ Yes ☐ No ☐ Don't know
K3a. If yes to K3, do you eat special foods?	☐ Yes ☐ No
K4. In the <u>last 7 days</u> have you fasted?	☐ Yes ☐ No
K5. Do you know about Vitamin A?	☐ Yes ☐ No
K5a. If yes to K5, how did you learn about Vitamin A (check all that apply)?	☐ School ☐ Health Center ☐ Radio ☐ Family, friends, and neighbors ☐ Other (specify):
K5b. If yes to K5, is Vitamin A important for good health?	☐ Yes ☐ No ☐ Don't know
K5c. If yes to K5a, why is Vitamin A important?	☐ Good growth/development of child ☐ Protects against disease ☐ Good for vision ☐ Other: _____ ☐ Cannot identify a reason
K6. What foods are good sources of Vitamin A (check all that apply)?	☐ Orange fleshed sweet potato ☐ Carrots ☐ Dark Leafy Greens ☐ Animal Sources/Liver ☐ Chilies (Powder, Sauce, Whole) ☐ Don't know ☐ Other: _____
K7. In the <u>last 7 days</u>, has <u>anyone in your household</u> eaten any potato products?	☐ Yes ☐ No
K7a. If yes to K7, which P products have they eaten (check all that apply)?	☐ Potato Fried ☐ Potato Bread ☐ Potato Boiled ☐ Other: _____
K7b. If yes to K7, how many days were P consumed?	_____ days

Individual ID Number: ___ ___

K8. In the last 7 days, has anyone in your household eaten any WFSP products?	☐ Yes ☐ No
K8a. If yes to K8, which WFSP products have they eaten (check all that apply)?	☐ WFSP Fried ☐ WFSP Bread ☐ WFSP Boiled ☐ Other: _____
K8b. If yes to K8, how many days were WFSP consumed?	_____ days
K9. In the last 7 days, has anyone in your household eaten OFSP products?	☐ Yes ☐ No
K9a. If yes to K9, who in your household has eaten OFSP (check all that apply)?	☐ Husband ☐ Child/ren 6 years or older ☐ Wife ☐ Child/ren between 3-5 years ☐ Other (grandparent, etc.) ☐ Child/ren under 2 years
K9b. If yes to K9, which OFSP products?	☐ OFSP Leaves ☐ OFSP Boiled ☐ OFSP Juice ☐ OFSP Bread ☐ OFSP Flour ☐ OFSP Cake ☐ OFSP Porridge ☐ Other: _____
K9c. If yes to K9, how many of the last 7 days has OFSP been consumed?	☐ 1 day ☐ 4 days ☐ 2 days ☐ 5 days ☐ 3 days ☐ 6 or more days ☐ Don't remember
K9d. If yes to K9, where did you get the OFSP?	☐ Own harvest/garden ☐ Market ☐ Neighbor ☐ Other: _____
K10. When you consume OFSP, do you prepare and eat OFSP with an animal fat? (e.g., liver, meat, eggs, butter, milk)	☐ Do not consume OFSP ☐ Always ☐ Sometimes ☐ Rarely ☐ Never
K11. When you consume OFSP, do you prepare and eat OFSP with a vegetable fat? (e.g., avocado, nuts, vegetable oil)	☐ Do not consume OFSP ☐ Always ☐ Sometimes ☐ Rarely ☐ Never

