## Food Security and Livestock Production among Haitian Smallholder Farmers

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April 2014

A thesis submitted to McGill University in partial fulfillment of the requirements for the degree of Master of Science © Kate M. Sinclair 2014

#### Abstract

Food insecurity is a multi-faceted phenomenon that has become of increasing interest in recent decades. One widely accepted definition is that of the United Nations' Food and Agriculture Organization, which states that food security "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life." Accurately measuring food security is challenging. One tool that has been validated in several Latin American countries is the Latin American and Caribbean Food Security Scale (ELCSA). Haiti is the poorest country in the Western Hemisphere and one of the poorest in the developing world. It is currently estimated that upwards of 44 percent of the Haitian population is undernourished and more than 50 percent of households live on less than one US dollar per day. Consequently, food insecurity is highly prevalent. Some of the factors that influence food insecurity are better understood than others. For instance, poverty and lack of education are well-established predictors, whereas the role of livestock is under-researched. It is, however, widely accepted that livestock influences food security in many ways: it provides essential food products, serves as a source of income, provides manure, provides draught power, and increases social status. Most Haitian farmers possess at least some livestock and these animals play a vital role in their livelihood. The present study determined the food security status of smallholder farmers in Haiti, assessed livestock's contribution towards food security status among smallholder farmers in Haiti and examined possible associations between livestock holds and animal source food consumption. This project was quantitative in nature. It used a secondary data set that was collected using a cross-sectional survey design. Departments were chosen based on differences in their agro- and ecological systems in order to provide a broad depiction of the whole country. A stratified random sampling method was used to select participants. The stratum used for the sample selection was "small agriculture producer." Surveys from 500 households collected by the Inter-American Institute for Cooperation on Agriculture were used in this study. Secondary data were analyzed using IBM SPSS Statistic 22.0 © 2012 software. Both descriptive and correlational research analyses were performed. An ordinal regression examined the contribution of livestock to a household's food security status and a multiple regression investigated the relationship between food security status and the consumption of animal source foods. Results show that the prevalence of food insecurity among this population was very high. Sixty-two percent of households were severely food insecure and only 2.6 percent of the households were food secure. Ordinal regression results indicate that Tropical Livestock Units (TLU) (OR = 0.88), total land size (OR = 0.80) and extreme poverty status (OR = 0.65) all had statistically significant associations with food security. The multiple regression revealed that a household's food insecurity category ( $\beta = -$ 0.242, p < 0.001), TLU ( $\beta$  = 0.334, p < 0.003), daily per capita income ( $\beta$  = 0.145, p < 0.002), and education level ( $\beta = 0.172$ , p < 0.001), added significantly to the prediction of total number of animal source foods consumed in the last month. Having more TLU significantly increased a household's odds of being less food insecure, and less food insecure households consumed significantly more animal source foods. Haitian institutions, both governmental and nongovernmental, and international corporations should not only be informed about the high prevalence of food insecurity among Haitian smallholder farmers, but also the factors that contribute to this phenomenon. Possible interventions to improve food security and build resiliency among smallholder farmers in Haiti should include increasing the number and productivity of a household's livestock.

#### Résumé

L'insécurité alimentaire est un phénomène à multiples facettes et un intérêt croissant au cours des dernières décennies. Une définition largement acceptée est celle de l'Organisation des Nations Unies pour l'alimentation et l'agriculture. Elle affirme que la sécurité alimentaire « existe lorsque tous les êtres humains ont, à tout moment, la possibilité physique, sociale et économique de se procurer une nourriture suffisante, saine et nutritive leur permettant de satisfaire à leurs besoins et préférences alimentaires pour mener une vie saine et active. » Mesurer la sécurité alimentaire avec précision est difficile. Un outil qui a été validé dans plusieurs pays de l'Amérique latine est l'échelle de sécurité alimentaire de l'Amérique Latine et des Caraïbes (ELCSA). Haïti est le pays le plus pauvre dans l'hémisphère Ouest et un des plus pauvres des pays en voie de développement. On estime que plus que 44 pour cent de la population haïtienne est sousalimentée et plus que 50 pour cent des ménages vivent avec moins d'un dollar US par jour. Par conséquent, l'insécurité alimentaire est très répandue. Certains des facteurs qui influencent la sécurité alimentaire sont mieux compris que d'autres. Par exemple, la pauvreté et l'éducation sont des prédicteurs bien établis, tandis que le rôle de l'élevage est sous recherché. Il est, cependant, largement accepté que l'élevage influence la sécurité alimentaire de plusieurs façons: elle fournit des produits alimentaires de base, constitue une source de revenu, fournit du fumier, fournit la traction et augmente le statut social. La plupart des agriculteurs haïtiens possèdent au moins un peu d'élevage et ces animaux jouent un rôle essentiel dans leur vies. La présente étude vise à déterminer l'état de la sécurité alimentaire des petits exploitants agricoles en Haïti, la contribution de l'élevage évalué vers l'état de la sécurité parmi les petits agriculteurs en Haïti, et examiner les associations possibles entre l'élevage et la consommation d'aliments de source animale. L'étude était de nature quantitative. Elle a utilisé un ensemble de données secondaires qui ont été recueillies au moyen d'un plan d'enquête transversale. Les départements ont été choisis en fonction de différences dans leurs systèmes agro-écologiques et afin de fournir une bonne représentation du pays. Une méthode d'échantillonnage aléatoire stratifiée a été utilisée pour sélectionner les participants. La strate utilisée pour la sélection de l'échantillon était « petit producteur agricole. » Des enquêtes de 500 ménages recueillies par l'Institut interaméricain de coopération pour l'agriculture ont été utilisées dans l'étude. Des données secondaires ont été analysées à l'aide de logiciels IBM SPSS 22.0 © 2012. Les analyses de recherche descriptives et corrélationnelles ont été effectuées. Une régression ordinale a examiné la contribution de l'élevage à l'état de la sécurité alimentaire des ménages et une analyse de régression multiple a examiné la relation entre l'état de la sécurité alimentaire et la consommation d'aliments d'origine animale. La prévalence de la sécurité alimentaire au sein de cette population est très élevée. Soixante-deux pour cents des ménages étaient en insécurité alimentaire sévère et seulement 2,6 pour cent des ménages étaient en sécurité alimentaire. Les résultats de la régression ordinale indiqué que les Unités Bétail Tropical (UBT) (OR = 0.88), la taille totale des terres (OR = 0.80) et l'état de pauvreté extrême (OR = 0.65) avaient tous des associations statistiquement significatives avec l'état de la sécurité alimentaire. La régression multiple a révélé que l'insécurité alimentaire dans la catégorie des ménages ( $\beta = -0.242$ , p < 0.001), UBT ( $\beta = 0.334$ , p < 0,003), le revenu quotidien par habitant ( $\beta = 0,145$ , p < 0,002), et le niveau d'éducation ( $\beta =$ 0,172, p < 0,001), ajoutent de manière significative à la prédiction du nombre total de produits d'origine animale consommées dans le dernier mois, p < 0.05. Ayant plus de UBT augmente de façon significative les chances qu'un ménage soit moins exposé à l'insécurité alimentaire, et les ménages en situation d'insécurité alimentaire moins sévère consommaient de manière significative plus d'aliments d'origine animale. Les institutions haïtiennes, gouvernementales et

non-gouvernementales et les sociétés internationales doivent être informées de la forte prévalence de l'insécurité alimentaire parmi les petits agriculteurs haïtiens et les facteurs qui contribuent à ce phénomène. Les interventions possibles pour améliorer la sécurité alimentaire et renforcer la résilience chez les petits exploitants en Haïti comprennent l'augmentation du nombre et de la diversité du bétail d'un ménage.

## Acknowledgements

Completing this master's thesis has been an incredibly challenging and rewarding experience. I would like to acknowledge several people, without whom I would not have been able to complete this project. First and foremost, I would like to thank Dr. Hugo Melgar-Quiñonez for taking me on as a master's student and providing me with continual support, guidance and encouragement over the past two years. He is an inspirational person and I am forever grateful for his mentorship. He has helped foster my growing enthusiasm for global food security, nutrition and academia. I would also like to thank my co-supervisor Humberto Monardes for providing me with important feedback and guidance throughout the course of this degree.

I would like to thank Diana Dallmann for her continual help, statistics tutoring and friendship. Thanks to her I am finishing this degree with a much broader understanding and appreciation for SPSS and statistics in general. I would also like to thank Jasmine Parent for her countless hours of data entry, her indelible support, our amazing travel memories and most importantly her friendship. Many thanks as well to everyone in the global food security group—I greatly appreciate your feedback and wisdom. Our Tuesday group meeting created a real sense of community and made this experience richer than I could have ever imagined.

Thank you to the School of Dietetics and Human Nutrition for their support. In particular I would like to thank Lise Grant for all her help. Many thanks to IICA for collecting the data and allowing me to use it to complete my master's thesis. Thanks also to Dr. Tim Johns and the Faculty of Agriculture and Environmental Sciences for awarding me the Graduate Mobility Research Award, which financed my trip to Haiti. And a big thanks to Colin Throness for his continual support and valuable editing services. Finally, it would be remiss of me not to acknowledge my family for their love, support and infinite encouragement.

#### **Contribution of Authors**

The manuscript included in this thesis was accomplished through collaboration with the coauthors. As the first author of the manuscript, I was responsible for the conceptualization of the research questions, submission of research ethics applications, data analysis, interpretation of findings, and for writing the manuscript. Dr. Hugo Melgar-Quiñonez and Dr. Humberto Monardes provided guidance and support through all stages of the dissertation research. Diana Dallmann contributed to the refinement of the quantitative data analysis, and participated in the data entry and cleaning. Jasmine Parent also contributed to the data entry and cleaning. Miguel Garcia, in his role as the director of agribusiness and trade at the Inter-American Institute for Cooperation on Agriculture, was responsible for developing the initial study and for organizing the data collection.

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## List of Abbreviations

Analysis of Variance
Unstandardized regression coefficient
Caribbean Community
Escala Latinoamericana y Caribeña de Seguridad Alimentaria
Food and Agriculture Organization of the United Nations
Food insecurity
Food secure
Global Hunger Index
Gross domestic product
Human Development Index
Haitian Gourdes
Inter-American Institute for Cooperation in Agriculture
Number
Odds Ratio
p-value
Standard deviation
Standard error
Standard error of the coefficient
Tropical Livestock Units
US dollars
Years
Years old
Beta

#### **CHAPTER 1: GENERAL OVERVIEW**

### **1.1 Introduction**

Food is one of the most basic human needs. It has been well established that enough food is produced to meet the entire world population's needs, but nonetheless hunger remains a serious problem, namely in developing nations (Gebrehiwot & Van der Veen, 2014). Hunger is not a new phenomenon; it has been a long-standing issue in our society and one that has been of great concern for world leaders. In fact, the right to food was even included in the 1948 Universal Declaration of Human Rights, which states that "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food..." (United Nations High Commissioner for Human Rights, 1998). Hunger is a key component of food insecurity; however, the two terms are not synonymous.

Food security is defined as a state in which "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preference for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996). It is estimated that upwards of 800 million people worldwide are food insecure, the majority of which live in developing countries. These statistics, however, fail to account for the high levels of "hidden hunger," which refers to those individuals who are living with vitamin and mineral deficiencies without evidence of clinical symptoms (Food and Agriculture Organization of the United Nations, 2012). Thus, the true number of individuals living with some degree of malnutrition or food insecurity is likely higher than current estimates indicate. The complex nature of the food security phenomenon makes it difficult to measure. No single indicator is able to measure on its own all aspects of food security simultaneously, so a combination of several is generally used. As such, to date there is no gold standard for measuring food security rates. One tool that has been proven to be valid in several Latin American and Caribbean countries is the Latin America and Caribbean Food Security scale (Escala Latinoamericana y Caribena de Seguridad Alimentaria -ELCSA). This survey utilizes the more common quantitative measures but also takes into consideration the experience of food insecurity. The relationship between certain factors, such as income, lack of education and household size, are better understood than others. One factor that has yet to be properly investigated, but that based on theory may notably contribute to food security, is the role of livestock. Livestock can play various essential roles, especially for poor smallholder farmers.

Haiti is the poorest country in the Western Hemisphere. As a country it has experienced major political instability, civil unrest and vast ecological destruction (Ministry of Planning and External Cooperation, 2007). Its economy relies heavily on the agriculture sector; however, it lacks access to many essential agriculture inputs and infrastructures, which hinders its productivity and overall food supply for its population. Approximately 90 percent of agriculture activities occur on smallholder farms. These famers and their families are among the poorest in the country and make up nearly 60 percent of the country's population (International Fund for Agriculture Development, 2008; Haiti Ministère de l'Agriculture, 2013). As such, it is not surprising that food insecurity has been a long-standing issue in Haiti and remains a serious problem today (Perez-Escamilla, 2009). Gaining a better understanding of the factors associated with a family's household food security status is a necessary step in developing sustainable and effective interventions targeted towards improving food security among Haitian smallholder farmers.

#### 1.2 Study Rationale

Food insecurity is of significant concern in Haiti. There is a wide variety of factors contributing to the high rates of household food insecurity in this country, including: lack of arable land, political instability, poor infrastructure, extreme poverty, and environmental shocks. Much research has been done in recent decades regarding food security in developing countries, and Haiti is no exception; however, very few examine the relationship between food security and the contribution of livestock. The present study aims to fill this knowledge gap by exploring how livestock contributes to the food security status of smallholder farmers in Haiti. Gaining a better understanding of this relationship with food security, among others, will ultimately lead to the development and implementation of more effective and sustainable programs and interventions.

## 1.3 Overall Study Aim

The purpose of this study is to determine the prevalence of household food insecurity among smallholder farmers in Haiti and to examine the contribution that livestock production has on food insecurity rates.

#### **1.4 Study Questions and Objectives**

The questions this study aims to address are:

- What is the current state of food security among smallholder farmers in Haiti?
- How does the livestock of smallholder farmers contribute to household food security?
- Could this contribution in turn influence the household consumption of animal-based products?

The objectives of this project are to:

- Determine the food security status of smallholder farmers in Haiti.
- Assess livestock's contribution towards food security status among smallholder farmers in Haiti.
- Examine a possible association between livestock possession and animal source food consumption.

## **1.5 Hypotheses**

The hypotheses of this project are that:

- Having a greater variety of livestock species will contribute to a better household food security status.
- Households with a higher number of livestock will consume more animal source food.

#### **CHAPTER 2: LITERATURE REVIEW**

## 2.1 Food Security

Food insecurity is a multi-faceted phenomenon that has become of increasing interest in recent decades. Its complex nature makes it difficult to define and measure. It is important to note that no single indicator is capable on its own of measuring all aspects of food insecurity (Webb, 2006). One widely accepted definition is that of the United Nations' Food and Agriculture Organization, which states that food security "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996). Household food security applies this concept at the familial level, where the focus of concern is placed on each individual within a household (Food and Agriculture Organization of the United Nations, 1996).

Despite the many efforts in recent decades to reduce poverty, hunger and food insecurity rates around the world, these issues remain prevalent. The United Nations' Millennium Development goal to reduce extreme poverty rates by half by 2015 was met ahead of schedule, yet poverty is still pervasive in many areas of the world, particularly in rural territories where "for most countries 60% of the population lives below the poverty line" (Devendra & Pezo, 2002, p. 127). It must also not be ignored that the goal of halving the number of hungry people in the world has not yet been achieved. Poverty reduction must remain a priority for the international community, and so must food security and hunger; improvements in these areas will require a variety of measures.

It is currently estimated that 802 million people, or 24 percent of the global population, are food insecure, with disproportionately high amounts in rural areas (Rosen et al., 2012). Also,

more than 900 million individuals are undernourished, upwards of two billion people suffer from one or more micronutrient deficiencies, and more than two billion people are considered malnourished (Food and Agriculture Organization of the United Nations, 2010; World Health Organization, 2007). Malnutrition is not synonymous with undernourishment. In today's society, the issue of malnutrition is found across all income groups and is of great concern in both developed and developing countries alike. Malnutrition is complex in nature and is caused by a variety of factors. At the root of all its forms, it is simply put a nutritionally inappropriate diet. The Food and Agriculture Organization of the United Nations (2011) explains that often "the poorest lack an adequate supply of energy, protein and micronutrients, while for those who can afford sufficient calories, overconsumption and poorly balanced diets" (p. 5) are causing health problems. In recent decades, the prevalence of the latter has increased exponentially: statistics show that more than 1.4 billion adults are now overweight, of which 500 million are considered obese (Food and Agriculture Organization of the United Nations, 2013). Yet, the former remains of greater concern namely in low-income or developing countries. Within a country, community, and even a household, more than one type of malnutrition can exist (Food and Agriculture Organization of the United Nations, 2013).

All types of malnutrition have detrimental consequences on health and food security status; they are also financially burdensome on our society in terms of both direct and indirect costs (Food and Agriculture Organization of the United Nations, 2011; Food and Agriculture Organization of the United Nations, 2013). In fact, it is estimated that nearly 5 percent of the global gross domestic product, or US\$3.5 trillion per year, are allocated to malnutrition in the form of lost productivity and direct health costs (Food and Agriculture Organization of the United Nations, 2013). In addition, not having an adequate food supply can result in

physiological and social stresses, such as anxiety, depression, sadness and other mental health issues. This disparity can in turn intensify health risks and cause conflict and political unsteadiness (Melgar-Quiñonez & Hackett, 2008).

## 2.2 Defining Food Security

As a means of helping to better define food security, the Food and Agriculture Organization of the United Nations explains that it is comprised of four pillars and two main dimensions. In order to satisfy food insecurity reduction targets, each of these pillars must be addressed (Food and Agriculture Organization of the United Nations, 2011; Food and Agriculture Organization of the United Nations, 2006a, p. 1). The pillars include:

<u>Food availability:</u> This pillar deals with the food supply and ensuring that domestic production and imports (including food aid) are able to make sufficient quantities of appropriate quality available to the population (Food and Agriculture Organization of the United Nations, 2006a).

<u>Food access</u>: This pillar means that when food is available people are able to access it, physically and economically. In order for this to be realized, one must possess adequate resources to acquire the appropriate food products needed to maintain a nutritional diet (Food and Agriculture Organization of the United Nations, 2006a). These resources go beyond money; in this case they can be defined as "the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources)" (Food and Agriculture Organization of the United Nations, 2006a, p. 1).

Stability: A household or population must have access to sufficient food at all times in order to be food secure. Their food access should be resilient to cyclical or sudden shocks (Food

and Agriculture Organization of the United Nations, 2006a). For example, they should be able to maintain their access to food despite an economic crisis or seasonal fluctuation in food security (Food and Agriculture Organization of the United Nations, 2011). This shows that the concept of stability can be directly linked to both availability and access (Food and Agriculture Organization of the United Nations, 2006a).

<u>Utilization</u>: This pillar incorporates nutritional well-being and food safety issues. It ensures one is able to utilize food through adequate diet, sanitation, clean water and health care (Food and Agriculture Organization of the United Nations, 2006a) as a means of attaining a state of well-being where all physiological needs are met. This pillar highlights the importance of some of the non-food inputs of food security.

Simultaneously paying attention to each pillar remains a persistent challenge in the realm of food security (Food and Agriculture Organization of the United Nations, 2011). For instance, in today's society we are able to produce sufficient amounts of food to feed the human population, but because the distribution is unequal it is not adequately available to all. Also, when international food prices increase, countries relying on imports are faced with an unstable food supply (Food and Agriculture Organization of the United Nations, 2011). Similarly, even when food is available, many individuals don't have the resources needed to acquire a nutritionally adequate diet. On the other hand, if market prices dropped to accommodate the poorest consumers, the profit would potentially not be sufficient to support the livelihood of the producers (Food and Agriculture Organization of the United Nations, 2011). A lack of nutrition, sanitation and preparation knowledge also has detrimental consequences on food security. These are just a few of the many possible situations that have the potential to hinder food security. Each one demonstrates the strong relationships between the four pillars and highlights the importance

of ensuring each one is appropriately addressed, developed and maintained (Food and Agriculture Organization of the United Nations, 2011).

The two dimensions that help to define food security are:

<u>Chronic:</u> This type of food insecurity is the consequence of persistent shortage in food supply and/or longstanding circumstances that limit one's ability to access sufficient food (Food and Agriculture Organization of the United Nations, 2011).

<u>Transitory:</u> This form of food insecurity is usually caused by a crisis (Food and Agriculture Organization of the United Nations, 2011). Conflict was identified by the Committee on World Food Security as the most common cause of transitory food insecurity, followed by weather-related problems (Food and Agriculture Organization of the United Nations, 2005).

Both dimensions must be addressed simultaneously because individuals and communities who are in a state of chronic food insecurity lack safety nets, and as a result they become vulnerable to transitory issues. The way in which these issues are addressed is critical. Failing to appropriately deal with food insecurity events will potentially worsen long-term food security by creating dependencies and/or weakening local markets (Food and Agriculture Organization of the United Nations, 2011; Webb, 2006).

#### 2.3 Measuring Food Security

Although it is well known that there exists a high level of food insecurity in developing countries, the exact number of food insecure individuals and the extent to which they are affected remains unspecified. Measuring food insecurity appropriately is essential in order to efficiently tackle the problem. Sound measurements will provide an estimation of prevalence, as well as identify associations and high-risk populations so that policy makers can better target and intervene in order to aid the populations at most risk (Food and Agriculture Organization of the United Nations, 2011; Webb, 2006). It will also allow for reliable monitoring and evaluation of programs that aim to eliminate food insecurity. Nonetheless, measuring food insecurity can be a complicated process. To date there is no one method that is able to measure each aspect of food insecurity. It is often necessary to combine a variety of methods and strategies in order to address all dimensions of food security (Food and Agriculture Organization of the United Nations, 2011; Webb, 2006).

Until recently, food security was generally measured on regional and national levels using economic indicators of food availability, food production and income. National levels of dietary energy supply, anthropometric measures, and individual food intake reports are among the most common methods used to measure food insecurity. These methods have proven to be expensive and time consuming and they fail to evaluate the experience of food insecurity (Melgar-Quiñonez & Hackett, 2008). In recent decades, experts have been working towards the development of efficient and affordable tools that are both valid and accurate in measuring food security at a household level. Nonetheless, there exists no "gold standard" as of yet. One tool that has been validated in several Latin American countries is the Latin America and Caribbean Food Security scale (Escala Latinoamericana y Caribena de Seguridad Alimentaria -ELCSA).

## 2.4 Factors Affecting Food Security

There is such a vast array of elements that influence food security; some are better established than others (Food and Agriculture Organization of the United Nations, 2011). There are various factors that influence the status of food security at the household level. Some of the most influential are household size, poverty status, income, age, ethnicity group, and mother's education level (Melgar-Quiñonez & Hackett, 2008; Zakari et al., 2014). Similarly there are many factors that have a more broad effect; these elements tend to affect the stability of food

security of communities or populations as a whole. A non-exhaustive list of critical global elements follows, which were chosen due to their strong links to livestock production.

#### 2.4.1 Arable Lands

There are approximately 14 billion hectares of land in our world, of which only 3 billion are arable, and this area continues to be reduced over time (Turral, Burke & Faurès, 2011; Premanandh, 2011). One factor that is believed to contribute greatly to this reduction is rapid population growth (Premanandh, 2011). This is highlighted by the fact that in 1959 there were approximately 12 acres per person and by 2006 only 6 acres per person. It is predicted that this ratio will drop to 2.8 by 2040. Furthermore, in developing countries, the ratio of arable land to population experienced a 55 percent decline between 1960 and 2000 (Premanandh, 2011).

Desertification, urbanization and land degradation also play a large part in the loss of arable land (Turral et al., 2011). On a global level it is believed that approximately 2 to 5 million hectares of arable land will be lost annually due to degradation, namely soil erosion. Asia, Latin America and Africa have a six-times-greater rate of degradation compared to Europe and North America (Premanandh, 2011). It is expected that by 2050 half of the current arable land will become unusable as a result of desertification and land degradation. This is problematic because research shows that in order to provide an adequate diet, it is estimated that the minimum required amount of arable land per capita is 0.5 hectares when managed using a modest level of inputs (Devendra & Pezo, 2002). Much of the Caribbean and Central and South America currently fall below this threshold (Devendra & Pezo, 2002). This trend has detrimental consequences on food production and the livelihoods of smallholder farmers, where the poorest populations in developing countries will bear the greatest burden. As the demand for bioenergy, wood and feed continues to increase in our society the amount of land available for food

production will be further reduced (Premanandh, 2011).

## 2.4.2 Climate Change

The implications of climate change are vast. In recent decades it has become an area of great international concern. Some of the common factors contributing to climate change include, but are not limited to, rising average temperatures, thawing of glaciers and alteration in rainfall patterns. A heat stress is created when temperatures rise (Patrick et al., 2008). Under these circumstances more water evaporates from the plants and soil and water becomes scarce. Plant sterility also increases and overall productivity drops (Premanandh, 2011). These changes will have a global effect, but the severity of the effects will not be experienced equally among all populations (Turral et al., 2011). It is predicted that the world's poorest populations will experience more severe consequences (Patrick et al., 2008). Specifically, smallholder farmers who rely directly on their own agriculture outputs for household human consumption and household income are among the most vulnerable to the effects of climate change.

Gradual climate change and the increased occurrence of extreme weather events have caused issues for many of these farmers (Patrick et al., 2008; Premanandh, 2011). As a result, crop yields suffer and many are no longer able to produce the staple crops they once relied on for their livelihood. This causes a ripple effect that cascades down the food chain and affects livestock production as well. With fewer resources available, many smallholder farmers struggle to feed their livestock or are forced to sell them in order to purchase food to feed their families (Finnis et al., 2012). There has been an evident increase in the number of droughts, floods and other extreme weather events in recent years. When smallholder farmers are forced to cope with these adversities, their poverty and food insecurity is further exacerbated (Food and Agriculture Organization of the United Nations, 2005; Gross, 2013; Patrick et al., 2008). Even in regions that

previously had fairly stable food security conditions, agricultural outputs can be pushed to dangerously unstable levels as a result of extreme weather (Gross, 2013).

## 2.4.3 Water Supply

Despite the fact that water covers 70 percent of the world's surface, it remains limited due to high human demand. Much of the increased demand can be attributed to population growth, irrigated agriculture and industrial expansion (Patrick et al., 2008; Premanandh, 2011). Both in developed and developing countries the demand for water exceeds the supply. Since there are no new sources of water being created on earth and it is widely predicted that a global water crisis is afoot (Premanandh, 2011).

As with the food supply, the water supply is not equally distributed around the planet. Some areas have more abundant reserves while other have limited water available. The United Nations Environment Program defines the water scarcity category as having less that 1700m<sup>3</sup> of water per capita. They estimate that by 2025 more than three billion people will fall into this category (Premanandh, 2011). The agriculture sector is responsible for 70 to 80 percent of the world's fresh water consumption, making it the biggest consumer (Gleick, 2014; Premanandh, 2011). Given that our food system is heavily reliant on water, it is clear that a shortage will have a direct negative impact on our capacity to produce food (Premanandh, 2011; Turral et al., 2011). The quantity of water available also has a considerable effect on the quality of water supplied (Turral et al., 2011).

### 2.4.4. Livestock Diseases

In the global livestock sector, infectious diseases serve as the leading cause of financial loss. These diseases cause elevated rates of poor health and mortality among livestock. Vaccines are available for many of these diseases, but unfortunately their widespread use is hindered, particularly in developing countries, for several reasons, including their high cost, availability, need for refrigeration and unequal distribution. Seeing as livestock plays such an integral role in the livelihood and food security status of smallholder farmers in developing countries such as Haiti, this phenomenon is extremely problematic for these populations (Dale, 2013; Wallace & Babiuk, 2012). In addition, diseases affecting livestock can be transmitted to human beings; as a result their health and their food security is compromised (Delgado et al., 2001).

## **2.5 Agriculture**

#### 2.5.1 Effect on Poverty

Lawrence Haddad (2013) explains that the world's agricultural system has the potential to positively impact our global nutritional status to a much greater extent than is currently being realized. The pathways for which nutrition and agriculture are linked are not a mystery. They are well known, but for the most part insufficient evidence exists regarding the ways and extent to which agricultural efforts are able to impact nutritional status (Haddad, 2013; Webb, 2012). This lack of evidence makes it difficult to determine whether or not these pathways are being realized, thus hindering the possibility of improving future initiatives to strengthen this relationship. This highlights the need for increased research efforts in this area (Haddad, 2013; Webb, 2012).

Many experts have shown that there are well-documented links between agriculture development and poverty reduction (Reist et al., 2007; Thomas et al., 2002). For example, the 2008 World Development Report provides the following evidence:

Among 42 developing countries over 1981-2003, 1 percent GDP growth originating in agriculture increased the expenditures of the three poorest deciles at least 2.5 times as much as growth originating in the rest of the economy...

Similarly, Bravo-Ortega and Lederman (2005) find that an increase in overall GDP coming from agricultural labor productivity is on average 2.9 times more effective in raising the incomes of the poorest quintile in developing countries ... than an equivalent increase in GDP coming from non-agricultural labor productivity...

Using cross-country regressions per region and looking at \$2-a-day poverty, Hasan and Quibriam (2004) find larger effects from agricultural growth on poverty reduction in Sub-Saharan Africa and South Asia... (The World Bank 2007, Box 1.2)

This highlights the potential ripple effect of benefits that can occur from investing and improving the agriculture sector. Nonetheless, these mutually beneficial relationships are not automatically achieved. It should be acknowledged that many historical reviews and studies indicate that small-scale farming has been at the forefront of many agricultural booms – periods where the marketed output of both food and cash crops have increased substantially. Both export and food crops are known to benefit in such periods (Collier & Dercon, 2013).

#### 2.5.2 Current System

Our present day global agriculture system continues to move towards an industrial model, which is problematic because it has shown to be not sustainable (Altieri & Toledo, 2011). It is limited in its ability to feed the world now and in the future for several reasons. It relies heavily on costly external inputs such as fossil fuels, a non-renewable, costly and heavily pollutant energy source. It uses a very limited genetic base and has low ecological diversity (Altieri & Toledo, 2011). As a result the crop and livestock's resiliency to external pressures are greatly reduced. As our climate continues to deteriorate the vulnerability of this system is exacerbated.

Lastly, of the world's 1.5 billion hectares of agricultural land, 91 percent are increasingly "being devoted to agroexport crops, biofuels and transgenic soybean to feed cars and cattle" (Altieri & Toledo, 2011, p. 593). As more land becomes allocated to growing such crops, food prices rise, making products even less accessible (Altieri & Toledo, 2011). As a result, the

majority of staple crops required to feed both rural and urban populations are produced by millions of smallholder farmers in developing countries. In Latin America, 34.5 percent of the arable land, or 60.5 million hectares, is cultivated by 17 million smallholder farm units. The average size of these crops is approximately 1.8 hectares. These crops provide "51% of the maize, 77% of the beans, and 61% of the potatoes for domestic consumption" (Altieri & Toledo, 2011, p. 593). In terms of livestock, as the global demand for animal source food continues to increase, priority is often given to the development of technologies that "maximize the productivity of individual animals" (p. 2788) and facilitate the efficiency of large-scale industry farms (Randolph et al., 2007). Many of these efforts have little or no benefit in the developing country context. For example, often non-native or "introduced" animal breeds have difficulty adapting to the needs, environment and limited resources of poorer smallholder farmers (Randolph et al, 2007). Investing in the improvement of productivity of smallholder farmers will be essential if we hope to feed the world's ever-growing population in the future.

## 2.5.3 Rural Farmers

The definition of a smallholder farm varies depending on the social context and the geographical location. When comparing large-scale farming to small-scale farming, the level and growth rate of labour productivity is hindered for small-scale farmers. This is not surprising seeing as small farms usually require more labour per hectare than large-scale farms (Wiggins, 2009). In theory this has the potential to create employment, reduce poverty and improve food security because of the increased ability to purchase available food among land-poor rural households (Wiggins, 2009; Lammers, et al., 2009). Nonetheless, the statistics indicate that often these rewards fail to be realized (Wiggins, 2009).

Animal husbandry and crop production offer beneficial results for increasing food security in that they provide consumable and marketable products (Altieri & Toledo, 2011; Lammers et al., 2009; Reist et al., 2007). Many small-scale farmers produce solely for home consumption while others strive to earn income from their agriculture. The later case is becoming increasingly prominent (Altieri & Toledo, 2011; Reist et al., 2007). Farmers must deal with market access, conditions and all of the corresponding issues. These issues include reliable transportation, product preservation, accurate pricing information, customers and restrictive policies, but many other more specific issues arise on individual, regional and national levels. Many smallholder farmers reside in isolated rural areas, in which case it is often the lack of appropriate infrastructure that is most detrimental.

The limitations associated with smallholder farming make it difficult to infiltrate the regional and international markets (Altieri & Toledo, 2011; Reist et al., 2007). Many governments prefer to satisfy increases in demand by using large-scale producers or imports. As a result regulations are often put in place to favour these producers. In many areas large-scale farmers benefit from increased access to credit, beneficial customs and tax rates. They are also often relieved of accountability when violations of environmental standards occur. Consequently, small-scale farmers' ability to compete in the market is further hindered (Reist et al., 2007). It is important that economic development does not simply encourage large-scale production and importing. Improving credit conditions, especially for women, is one way in which the exclusion of small-scale farmers from the market can be lessened (Reist et al., 2007).

In recent years many developing countries have witnessed a great expansion in the number of international supermarket chains. As the middle class increases in population they begin to demand choice, variety, ready-made foods and better quality. These requirements rely

on consistent, high quality and large-scale orders, criteria that is often extremely difficult for small-scale farmers to meet (Reist et al., 2007).

## 2.6 Livestock and Household Food Security

## 2.6.1 Livestock's Role

Improving livestock production is one useful strategy to reduce poverty and in turn improve nutrition and health (Eisler et al., 2014; Randolph et al., 2007). Animal source food contributes greatly to human development. For those residing in poorer communities in the developing world, livestock have and will continue to play a very important role in their livelihoods and overall health (Randolph et al., 2007; Food and Agriculture Organization of the United Nations, 2006b). Food and Agriculture Organization of the United Nations statistics state that nearly 80 percent of the world's 1.3 billion poor people reside in rural areas, approximately two-thirds of which possess livestock (2006). The primary intention of livestock development in developing countries is to generate income and provide households and local communities with animal source food (Randolph et al., 2007). When compared to industrialized countries, these livestock systems have much lower productivity per animal and per land unit. Several factors contribute to these lower productivity levels, most of which reflect the limited resources available to these farmers. Since feed and other purchased inputs are often costly, little or no inputs are utilized in the management of these systems (Pica-Ciamarra et al., 2011; Randolph et al., 2007).

In these systems, one is often able to feed these animals with residue and forages from agricultural production, or with products such as food wastes and grain that might be infested with insects – the food that humans cannot or would rather not consume. In turn livestock provides the farmers with many beneficial products and securities (Eisler et al., 2014). The functions of these animals systems are abundant and diverse. An explanation of some their

functions follow.

#### **2.6.1.1 Producing Essential Food Products**

Many arguments are made against the increasing consumption of animal source proteins as it may hinder the earth's ability to feed the global population. For example, in recent decades many concerns have been raised regarding the fact that as a society we consume grain-fed animals rather than consuming the grains ourselves. Recent statistics indicate that approximately "1 billion tonnes of wheat, barley, oats, rye, maize (corn), sorghum and millet are poured annually into livestock troughs" (Eisler et al., 2014, p. 32) and that this could "technically" feed 3.5 billion human beings. It is argued that we create a system that requires more calories to be produced in order to generate the same amount of human caloric intake (Lammers, 2009). Consequently, initiatives have been created to reduce or even eliminate animal source protein from human diets. As with most reasoning of this nature, they tend to discount the health benefits of moderate meat consumption and fail to recognize the fact that not all animal feed is fit for human consumption (Eisler et al., 2014). When an appropriate diversity of food products are available and the necessary attention is given to nutritional needs, vegetarian diets can be completely nutritionally adequate; however, for many this is not the case (Food and Agriculture Organization of the United Nations, 2011; Food and Agriculture Organization of the United Nations, 2013; Young & Pellett, 1994).

Food security is not only affected by food quantity but also by diversity and quality. It is important to acknowledge that the amount of energy, nutrients and minerals that animal source protein provides can be very difficult to obtain from plant sources alone (Eisler et al., 2014; Murphy & Allen, 2003; Smith et al., 2014). For example, milk, meat and eggs have much higher quantities and bioavailability of certain nutrients when compared to their plant counterparts

(Young & Pellett, 1994). As a result, for many it is easier to obtain a nutritionally-balanced diet by incorporating both animal- and plant-based products into their diets (Lammers, 2009; Murphy & Allen, 2003). This is especially true for poor, rural residing populations in developing countries (World Health Organization, 2011).

Through the provision of meat, eggs, milk and offal, livestock directly contributes to 12.9 percent of global calories and 27.9 percent of protein (Food and Agriculture Organization of the United Nations, 2011; Smith et al., 2013). Staple plant-based diets are, however, inadvertently common among poor populations in developing countries. Possessing livestock can provide poor households access to a relatively regular supply of animal source food, thus, allowing one to supplement and diversify their diets (Randolph et al., 2007). More specifically, "meat, milk, and eggs provide proteins with a wide range of amino acids that match human needs as well as bio-available micro-nutrients such as iron, zinc, vitamin A, vitamin B12 and calcium in which many malnourished people are deficient" (Food and Agriculture Organization of the United Nations, 2011, p. 8).

For low-income households, even small amounts of animal source foods can be beneficial in improving the nutritional statuses as they address both micro- and macronutrient deficiencies (Eisler et al., 2014; Smith et al., 2013). This is particularly important for children and pregnant and lactating women. Numerous studies demonstrate that even a small amount of animal source foods, namely meat and milk in these studies, can increase a child's energy, cognitive development, and improve their anthropometric measurements, reduce morbidity from illness, and improve pregnancy outcomes (Hulett et al. 2013; Neumann et al., 2002; Neumann et al., 2010; Sadler et al., 2012).

Also, livestock can aid in the attenuation of seasonal fluctuation of grain availability

throughout the year. For instance, milk and eggs can help sustain household food security when faced with significant seasonal fluctuations in grain availability, a common reality for many (Randolph et al., 2007). Furthermore, during storage, many crops are susceptible to animal and insect predication or spoilage. By possessing livestock one has the option to preserve the calories and nutrients of these perishable crops by using them as feed for their animals (Lammers et al., 2009). As a result these calories and nutrients can be available in the future. This helps satisfy the critical food security issue of nutrient availability timing, in that it permits more consistent nutrient availability and thus a more stable household food-security status (Lammers, 2009).

#### 2.6.1.2 Providing Manure

Animals can effectively convert the aforementioned foraged or waste products into valuable animal products such as manure for improved crop production (Randolph et al., 2007; Smith et al., 2013). In fact, "a cow produces up to 70 kg of manure per day, providing enough fertilizer in a year for one hectare of wheat, equivalent to 128 kg of synthetic nitrogen that might otherwise derive from fossil fuels" (Eisler et al., 2014, p. 34). This manure has both short- and long-term benefits (Lammers et al., 2009; Randolph et al., 2007; Reis, 2007; Thomas et al., 2002). In the short term it immediately provides nutrients namely plant available forms of nitrogen and phosphorus. In the long term, its benefits include increasing the soil fertility reserves and enhancing the soils organic matter content (Food and Agriculture Organization of the United Nations, 2011; Premanandh, 2011). Plus, the efficacy of inorganic fertilizer can be improved when used with manure (Tittonell et al., 2008). Using manure produces greater crop yields which can result in greater food and income available for the household.

#### 2.6.1.3 Serving as a Source of Income

Unlike crops which are seasonal with harvest periods that do not always correspond with a one's cash needs, livestock or their products can be sold to meet these needs at any time, assuming customers or market access is available (Food and Agriculture Organization of the United Nations, 2011; Lammers et al., 2009; Reis, 2007; Thomas et al., 2002). This is particularly important when urgent needs for cash arise such as, medical bills or school fees (Food and Agriculture Organization of the United Nations, 2011; Randolph et al., 2007). In addition, to providing cash-generating activities for livestock owners these animals also have the ability to create jobs for landless community members as well as small business opportunities in the community (Smith et al. 2013). In developing countries the contribution of livestock to household income varies greatly from two percent to 33 percent (Staal et al., 2009; Pica-Ciamarra et al., 2011).

#### **2.6.1.4 Providing Draught Power**

Larger animals can be used as equipment in farming systems comprised of livestock and crops. They are able to weed crop fields, haul water, plough, carry loads, transport people, pull carts, trash harvests and puddle, et cetera. In addition, they can be hired out by other community members for similar jobs, thus serving as a direct source of income (Food and Agriculture Organization of the United Nations, 2011; Randolph et al., 2007; Reis, 2007; Smith et al., 2013; Thomas et al., 2002).

#### 2.6.1.5 Fulfilling Banking and Insurance Functions

Under certain circumstances, livestock can be thought of as a "bank on legs" or a "living savings account" (Randolph et al., 2007). Standard financial markets and banks are often not accessible

for many poor smallholder farmers. Alternatively, they are able to invest their accumulated capital or savings into livestock which provides reasonable protection against inflation. Livestock can also be converted to cash when necessary and serve as a form of liquidity. In times of crisis it acts as a form of insurance in that it provides assets that can be sold to provide other necessary resources (Randolph et al., 2007; Smith et al., 2013).

#### 2.6.1.6 Providing Social Recognition and Status

In many societies livestock is regarded as a highly valuable asset; the amount of livestock a household owns or the way in which its livestock is shared reflects social status (Food and Agriculture Organization of the United Nations, 2011; Otte, 2012; Randolph et al., 2007; Reis, 2007; Thomas et al., 2002). This is beneficial because higher social status translates to more power and resources, as well as better marital choice given that livestock is often used as a dowry (Food and Agriculture Organization of the United Nations, 2011; Otte, 2011; Otte, 2012; Randolph et al., 2007).

Many of these functions can be capitalized on with relatively little investment, namely when it comes to small animals. Small-scale farmers and their families can achieve an improved supply of vitamins, minerals and protein as well as an overall improvement in livelihood simply by increasing the production of small livestock such as chicken, goats, sheep, and guinea pigs (Reist et al., 2007). Nonetheless, there is still incentive for many small-scale farmers to acquire larger animals such as cattle. These larger animals can produce greater outputs of food-based products, are viewed as more valuable assets and, in certain cultures, provide increased social recognition. They do, however, require more resource input such as grazing land, feed and water (Lammers et al., 2009; Reist et al., 2007). Overall, the research shows that the food supply and livelihood of small-scale farms is more diverse, stable, and secure when they possess livestock

(Lammers et al., 2009; Reist et al., 2007; Owen et al., 2005; Randolph et al., 2007).