Individual ID Number: ___ ___

K12. Has your household observed fasting in the past 24 hours?	☐ Yes ☐ No
K13. In the past 24 hours, has anyone in <u>your household</u> eaten any of these foods?	**HDDS Score (0 or 1)**
a. Cereals	***a.* _____**
Barley (e.g., cooked or roasted as *kolo*)	☐ Yes ☐ No
Maize	☐ Yes ☐ No
Millet	☐ Yes ☐ No
Oats	☐ Yes ☐ No
Rice	☐ Yes ☐ No
Sorghum	☐ Yes ☐ No
Teff	☐ Yes ☐ No
Wheat	☐ Yes ☐ No
b. Roots and Tubers	***b.* _____**
Enset	☐ Yes ☐ No
Cassava/Manioc	☐ Yes ☐ No
Irish Potatoes	☐ Yes ☐ No
White Fleshed Sweet Potato (WFSP)	☐ Yes ☐ No
Taro	☐ Yes ☐ No
Other (specify):	☐ Yes ☐ No
c. Vitamin-A rich plant foods	***c.* _____**
OFSP (roots, leaves)	☐ Yes ☐ No
Carrots	☐ Yes ☐ No
Dark Leafy Greens (e.g., spinach, kale, amaranth leaves)	☐ Yes ☐ No
Mango	☐ Yes ☐ No
Moringa	☐ Yes ☐ No
Papaya	☐ Yes ☐ No
Pumpkin or squash that are orange inside	☐ Yes ☐ No
Berbere, mitmita, or other spices	☐ Yes ☐ No
d. Other fruits or vegetables	***d.* _____**
Any other vegetable (e.g., beet, cabbage, onion, tomato):	☐ Yes ☐ No
Any other fruits (e.g., banana, pineapple, orange):	☐ Yes ☐ No
e. Meat and poultry	***e.* _____**
Beef	☐ Yes ☐ No
Chicken	☐ Yes ☐ No
Goat	☐ Yes ☐ No
Lamb	☐ Yes ☐ No
Heart, liver, or other organ meat	☐ Yes ☐ No
Pork	☐ Yes ☐ No
Wild game or other	☐ Yes ☐ No
f. Eggs	***f.* _____**
Eggs	☐ Yes ☐ No
g. Fish and seafood	***g.* _____**
Fresh or dried fish	☐ Yes ☐ No

Individual ID Number: ___ ___

K13, continued. In the past 24 hours, has anyone in your household eaten these foods:		**HDDS Score (0 or 1)**
h. Pulses, legumes, nuts		***h.*** _____
Beans or Lentils	☐ Yes ☐ No	
Shiro	☐ Yes ☐ No	
Nuts (e.g., peanuts)	☐ Yes ☐ No	
i. Dairy and dairy products		***i.*** _____
Cheese, yogurt, or milk products from COW	☐ Yes ☐ No	
Cheese, yogurt, or milk products from GOAT	☐ Yes ☐ No	
j. Fats, oils		***j.*** _____
Vegetable oil	☐ Yes ☐ No	
Margarine	☐ Yes ☐ No	
Butter	☐ Yes ☐ No	
k. Sugar, honey		***k.*** _____
Sugar	☐ Yes ☐ No	
Honey	☐ Yes ☐ No	
Sweets (e.g., chocolate, candies)	☐ Yes ☐ No	
l. Beverages		***l.*** _____
Coffee	☐ Yes ☐ No	
Tea	☐ Yes ☐ No	
Other (specify): _____	☐ Yes ☐ No	

Baseline Survey
L. Individual: Food Frequency Survey – Child
Individual ID Number: ___ ___

Reported By: ☐ 6-59 months old = Mother reported. Mother's ID Number: ___ ___ ☐ 6-59 months old = Father/other caretaker reported Father/other caretaker's ID Number: ___ ___	
L1. Woreda	☐ Hintallo Wujirat ☐ Qoula Temben ☐ Ganta Afeshum ☐ Gulo Mekeda ☐ Hawzen ☐ Samre Seharti ☐ Tanqua Abergelle ☐ Raya Azebo ☐ Enderta ☐ Mereb Leke
L2. Sex	☐ Male ☐ Female
L3. Age	☐☐ months
L4. Height	☐☐ cm
L5. Weight	☐☐ , ☐☐ kg
L6. Was this child ever breastfed?	☐ Yes ☐ No ☐ Don't know
L7. In the <u>last 24 hours</u>, has this child fasted?	☐ Yes ☐ No ☐ Don't know
L8. In the <u>last 7 days</u>, did this child eat OFSP?	☐ Yes ☐ No ☐ Don't know
L8a. If yes to L8, how many times?	☐ Don't know ☐ 1 time ☐ 2 times ☐ 3-5 times ☐ 6 or more times
L8b. If yes to L8, size of roots/amount:	☐ Small roots ☐ Medium roots ☐ Large roots ☐ Don't know
L8c. If yes to L8, what was the source of OFSP?	☐ Household and/or kitchen garden ☐ Market ☐ Neighbor ☐ Other: _____
L8d. If yes to L8, how often does the child eat OFSP when it is prepared with an animal fat?	☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ Don't know
L8e. If yes to L8, how often does the child eat OFSP when it is prepared with vegetable fat?	☐ Always ☐ Sometimes ☐ Rarely ☐ Never ☐ Don't know