## 2.6.2 Livestock Variety

Experts explain that it is common for many small-scale farmers to raise a variety of different species; in some instances multiple species are raised at the same time. At any given time and place, a wide range of factors influences animal diversity among rural small-scale farmers (Lammers et al. 2009; Pica-Ciamarra, 2011). It would be both impossible and irresponsible to identify one animal species as the best. Different species are able to fulfill different niches. The smallholder farmers' circumstances will affect which animals are best suited for ensuring household food security status (Lammers et al., 2009). It is believed that high livestock variety and diversity act as a protective measure against household food insecurity. This is partly due to the well-established fact that genetic diversity improves resistance against biological pressures (Råberg et al., 2007). Diversity is also thought to be beneficial in terms of the animal source foods produced. For instance, a household may be able to protect themselves from market fluctuations by possessing a wide variety of livestock products, as they are more self-sustaining and, hence, less reliant on the procurement of market products (Food and Agriculture Organization of the United Nations, 2011; Pica-Ciamarra, 2011).

Nonetheless, little literature exists to date regarding the validated use of an animal diversity index. Thus it is difficult to evaluate and compare the diversity of livestock among smallholder farmers. For the most part, the indices that do exist evaluate ecological diversity. Some agriculture-based indices do exist, though they tend to focus on crop diversity, and the animal diversity specific tools are not suitable for the household level since they tend to investigate diversity on a much larger scale (Buiteveld et al., 2009).

While there are many difficulties inherent in researching livestock's contribution to food security, some studies use Tropical Livestock Units (TLU) to investigate the relationship. This method is used to assign each household one single number that represents their livestock. The concept of an "Exchange Ratio" has been developed to perform these conversions. These calculations make it so that "different species of different average size can be described by a common unit and compared" (Njuki et al., 2011, p. 11). The TLU represent the number of livestock based upon predetermined conversion factors associated with a livestock diversity scale, which are in turn based predominantly on animal weight (Food and Agriculture Organization of the United Nations, 1999; Jahnke, 1982; Maass et al., 2012). Several different formulae are used to calculate different TLU scales, many of which are country or area specific in order to better reflect the common livestock breeds. This is important because the average size of the same species may vary greatly depending on where the animal is located geographically. In general, one cattle weighing 250 kg is used as the common standard for one TLU ("TLU = metabolic body weight for body weight X / metabolic body weight for 250 kg animal") (Njuki et al., 2011, p. 11).

An example of this technique being used is a study conducted in Congo by Maass et al. (2009) whereby they did find a positive correlation between animal diversity and TLU. More specifically, using a high/low cut of value of 2.6 TLU, they found the following: "respondents with high TLU (more than 2.6) had significantly more swine, goats and chicken than households with low TLU (lower than 2.6)" (p. 1226), sheep and cattle were found exclusively in household with high TLU; the number of cavies did not differ between the high and low TLU households (Maass et al., 2012).
## 2.7 Haiti

#### 2.7.1. Background

Haiti gained its independence in 1804; it was the first nation to gain independence from a successful slave revolt. Haiti has a longstanding history of political instability and civil unrest; still today, many of its issues, such as corruption, injustice, poverty and environmental degradation, can be largely attributed to these factors (Coupeau, 2008; Ministry of Planning and External Cooperation, 2007; Smarth & Balutansky, 1991). It has two official languages, French and Haitian Creole. Currently Haiti has a total population of roughly 10.17 million people making it the most densely populated full-member state of the Caribbean Community (CARICOM). Roughly 52 percent of its population resides in rural areas comprised of roughly one million family farms, and approximately 64 percent of the country's land is devoted to agriculture (Ministry of Agriculture, Natural Resources, and Rural Development, 2010).

#### 2.7.2. Key Economic and Social Indicators

Haiti is the poorest country in the Western Hemisphere and one of the poorest in the developing world (USAID, 1995; World Bank, 2011). On the United Nation's 2010 Human Development Index (HDI) Haiti was ranked 145 out of 169 countries. Its ranking has remained stagnant for several years, which can be attributed to their failure to improve in any of the HDI components "including prevalence of undernourishment, underweight, and stunting among children; size of gross domestic product (GDP); and the overall poverty rate" (United Nations Development Program, 2011a, p.1). In 2013 Haiti was assigned a national Global Hunger Index (GHI) of 23.3 (International Food Policy Research Institute, 2013b). The GHI is a comprehensive method used by the International Food Policy Research Institute to measure and track hunger annually by

country (International Food Policy Research Institute, 2013b). A value of 23.3 falls into the category of "alarming".

Haiti's GDP per capita is \$1300 US. The country's main GDP sectors are services, agriculture, industry and remittances (Central Intelligence Agency, 2013; Glaeser et al., 2011). Its average yearly income is approximately \$400, notably less than one-tenth of the Latin American average (World Bank, 2011). It is estimated that those residing in rural areas have only one-third of the per capita income of urban dwellers. Studies show that upwards of 57 percent of the Haitian population is undernourished (Glaeser et al., 2011), 76 percent of households live on less than \$2 US per day, and 56 percent of households live on less than \$1 US per day (Poverty Reduction Strategy Paper, 2008). Administratively Haiti is divided into ten departments. The rural areas of the Nord-Est, Artibontie, Nord-Ouest and Centre departments have the highest incidence of poverty (less than \$2 US per day) and extreme poverty (less than \$1 US per day) (International Fund for Agricultural Development, 2008). As in most countries, this poverty is not equally distributed; the rural population experiences higher rates with approximately 80 percent of rural households living in poverty. Although nearly two-thirds of the population live in rural areas, only 20 percent of the public sector resources are allocated to these regions (International Food Policy Research Institute, 2008).

Due to these high levels of poverty and the country's weak economy, Haiti has a similarly alarming social profile. For example, recent statistics indicate: life expectancy is 61.7 years, which is low in comparison to other Latin American countries (United Nations Development Program, 2011b.); more than one-half of the population is illiterate; only about one quarter of the population has access to safe drinking water; only one in five children of secondary-school age actually attends secondary school; the health system is highly underfunded

with only \$21 per capita in health spending compared to the Latin American average of \$202; only approximately 25 percent of children are covered for vaccination (World Bank, 2011); and only 10 percent of the rural population has access to electricity (Food Security Portal, 2012).

## 2.7.3 Food Security and Hunger

Considering Haiti's dire economic and living conditions, it is not surprising that food insecurity and hunger have been longstanding issues there (Haiti Health Ministries, 2012; World Bank, 2011). The inability to access sufficient quantities of nutritious food is problematic for the Haitian people's overall health and wellbeing. In the last twenty years the number of undernourished people in Haiti has remained virtually unchanged, though the prevalence rate dropped from 63.5 percent in 1990 to 44.5 percent in 2010 (Food and Agriculture Organization of the United Nations, 2013). The United Nations (2008) explains that, chronic malnutrition is widespread in Haiti, especially among children. A study found that 24 percent of children under five were affected by stunting and 9 percent of children under five were affected by acute malnutrition (United Nations World Food Program, 2008).

Food security remains a serious issue in Haiti as well, with roughly 38 percent of the population, or 3.8 million Haitians, currently in a state of food insecurity (Food Security Portal, 2012). Certain population groups in Haiti are more vulnerable to food insecurity than others. Some of the groups with an elevated risk are small farmers who live only from their agricultural activities, wage earners engaged in agricultural activities and those whose main source of income is the sale of charcoal or transfers from other households (United Nations World Food Program, 2008). They are reported to have food insecurity rates of 34 percent, 34 percent and 32 percent, respectively. In addition, Haitian households with a member infected with HIV, a female head of household, no adult members that are able to work, more than seven members, and members

who are not of working age are also more susceptible to food insecurity (Haitian Coordination Nationale de la Sécurité Alimentaire, 2011; United Nations World Food Program, 2008). Households that are able to generate their income through a combination of agricultural activities and trade of non-agricultural or pastoral goods have lower rates of food insecurity. The lowest rate of food insecurity is among households that receive overseas remittances (United Nations World Food Program, 2008).

Certain departments also have a higher prevalence of food insecurity, particularly those in the north. It is estimated that 46 percent of the households in the Nord-Ouest are food insecure, 38 percent in the Nord, and 35 percent in the Nord-Est (Haitian Coordination Nationale de la Sécurité Alimentaire, 2011; United Nations World Food Program, 2008). Geographically the regions with the highest susceptibility are dry, mountainous agricultural regions (42.6%) and in dry-agro-pastoral zones (52.2%) (Haitian Coordination Nationale de la Sécurité Alimentaire, 2011; United Nations World Food Program, 2008). Food insecurity levels are the highest in rural areas (49.6%) followed by the metropolitan area of Port-au-Prince (39.9%), and the rest of the country's urban areas (34.6).

### 2.7.4 Agriculture Sector

Although Haiti imports approximately 50 percent of their food, its agriculture sector plays a large role, accounting for 25 percent of the country's GDP, not to mention that 75 percent of the country's poor are employed by the agriculture industry (United States Agriculture Department, 2013; World Bank, 2013). Some of the main agriculture crops include coffee, mangoes, cocoa, sugarcane, rice, corn, sorghum, wood and vetiver (Central Intelligence Agency, 2013).

Being that only 2 percent of Haiti's land is covered by forest, it lacks protection from extreme weather events, which are common occurrences because of its location in the Caribbean basin (Coupeau, 2008; Food and Agriculture Organization of the United Nations, 2011; World Bank, 2013). In one decade Haiti has experienced 34 major shocks (International Food Policy Research Institute, 2013). The most notable disaster was the devastating 7.0 Mw earthquake that took place on January 12, 2010, an event that the country continues to recover from today. The World Health Organization (2011) explains that Haiti's agriculture system is very vulnerable to such events – they destabilize the food system and hinder food security status among the affected populations. Obtaining insurance for smallholder farmers is extremely difficult and thus any shock is detrimental to their livelihood (Webb, 2006; World Bank, 2013).

There are very few large-scale farms in Haiti; 90 percent of the national agriculture production comes from small farmers (Ministry of Agriculture, Natural Resources, and Rural Development, 2010; Haiti Ministère de l'Agriculture, 2013). The average land holding does not exceed 1 hectare (International Fund for Agriculture Development, 2008). Most rural households are considered smallholder farmers and tend to implement mixed-agriculture practices, meaning they produce both crops and livestock. Regardless, 80 percent of smallholder farms fail to produce sufficient amounts of food to feed household members. As a result many must resort to off-farm activities to generate the complementary income needed for survival (Food Security Portal, 2012; International Fund for Agricultural Development, 2008)

Due to the high level of poverty and lack of resources among Haiti's rural population, farmers are faced with many challenges regarding their ability to effectively produce livestock, perhaps most notably the struggle to feed their livestock. Feed is costly and many households fail to produce sufficient amounts of grain and fodder from their own agriculture to support the food

needs of livestock (International Fund for Agriculture Development, 2008; Jean, 2008). Nonetheless, most Haitian farmers do own some animals. Eighty percent of small farmer produce poultry, 65 percent raise goats, 55 percent raise cows and 35 percent raise pigs. Finally, horses, mules, and donkeys still serve as the primary means of transportation for agricultural products in rural areas (Ministry of Agriculture, Natural Resources, and Rural Development, 2010; Haiti Ministère de l'Agriculture, 2013). As described above, household animal diversity is affected by a number of factors and as a result Haitian farmers' livestock holds vary greatly from one to the next. Similarly there exists great variation in the use of these animals and their products, such as for income generation, trade, or human consumption (Inter-American Institute for Cooperation in Agriculture, 1991; Jean, 2008). This study aims to examine how one's livestock may contribute to their household's food security status.

#### **CHAPTER 3: GENERAL METHODOLOGY**

### 3.1 Research Design

This project is quantitative in nature. It uses a cross-sectional survey design, meaning data were collected at one point in time and were thereafter used to describe important characteristics of the population of interest (Hall, 2008).

#### 3.2 Study Site

Haiti is a Caribbean country located in the West Indies and occupies the western third of the island of Hispaniola, which it shares with Dominican Republic to the east (Coupeau, 2008). As mentioned, French and Creole are the country's official languages. Its total land area is 27,750 square kilometers and has been divided into ten administrative regions (World Food Programme, 2013). Haiti has four principal agro-ecological zones: irrigated plains, non-irrigated (dry) plains, dry and humid hillsides. The greatest differences in agriculture practices and strategies occur between smallholder farmers in irrigated areas and those plots in the hillside or dry plain areas. Unlike the irrigated plains where monocultures of beans, corn and rice are common, in un-irrigated and hillsides areas "corn and beans are grown as part of intercropping systems that incorporate staple food crops such as yams, manioc, sweet potato, plantains, pigeon pea and peanut" (United States Agency for International Development, 2010, p.7). Overall, Haiti's climate is tropical, with slight variations depending on altitude. With regards to rainfall, there exists great variation based on region, with the lowlands and the northern and eastern slopes of the mountains receiving the greatest amounts. There are two distinct rainy seasons, April to June and October to November. Extreme weather patterns are common in Haiti; it is subject to periodic droughts, floods, and hurricanes (Encyclopedia of the Nations, 2014).

## 3.3 Sample Selection

#### **3.3.1 Department Selection**

This study utilizes a purposeful convenient sample. Five, rather than all ten, departments were selected for two fundamental reasons. Firstly, a limited budget was available for this project which made it impossible to conduct survey collection in all ten regions; it is estimated by the Inter-American Institute for Cooperation in Agriculture (IICA) that more than twice the allocated funding would have been necessary to carry out such a task. Secondly, since there exist strong similarities between certain departments, the surveyed departments were strategically selected to provide the best representation of the country's population and agro-ecosystems as possible, despite the previously mentioned limitations. Decisions were made based upon the expertise of IICA members in collaboration with the Ministry of Agriculture.

The Centre, Nord-Est and Nord-Ouest departments are very similar; they consist largely of a semi-arid ecosystem (800 to 1000 mm of rain) and have large grassland areas, making them favorable for the development of beef cattle, goats and horses. Thus, two of these three departments were chosen, the Centre and the Nord-Ouest. Nord, Nippes and Grande'Anse are similar in that they are for the most part considered wet, mountainous ecosystems (1500 to 2000 mm of rain) where much of the area is allocated to coffee production; of these the Nord department was chosen. The Artibonite and Ouest departments are both considered irrigation systems; Artibonite has the largest irrigation system in the country and as a result it was chosen. Lastly, the Sud and Sud-Est departments are considered to be a combination of semi-humid mountainous, semi-arid and irrigated plains areas; the Sud was chosen.



Figure 3.1 Departments (from (Ashleigh et al., 2011))

# **3.3.2** Community Selection

Within each department, IICA and the Ministry of Agriculture identified regions based on varying ecosystems. The communities within the departments were chosen with the intention of equally representing each identified ecosystem.

# **3.3.3 Household Selection**

A stratified random sampling method was used to select participants. A stratum can be defined as a subset of the population that shares at least one common characteristic (Lohr, 2010). The stratum that was used for the sample selection of this project was "small agriculture producer." However, unlike similar IICA projects in other Latin America, land size cutoff points could not be used as an inclusion criterion in this study because most Haitian farmers have plots less than 1.5 ha and they tend to share quite similar characteristics (Glaeser et al., 2011; International Fund for Agriculture Development, 2008; Haiti Ministère de l'Agriculture, 2013). Thus the objective was to exclude the few large-scale farmers and to interview farms with animals on the property and that agreed to participate in the survey. The Haitian Secretary of State for Animal Production, Michel Chancy, instructed his personnel at the municipal agriculture offices to use the "Farmers' Organization Lists" to identify all rural farmers' households that met this criterion. Random sampling techniques where then used to select participants from this stratum. In total, 500 households participated.

Department	Artibonite	100	Centre	101	Nord	10	Nord Ouest	99	Sud	100
Community	Grosmorn	20	Belladere	23	Dondon	20	Auber	1	Camperi	35
	March. Dessalines	19	Hinche	27	Limbe	13	Baie De Henne	20	Cayes	27
	Marmelad	20	Lascahobas	21	Limonade	26	Bombardopoli s	20	Laborde	6
	St Michel	21	Maissade	12	Plaine su.	21	Hinche	1	Torbeck	32
	Verrettes	20	Thomassique	8	St Raphael	20	Jean Rabel	20		
							Port De Paix	19		
							St Louis du Nord	18		

Table 3.1 Household distribution by department and community (n=500)

## 3.4 Data Collection

#### **3.4.1 Household Food Security**

ELCSA was used to assess food security in this study. It is based on the food security survey used in the United States (Food and Agriculture Organization of the United Nations, 2012). It has been used in several other studies and has been validated in numerous other Latin American and Caribbean Countries. In addition, the Food and Agriculture Organization of the United Nations has deemed it as a valid tool that is able to measure food insecurity at the household level and consequently will be utilizing it in future projects. Measurements generated from ELCSA provide comparable measures within and across countries. ELCSA is modified slightly on a per country basis in order to ensure cultural acceptability (Food and Agriculture Organization of the United Nations, 2012; Pérez-Escamilla et al., 2009). For this study the survey was translated into French and, for certain terms, into Creole by trained IICA professionals prior to application.

This survey does utilize the more common quantitative measures, such as income measurement and dietary intake questions (Food and Agriculture Organization of the United Nations, 2012). However, unlike many other methods for measuring food security, the ELCSA survey also takes into consideration the experience of food insecurity, an important measure that is often neglected (Webb, 2006). It aims to examine the psychological and social stresses that are associated with having insufficient food.

This aspect of the survey is captured through the inclusion of 16 questions that focus on the participant's household food situation in the previous month. The first nine questions pertain to the adults in the household and the last seven concern the children living in the household. Each question affirmatively answered was assigned a score of one. An additive score was used to classify households into food security categories. For households with children under the age of 18 the categories were defined as food secure (score, 0), food insecure (score, 1–5), very food insecure (score, 6–10), and severely food insecure (score, 11–16). For households without children the categories were defined as food secure (score, 0), food insecure (score, 1–3), very food insecure (score, 4–6), and severely food insecure (score, 7 or more).

The questions are listed in order of increasing severity. For example, it asks if a lack of money or other resources resulted in the household running out of food, or in any adult or child in the household having to skip meals or reduce portion sizes. Other questions examine whether the household could afford a nutritious, varied diet, and how frequently the household experienced such events. The last seven questions are targeted specifically to children. The purpose of this design is that it is assumed that within the household the children are "protected," meaning they would be the last to feel the effects of food insecurity (Nord et al., 2009). Theoretically, a severely food insecure household would first experience a decrease in food quality, then in the adults' food quantity, and finally in the quantity of the children's food (Food and Agriculture Organization of the United Nations, 2012; Melgar-Quiñonez, 2006; Pérez-Escamilla et al., 2009).

## **Table 3.2 ELCSA questions**

Questions referring to respondent and/or other adults in the household: During the last month...

- 1. Were you worried about running out of food?
- 2. Did your home run out of food at any time?
- 3. Was your home unable to eat at any time the kind of foods that make up a healthy diet?
- 4. Did you or anybody in your home usually have to eat the same foods almost every day?
- 5. Was there any day that you or any other adult in your home skipped a meal because of lack of food?
- 6. Did any adult in your home eat less food than what they needed because there wasn't enough food?
- 7. Was there any day when you or any other adult in your home felt hungry but did not eat because there wasn't enough food?
- 8. Was there any day when you or any other adult in your home didn't eat for a whole day or just ate once

during the day because there wasn't enough food?

#### Questions referring to children in the household: During the last month...

- 9. Were you unable to provide the children in your home with the kinds of foods they need to be healthy?
- 10. Did any children in your home usually have to eat the same foods almost every day?
- 11. Did any child in your home have to skip a meal?
- 12. Did any child in your home eat less food than what s/he needed because there wasn't enough food?
- 13. Did you have to serve less food to any child because there wasn't enough food?
- 14. Was there any day when any child in your home that felt hungry but could not be fed because there wasn't enough food?
- 15. Was there any day when any child in your home that didn't eat for a whole day or just ate once during the day because there wasn't enough food?

## **3.4.2 Food Consumption**

The survey also includes a comprehensive list of traditional food items tailored to the specific country of interest, in this case Haiti. This questionnaire was used as a reference to the National Survey of Living Conditions 2011 conducted by the National Statistical Institute of Guatemala, which is a survey supported by international institutions such as the Inter-American Development Bank and the World Bank. It examines which items were consumed in the last 30

days, how frequently they were consumed and how they were acquired. This allows for the examination of intake, not only regarding the quantity of calories but also the quality of calories, and their subsequent nutrients can also be assessed. This is an important aspect since research has shown that fruits and vegetables are often the first food groups to be eliminated when money and resources are limited, which has significant effects on one's nutritional status (Dixon et al., 2001). Potential relationships can also be examined regarding a household acquisition of food and their current agriculture practices. In order to properly assess food insecurity the survey as a whole must be evaluated, not simply founded on a question-by-question basis.

## 3.4.3 Socioeconomic and Demographic Characteristics

In addition, the survey included sections regarding: characteristics of the population (number of people living in the household, ages, literacy, formal education level, profession), land characteristics (size, ownership, allocation of land between agriculture activities, equipment etc.), income, animals (ownership, sales, slaughtered, estimated value, animal's purpose etc.) and food production (what types, how much, consumed, sold, traded, estimated value etc.). Again, these questionnaires were used as a reference to the National Survey of Living Conditions 2011. A copy of the survey in its entirety can be found in the appendices.

## 3.4.4 Interviews

Data were collected by a team that consisted of five surveyors and one supervisor, all of whom were IICA agronomists. Each member of the team was selected by the Minister of Agriculture and members of IICA in Haiti. Thorough training was conducted in May 2013 by Hugo Melagr-Quinonez, the Director of the Global Food Security Institute at McGill University, and Diana Dallmann, an IICA consultant. A training manual specifically was developed for this study to facilitate training sessions.

The surveys were conducted between June 4, 2013 and July 27, 2013. The entire team traveled to each of the selected departments. Each interviewer was then assigned to their respective households in that department. Approximately 100 surveys were conducted in each department. Once all surveys in a department were completed the team moved on to the next department. All completed surveys had to be reviewed and approved by the supervisor. Any surveys deemed incomplete or of insufficient quality had to be redone. The interviews were conducted in French and at times Creole, if necessary. The interviews were conducted on average 99.8 surveys ( $\pm$  19.4) and the average interview length was one hour and eleven minutes ( $\pm$  24 min).

### **3.4.5 Tropical Livestock Units**

The total ownership of livestock is measured by Tropical Livestock Units, this allows all different animal types to be aggregated to one single number. For this study TLU were calculated using the following weighted index factors: cattle= 0.7, horses= 0.5, mules=0.6, asses= 0.5, pigs= 0.25, sheep= 0.1, goats= 0.1, chickens= 0.01, ducks, turkeys, geese= 0.03, rabbits= 0.02 (Njuki et al., 2011). These values were obtained from both the International Livestock Research Institute (Njuki et al., 2011) and an article by Chilonda and Otte (2006). A combination of the two sources was used in order to utilize a more comprehensive list of animals, each index had values for animals that the other did not include; all animal types that were found in both indices had the same respective weighted number. In Haiti the possession of livestock serves as one of the basic assets among the rural population. When a household has the opportunity to save money it is common for them to convert this cash into livestock holds. Processing and selling livestock provides food both directly through animal source products and indirectly by providing

cash or trade opportunities. Plus they can provide draught power and hence increase the productivity of other agriculture activities (International Fund for Agriculture Development, 2008; Ministry of Agriculture, Natural Resources, and Rural Development, 2010; Haiti Ministère de l'Agriculture, 2013). Consequently, it was hypothesised that livestock would positively influence household food security.

### 3.5 Data Analysis

The completed surveys were transcribed into a specialized template in Epi Info <sup>TM</sup> 7. The data were then cleaned to identify outliers and to ensure accuracy of input by identifying and correcting any mistakes or inconsistencies. It was then analyzed using IBM SPSS Statistic 22.0 © 2012 software.

### **3.5.1 Descriptive and Bivariate Analyses**

Descriptive analyses were performed in order to find means, standard deviations, and ranges of continuous variables, while frequency distributions were generated for categorical variables. Bivariate tests between predictor variables, as informed by published literature, and outcomes of interest were performed. Similarly, bivariate analysis examined the differences between groups (ELCSA survey: food secure (FS), mild food insecurity, moderate food insecurity and severe food insecurity) using independent student's t-tests and Analysis of Variance (ANOVA). Categorical variables were analyzed using Chi-square tests, or Fisher's exact test where applicable. All associations found to be statistically significant or approaching significance were tested in the multivariate models. Statistical significance was set at <0.05 for all tests.

## **3.5.2 Multivariate Models**

Since there is such a high prevalence of severe food insecurity (n = 312, 62.4 %) and such a small number of food-secure households (n = 13, 2.6%) in this sample, using the food security

ordinal variable with four levels (FS, mild food insecure (FI), moderate FI, severe FI) in the multivariate analyses greatly reduces the power of the statistical test and skews results. For these reasons, the food-secure category was excluded and a tri-ordinal variable was used in the following multivariate analyses (mild FI, moderate FI, severe FI).

## 3.5.2.1 Ordinal Regression

A cumulative odds ordinal logistic regression with proportional odds was run to determine the effect of TLU on household food security adjusting for other independent predictors of food security. Based on a review of the current literature and local expertises' knowledge, nine variables were identified to be potential factors associated with household food security: TLU, number of people living in the household, proportion of children under the age of five living in the household, department, land size, poverty, age, gender and literacy of the head of household. The model for household food security is as follows:

$$\mathbf{Y}' = \alpha_i + \boldsymbol{\beta} * \boldsymbol{x}$$

Where:

Y'= the log of the odds for response (food security) category *j*:

$$Y' = Logit[P(Y \le j|\mathbf{x})] = \ln\left(\frac{P(Y \le j|\mathbf{x})}{1 - P(Y \le j|\mathbf{x})}\right)$$

x= the vector of explanatory variables

 $\beta$  = the vector of coefficients

 $\alpha_j$  = the threshold value for response (food security) category *j* 

## **Dependent Variable:**

**Food insecurity** referred to the household's food security status as classified by their ELCSA score. It was classified into three categories:

i. Mild food insecurity

ii. Moderate food insecurity

iii. Severe food insecurity

## **Independent Variables:**

**Livestock** referred to a household's possession of animals. Livestock was maintained as a continuous variable measure in TLU.

**Total land size** referred to the total amount of land owned by the household. Total land size was maintained as a continuous variable measure in *carreau* (1 carreau =1.29 ha).

**Poverty** referred to whether the household is living in extreme poverty, in other words if they are

living on less that one dollar US per day. This variable was maintained as a dummy variable.

**Family size** referred to the total number of people currently living in the household. It was maintained as a continuous variable.

**Proportion of children under 5 years old** refers to the number of people under the age of five currently living in the household divided by the total number of people currently living in the household. This variable was maintained as a continuous variable.

**Department** referred to the department in which the house is located. It was classified into five categories:

i.Artibonite

ii. Centre

iii. Nord

iv. Nord-Ouest

v. Sud

**Gender** referred to the sex of the head of household. This is a dummy variable where 1 represents male headship and 0 female headship.

Age refers to the age of the head of household in years and was maintained as a continuous variable.

**Education** this refers to the education level of the head of household. It is measured by a dummy variable; whether they are literate, if they can read and write 1 and if they cannot 0.

## 3.5.2.2 Multiple regression

A multiple regression was run to predict total number of animal source foods consumed in the last month. Based on a review of the current literature and local expertise's knowledge 10 variables were identified to be potential factors associated with animal source food consumption: food insecurity category, TLU, department, total land size, daily per capita income, number of people living in the household, proportion of people living in the household under the age of 5, and education, age and gender of the head of household. The predictive equation for household animal source food consumption is as follows:

$$\mathbf{Y} = \alpha + \sum_{i=1}^{k} \beta_i * x_i + \varepsilon$$

Where:

Y= Household Food Security

 $\alpha$  = the model intercept

 $x_i$  = the *i*<sup>th</sup> explanatory variable

 $\beta_i$  = the coefficient of the *i*<sup>th</sup> explanatory variable

k = the number of explanatory variables

 $\varepsilon$  = the error

## **Dependent variable:**

**Animal source food consumption** referred to the total number of different types of animal source food that the household consumed in the past 30 days.

## **Independent variables:**

**Livestock** referred to a household's possession of animals. Livestock was maintained as a continuous variable measure in TLU.

**Food insecurity** referred to the household's food security status as classified by their ELCSA score. It was classified into three categories:

i. Mild food insecurity

ii. Moderate food insecurity

iii. Severe food insecurity

**Total land size** referred to the total amount of land owed by the household. Total land size was maintained as a continuous variable measure in *carreau* (1 carreau =1.29 ha).

**Daily per capita income** referred to the amount of income each member has per day. This variable was recoded into US dollars and was maintained as a continuous variable.

**Family size** referred to the total number of people currently living in the household. It was maintained as a continuous variable.

**Proportion of children under 5 years old** refers to the number of people under the age of five currently living in the household divided by the total number of people currently living in the household. This variable was maintained as a continuous variable.

**Department** referred to the department in which the house is located. It was classified into five categories:

i.Artibonite

ii. Centre

iii. Nord

iv. Nord-Ouest

v. Sud

**Gender** referred to the gender of the head of household. This is a dummy variable where 1 represents male headship and 0 female headship.

Age refers to the age of the head of household in years and was maintained as a continuous variable.

**Education** this refers to the education level of the head of household. It is measured by a dummy variable; whether the head of household finished primary school, 1 for yes and 0 for no.

## **3.6 Ethical Considerations**

As this project utilized secondary data and presented minimal risk to participants, there are few ethical issues to consider. The Inter-American Institute for Cooperation on Agriculture (IICA) research team followed the organizations ethical guidelines and consent was collected from each household before any data were collected. Some participants, however, may have had a difficult time discussing their struggles and difficulties feeding their household, and consequently they may have experienced some emotional discomfort. This was the only anticipated risk, and it was considered minimal.

IICA provided McGill with formal permission to use their collected data for the purpose of this study. The surveys contained participants' names and personal information; however, they were kept confidential in accordance with the Institutional Review Board regulations and the government law and no names were used during the analysis. All records were kept in a secure environment. All electronic files associated with this study were saved on a password-protected computer and all hard copies of the surveys were kept in a locked office. Any published results utilizing this data maintained participant anonymity and no records were made public. All issues regarding confidentiality were explained to participants while obtaining written consent.

McGill Ethics approval was obtained from the Research Ethics Board of the Faculty of Agriculture and Environmental Sciences at McGill University and all of the study's procedures were conducted in accordance with the McGill policy on the Ethical Conduct of Research Involving Human Subjects, the Research Ethics Board guidelines, and the Ethical Conduct for Research Involving Humans.

# **CHAPTER 4: MANUSCRIPT**

Food Security and Livestock Production among Haitian Smallholder Farmers

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To be submitted to the Journal of Public Health Nutrition

# 4.1 Abstract

**Introduction**: Food insecurity is a multi-faceted phenomenon. Haiti is the poorest country in the Western Hemisphere. It is estimated that 44 percent of the Haitian population is undernourished and 50 percent of households live in extreme poverty. Most Haitian farmers possess at least some livestock and they play a vital role in their livelihood. However, the relationship between livestock and food security is not well researched.

**Objectives:** 1) Determine the food security status of smallholder farmers in Haiti. 2) Assess livestock's contribution towards food security status. 3) Examine associations between livestock and animal source food consumption.

**Methods:** This project used a cross-sectional survey design. Surveys from 500 households were collected. Data were analyzed using IBM SPSS Statistic 22.0 © 2012 software. The Latin American and Caribbean Food Security Scale (ELCSA) was used to measure food security. **Results:** Sixty-two percent of households were severely food insecure and only 2.6 percent of the households were food secure. Tropical Livestock Units, total land size and extreme poverty status all had statistically significant associations with food security. A household's food insecurity category, TLU, daily per capita income, and education level, added significantly to the prediction of total number of animal source foods consumed in the last month. Having more TLU significantly increased a household's of being less food insecure, and less food insecure households consumed significantly more animal source foods.

**Conclusions:** Possible interventions to improve food security among smallholder farmers should include increasing the number and productivity of a household's livestock.

Keywords: Food security, Haiti and livestock

### **4.2 Introduction**

Food security is defined as a state in which "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and health life" (Food and Agriculture Organization of the United Nations, 1996). Recent estimates indicate that upwards of 800 million people worldwide are food insecure, the majority of which live in developing countries. These statistics, however, fail to account for the high levels of "hidden hunger," which refers to individuals living with vitamin and mineral deficiencies but without evident clinical symptoms (Food and Agriculture Organization of the United Nations, 2012). Thus, the true number of individuals living with some degree of malnutrition or food insecurity is likely higher than current estimates suggest.

Haiti is the poorest country in the Western Hemisphere. It has experienced major political instability, civil unrest and vast ecological destruction (Ministry of Planning and External Cooperation, 2007). Its economy relies heavily on the agriculture sector, yet it lacks access to many essential agriculture-based inputs and infrastructures. This hinders the country's productivity and overall food supply for its population. Approximately 90 percent of Haiti's agricultural activities occur on smallholder farms. These farmers and their families are among the poorest people in the country and make up nearly 60 percent of the population (International Fund for Agriculture Development, 2008; Haiti Ministère de l'Agriculture, 2013). As such, it is not surprising that food insecurity is deep-rooted in Haiti's history and remains a pervasive problem today (Perez-Escamilla, 2009).

In recent decades much research has been dedicated to gaining a better understanding of the factors associated with food insecurity. Considerable progress has been made, yet many contributing factors remain relatively unknown, one of which being livestock. Animal source

food contributes greatly to human development. For those residing in poorer developing-world communities, livestock have and will continue to play a very important role in their livelihoods and overall health (Randolph et al., 2007; Food and Agriculture Organization of the United Nations, 2006b). Such is the case with smallholder farmers in Haiti. Nearly all Haitian smallholder farmers possess at least one animal (International Fund for Agriculture Development, 2008). The functions of these livestock are abundant and diverse: they provide essential food products, manure and draught power; they serve as sources of income; they fulfill banking and insurance functions; they also provide social recognition and status (Lammers et al., 2009; Pica-Ciamarra, 2011; Randolph et al., 2007; Reist, et al., 2007; Thomas et al., 2002).

The present study addressed this issue by investigating whether having a higher number of TLU was associated with household food security. Furthermore, the study explored the relationship between animal source food consumption, food security and livestock. A better understanding of the contributing factors of food security could ultimately lead to the development and implementation of more effective and sustainable interventions and policies.

### 4.3 Methodology

This project is quantitative in nature. It uses a cross-sectional survey design, meaning data were collected at one point in time and were thereafter used to describe important characteristics of the population of interest (Hall, 2008). The completed surveys were transcribed into a specialized template in Epi Info <sup>™</sup> 7. The data were then cleaned to identify outliers and to ensure accuracy of input by identifying and correcting any mistakes or inconsistencies. All data were then analyzed using IBM SPSS Statistic 22.0 © 2012 software.

#### 4.3.1 Study Site

Haiti is a Caribbean country located in the West Indies and occupies the western third of the island of Hispaniola, which it shares with Dominican Republic to the east. According to the World Bank (2011) Haiti is the poorest country in the Western Hemisphere and one of the poorest in the developing world. Its total land area is 27,750 square kilometers and is divided into ten departments (World Food Programme, 2013). Selected households were chosen from five of the country's ten departments: Nord, Nord-Ouest, Sud, Artibonite, and Centre.

#### 4.3.2 Participants and Sampling

These particular departments were chosen because they provide a broad depiction of the whole country. Departments were categorized based on similarities in their agro- and ecological systems, and one or two departments were selected from each of these categories. IICA experts, in cooperation with the Ministry of Agriculture, were responsible for all selections. A stratified random sampling method was then used to select participants. The stratum that was used for the sample selection of this project was "small agriculture producer." However, unlike similar IICA projects in other Latin America, land size cutoff points could not be used as an inclusion criterion in this study because most Haitian farmers have plots less than 1.5 ha and they tend to share quite similar characteristics (Glaeser et al., 2011; International Fund for Agriculture Development, 2008; Haiti Ministère de l'Agriculture, 2013). Thus the objective was to exclude the few large-scale farmers and to interview farms with animals on the property and that agreed to participate in the survey. The Haitian Secretary of State for Animal Production instructed his personnel at the municipal agriculture offices to identify all rural farmers' households that met this criterion. Random sampling techniques were then used to select sufficient participants from this stratum. Approximately 100 surveys were collected in each region; 500 households

participated in total. All of the data were collected by a team of six IICA members; five interviewers and one supervisor, between June 4, 2013 and July 27, 2013.

### 4.3.3 Data Collection

The Latin America and Caribbean Food Security scale (Escala Latinoamericana y Caribena de Seguridad Alimentaria -ELCSA) is based on the food security survey used in the United States (Food and Agriculture Organization of the United Nations, 2012). A French version of this survey, translated by IICA experts, was used in this study. It has been validated in numerous other Latin American and Caribbean Countries as a tool that accurately measures food insecurity at the household level.

In addition to examining various common quantitative measures such as income, this survey also took the experience of food insecurity into consideration, meaning that it explored the psychometric and physical conditions of each household. ELCSA consists of 15 questions regarding different conditions that households experience at different levels of food insecurity. The first eight questions apply to all households and the last seven questions apply only to households with members under the age of 18. This design assumes that within the household the children are "protected," meaning they would be the last to feel the effects of food insecurity. Theoretically, a severely food insecure household would first experience a decrease in food quality, then in the adults' food quantity, and finally in the quantity of the children's food (Food and Agriculture Organization of the United Nations, 2012; Melgar-Quiñonez, 2006; Pérez-Escamilla et al., 2009). All affirmative answers were summed to provide each household with a food security score. Households were classified into the following four categories: food secure (0 points), mild food insecurity (1-3 points without children and 1-5 with children), moderate food

insecurity (4-6 points without children and 6-10 with children) and severe food insecurity (7-8 points without children and 11 to 15 with children).

The survey included a food frequency question that contained a comprehensive list of food items tailored specifically to the Haitian culture. The survey also contained sections regarding characteristics of the population (number of people living in the household, ages, literacy, formal education level, profession), land characteristics (size, ownership, allocation of land between agriculture activities, equipment, etc.), income, animals (ownership, sales, slaughtered, estimated value, animal's purpose, etc.) and food production (what types, how much, amount consumed, sold, traded, estimated value, etc.). A copy of the survey in its entirety can be found in the appendices. These questionnaires were used as a reference to the National Survey of Living Conditions 2011 conducted by the National Statistical Institute of Guatemala, which is a survey supported by international institutions such as the Inter-American Development Bank and the World Bank.

### 4.3.4. Tropical Livestock Units

Each household's livestock holds were converted into TLU in order to assign them one single number to represent their livestock. This was done because it provides a better depiction of the livestock ownership and its corresponding value, and it also facilitates the analysis of their contribution as a whole to household food security (Food and Agriculture Organization of the United Nations, 1999; Ghirotti, 1993; Jahnke, 1982; Njuki et al., 2011). There is currently no TLU index created specifically for Haiti, but the indexes for Latin America and the Caribbean were used in this study. The TLU were calculated with the following weighted index factors: cattle = 0.7, horses = 0.5, mules = 0.6, asses = 0.5, pigs = 0.25, sheep = 0.1, goats = 0.1, chickens = 0.01, ducks, turkeys, geese = 0.03, rabbits = 0.02 (Njuki et al., 2011). These values were

obtained from the International Livestock Research Institute (Njuki et al., 2011) and an article by Chilonda and Otte (2006); a combination of the two sources was used to generate a more comprehensive index.

#### 4.3.5 Statistical Analysis

#### **4.3.5.1 Descriptive Analysis**

Descriptive analyses were performed in order to find means, standard deviations, and ranges of continuous variables. Frequency distributions were generated for categorical variables. During all analysis, monetary values were analyzed as Haitian Gourdes (HTG); however, for the purpose of this paper they are presented in US dollars (USD) (1 USD = 39.4 HGT).

#### 4.3.5.2 Bivariate Analysis

Bivariate tests between predictor variables, as informed by published literature, were performed, as were outcomes of interest. Bivariate analysis examined the differences between food security groups (ELCSA survey: food secure, mild food insecurity, moderate food security and severe food insecurity). Continuous independent variables were tested using independent student's t-tests and Analysis of Variance (ANOVA) and categorical variables were analyzed using Chi-square tests, or Fisher's exact test where applicable. During this analysis, no outliers were discarded. Statistical significance was set at <0.05 for all tests.

#### 4.3.5.3 Multivariate Analysis

Since there is such a high prevalence of severe food insecurity (n = 312, 62.4 %) and such a small prevelence of food secure households (n = 13, 2.6%) in this sample, using the food security ordinal variable with four levels (FS, mild FI, moderate FI, and severe FI) in the multivariate analyses greatly reduces the power of the statistical test and skews results. For this reason, the

food secure category was excluded and a tri-ordinal variable was used in the following multivariate analyses (mild FI, moderate FI, and severe FI).

## 4.3.5.3.1 Tropical Livestock Units

A cumulative odds ordinal logistic regression with proportional odds was run to determine the effect of TLU on household food security adjusting for other independent predictors. There were proportional odds, as assessed by a full likelihood ratio test comparing the fitted model to a model with varying location parameters,  $\chi^2(12) = 20.213$ , p = .063. The deviance goodness-of-fit test indicated that the model was a good fit to the observed data,  $\chi^2(956) = 766.336$ , p = 1.00, but most cells were sparse with zero frequencies in 66.7% of cells. The final model, however, did significantly predicted the dependent variable over and above the intercept-only model,  $\chi^2(12) = 45.816$ , p < .001.

#### 4.3.5.3.2 Animal source foods

A multiple regression was run to predict total number of animal source products consumed in the last month, adjusted for food insecurity category, TLU, department, total land size, daily per capita income, number of people living in the household, proportion of people living in the household under the age of 5, and education (finished primary school yes or no), age and gender of the head of household. The assumptions of linearity, independence of errors, homoscedasticity, unusual points and normality of residuals were met.

#### **4.4 Ethics Considerations**

Ethics approval was obtained from the Research Ethics Board of the Faculty of Agricultural and Environmental Sciences of McGill University.

## 4.5 Results

#### **4.5.1 Sample Characteristics**

A total of 500 households were included in the present study. A summary of key descriptive findings can be found in Table 4.1. The number of people living in the households varied from 1 to 18, with an average household size of 6.2 people. The mean age of the heads of households was 49 years. Of the 500 heads of households, only 10.8 percent were female, 66 percent had not completed primary school and 35 percent were illiterate. Sixty-two percent of households were severely food insecure and only 2.6 percent of the households were food secure. Mild food insecurity accounted for 7.2 percent of the household and the remaining 27.8 percent were moderately food insecure.