Individual ID Number: ___ ___

L8f. If no to L8, why not?	Reason:
L9. In the <u>last 7 days</u>, has this child eaten any potato or WFSP products (if yes, check all that apply)?	☐ Yes ☐ No ☐ Don't know
L9a. If yes to L9, which potato and/or WFSP products has this child eaten (check all that apply)?	☐ WFSP Fried ☐ WFSP Bread ☐ WFSP Boiled ☐ WFSP Other: _____ ☐ Potato Fried ☐ Potato Bread ☐ Potato Boiled ☐ Potato Other: _____

Individual ID Number: ___ ___

L10. In the past 24 hours, has the child eaten any of the following items:		IDDS Score (0 or 1)
a. Breast milk	☐ Yes ☐ No	
b. Grains, roots or tubers		***a.*** _____
Barley (e.g., cooked or roasted as *kolo*)	☐ Yes ☐ No	
Wheat	☐ Yes ☐ No	
Enset	☐ Yes ☐ No	
Maize	☐ Yes ☐ No	
Rice	☐ Yes ☐ No	
Teff	☐ Yes ☐ No	
Irish potatoes, WFSP, white yams, manioc, cassava	☐ Yes ☐ No	
Local weaning food	☐ Yes ☐ No	
Other:	☐ Yes ☐ No	
c. Vitamin-A rich plant foods		***b.*** _____
OFSP (roots, leaves)	☐ Yes ☐ No	
Carrots	☐ Yes ☐ No	
Dark Leafy Greens	☐ Yes ☐ No	
Mango	☐ Yes ☐ No	
Moringa	☐ Yes ☐ No	
Papaya	☐ Yes ☐ No	
Pumpkin or other squash with orange flesh	☐ Yes ☐ No	
Berbere, mitmita, or other spices	☐ Yes ☐ No	
d. Other fruits or vegetables		***c.*** _____
Any other vegetable (e.g., beet, cabbage, onion, tomato)	☐ Yes ☐ No	
Any other fruits (e.g., banana, pineapple, orange):	☐ Yes ☐ No	
e. Meat, poultry, fish and seafood		***d.*** _____
Beef	☐ Yes ☐ No	
Chicken	☐ Yes ☐ No	
Fish	☐ Yes ☐ No	
Goat or Lamb	☐ Yes ☐ No	
Heart, liver, or other organ meat	☐ Yes ☐ No	
Pork	☐ Yes ☐ No	
f. Eggs		***e.*** _____
Eggs	☐ Yes ☐ No	
g. Pulses, legumes, nuts		***f.*** _____
Beans or lentils	☐ Yes ☐ No	
Shiro	☐ Yes ☐ No	
Nuts (e.g., peanuts)	☐ Yes ☐ No	
h. Dairy and dairy products		***g.*** _____
Cheese, yogurt, or other milk products	☐ Yes ☐ No	
i. Fats, oils, and sugar		***h.*** _____
Vegetable oil or butter	☐ Yes ☐ No	
Honey/sugar	☐ Yes ☐ No	
Sweets (e.g., chocolates, candies)	☐ Yes ☐ No	
Beverages (specify): _____	☐ Yes ☐ No	