There was great variation among the household incomes: they ranged from 88.83 USD to 16,732 USD. The average total annual household income is 2,550 USD ( $\pm$  2,567.70) and the mean daily per capita income was 1.19 ( $\pm$ 1.29) USD. On average households reported having 3.87 ( $\pm$ 1.17) different sources of income. The highest incomes came from wages; however, only one quarter of the household reported this type of income. The two most common income sources were sale of agricultural products and livestock activities (sale of animals, meat and animal products), with 95 and 71.8 percent of households reporting these income sources, respectively. The average total land size per household was 1.60 carreau, which is equivalent to 2.06 hectares. All participating households had at least an animal; on average there was a total of 17.5 animals per farm (SD  $\pm$ 14.7). The overall mean TLU per household was 3.034 ( $\pm$  0.117).

### 4.5.2 Bivariate Analysis

Table 4.2 provides a summary of the bivariate analysis of various sample characteristics by food insecurity category. Results showed that food secure households had a significantly higher mean

daily per capita income and total land size compared to moderate and severe households. Less food insecure households were also significantly less likely to be living in extreme poverty (<1 USD/day). The number of animals a household possessed decreased significantly as they became more food insecure (p < 0.001). Severe FI households had significantly less animals compared to each of the other food security groups (food secure, mild FI, Moderate FI). Similarly, there is a significant difference between the mean number of TLU that food-secure households had compared to moderate and severe food-insecure households. A simple linear regression established that the total number of TLU a household had could significantly predict the total number of animal source foods that a household consumed in one month; F(1, 498) = 24.600, p < 0.001 and TLU accounted for 4.5% of the explained variability in the number of animal source foods a household consumed in one month. The regression equation was as follows: the predicted total number of animal source foods a household consumes in one month = 5.772 + 0.250 x (TLU).

The number of animal source foods consumed was not equal in all food-security categories; severe food-insecure households consumed significantly less animal source foods in the last month compared to all other categories (mild FI, Moderate FI and FS). Statistically significant positive correlations were also found between a household's total TLU and the total number of animal source foods the household consumed in the last month, including meat, eggs and dairy products (Pearson correlation (PC) = 0.217); number of agriculture products produced (PC = 0.192); value of their own meat products consumed in the last month (PC = 0.312); daily per capita income (PC = 0.214) and total land size (PC = 0.344).

## 4.5.3 Tropical Livestock Units and Food Security

The final model included food security as the tri-ordinal dependent variable (mild, moderate and severe). Independent variables included TLU, number of people living in the household, proportion of children under the age of five living in the household, department, land size, poverty and the head of household's age, gender and literacy. Based on the results from the ordinal regression (Table 4.3), an increase in TLU, adjusting for all other independent variables, was associated with a statistically significant increase in the odds of being in a less severe foodinsecurity category, with an odds ratio of 0.8781 (95% CI, -0.209 to -0.051),  $\chi^2(1) = 10.492$ , p < 10.4920.001; that is, for every one unit increase in total TLU, the odds of being less food insecure increased by 0.8781 times. TLU were higher in households with less severe classification of food insecurity (p < 0.001). Total land size was associated with a statistically significant increase in the odds of being in a less severe food insecurity category, with an odds ratio of 0.8033 (95% CI, -0.394 to -0.043),  $\chi^2(1) = 5.940$ , p < 0.015; that is, for every one unit increase in total land size, the odds of being less food insecure increases by 0.803 times. Whether a household was living in extreme poverty or not was also statistically significant. Not living in extreme poverty was associated with a statistically significant increase in the odds of being in a less severe food insecurity category, with an odds ratio of 0.6505 (95% CI, -0.858to -0.003),  $\chi^2(1) = 3.893$ ,  $p < 10^{-10}$ .048; that is, for a negative response to living in extreme poverty, the odds of being less food insecure increased by 0.6505 times. All other variables were not significant but were kept in the model due to their theoretical relevance. Furthermore, their removal had very little effect on the overall model results.

### 4.5.4 Animal source foods and Food Security

The model in its entirety significantly predicted total number of animal source foods consumed in the last month: F(10, 475) = 13.201, p < .0005, adj.  $R^2 = 0.201$ . A household's food insecurity category ( $\beta = -0.242$ , p < 0.0001), TLU ( $\beta = 0.334$ , p < 0.003), daily per capita income ( $\beta =$ 0.145, p < 0.002), and education level ( $\beta = 0.172$ , p < 0.001), added significantly to the prediction, p < .05. This means that as a household's level of food insecurity increased they became significantly less likely to consume as many animal source foods. Households where the head completed primary school consumed significantly more animal source foods. As a household's number of TLU and daily per capita income increased so did their consumption of animal source foods. All non-significant variables were kept in the model due to their theoretical relevance and because their removal had very little effect on the overall model results. Regression coefficients and standard errors can be found in Table 4.4.

## 4.6 Discussion

#### 4.6.1 Food Security

As with most of the Haitian population (Ministry of Agriculture, Natural Resources, and Rural Development, 2010), the majority of the households in this study lacked the resources (such as income, education and basic technologies) that are vital in buffering a household from poor food-security outcomes (Food and Agriculture Organization of the United Nations, 2013). As such, the prevalence of severe food insecurity was very high in this population: 62 percent of households were living in a state of severe food insecurity and only 2.6 percent of the households were living in a food-secure state. These results are similar to those found by Pérez-Escamilla et al. (2009), where the prevalence of food insecurity was evaluated using ELCSA for a sample of 153 households in the southern region of Haiti. They found that 57.3 percent of their population

was severely food insecure and only 2 percent was food secure. Households with children under the age of 18 had significantly higher prevalence rates of food insecurity when compared to households that did not have children under the age of 18 (p = 0.0001), which coincides with the theoretical framework of food insecurity (Food and Agriculture Organization of the United Nations, 2013). When comparing food security among the five departments, no statistically significant differences were found; however, the results indicate that the Nord-Ouest department had the highest proportion of households in the severe food-insecurity category. This particular department is noted as one of the top two most food-insecure departments (Coupeau, 2008; Haitian Coordination Nationale de la Sécurité Alimentaire, 2011; Inter-American Institute for Cooperation in Agriculture, 1991). Much of this is attributable to the fact that this department's productive resources have been deteriorating at a faster rate than the rest of the country's regions. More specifically, the Nord-Ouest department has experienced more notable soil erosion, inadequate land tenure arrangements, increased population pressure on the land and agricultural droughts (Inter-American Institute for Cooperation in Agriculture, 1991).

#### 4.6.2 Livestock

Livestock have always been an integral part of the Haitian agricultural sector and the livelihood of smallholder farmers (Ministry of Agriculture, Natural Resources, and Rural Development, 2010). Livestock production represented the second most common source of income for this study's population. In Haiti, most peasant farmers hold at least one animal, if not more (Ministry of Agriculture, Natural Resources, and Rural Development, 2010). Findings from this study reaffirm this fact: all households in this sample possessed at least one animal. Similarly, many experts believe that poor smallholder farmers keep multiple types of animals to avoid risk
(Maass et al., 2012; Perry et al., 2002). In this study only 12 households (2.4 percent) possessed only one type of animal.

Risk prevention likely serves as a motivating factor for diversifying livestock holdings in this population for several reasons. First, livestock illness is prominent in Haiti and can in fact account for approximately 60 percent of livestock death in any given year. The principal disease affecting fowl is Newcastle. Every year this disease becomes an endemic from March to April and September to October (Baro, 2002). It was noted that nearly 700 chickens died from Newcastle in this study. The survey, however, did not include questions that specifically investigated livestock disease and death; this data were obtained from interviewers' observations, and thus it is likely that the number of deaths is underestimated. The high prevalence of livestock disease, coupled with the fact that veterinarian services and vaccine supplies for such diseases are extremely limited in developing countries, is problematic for the livelihood and safety of poor smallholder farmers (Vallat & Mallet, 2006). Haiti is also very susceptible to unstable economic and political climates and to volatile weather (Smarth & Balutansky, 1991). This instability can jeopardize the benefits of livestock holds in a variety of ways, including destruction due to extreme weather events, harmful agricultural policies, political corruption and unpredictable market prices, to name a few (Delgado et al., 2001; Food Security Portal, 2012). The loss of function or value of livestock, regardless of the reason, can potentially influence a household's food security status. Possessing a diverse livestock hold may have a protective effect against such risks because it can increase resiliency against external pressures.

While there are many difficulties inherent in researching livestock's contribution to food security, using TLU allowed each household to be assigned a single value that represented the household's entire livestock hold. Results indicated that the mean TLU were not equal among

food-security categories. Mildly food-insecure households had significantly more TLU when compared to moderate and severe food-insecure households. Findings indicated that TLU remained a significant predictor of household food insecurity in the ordinal regression. As a household's TLU increased, so did their likelihood of belonging to a less severe category of food insecurity. This is an area that has yet to be explored in Haiti, though the results of this study do align with several other studies that used TLU in that having higher TLU was associated with a better household food security status (Feleke et al., 2005; Kassa et al., 2002; Maass et al., 2012; Gebrehiwot & Van der Veen, 2011). This suggests that initiatives to increase the number of livestock, or TLU, should be promoted as a strategy to improve household food security status. Future research is needed to investigate the relationship between livestock diversity and household food insecurity as it may give a better picture of the farmer's situation. For instance, if two households have equal TLU but their livestock holds are comprised of different animals it is not clear whether one is at a higher risk of being food insecure than the other.

## 4.6.3 Livestock and Diet

Many individuals consume a diet with limited or no animal source foods. For some this is a choice; for others it is a necessity. It is well established in the literature that a mixed diet, including meat and plant products, is more likely to satisfy all of one's micro- and macronutrient requirements compared to a plant-based diet (Murphy & Allen, 2003; Neumann et al., 1996; Neumann et al., 2002). This is not to say that vegetarian or vegan diets cannot be nutritionally adequate; rather it is acquiring the food diversity needed to provide a balanced and complete plant-based diet that is challenging, especially for individuals in developing countries (Delgado et al., 2001; Murphy & Allen, 2003).

Many experts recommend that smallholder farmers raise livestock as a means of protecting themselves and their families from many diet-related illnesses such as protein-energy malnutrition and anemia (Müller & Krawinkel, 2005; Nemer et al., 2001; Tontisirin et al., 2002), both of which are major health burdens in Haiti (Baro, 2002). Results highlight that households with more TLU consumed significantly more eggs, meat and dairy products in the last month. Although it is common for poor smallholder farmers to sell their animal source food products for profit, many do consume at least a portion themselves (Dixon et al., 2001; Otte et al., 2012). Results from this study lead one to believe that households with more TLU may have consumed more of their own livestock products. It is, however, important to note that food security itself was an independent predictor of increased animal source food consumption. Less severe food-insecure households were more likely to consume more animal source foods, adjusting for TLU and other independent variables, which coincides with the literature (FAO, 2011).

Although specific health outcomes were not assessed in this study, consuming more animal source foods would, in theory, have a protective effect against many illnesses such as anemia and protein energy malnutrition (Müller & Krawinkel, 2005; Murphy & Allen, 2003, Food and Agriculture Organization of the United Nations, 2013; Yeudall et al, 2007). Given the potential health benefits of animal source foods on health status (Neumann et al., 2002), future research in Haiti should be conducted to investigate this relationship. Furthermore, with an increased income from the sale of livestock products, a household becomes better equipped to acquire the resources necessary to achieve or sustain a food-secure state.

It is, however, important to note that food security itself was an independent predictor of increased animal source foods, in that less severely food-insecure households were more likely to consume more animal source foods adjusting for TLU and other independent variables. Results highlighted that household food security was positively associated with consumption of animal source food consumption, in that less food-insecure households consumed significantly more animal source foods (eggs, meat and dairy products) in the last month.

## 4.6.4 Education

It is believed that education plays an important role in disseminating public information on nutrition, health and hygiene (Gebrehiwot & Van der Veen, 2014; Mukudi, 2003). When people are educated they tend to prioritize valuable life objectives, for instance, ensuring their household has stable access to sufficient and appropriate food, such as adequate animal source foods (Sen, 1999). An educated smallholder farmer would be more able to translate information regarding improved productivity and more likely to put that knowledge into practice. In this study, 66 percent of heads of households had not completed primary school and 35 percent were illiterate.

The coefficient for the head of household's education level (whether they finished primary school or not) was positive and significant in the multiple regression model, indicating that if the head of household did complete primary school, the household was more likely to consume more animal source foods. An educated head of household may be more aware of the importance of animal source foods in the diet and more likely to prioritize its consumption within the household. A similar trend was found in the ordinal regression model, in that educated heads of households were less severely food insecure, though this was not statistically significant.

These findings are similar to those of Ayele and Peacock (2003), in that as a smallholder farmer develops the capacity to own and manage livestock it can impact the household's ability to counteract the vicious poverty cycle, improve access and consumption of animal source foods and improve food security.

# 4.6.5 Age

The age of the head of household was found to be not statistically significant. The relationship between age and food security is not as clear-cut as other determinants like poverty. The age-old saying states "with age comes wisdom" and many believe this to be true regarding the relationship between age and food security. It is argued that as the head of household ages they accumulate more knowledge and physical assets, all of which can contribute positively to household food security. In addition to having more experience in their physical and social environments, older individuals have more agricultural experience. This belief contributes to the idea that the economy of a smallholder farmer's household becomes more stable as the head of household ages (Gebrehiwot & Van der Veen, 2014; Hofferth, 2004). Another theory, however, posits that older individuals may be less efficient or able to conduct farm activities, which hinders productivity and can be detrimental to household food security (Gebrehiwot & Van der Veen, 2014). The results from this study may be attributed to this hypothesis.

## 4.6.6 Gender

The coefficient for gender in the multiple regression was negative, which implies that male-run households were less food insecure; however, this variable was not statistically significant, possibly due to the fact that so few households (10.8%) were female run. Nonetheless, this follows what is presented in the literature, meaning that woman-run households tend to be more susceptible to food insecurity. It is often believed that male heads of households have better

access to the resources that improve food security. Some of these resources include access to credit and land, advanced technologies, training and agricultural extension (Food and Agriculture Organization of the United Nations, 2013; Gebrehiwot & Van der Veen, 2014; Kassie et al., 2012; Modirwa & Oladele, 2012).

#### 4.6.7 Household Size

In some instances a larger household size can be beneficial because it provides a large labour force, which is an asset for poor smallholder farmers. On the other hand, a large family size requires more resources to satisfy all the members' food needs (Gebrehiwot & Van der Veen, 2014; Kidane et al., 2005). In this study the latter trend was witnessed. This variable was not statistically significant at the 5 percent level. Similarly, it is believed that having a high proportion of children under five will hinder household food security since they act as a stressor on food needs (Gebrehiwot & Van der Veen, 2014). This trend was found in this study, but the variable was not statistically significant.

# 4.6.8 Income

Results indicated that the average daily per capita income was 1.19 USD and 86 percent of households were living in poverty (less than 2 USD per day), 59 percent of which were living in extreme poverty (less than 1 USD per day). The Haitian Ministry of Agriculture, Natural Resources, and Rural Development (2010) states that the high rate of poverty is one of the most detrimental factors affecting Haitian smallholder farmers as they strive to escape food insecurity. Also, it serves as the underlying cause of malnutrition and its determinants, all of which contribute to households being "trapped" in a state of food insecurity (Müller & Krawinkel, 2005). As such, it is not surprising that a household's extreme poverty status and their daily per capita income were found to be independent predictors of household food-insecurity status and

animal source food consumption, respectively. Households that were not living in extreme poverty (>2 USD/day) were significantly more likely to be in a less severe food-insecure category. Households with higher daily per capita income were also significantly more likely to consume more animal source foods.

Most Haitian farmers are unable to support their household needs from one income source alone (International Fund for Agriculture Development, 2008). This study's findings suggest this was the case because on average Haitian households reported having 3.87 (±1.17) different sources of income. Over 90 percent of households reported the sale of agricultural products as an income source and 72 percent reported livestock activities. Ninety percent of the food produced in Haiti comes from smallholder farmers (International Fund for Agriculture Development, 2008; Ministry of Agriculture, Natural Resources, and Rural Development, 2010; Haiti Ministère de l'Agriculture, 2013), which reaffirms the importance and impact that this sector has on the food security of not only this population but on the entire country. More efforts are clearly needed to build the resiliency and strengthen the productivity of smallholder farmers.

# 4.6.9 Land Ownership

Haiti's agricultural sector is comprised almost entirely of small farms and the agro-industry generates employment for more than 75 percent of the country's poor. Their products contribute 25 percent of the total GDP, provide upwards of 70 percent of domestics consumption and account for over 40 percent of total exports (United States Agriculture Department, 2013; World Bank, 2011; World Bank, 2013). A report from the International Fund for Agriculture Development (2008) explains that the average land holdings in Haiti are approximately one hectare. Our results vary slightly in that the average land size reported was 2.06 hectares. The geology of the land is unspecified, and whether it is all suitable for farming activities is

unknown. It is likely that not all of reported land is able to support agricultural activities due to undesirable terrain conditions; thus, the actual farm land may be smaller than reported. This hypothesis is supported by the literature, which explains that when a recent USAID survey form Haiti was interpreted, the average farm size was approximately 1.7 hectares, and that on average farmers only had 0.6 hectares of good- or mixed-quality soil for agriculture (Smucker et al., 2000).

It is evident that owning land is a basic and very important asset for Haiti's rural population. Accordingly, a household's land size was associated significantly with food insecurity status and total animal source food consumption. The coefficient for total land size was positive and significant in both multi-variate models, indicating that the larger a household's land size, the higher the odds of being in a less severe food insecurity category and the higher the likelihood of consuming more animal source foods. This is not surprising seeing as expanding the size of the area used for cultivation will surely increase a household's food production considerably (Kidane et al., 2005; Najafi, 2003). Nonetheless, much of the literature highlights that land area alone will not increase the productivity and livelihood of the farmers. The relationship between land size and livelihood outcomes is immensely complex and experts explain that access to productivity-enhancing tools, such as capital education and technology, is critical (Baro, 2002; Fan et al., 2013).

# 4.7 Limitations

Certain limitations must be considered for the present study. This study only used cross-sectional data, thus no long-term changes in a household's circumstances can be observed. Accordingly, the seasonal elements of food security could not be investigated. This also makes it impossible to distinguish causality; only associations can be inferred. For instance, we cannot determine

whether having low TLU is responsible for a household being severely food insecure or whether a household being in a severely food insecure state prevented them from acquiring more TLU. In order to understand the temporal sequence of events, longitudinal cohort studies are required.

The sample consisted of 500 households that were selected from five rather than all ten departments; consequently, it is not representative of the entire smallholder farmer population in Haiti. Nonetheless, the departments and their communities were chosen by experts in order to provide a good depiction of the country's smallholder farming population.

Lastly, the method of TLU is not without its limitations. For example, it fails to account for the variety of the actual livestock species, such as the different types of cattle, which may differ significantly in size. The TLU method is also based on body weight rather that metabolic weight, so it does not consider the age or role of the animal. It assumes that all households provide the same feed, which is often not the case, and it uses Latin American conversion factors which may be inaccurate, because animals in Haiti often vary in size and weight compared to their counterparts in other countries. Initiatives to develop a more precise method of measuring a household's livestock diversity are warranted.

#### 4.8 Conclusions

The present study highlights the high prevalence of severe food insecurity among smallholder farmers in Haiti. It is evident that the determinants of food security are highly complex; they are not autonomous and their effects are intertwined, making it difficult to examine them independently. Nonetheless, this study's findings indicate that farmers with more TLU were associated with increased odds of being less food insecure and likely to consume more animal source foods. Haitian institutions, both governmental and non-governmental, and international corporations should not only be informed about the high prevalence of food insecurity among

Haitian smallholder farmers, but also the factors that contribute to this phenomenon. Initiatives to increase households' amount and productivity of livestock should be included in programs and interventions aimed to improve Haiti's food security crisis.

# 4.9 Tables

# Table 4.1 Characteristics of the Sample

Characteristic		
Total Tropical Livestock Units	3.0 (±2.6)	
Total number of livestock owned	17.5 (±14.7)	
Head of household gender		
Male	89.2 (446)	
Age of head of household, yrs.	49.2 (±12.0)	
Household size, no.	6.2 (±2.6)	
Proportion of children <5 per household	7.0 (11.7)	
Education level of head of household		
< primary school	66.0 (330)	
Illiterate	35.2 (176)	
Marital status of head of household		
Married or with partner	85.8 (429)	
Food security status		
Food secure	2.6 (13)	
Mild food insecurity	7.2 (36)	
Moderate food insecurity	27.8 (139)	
Severe food insecurity	62.4 (312)	
Daily per capita income	1.2 (±1.3)	
Household living in extreme poverty		
Yes (< 1 USD/day)	59.0 (295)	
Total land size per household (carreau)	1.6 (±1.2)	
Animal course food consumed in the last month		
Animal source food consumed in the fast month	6.5 (±3.0)	
Income sources (USD)		
Sale of agricultural products $(n = 476)$	665.9 (±876.6)	
Livestock activities ( $n = 359$ )	413.1 (±1,029.6)	

Values represent % (n) or means  $\pm$  Standard Deviation

Food Security Category										
Characteristics	Food secure	Mild FI	Moderate FI	Severe FI	P Value					
Tropical Livestock Units	5.1 <sup>a, b</sup> ± 4.8	5.2 ± 4.8	3.1 <sup>a</sup> ± 2.7	$2.7^{b} \pm 1.8$	0.001*					
Number of livestock owned	26.6 <sup>a</sup> ± 14.4	$25.3^b\pm23.3$	$17.3 ^{\circ} \pm 1.5$	$11.3^{a, b, c} \pm 0.6$	0.001*					
Animal source foods consumed in past month	8.1 <sup>a</sup> ± 4.0	$9.3 b, c \pm 2.8$	7.3 <sup>b, d</sup> ±2.6	$5.8^{a, c, d} \pm 2.9$	0.001*					
Head of household gender (Male)	100 (13)	88.9 (32)	89.9 (125)	88.5 (276)	0.611					
Daily per capita income (USD)	$3.6^{a, b} \pm 2.0$	$2.6 \pm 2.2$	1.2 <sup>a</sup> ± 1.1	$1.0^{b} \pm 1.0^{b}$	0.001*					
Age of head of household, yrs.	$47.8 \pm 13.7$	$49.7 \pm 12.8$	$48.6 \pm 13.0$	49.5 ± 11.4	0.844					
Household size (# of members)	5.7 ± 2.8	5.6 ± 2.4	6.2 ± 2.5	$6.3 \pm 2.6$	0.444					
Proportion of children <5 per household	9.3 ± 11.9	8.4 ± 13.0	$5.5 \pm 10.0$	7.4 ± 12.0	0.304					
Education level of head of household < primary school Illiterate	61.5 (8) 30.8 (4)	50.0 (18) 25.0 (9)	64.7 (90) 31.7 (44)	68.8 (214) 38.4 (119)	0.143 0.274					
Marital status of head of household (Married or with partner) Yes	100.0 (13)	83.3 (30)	88.5 (123)	84.3 (263)	0.291					
Household in extreme poverty Yes ( < 1 USD/ day) No ( > 1 USD/ day)	15.4 (2) 84.6 (11)	19.4 (7) 80.5 (29)	61.7 (82) 38.3 (51)	65.4 (204) 34.6 (108)	0.001*					
Department Artibonite Centre Nord Nord-Ouest Sud	38.5 (5) 23.1 (3) 23.1 (3) 7.7 (1) 7.7 (1)	19.4 (7) 19.4 (70 25.0 (9) 8.3 (3) 27.8 (10)	19.4 (27) 23.0 (32) 18.0 (25) 17.3 (24) 22.3 (31)	19.6 (61) 18.9 (59) 20.2 (63) 22.8 (71) 18.6 (58)	0.456					
Total land size (carreau)	$3.248^{a, b} \pm 1.6$	$2.51 \pm 1.6$	1.53 = 0.9	$1.46^{\text{b}} \pm 1.2$	0.001*					

 Table 4.2 Bivariate Analysis of Sample Characteristics by Food Insecurity Category

\* p < 0.05; Values represent % (n) or means  $\pm$  SD; Mann-Whitney U and Kruskal Wallis tests were conducted for non-normally distributed continuous variables; Fisher's Exact test were used when cells had <5 observations; p-values correspond to differences between FS categories; <sup>a, b, c</sup> or <sup>d</sup> indicates a statistically significant difference exist between the categories with the same superscript

Variable	Estimate	OR	SE	Wald	P value	95% Co Inte	nfidence
						Lower Bound	Upper Bound
TLU	-0.130	0.878	0.040	10.492	0.001*	-0.209	-0.051
Department Artibonite	0 245	1.278	0 304	0 649	0 421	-0 351	0 841
Centre Nord	0.099 0.234	1.104 1.264	0.302 0.302	0.107 0.598	0.744 0.439	-0.494 -0.358	0.691 0.825
Nord-Ouest Sud	$\begin{array}{c} 0.687\\ 0\end{array}$	1.988 1	0.325	4.482	0.054	0.051	1.323
Extreme Poverty (< 1USD/day)	-0.430	0.651	0.218	3.893	0.048*	-0.858	-0.003
Proportion of children <5 y.o	0.008	1.008	0.008	0.834	0.361	-0.009	0.024
Total land size (carreau)	-0.219	0.803	0.090	5.940	0.015*	-0.394	-0.043
Household size (# of members)	0.24	1.271	0.042	0.318	0.573	-0.058	0.106
Age (yr.)	0.006	1.006	0.009	0.572	0.450	-0.010	0.023
Gender (male)	-0.282	0.754	0.321	0.770	0.380	-0.911	0.347
Education level (literate)	0.416	1.516	0.220	3.577	0.059	-0.015	0.848

# Table 4.3 Summary of Ordinal Regression Analysis of Factors Associated with Food Insecurity

\* p < 0.05; OR = Odds Ratio; SE = standard error of the estimate.

Variable	В	SE <sub>B</sub>	β	P value
Intercept	9.26	0.83		
TLU	0.16	0.05	0.33	0.003*
Food security category	-1.15	0.21	-0.24	0.001*
Department	-0.15	0.09	-0.07	0.087
Total land size (carreau)	0.12	0.11	0.05	0.301
Household size (# people)	0.08	0.05	0.07	0.118
Age of head of household, yrs.	-0.21	0.01	-0.08	0.063
Gender of head of household (male)	-0.35	0.39	-0.04	0.381
Heads of households with at least primary school	1.09	0.28	0.17	0.001*
Proportion of people < 5 y.o.	0.006	0.01	0.02	0.591
Daily per capita income (USD)	0.36	0.12	0.15	0.002*

 Table 4.4 Multiple Regression Analysis of Factors Associated with Animal source food

 Consumption

\* p < 0.05; b = unstandardized regression coefficient;  $SE_B =$  standard error of the coefficient;  $\beta =$  standardized coefficient

# **CHAPTER 5: FINAL CONCLUSIONS**

Achieving a better understanding of the contributing factors of food insecurity has been a global concern for decades, yet research is lacking with regards to livestock's influence on the food security of smallholder farmers. The present study contributes to the literature on food security by attempting to better understand the ways in which livestock contributes to the food security status of smallholder farm households, specifically in rural Haiti.

Food insecurity is deep rooted in Haiti's history and remains an issue that continues to warrant great concern today. The study's descriptive findings indicate that more that 60 percent of the households are living in a state of severe food insecurity and that only 2.6 percent were living in a food-secure state. This prevalence rate is one of the highest in the developing world (Food Security Portal, 2012) and must be addressed.

With regards to livestock, results indicate that households with a higher number of TLU were significantly more likely to pertain to a less severe food-insecurity category and also consumed significantly more animal source foods. It is, however, important to note that food security itself was an independent predictor of increased animal source foods, in that less severely food-insecure households were more likely to consume more animal source foods adjusting for TLU and other independent variables. For low-income households, even small amounts of animal source foods can be beneficial in improving the nutritional statuses as they address both micro- and macronutrient deficiencies (Eisler et al., 2014; Smith et al., 2013). As such, having more livestock units and being less food insecure may be associated to an improved diet, which could in turn improve one's overall health status. More research is required to investigate these potential relationships.

Overall this study highlights that if a smallholder farmer develops the capacity to own and manage livestock, it can impact the household's ability to counteract the vicious poverty cycle, improve access to and consumption of animal source foods, and improve food insecurity. Future longitudinal cohort studies are needed in order to understand the temporal sequence of events. The findings from this study suggest that initiatives to increase households' amount and productivity of livestock should be included in programs and interventions aimed to improve Haiti's food insecurity crisis. For this to be effective, it is also suggested that policies and programs designed to enhance food security must focus on building capacity among smallholder farmers, which will generate more meaningful and sustainable improvements.

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# **APPENDICES**

# APPENDIX A

# Consentement éclairé

# 1. Institution et But

Bonjour, mon nom est :....,. Je travaille pour le Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR) de la République d'Haïti. Le Ministère travaille en collaboration avec l'Institut Interaméricain de Coopération pour l'Agriculture (IICA), qui a des bureaux dans 34 pays de l'Amérique et l'Université McGill du Canada. Nous faisons une enquête auprès des agriculteurs dans les différents départements d'Haïti, afin de mieux comprendre quel type d'animaux ils possèdent, ils produisent, et aussi quel type d'aliments ils consomment.

# 2. Informateur

Afin de faire cette enquête, j'ai besoin de parler à la personne de votre famille qui a la capacité de me donner des informations sur la production agricole au sein de votre famille et également sur les aliments que vous consommez. Peut-être aurai-je besoin de parler avec plus d'une personne qui pourraient être le chef de famille ou la patronne de votre foyer.

# 3. Avantages

Je tiens à dire que nous ne percevons pas cette information pour aucun programme du gouvernement ou aucune agence de développement ou de support. Ce que nous voulons, c'est de mieux connaitre cette zone et la façon dont vous travaillez les champs ici et ce que les gens mangent. Donc, les informations que vous pourrez me donner n'affecteront en aucune manière les avantages que vous pourriez recevoir d'un programme ou d'une assistance quelconque ou que vous seriez susceptible de recevoir. Le seul avantage que vous tirerez de cette enquête est que la région dans laquelle vous vivez sera mieux connue, ce qui est important pour son développement futur.

#### 4. Confidentialité

Je voudrais vous dire également que tous les renseignements que vous me fournirez seront confidentiels. Cela signifie que, à aucun moment, on ne va utiliser votre nom dans aucun rapport. Je vais vous demander vos renseignements seulement pour pouvoir entrer en communication avec vous, au cas où je devrais revenir poser une question quelconque que j'aurais oublié de vous poser aujourd'hui. Mais tant votre nom que vos données sont strictement confidentiels et ne seront pas partagés avec qui que ce soit, ni avec aucune institution. Si vous me permettez de vous poser quelques questions et acceptez de participer à cette enquête, je vous remercierai beaucoup.

# 5. Vos Droits

Bien sûr, si vous ne voulez pas participer à cette enquête, je le comprends. Je le répète, si vous y participez, cela ne déterminera aucun avantage additionnel ou assistance d'un quelconque programme dont vous êtes déjà bénéficiaire ou êtes susceptible de bénéficier dans le futur. Vous pouvez donc décider de participer ou non à cette enquête.

Enfin, je tiens à vous dire que j'aurai besoin de plus ou moins deux (2) heures de votre temps pour remplir ce questionnaire. Si vous êtes d'accord et pouvez me donner ce temps, je vous serai très reconnaissant.

APPI	ENDIX B					Numára	de monage:		
Numér	o de Formulaire: (		)			Numero	de menage.		
SECTION	1. DONNÉES GÉNÉ	ERALES				·			
A. IDE	NTIFICATION CAR	TOGRAPHIQUE E	ET LOCALISATION DE L'E	XPLOITATION A	AGRICOLE				
01. Pro	vince:	(	02. Commune:			03. Section:			
04. Ad	resse de l'exploitatior	n agricole:				05. Téléphone:			
06. Co	les d'Identification et	ou de Signalisation	:						
B. DONNEES DE CONTROLE									
01. Date de la visite	02. Heure Début	03. Heure Fin	04. Entretien complété lors de la visite N°:	Identification					
Visite Jour Mois	Heure Min	Heure Min			05. Nom et Si	gnature			
1°			1	a. Enquêteur					
2°			2	b. Superviseur					
C. MEI	NAGES VIVANT DA	NS L'EXPLOITA	TION AGRICOLE						
01. Est séparée SI LA I FORM	-ce que, dans cette exp ? OUI □ NON RÉPONSE EST "OUI ULAIRE, EN HAUT	bloitation agricole v V □ SI LA RÉPC ", ENTREZ LE NU A DROITE ET LA	ivent des groupes de personn DNSE EST "NON", PASSEZ JMÉRO DE LA MENAGE V QUANTITÉ DE MENAGES	es (menages) qui p A LA QUESTION TISITÉE, A COTE S DANS LA QUES	oréparent leurs a l N° 03. DU NUMÉRO STION N° 02.	liments de manière DU	02. Combien de menages (ou de menages) y a t'il dans cette exploitation agricole?		
03. Coi	nbien de gens personr	nes mangent et dorr	nent régulièrement dans cette	menage, qu'elles	soient liés ou no	n du chef ou de la pa	atronne de la menage, y compris		
les nou	veau-nés, les enfants,	les personnes âgées	s, etc.,						
à l'excl	usion des personnes q	ui, pour diverses ra	isons, se trouvent absentes de	la menage pendar	it 9 Mois consée	utits ou plus.			
Aonsieur	(ou Madame) J'ai bes	oin de préparer une	liste avec les noms et prénom	ns de chacune des	personnes qui n	angent et dorment ré	egulièrement dans cette menage à		
exclusion	n de ceux qui préparer	it leurs aliments a p	art. En plus de leurs noms et j	prenoms, je vous c	temanderai d'au	tres données telles qu	ue: le Sexe, l'Age, la Date de naissance		
angue pri	ncipale, l'occupation j	principale, entre aut	I'ES. WANTE N'OUDLIEZ DAGI	O'ENDECISTDEI		NES OUI SONT TE	MODAIDEMENT ADSENTES I ES		
	EZ CES DUNNEES S	ON LA PAGE SU	IVANTE. IN OUDLIEZ PAST	U ENKEOISIKEI	LES PERSON	INES QUI SUNT TE	INFORAIKEINIENI ADSENIES, LEN		

NOUVEAU-NÉS ET LE PERSONNEL DOMESTIQUE DE MENAGE ET EXCLURE LES PERSONNES QUI, POUR QUELCONQUE RAISON, SE TROUVENT HORS DE LA MENAGE POUR UNE PÉRIODE DE 9 MOIS CONSÉCUTIFS OU PLUS.

S'il y a des personnes qui ne sont pas des parents du chef ou de la patronne de la famille qui mangent et dorment régulièrement dans cette menage pour une période de trois mois ou plus, incluez les, s'il vous plait.

S'il y a des personnes qui sont membres de cette menage mais ne sont pas présents, pour raisons de vacances, du travail, de leurs études, ou pour des raisons de santé, indiquez moi leurs noms et prénoms, s'il vous plaît (tant qu'ils sont définis «membre de cette menage").

N'oubliez pas d'inclure les enfants, les personnes âgées et les handicapés, s'il y en a dans l'exploitation agricole.

Indiquez-moi, le nom et prénom de la personne que les membres de ce menage reconnaissent comme chef ou patronne de cette menage, qui mange et dort régulièrement dans cette menage (*NOTEZ SON NOME ET PRÉNOMS DANS LA FILE 01 DE LA QUESTION N° 1 DE LA PROCHAINE PAGE*),

Maintenant, indiquez-moi le nom de l'époux ou de l'épouse ou du compagnon ou de la compagne qui mange ou dort habituellement dans cette menage,

Indiquez-moi le nom et prénom de chacun des fils ou des filles, beau-fils ou belles-filles, célibataires et sans enfants qui vivent habituellement dans cette menage (y compris les enfants nouveau-nés et tous les enfants mineurs),

Indiquez-moi les noms et prénoms de chacun des fils ou filles, beau-fils ou belles filles mariés ou vivant en union libre qui résident habituellement dans cette menage, ainsi que celui de leurs époux ou épouses, de leurs filles ou de leurs filles, en notant en suite, au conjoint et à ses enfants.

Indiquez-moi les noms et prénoms de chacun des fils ou filles, beau-fils ou belles filles divorcés, séparés ou dont le conjoint est décédé et dont les enfants, fils ou filles, vivent avec eux, en notant ensuite chacun de ces enfants.

Indiquez-moi les noms et prénoms des autres parents du chef ou de la patronne de la menage ou de son compagnon ou compagne, qui mangent et dorment régulièrement dans cette menage. Indiquez-moi les noms et prénoms des employés de menage des deux sexes et de leurs parents qui mangent et dorment régulièrement dans cette menage.

Indiquez-moi les noms et prénoms des personnes qui ne sont pas des membres de la famille, mais qui sont des membres réguliers de cette menage.

#### SECTION 2. CARACTÉRISTIQUES DE LA POPULATION (1 - 15)

	POUR TOUS LES MEMBRES DE LA MENAGE					MEMBRES DU MENAGE QUI ONT UN ÂGE DE 5 ANS OU PLUS					
	01. Nom et prénoms.	02. Quelle	03	04. Quel est	05.	06.	07. Quel est le	08. S'il vous plait,	COMPLÉTEZ LA		
	ENREGISTREZ LE PREMIER NOM ET LES	relation de		l'âge de	Sait	Sait	niveau d'éducation	informez-moi à propos	QUESTION		
	PREMIERS PRÉNOMS SELON	parenté	Se	<i>[NOM]</i> en	lire	écrir	atteint par	de la profession	SUIVANTE		
de	L'ARRANGEMENT SUIVANT:	a.[NOM] avec	-	années, mois ou		e	[NOM]?	principale de	SEULEMENT		
Co	a. Chef ou patronne du menage	le Chef ou la	xe	jours vécus?		[NO		[NOM]?	POUR LES		

	b. Époux ou épouse, compagnon ou compagne du chef de menage) c. Fils ou Filles, beau-fils ou belles filles – célibataires sans descendance (garçons ou filles) e. Fils ou Filles, beau-fils ou belles filles – célibataires avec enfants f. Fils ou Filles, beau-fils ou belles filles – marié(e)s avec ou sans enfants g. Autres parents h. Autres non parents i. Employés(ées) de menage	patronne du Menage? Chef ou patronne I Époux(se) ou compagnon(e) .2 Fils(le) 3 Beau- fils(fille)4 Gendre ou Bru5 Petit fils(le)6 Père ou Mère7 Beau-père ou Belle- mère8 Frère ou sœur9 Beau-frère ou belle- sœur10 Autre parent11 Autre non		SELON LA SITUATION : annéesa ex.: 30 années = 30 a <u>*enfants âgés de</u> <u>moins de 2</u> <u>années: moism</u> Ex.: 1 année + 5 mois= 1a 5 m, ou 3 mois = 3 m <u>*enfants âgés de</u> <u>moins d'1 mois:</u> joursd Ex.: 15 jours =15 d	[NO M]. ? Oui 1 NO N 0	MJ ? Oui 1 NO N 0	Aucun0 Kindergarten	Agriculteur 1 Marchant 2 :xclusivement aux travaux de menage 	PERSONNES QUI ONT UN EMPLOI COMME OCCUPATION PRINCIPALE 09. Quelle est la catégorie ou position que [NOM] exerce dans cette occupation? Travailleur indépendant.1 Employé/ouvrier public.2 Employé/ouvrier privé3 Employé/ouvrier privé3 Employévouvrier privé3 Employeur ou patron4 Travailleur familial non rémunéré5 Travailleur familial rémunéré6 Employé
		parent 12 Personnel Domestique ou leur famille 13	Aasculin1						domestique7
0 1		Junnetture							
0 2									
03									
0 4									
0									
5 0									
6 0									
7									

0						
8						
0						
9						
1						
0						
1						
1						
1						
2						
1						
3						
1						
4						
1						
5						
	IONA CARACTÉRISTIQUES DE LA BORULATI	(1)				

# SECTION 2. CARACTÉRISTIQUES DE LA POPULATION (16 – 28)

	POUR TOUS LES MEMBRES DE LA MENAGE				MEMBRES DU MENAGE QUI ONT UN ÂGE DE 5 ANS OU PLUS				
	<b>01.</b> Nom et prénoms.	02. Quelle	03	04. Quel est	05.	06.	07. Quel est le	08. S'il vous plait,	COMPLÉTEZ LA
	ENREGISTREZ LE PREMIER NOM ET LES	relation de		l'âge de	Sait	Sait	niveau d'éducation	informez-moi à propos	QUESTION SUIVANTE
	PREMIERS PRÉNOMS SELON	parenté	Se	[NOM] en	lire	écrir	atteint par	de la profession	SEULEMENT POUR LES
de	L'ARRANGEMENT SUIVANT:	a.[NOM] avec	-	années, mois ou		e	[NOM]?	principale de	PERSONNES QUI ONT
S	a. Chef ou patronne du menage	le Chef ou la	xe	jours vécus?		[NO		[NOM]?	UN EMPLOI COMME

	b. Époux ou épouse, compagnon ou compagne	patronne du	[	SELON LA	INO	M1	Aucun	Agriculteur	OCCUPATION
	du chef de menage)	Menage?		SITUATION ·	MI	2	0	1	PRINCIPALE
	c. Fils ou Filles, beau-fils ou belles filles –	Chef ou		annéesa	?		Kindergarten	Marchant	09. Quelle est la catégorie
	célibataires sans descendance (garcons ou filles)	patronne		ex.: 30 années			1	2	ou position que
	e. Fils ou Filles, beau-fils ou belles filles –	1		= 30 a		Oui	Alphabétisation	- xclusivement aux	[NOM] exerce dans cette
	célibataires avec enfants	Époux(se) ou		*enfants âgés	Oui	1	2	travaux de menage	occupation?
	f Fils ou Filles, beau-fils ou belles filles –	compagnon(e)		de moins de 2	1		Primaire	3	Travailleur indépendant 1
	mariéle)s avec ou sans enfants	2		années:		NO	incomplète 3	11 est	Employé/ouvrier public 2
	g Autres parents	 Fils(le)		mois m	NO	N	Primaire	étudiant	Employé/ouvrier privé 3
	h Autres non parents	3		Ex · 1 année +	N	0	Complète 4	4	Employeer ou patron 4
	i Employés(ées) de menage	Reau-		5 mois =	0	Ŭ.	Secondaire	Il vit de ses rentes	Travailleur familial non
	" Employes(ces) ac menage	fils(fille)4		la 5 m	, in the second		incomplète	5	rémunéré 5
		Gendre ou		ou 3 mois = 3			5 Secondaire	Il est retraité ou	Travailleur familial
		Bru5		m			Complète	pensionnaire	rémunéré
		Petit		*enfants âgés			6	6	Employé domestique 7
		fils(le) 6		de moins d'1			École Prof	ll est âgé ou invalide	
		Père ou		mois: <i>jours</i> d			Incomp7		
		Mère7		Ex.: 15 jours			École Prof.	Il cherche du travail	
		Beau-nère ou		=15 d			Comp8		
		Belle-					Études Univ.	Il est un mineur	
		mère8					incomp		
		Frère ou					9	Autre (à spécifier)	
		sœur9					Études Univ.	Ex.: mécanicien:	
		Beau-frère ou					Comp.10	secrétaire; cordonnier;	
		belle-					Ne sait	etc.	
		sœur10					pas		
		Autre					1		
		parent11							
		Autre non							
		parent	7						
		12							
		Personnel	ı						
		Domestique ou	dir i						
		leur	scı						
		famille13	Ma						
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

10. Pourriez-vous m'indiquer s'il vous plait combien de personnes du menage se dédient à des activités agricoles?

#### SECTION 3. TYPE DE TENURE DES TERRES ET DE L'UNITÉ DE PRODUCTION:

	<b>01.</b> Pourriez-vous m'indiquer, s'il vous plait, quelle quantité de terres travaillez-vous en tout? <i>SPÉCIFIEZ L'UNITÉ DE MESURE UTILISÉE</i>	UM	payé pour le loyer au cours des der	miers 12 mois (\$):	
	<b>02.</b> De la superficie que vous travaillez, Combien vous Appartient en Propre? Combien est Prêtée ou louée , …? <i>COMPLÉTEZ LA VALEUR</i>		derniers mois (\$):		leçu pour le loyer au cours des 12
	QUI CORRESPOND A CHAQUE TYPE DE TENURE, SI VOUS		<b>07.</b> Pour l'activité agricole,	<b>08.</b> Pour l'activité agricole,	<b>09.</b> Pour l'activité agricole,
	N'AVEZ PAS DE TERRE, ECRIVEZ "0")		disposez-vous de machineries)?	disposez-vous d'équipements de	disposez-vous
	01 Propriétaire	/	OUI NON SLLA PÉPONSE EST "NON"	traction animale?	OUU NON
	02 Usufruit		PASSEZ À LA OUESTION 8	SI LA RÉPONSE EST <b>"NON"</b>	SILA RÉPONSE EST "NON"
ĺ	03 Fermage		<b>07a.</b> Pourriez-vous	PASSEZ A LA QUESTION 09	PASSEZ A LA SECTION 4
	04 Métayage		m'indiquer, s'il vous plait, de	8a. De Combien	<b>09a.</b> De combien
	05 Indivision		combien de machineries	d'équipements de traction	d'infrastructures de gestion
	<b>03.</b> Utilisez-vous une partie de cette terre pour des activités d'élevage? <i>OUI NON SI LA RÉPONSE EST "NON", PASSEZ À LA</i> <i>QUESTION 4</i>		disposez-vous en total? COMPLÉTEZ LA PREMIÈRE RANGÉE	animale disposez-vous en total? <i>COMPLÉTEZ LA PREMIÈRE</i> <i>RANGÉE</i>	disposez-vous en total? <i>COMPLÉTEZ LA PREMIÈRE</i> <i>RANGÉE</i>
	<b>03a.</b> Quelle quantité de la terre totale destinez-vous aux activités d'élevage?		<b>07b.</b> De ces machineries dont vous disposez, Combien sont votre Propriété? Combien	<b>8b.</b> De ces équipements de traction animale dont vous disposez, Combien sont votre	<b>09b.</b> De ces infrastructures de gestion dont vous disposez, Combien sont
	<ul> <li>04. Utilisez-vous une partie de cette terre pour des activités agricoles?</li> <li>OUI NON SI LA RÉPONSE EST "NON", PASSEZ A LA QUESTION 5</li> <li>04a. Quelle quantité de la terre totale est destinée à des activités</li> </ul>		sont Prêtées? CONTINUEZ A COMPLÉTER LA TABLE	Propriété? ; Combien sont Prêtés? CONTINUEZ A COMPLÉTER LA TABLE	votre Propriété? Combien sont Prêtées,? CONTINUEZ A COMPLÉTER LA TABLE
	agricoles?		01 TOTAL		
			02 Propre		
A	VANT DE PASSER A LA QUESTION SUIVANTE, CONFIRMEZ QUE LES		03 Prêtée		

UNITÉS DE MESURE SOIENT COMPLÈTES POUR TOUTES LAS SUPERFICIES. Au cas où vous avez loué la terre d'autres personnes, combien vous avez

UNITÉS DE MESURE. UTILISEZ LA CODIFICATION SUIVANTE POUR LES UNITÉS DE MESURE TOUT AU LONG DE CETTE ENQUÊTE.

1. SUPERFICIE (ÉTENDUE)	2. POIDS	3. VOLUME (LIQUIDES)	4. QUANTITÉ (UNITÉS)	
Hectares10	Quintal20	Litres (1000ml)	Unité41	
Carreau11	Arroba21	Bouteille de rhum (350 ml)31	Douzaine42	
Pied carré12	Livres	Bouteille de bière (720 ml)32	Centaines43	
Mètre carré13	Kilogrammes23	Coqn	Milliers44	
Fanegada14	Fanega24	*Pour les abeilles		
Acres15		Ruches		
		<u>Barrique</u> *35		

04 Louée

#### SECTION 4. REVENUS ÉCONOMIQUES DU MENAGE

Pourriez-vous m'indiquer, s'il vous plait, quelles ont été toutes les sources de revenus de votre menage au cours des 12 derniers mois?

<b>01.</b> <i>A</i> men <i>COM</i> <i>A P2</i> "0"	Au cours des 12 derniers mois, le revenu du age a été fourni par? <i>MPLÉTEZ LA COLONNE SUIVANTE. SIL N Y</i> <i>4S EU DE SOURCE DE REVENUS, NOTEZ</i>	0ui1 Non0	<b>02.</b> Quel a été le revenu total au cours des derniers12 mois en provenance de? \$ <i>COMPLÉTEZ POUR</i> <i>CHAQUE SOURCE DE</i> <i>REVENU MARQUÉE</i> "OUI" (1)
01	Salaire (ouvrier, journalier, etc.)		
02	Services professionnels		
03	Entreprises non agricoles		
04	Aide familiale de l'extérieur		
05	Aide familiale du pays		
06	Retraite ou Pension (vieillesse, incapacité)		
07	Aide du gouvernement / Revenus de l'État		

<b>01.</b> <i>A</i> PA "0"	Au cours des 12 derniers mois, le revenu du age a été fourni par? <i>MPLÉTEZ LA COLONNE SUIVANTE. SIL N Y</i> <i>4S EU DE SOURCE DE REVENUS, NOTEZ</i>	0ui1 Von0	<b>02.</b> Quel a été le revenu total au cours des derniers12 mois en provenance de? \$ <i>COMPLÉTEZ POUR</i> <i>CHAQUE SOURCE DE</i> <i>REVENU MARQUÉE</i> "OUI" (1)						
08	Location de terres								
09	Vente de terres								
10	Autres revenus (spécifiez):								
TOT	TOTAL (ADDITIONNEZ de 1 A 10)								

#### **SECTION 5: ANIMAUX ET PRODUCTION ANIMALE**

Est-ce que vous me donneriez la permission, s'il vous plait, d'observer vos animaux et les installations dans lesquelles ils se trouvent?

OBSERVEZ L'ÉTAT SANITAIRE ET LA COMPOSITION CORPORELLE DES ANIMAUX. OBSERVEZ LA CONDITION DES INSTALLATIONS.

<b>01.</b> En général, comment se trouve l'état sanitaire et la condition corporelle des animaux et des installations?	<b>02.</b> Qualification	03. Commentaires de l'enquêteur
01 État sanitaire des animaux*		
02 Condition corporelle des animaux**		
03 Condition des installations***		

\*0 = on n'a pas pu l'observer; 1 = en mauvais état; 2 = régulier; 3 =bon
\*\*0 = on n'a pas pu l'observer; 1 = maigre, 2 = régulier (limite), 3 = optimal (bon), 4 = obèse (gros)
\*\*\*0 = on n'a pas pu l'observer; 1 = sales, 2 = régulières; 3 =propres et adéquates

Ensuite, je vais vous demander des informations à propos des animaux que vous avez élevés au cours des 12 derniers mois.

# SECTION 5. ANIMAUX ET PRODUCTION ANIMALE (cont.) – ÉLEVAGE DES ANIMAUX I (1 - 16)

	01. Pourriez-vous 02. 03. Si		03. Si vous	04. Au cours d	es derniers12	05. Au cours de	es derniers12 mo	<b>06.</b> Si	07. Quel est l'usage		
	m'indiquer, s'il		Combien d'	deviez	mois, avez-vous acheté un ou		vendu ou donn	é un animal quel	quelqu'un	principal que vous faites	
	vous plait si vous		[ANIMAU	vendre tous	des animaux?					a volé	des [ANIMAUX] que
	avez fait l'élevage,		X]avez-	vos	SI 🔲; NO 🗌 (SI LA		(SI LA REPONSE EST "NON", PASSER à LA			leurs	vous possédez
	au cours des		vous	[ANIMAU	REPONSE EST	Г "NON",	Q. 06)			animaux	actuellement?
	derniers 12 mois		actuelleme	X]	PASSER à LA Q. 05)					au cours	l'alimentation familiale
	[ANIMAL]?		nt?	aujourd'hu	04a. Combien	04b. Combien	05a. Combien	05b.	05c.	des 12	1
	NOTEZ 1 OU 0		INDIQUEZ	i, combien	d'	avez-vous navé	d'	Combien	Combien d'	derniers	Vente2
	DANS LA		$LA \sim$	cela vous		en total nour	TANIMALIYI	avez-vous		mois.	Travail de champ3
	COLONNE		OUANTIT	rapporterai		tous los		recu en total		porriez-	Traite
	SUIVANTE SELON		<b>É</b> TOTALE	t-il en tout?	avez-vous		avez vous	nour la vonto	donná on total	VOUS	Combat 5
	LES NÉCESSITES		LIGHTEL	s s	achete en			dog	uonne en total,	m'indique	Reproduction 6
	LES MECESSITES				total, au	que vous avez	au cours des		au cours des	r combien	nour une autre
					cours des	achete au cours	derniers12		derniers 12	il a átá	pour une unire
				MONTANT	derniers12	des derniers12	mols?	au cours des	mois?	n a ete	Donna das animaux à
				TOTAL	mois?	mois? \$	INDIQUEZ	derniers 12	INDIQUEZ LA	total?	downe des animaux a
		u.		TOTAL	INDIQUEZ	INDIQUEZ LE	LA	mois ? \$	QUANTITE	iotal?	elever a a autres
		N			LA	MONTANT	QUANITIE	INDIQUEZ	TOTALE		Autura (an ácifica)
		-			QUANITIE	TOTAL	TOTALE	LE			Autres (specifiez)
					TOTALE			MONTANT			Ex Caaeau, taine
e								TOTAL			
Cod		0m									
0 1	Veau / Veaux										
0 2	Jeune taureaux										
0 3	Taureaux										
$\begin{array}{c} 0\\ 4\end{array}$	Taureaux combat										
0	Génisses										
5											
6	Vache										
0 7	Moutons										
0 8	Brebis										
0 9	Chèvres										
1 0	Agneau/ agnelle										
1 1	Verrat										
1 2	Truies										
1 3	Coqs										

1     Poules     Image: Construct of the second se		1 4	Coqs de combat										
1/2     Dindes       1/2     Dindes       1/2     Office of the second seco		1 5	Poules										
SECTION 5. ANIMALXET PRODUCTION ANIMALE (com) - ELEVAGE DES ANIMAUXI II (7-27) 10. Pourriez-roum mindiquer, s'il vor pair is vous arcorite des deriniers12 mois, avez-rous particular vois arcorite des deriniers12 mois, avez-rous arcorite des deriniers12 mois, avez-rous arco	Γ	1 6	Dindes										
01.       Purvice-sname       02.       03.       Streame       04.       Ascore state de carizer 12 mois, avez-sous mois	SE	CTI	ON 5 ANIMALIX FT	PR	ODUCTION A	NIMALE (con	t) – ÉLEVAGE	DES ANIMALIX I	T (17 - 27)				
0     0.0					02			as dorniors17		a dornioral? ma	S AVAZ-VOUS	06 5	07 Quel est l'usage
Image: State is a construction of the state i			m <sup>2</sup> indianan a <sup>2</sup> il		02. Combion d?	devier	04. Au cours u	cs uci ilici si 2	US. Au cours us	é un onimal qual	is, avez-vous	gualgu'un	principal que vous faites
Nois part is yous, avec fail features, deriners 12 mois, (ANIMAL)         (ANIMAL) weight (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL) (ANIMAL)         (CANIMAL)         (CANI			m indiquer, s'il			deviez	mois, avez-vou			e un animai quei	queiqu un	principal que vous faites	
vizz fair feterage, au cours des derniers 12 mois (ANNAUX) (A			vous plait si vous		IANIMAU	venare tous	des animaux?					a vole	des [ANIMAUX] que
International construction         ANIMAU derriers 12 mois. (ANIMAU); DANSLA COLONRE SUIVANTE. SELON LES NÉCESSITES         Vous instruction not particulation (CLONRE SUIVANTE. SUIVANTE. SELON LES NÉCESSITES         NOTEST (ANIMAU); PASSER a LAQ.05)         Q.06)         animatic summatic (S.C.Combien d' (ANIMAU); actuellement/* avez-vous actuellement/* (ANIMAU); SUIVANTE.SELON LES NÉCESSITES         actuellement/* augure 101 (S.C.Combien d' (ANIMAU); SUIVANTE.SELON LES NÉCESSITES         actuellement/* augure 101 (S.C.Combien d' (ANIMAU); SUIVANTE.SELON LES NÉCESSITES         actuellement/* augure vous sector in total pour ter vous actuellement/*         actuellement/* augure vous actuellement/*           7         Pointade         S.S.Combien (CLONRE SUIVANTE.SELON LES NÉCESSITES         S.S.Combien d' (ANIMAUX); NDIQUEZ MONTANT TOTAL         05b. (ANIMAUX); NDIQUEZ MONTANT TOTAL         05b. (ANIMAUX); NDIQUEZ MONTAN			avez fait l'elevage,		X]avez-	VOS	(SI LA REPOR	NSE EST "NON",	Q. 06)			leurs	vous possedez
derniers 12 mois m.: (ANMAL)?     Attentione mt? (ANMAL)?     Attentione mt? (ANMAL)? </td <td></td> <td></td> <td>au cours des</td> <td></td> <td>vous</td> <td>IANIMAU</td> <td>PASSER à LA</td> <td>Q. 05)</td> <td>animaux</td> <td>actuellement?</td>			au cours des		vous	IANIMAU	PASSER à LA	Q. 05)				animaux	actuellement?
I. (ANMAL)?     n?     aujourfun     04a. Combien     04b. Combien     05b.     05c.     dentification       NOTEZ 10 U0 DANS LA COLONNE SULVANTE, SELON     (DANC trapporterial)     (a) (Combien (cla vois)     (d) (			derniers 12 mois		actuelleme	X]					au cours	raumentation	
NOTEZ 1 OU 0 DANSE LA COLONNE SUIVATTE SELON LES NÉCESSITES       INDIQUEZ LA QUANTTE ÉTOTALE       i. combien (an inter) POTEZ- NOTEZ 1000 QUANTTE ÉTOTALE       i. combien (an inter) NDIQUEZ IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUEZ IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDIQUE IS NDI IS NDI IS NDIQUE IS NDIQUE IS NDI IS NDIQUE IS NDIQU			[ANIMAL]?		nt?	aujourd'hu	04a. Combien	04b. Combien	05a. Combien	05b.	05c.	des 12	familiale1
JAMS LA       COLONNE SUPARTE, SELON LES NÉCESSITES       LA QUANTT E TOTALE       chei a rous rapporterai tel a total port and, au cours des derniers12 INDIQUEZ LE MONTANT TOTAL       chei a rous rapporterai tel a total port and, au cours des derniers12 INDIQUEZ LE MONTANT TOTAL       chei a rous rapporterai accurs des derniers12 INDIQUEZ LE MONTANT TOTAL       chei a rous rapporterai accurs des derniers12 mois?       avez-vous reque n total au cours des derniers12 mois?       avez-vous r			NOTEZ 1 OU 0		INDIQUEZ	i, combien	d'	avez-vous payé	ď	Combien	Combien d'	derniers	Vente2
COLONNE SUTIALTE, SELDANE LES NECESSITES       QUANTT E TOTALE       rapporterat is en cut DUILES       rapporterat is en cut SUTIALE       rapporterat is en cut SUTIALE       rapporterat is en cut SUTIALE       rapporterat is en cut cours des demisers12 mois?       avez-rous pour la cut des demisers12 mois?       pour la vez-rous cours des demisers12 mois?       pour la vez-rous des demisers12 mois?       pour la vez-rous des demisers12 mois?       pour la vez-rous mois?			DANS LA		LA	cela vous	[ANIMAUX]	en total pour	[ANIMAUX]	avez-vous	[ANIMAUX]	mois,	Travail de champ3
JULYATE, SELON LES NÉCESSITES       É TOTALE S INDIQUEZ LE MONTANT TOTAL       É TOTALE STUDUEZ LE MONTANT TOTAL       É TOTALE su total, au cours des deriners12 mois?       NUMAUX au cours des deriners12 mois?       vous achté au cours des derniers12 mois?       vous au cours des derniers12 mois?       vous derniers12 mois?       vous au cours des derniers12 mois?       vous au co			COLONNE		QUANTIT	rapporterai	avez-vous	tous les	avez vous	recu en total	avez-vous	porriez-	Traite4
Image: space of the system     Section and course destination     Seconodimension and course destination     Section a			SUIVANTE, SELON		É TOTALE	t-il en tout?	acheté en	[ANIMAUX]	vendu en total	pour la vente	donné en total.	vous	<i>Combat5</i>
iImage: NDIQUEZ LE LE MONTANT TOTALcours des deriners12 mois? mois?dentiers12 mois?dentiers12 mois?1PintadeII<			LES NÉCESSITES			\$	total, au	que vous avez	au cours des	des	au cours des	m'indique	Reproduction6
B     LE     LE     deriners12 mois?     des demiers12 mois?     mois? INDIQUEZ, LA QUANTITÉ     mois? INDIQUEZ, LA QUANTITÉ     mois? INDIQUEZ, LA QUANTITÉ     mois? INDIQUEZ, LA QUANTITÉ     mois? INDIQUEZ, LA QUANTITÉ     mois?     II a été volé au train?     Donne des animaux à tever à d'aures personnes pour lui8 Aures (spécificz) Ex: cadeau; laine       1     Pintade     III     IIII     IIIII     IIIIII     IIIIIIII     IIIIIIIII     IIIIIIIIIIII     IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII						INDIQUEZ	cours des	acheté au cours	derniers12	[ANIMAUX]	derniers 12	r, combien	pour une autre
Note and antice of the second and a secon						LE	derniers12	des derniers12	mois?	au cours des	mois?	il a été	personne7
g     TOTAL     INDIQUEZ LA QUANTITÉ     INDIQUEZ LE MONTANT TOTALE     INDIQUEZ LE MONTANT TOTALE     India?     éferer à d'aures personnes pour lui8 Autres (spécifie)       g     Pintade     Image: Construction of the second of the seco				0		MONTANT	mois?	mois? \$	INDIOUEZ	derniers 12	INDIOUEZ LA	volé au	Donne des animaux à
Image: specific of the second system     Image: specific of the second						TOTAL	INDIOUEZ	INDIOUEZ LE	LA	mois ? \$	OUANTITÉ	total?	élever à d'autres
g     QUANTITÉ TOTALE     TOTALE     TOTALE     TOTALE     Le MONTANT TOTALE     Autres (spècifiez) Ex.: cadeau, laine       1     Pintade     Image: Strain				on.			LA	MONTANT	OUANTITÉ	INDIOUEZ	TOTALE		personnes pour lui8
g     TOTALE     TOTAL     TOTAL     TOTAL     TOTAL     TOTAL       1     Pintade     Image: Contract of the second secon				N			OUANTITÉ	TOTAL	TOTALE	LE	TOTILL		Autres (spécifiez)
g     round     round     round       1     Pintade     Image: Strain and Strain				1			TOTALE	TOTAL	TOTILL	MONTANT			Ex.: cadeau; laine
3       3       3       1							TOTILL			TOTAL			
X       X <thx< th=""> <thx< th=""> <thx< th=""></thx<></thx<></thx<>		bde		ú.						-			
1       Pintade       Image: Construction of the second se		ŭ		õ									
7       Fried       Image: Constant of the second s		1	Pintade										
Image: second		7	1										
8       Autres oiseaux (préciser):       Image: Construction of the structure of the structur		1	Canard										
1       Address orseaux (préciser):       Image: Construction of the state of the stat	H	8	Autros sisseur										
9       (preciser):       Image: Construction of the second secon		1	Autres ofseaux										
2       Lapins       Image: constraint of the second secon		9	(preciser):										
$2\\0$ LapinsImage: Construct of the state of the s		_											
0       1       0       1       0       1       0       1       0       1		2	Lapins										
$\frac{1}{1}$ PoissonsImage: Constraint of the second symbolImage: Constraint of			•										
1		2	Poissons										
$\frac{2}{2}$ Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{3}$ PigeonImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{3}$ PigeonImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{4}$ Abeilles et ruchesImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{4}$ Abeilles et ruchesImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{5}$ Boeufs CharrueImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde $\frac{2}{6}$ ChevauxImage: Cochons d'IndeImage: Cochons d'IndeImage: Cochons d'Inde		1											
2     a     b     b     b     b     b       2     3     Pigeon     Image: Constraint of the set of t		2	Cochons d'Inde										
2     Pigeon     Image: Charge of the set	-	2											
3		2	Pigeon										
$\frac{2}{4}$ Abeilles et ruches     Image: Constraint of the set of the se		, ,											
2     Boeufs Charrue     Image: Chevaux     Image: Chevaux     Image: Chevaux     Image: Chevaux		4	Abeilles et ruches										
5     Boeufs Charrue       2     Chevaux		τ γ											
2     Chevaux		2 5	Boeufs Charrue										
<sup>2</sup> / <sub>6</sub> Chevaux	-	2											
		6	Chevaux										
2 7	Ânes												
--------	-------------------	--	--	--	--	--							
2 8	Mules												
2	Autre (préciser):												
9													

08. Avez-vous abattu d'animaux au cours des derniers 12 mois? OUI NON (SI LA RÉPONSE EST "NON", PASSER A LA SECTION 06) SECTION 5. ANIMAUX ET PRODUCTION ANIMALE (cont.) – ABATTAGE D'ANIMAUX

Code	09. Pourriez-vous m'indiquer, s'il vous plait si vous avez abattu des [ANIMAUX] au cours des derniers 12 mois? NOTEZ 1 OU 0 DANS LA COLONNE SUIVANTE, SELON LA SITUATION	0ui 1 Nan 0	10. Combien d' [ANIMAUX] au total, ont été abattus au cours des 12 derniers mois? INDIQUEZ LA QUANTITÉ TOTALE	11. Des [ANIMAUX] qui ont été abattus, combien en avez-vous vendu au cours des 12 derniers mois? INDIQUEZ LE NOMBRE DE CES ANIMAUX	12. Si vous avez vendu toute ou une partie de la viande provenant des [ANIMAUX] abattus, quel revenu en avez- vous obtenu, en total, au cours des derniers12 mois? \$ INDIQUEZ LE MONTANT TOTAL	13. Des [ANIMAUX] qui ont été abattus, combien en avez- vous mangé au cours des 12 derniers mois? INDIQUEZ LE NOMBRE DE CES ANIMAUX	14. Si vous avez consommé toute ou une partie de cette viande, à combien estimez- vous sa valeur? <i>INDIQUEZ LE</i> <i>MONTANT</i> <i>TOTAL</i>	15. Si vous n'avez pas vendu ou consommé une partie de la viande provenant des animaux abattus, qu'en avez-vous fait?Dons1Perte2Vols3Alimentation de mascottes4 Autres (spécifiez)5
0 1	Veau / Veaux							
0 2	Jeune taureaux							
0 3	Taureaux							
0 4	Génisses							
0 5	Vache							
0 6	Moutons							
0 7	Brebis							
0 8	Chèvres							
0 9	Agneau/ agnelle							
1 0	Verrat							
1 1	Truies							
1 2	Coqs							
1 3	Poules							
1 4	Dindes							
1 5	Pintade							

1 6	Canard				
1 8	Lapins				
1 9	Poissons				
2 0	Cochons d'Inde				
2 1	Pigeon				
2 2	Chevaux				
2 3	Autre (préciser):				

## SECTION 6. SOUS-PRODUITS DE L'ÉLEVAGE ET DES ŒUFS

ode	01. Pourriez-vous m'indiquer, s'il vous plait si vous avez élaboré ou produit, au cours des derniers12 mois les [PRODUITS]? NOTEZ 1 OU 0 DANS LA COLONNE SUIVANTE, SELON LA SITUATION	Jui1; Non0	02. Combien avez-vous produit de [PRODUIT] au total, au cours, des derniers12 mois? INDIQUEZ LE POIDS, LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE MESUBE UM	UM	03. Combien Avez-vous vendu, au total, du [PRODUIT] au cours des derniers12 mois? INDIQUEZ LE POIDS, LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE MESURE (UM)	U M	04. Quel revenu avez-vous obtenu, en total, de la vente de [PRODUIT ] au cours des derniers12 mois? \$ INDIQUEZ LE MONTANT TOTAL	05. Combien avez-vous consommé, en total, du [PRODUIT], au cours des derniers12 mois? INDIQUEZ LE POIDS, LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE MESURE(UM)	UM	06. Si vous avez consommé toute ou une partie de[PRODUIT], à combien estimez- vous sa valeur? \$ INDIQUEZ LE MONTANT TOTAL	07. Si vous n'avez ni vendu, ni consommé une partie des produits, qu'en avez-vous fait ? Don1 Perte2 Vols3 Autres (spécifiez)
0	Le lait de vache										
0 2	Lait de chèvre										
0 3	Fromage de vache										
0 4	Yaourt de vache										
0 5	Beurre										
0 6	Dulce de leche										
0 7	Poulet frit										
0 8	Viande de boeuf séchée										
0 9	Lait caillee										
1 0	Soupoudre										
1	Enduis										
1 2	Les œufs de poulet										
1 3	Les œufs de canard										
1 4	Œufs d'autres spèces										
1 5	Miel d'Abeille										

1 6	Cire d abeille					
1 7	Graisse					
1 8	Peau/Cuir					
1 9	Autre (précisez)					

## SECTION 7. DONNÉES DE PRODUCTION AGRICOLE

01. Au cours des derniers 12 mois, avez-vous récolté quelconque produits agricoles, soit pour la consommation propre, la vente et/ou la transformation? OUI \_\_\_\_\_ NON \_\_\_\_ SI LA RÉPONSE EST "NON", PASSEZ A LA SECTION 8

	,	-		
	CLUA DEDONCE	FET "NON"	DACCEZ	A LA SECTION
	SI LA REFUNSE	LOI NON .	FASSEL	A LA SECTION

Γ	02. Pourriez-vous m'indiquer, s'il		03. Au cours	<b>04.</b> Au cours des derniers12 mois,	<b>05.</b> Au cours des derniers12 mois,	<b>06.</b> Au cours des 12 derniers mois,
	vous plait si vous avez récolté, au		des derniers12	quel a été l'usage principal que vous	quel a été le deuxième objectif de	avez-vous vendu une partie de la
	cours des derniers12 mois, soit		mois, en total,	avez donné à la [CULTURE] ?	l'usage que vous avez donné à la	récolte d'une culture donnée?
	pour l'autoconsommation, la vente,		combien de	Consommation familiale1	[CULTURE] ?	OUI 🗌 NON 🗌 SI LA RÉPONSE
	et/ou la transformation		fois avez-vous	Consommation animale2	Consommation familiale1	EST "NON", PASSEZ A LA
	[CULTURE]?	6	récolté	Vente	Consommation animale2	SECTION 8
	NOTEZ 1 OU 0 DANS LA		[CULTURE]?	Transformation4	Vente	07. Au cas où vous auriez vendu
	SUIVANTE COLONNE, SELON	n.	INDIQUEZ	Autres (spécifiez)	Transformation4	[CULTURE] au cours des 12 derniers
	CORRESPOND	N	LA		Autres (spécifiez)	mois, pourriez-vous m'indiquer, s'il
		Γ	QUANTITÉ			vous plait, le total des revenus obtenus
	٩		DE FOIS			de la vente? \$
		Oui				INDIQUEZ LE <b>MONTANT</b> TOTAL
	0					
	1 Musáceas					
	0		l			
	2 Les racines et tubercules					
			1			
	3 Plantez les bulbes et tubercules					
	1 Celeales					
	5 Légumineuses					
	0					
	6 Oléagineux					
	0					
	7 Les légumes à feuilles					
	0		l			
	8 Les légumes qui portent leurs fruits					
	0					
-	9 cannes à sucre					
	1 0 Snuff					
	1					
	1 Fibres					
	1					
	2 Les résidus de tonte					

1 4	Fruits tropicaux et subtropicaux			
1 5	Agrumes			
1 6	Fruits à pépins et fruits à noyau			
1 3	Cépages			
1 7	Autres fruits et aux noix			
1 8	Fruits oléagineux			
1 9	Plantes pour boissons			
2	Les plantes aromatiques et médicinales			
2	Autre (précisez)			
1				

## SECCIÓN 8. SECURITE ALIMENTAIRE DU MENAGE ECHELLE LATINO-AMERICAINE ET CARIBEENNE DE SECURITE ALIMENTAIRE-- ELCSA

_		ID: (IIIIII	 011		
	COMPLÉTEZ LAS QUESTIONS DE 1 A 9 DANS TOUS LES MENAGES. EN CAS DE MENAGE OU SE TROUVENT DES MINEURS DE 18 ANNÉES OU MOINS, CONTINUER JUSQU'A LA QUESTION	Oui1 Non0 NS .09	0 9	Dans votre menage est-ce que vivent des personnes âgées de moins de 18 an OUI (CONTINUER AVEC LE QUESTIONNAIRE) NON (PASSER SECTION 9)	nées? A LA
	NUMÉRO 16.	NR. 99		COMPLÉTEZ LAS QUESTIONS DE 1 A 9 DANS TOUS LES MENAGES.	Oui1
	뤽 Lors du dernier mois, par manque d'argent ou d'autres ressources,			EN CAS DE MENAGE OU SE TROUVENT DES MINEURS DE 18	Non0
	g quelquefois			ANNÉES OU MOINS, CONTINUER JUSQU'A LA QUESTION	NS .09
	0 Vous êtes-vous préoccupé que les aliments pourraient être épuisés dans			NUMÉRO 16.	NR. 99
	1 votre menage?		de	Lors du dernier mois, par manque d'argent ou d'autres ressources,	
(	0 Atac your rostác concelimente done yotro monogo?		Co	quelquefois	
	2 etes vous restes sans annents dans voire menage?		1	Un jeune âgé de 18 ans ou moins dans votre menage, a cessé d'avoir	
(	0dans votre menage, avez-vous cessé d'avoir une alimentation saine et		0	une alimentation saine et nutritive?	
	3 nutritive?		1	Un jeune âgé de 18 ans ou moins dans votre menage avez eu une	
(	0 Vous ou l'un des adultes dans votre menage avez eu une alimentation		1	alimentation basée sur des aliments peu variés?	
	4 basée sur des aliments peu variés?		1	Un jeune âgé de 18 ans ou moins dans votre menage à cesser de prendre	
(	0 Vous ou l'un des adultes dans votre menage a cessé de prendre le petit		2	le petit déjeuner, le déjeuner ou de diner?	
	5 déjeuner, le déjeuner ou le souper?		1	Un jeune âgé de 18 ans ou moins dans votre menage a mangé moins que	
(	0 Vous ou l'un des adultes dans votre menage a moins mangé que ce qu'il		3	ce qu'il devrait?	
	6 devrait manger?		1	Un jeune âgé de 18 ans ou moins dans votre menage a du diminuer la	
(	0 Vous ou l'un des adultes dans votre menage a ressenti de la faim mais		4	quantité d'aliments servie aux repas?	
	7   n'a pas pu manger?		1	Un jeune âgé de 18 ans ou moins dans votre menage a ressenti de la	
(	0 Vous ou l'un des adultes dans votre menage avez mangé seulement une		5	faim mais n'a pas pu manger?	
	8 fois par jour ou a passé une journée entière sans manger?		1	Un jeune âgé de 18 ans ou moins dans votre menage a mangé seulement	
			6	une fois par jour ou a passé une journée entière sans manger?	

\* NS: Ne sait pas; NR: N'a pas répondu

### SECTION 9. ALIMENTS ET COMBUSTIBLES POUR LE MENAGE

01. Au cours des 12 derniers mois, est-ce qu'un membre quelconque de votre menage a reçu une assistance du gouvernement ou d'une autre institution? OUI

NON 🗌

<b>02.</b> A	u cas où la réponse est affirmative, dans quel typ	oe de prog	gramme est enrôlée cette personne? (spéc	ifiez)					
	03. Généralement, à quelle fréquence, sortez-vo	ous achete	er des aliments pour votre menage? CHO	ISISSEZ UNE SEULE RÉPONSE					
	a. Tous les jours 🗌 b. Chaque semaine		c. Deux fois par mois 🗌 d. Une	fois par mois 🗌					
	04. Généralement, à quelle fréquence sortez-vous, vous ou votre famille manger hors de chez vous? CHOISISSEZ UNE SEULE RÉPONSE								
	a. Jamais ou moins de 1 fois par semaine		b. 1-2 fois par semaine	c. 3-5 fois par semaine					
	d. 6 à 8 fois par semaine		e. 9 à 11 fois par semaine	f. 12 ou plusieurs fois par semaine					

# TOUS LE JOUR: 4 FOIS OU PLUS PAR SEMAINE / CHAQUE SEMAINE: 1-3 FOIS PAR SEMAINE OU 4 FOIS PAR MOIS / QUINZAINE: 2 OU 3 FOIS PAR MOIS / MENSUELLE: 1 FOIS PAR MOIS

Ensuite Je vous demanderai des informations à propos des aliments consommés dans le menage. S'il vous plait, incluez les aliments sylvestres collectés au champ, chassés ou pêchés; Non seulement les produits achetés ou produits par le menage.

	<b>05.</b> Pourriez-vous m'informer si		<b>06.</b> Principalement,	<b>07.</b> Lors du	019	Lambi			
	pendant le dernier mois, votre		comment avez-vous	dernier mois, avec	020	Charcuterie (saucisson)			
	famille et vous avez mangé des		obtenu le	quelle fréquence a		<b>05.</b> Pourriez-vous m'informer si		<b>06.</b> Principalement,	07. Lors du
	[ALIMENT]?	0.	[ALIMENT] que vous	consommé votre		pendant le dernier mois, votre		comment avez-vous	dernier mois, avec
	AU CAS QUI N'A PAS ETE	n	avez consommé?	famille, le		famille et vous avez mangé des		obtenu le	quelle fréquence a
	CONSOMME L'ALIMENT,	No	Autoproduction1	[ALIMENTS]?		[ALIMENT]?	0	[ALIMENT] que vous	consommé votre
	NOTEZ 0 DANS LA COLONNE	1	Achat2	tous les jours1		AU CAS QUI N'A PAS ETE	<i>.1</i>	avez consommé?	famille, le
	SUIVANTE ET 2 ET 3 POUR		Chasse/cueillette3	semaine2		CONSOMME L'ALIMENT,	Vor	Autoproduction1	[ALIMENTS]?
	L'ALIMENT CORRESPONDENT.		Don4	quinzaine3		NOTEZ 0 DANS LA COLONNE	~	Achat2	tous les jours1
de		<i>i</i>	Échange5	mensuelle4		SUIVANTE ET 2 ET 3 POUR		Chasse/cueillette3	semaine2
C		0n	Prog. Alimentaire.6			L'ALIMENT CORRESPONDENT.	Γ.	Don4	quinzaine3
PAN,	FARINES Y CÉRÉALES				de			Échange5	mensuelle4
001	Riz				CC		Ои	Prog. Alimentaire.6	
002	Maïs moulue				021	Abats (foie, ris de veau, etc)			
003	Spaghetti ou autre Pâtes				022	Beef seché			
004	Farine ou d'amidon (blé, maïs et /				Autre	s viandes comme: viande salée y séch	ée, laj	pin, etc. (spécifier)	
004	ou manioc)				023				
005	Maïs en grain				024				
006	Bonbon sucre et sale				025				
007	Pain				POISS	SONS			
008	Avoine				026	Poisson en boite (sardines, etc)			
Autre	s céréales comme: flocons, etc. (spéci	fier)			027	Sea Fresh Fish			
009					028	Poisson d eau douce			
010					PROD	DUITS LAITIERS			
VIAN	DE, ABATS Y SAUCISSES				029	Lait			
011	Viande de Poulet				030	Lait en poudre			
012	Viande de Pintade				031	Lait de chèvre liquide			
013	Viande de Porc				032	Fromage			
014	Viande de Mouton				033	Yogourt			
015	Viande de chèvre ou de cabri				Autre	s produits laitiers comme lait fermen	té, lai	t caillé, etc. (spécifier)	•
016	Viande de bœuf (avec / sans os,				034				
010	moulue, os seulement)				035				
017	Viande de lapin; dindon, canard				036				
018	Cochon d'Inde				ŒUFS	5			

037	Les œufs de poule					<b>05.</b> Pourriez-vous m'informer si		<b>06.</b> Principalement,	<b>07.</b> Lors du
038	Les œufs de canard					pendant le dernier mois, votre		comment avez-vous	dernier mois, avec
039	Les œufs de pintade					famille et vous avez mangé des		obtenu le	quelle fréquence a
	<b>05.</b> Pourriez-vous m'informer si		<b>06.</b> Principalement,	<b>07.</b> Lors du		[ALIMENT]?	0.	[ALIMENT] que vous	consommé votre
	pendant le dernier mois, votre		comment avez-vous	dernier mois, avec		AU CAS QUI N'A PAS ETE	n	avez consommé?	famille, le
	famille et vous avez mangé des		obtenu le	quelle fréquence a		CONSOMME L'ALIMENT,	No	Autoproduction1	[ALIMENTS]?
	[ALIMENT]?	0	[ALIMENT] que vous	consommé votre		NOTEZ 0 DANS LA COLONNE		Achat2	tous les jours1
	AU CAS QUI N'A PAS ETE	1	avez consommé?	famille, le		SUIVANTE ET 2 ET 3 POUR		Chasse/cueillette3	semaine2
	CONSOMME L'ALIMENT,	No	Autoproduction1	[ALIMENTS]?		L'ALIMENT CORRESPONDENT.	<i></i>	Don4	quinzaine3
	NOTEZ 0 DANS LA COLONNE		Achat2	tous les jours1	ode		<i>ii</i>	Échange5	mensuelle4
	SUIVANTE ET 2 ET 3 POUR		Chasse/cueillette3	semaine2	Ŭ		õ	Prog. Alimentaire.6	
	L'ALIMENT CORRESPONDENT.	<i>I</i>	Don4	quinzaine3	Autre	s légumes feuilles frais (spécifier)	-	1	
ode		ui	Échange5	mensuelle4	060				
ŭ		õ	Prog. Alimentaire.6		061				
040	Oeufs de dinde				062				
Autre	es œufs (spécifier)				063				
041					TUBE	RCULES		1	1
042					064	La patate douce			
HUII	LES Y GRAISSES				065	Manioc			
043	Huile comestible				066	Pommes de terre			
044	Appât				067	Taro			
045	Beurre				068	Igname			
Autre	es graisses (spécifier)				Autre	s racines (spécifier)			
046					069				
047					070				
LÉG	<u>UMES FEUILLES ET AUTRES LÉ</u>	GUM	ES		071				
048	Poivrons ou piment doux				072				
049	Piment				LÉGU	JMINEUSES			
050	Les petit pois ou pois france				073	Pois congo, pois inconnu, pois			
051	Aubergines, concombres				015	souche, pois boukousou,			
052	Oignons				074	Haricots			
053	Chou, chou-fleur, brocolis				075	Pistache			
054	Épinards ou lalo				076	Avocat			
055	Laitue				077	Amandes, noisettes			
056	Tomate crue				078	Caimite			
057	Carotte, potiron (Bangana)				079	Arbre a pain\ arbre veritable			
058	Gombo					<b>05.</b> Pourriez-vous m'informer si		<b>06.</b> Principalement,	<b>07.</b> Lors du
059	Giraumont					pendant le dernier mois, votre		comment avez-vous	dernier mois, avec
						famille et vous avez mangé des		obtenu le	quelle fréquence a
						[ALIMENT]?	0	[ALIMENT] que vous	consommé votre
						AU CAS QUI N'A PAS ETE	m	avez consommé?	tamille, le
						CONSOMME L'ALIMENT,	Ň	Autoproduction1	[ALIMENTS]?
						NOIEZ U DANS LA COLONNE		Achat2	tous les jours1
						JUIVANIE EI ZEI SPOUK	1	Chasse/cueillette5	semaine2
					e	L ALIMENT CORRESPONDENT.		Échange 5	quinzuine
					pog		)ui	Prog Alimentaine 6	mensuelle4
					0		0	1 rog. Aumentatre.0	

080			Autres fruits frais (spécifier)					
081					097			
082					098			
FRUITS					099			
083	Cerises, prunes, noix de cajou				SUCF	RE ET ADOUCISSANTS		
084	Cocoyer				100	Sucre crème		
085	Fraises				101	Sucre raffiné		
086	Goayave				102	Marmelades et gelées		
087	Papaye, quenepe				102	Sirop de canne (mélasse) et miel		
088	Mangue				105	d'abeille		
089	Pomme, poire				104	Jus en poudre et friandises en		
090	Melon				104	poudre		
091	Orange, pamplemousse, mandarine,				105	105 Rapadour		
	citron				Autres adoucissants (saccharine, stevia, etc.)			
092	Ananas				105			
093	Banane, figue banane				106			
094	Melon d'eau				107			
095	Raisin				INFU	INFUSIONS		
096	Abricot				108	Café		
	<b>05.</b> Pourriez-vous m'informer si		06. Principalement,	<b>07.</b> Lors du	109	Cacao poudre de chocolat		
	pendant le dernier mois, votre		comment avez-vous	dernier mois, avec	110	Thés		
	famille et vous avez mangé des		obtenu le	quelle fréquence a	OUEI	LOUE AUTRE ALIMENT NON MENTIONNE PLUS HAUT		
	[ALIMENT]?	0.	[ALIMENT] que vous	consommé votre	111			
	AU CAS QUI N'A PAS ETE	п	avez consommé?	famille, le	112			
	CONSOMME L'ALIMENT,	No	Autoproduction1	[ALIMENTS]?	112			
	NOTEZ 0 DANS LA COLONNE		Achat2	tous les jours1				
	SUIVANTE ET 2 ET 3 POUR		Chasse/cueillette3	semaine2				
	L'ALIMENT CORRESPONDENT.	1	Don4	quinzaine3				
ode		<i>ii</i>	<i>Echange</i> 5	mensuelle4				
ŭ		0°	Prog. Alimentaire.6					