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1. INTRODUCTION¹

African agriculture is in a phase of rapid commercialisation and governments are promoting large plantations and estate. One of the most important steps for planning agricultural investment or more generally a sustainable development is to consider the possible impact of this process on food security. For example, it may help to design schemes to prevent over expansion of cash crops at the expense of food production. Moreover, planners should consider how farm and plantation workers will achieve food security particularly in areas with thin food markets or when landless migrant workers will be employed, as in the investigated area, that of the Lake Naivasha where a flower enclave is shaping its economic development. In this context, the challenge is how to make the flower sector a different model than that dominating during colonialism that often exploited human and natural resources.

The aim of this paper is to provide a description of the state of food security in the rural areas of the Lake Naivasha Basin located in the Nakuru County in Kenya. Specific focus is devoted to traditional species because of their relevance not only for their contribution to food security, but also for their role in bio-diversity protection, non-communicable diseases prevention (policy framework) and cultural values transmission. We interpreted the situation within the policy frameworks adopted by the Government of both Kenya and Nakuru County in the food and nutrition security field.

The scant literature studies floriculture from a farming system perspective addressing issues such as land acquisition and competition, business model, and employment generation. In this paper we take another view. At the heart of our analysis, there are the households leaving in the investigated area because planning a sustainable development requires a fully comprehension of local needs. The

¹ The paper was financed by the project Sustainable Agri-food Systems Strategies (SASS). We thank you Marina Fiorella for the revision of the paper.

household perspective is relevant under several aspects. For example, the literature highlights that income from floriculture in Kenya is above the minimum wage. However, the adult equivalent income could be lower in households with a high number of dependent members, making this salary not enough for achieving food security.

In order to investigate these aspects, we collected primary data from a sample of 606 households in February 2018. After the estimate of the food insecurity state, based on the evidence provided by the survey's respondents on the most important causes of food insecurity, we investigated some critical issues relevant for policy implications.

From these considerations, we suggested some policy recommendations for improving food security in the Lake of Naivasha as a key element for the promotion of a sustainable development.

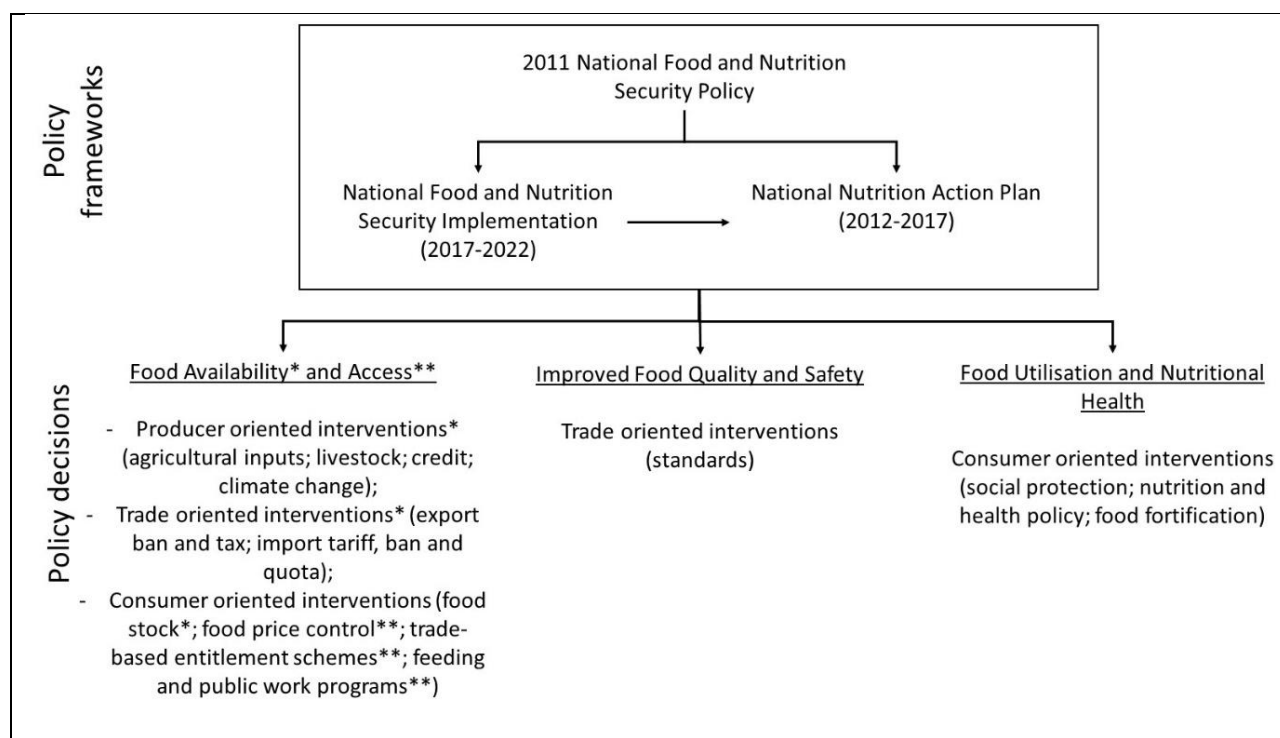
The work is structured as follows. Section 2 presents the main policy frameworks in food and nutrition security adopted at national and at the Nakuru County level. Section 3 describes the survey process. Section 4 presents the applied methodology. Section 5 shows the food insecurity status in the rural Lake Naivasha Basin. Section 6 discusses the main results achieved. Section 7 concludes the work, suggesting some policy recommendations.

2. THE POLICY FRAMEWORK

2.1 The national Kenyan policies

The policy tools adopted by the Government of Kenya in the food and nutrition security field consist of a set of policy frameworks and decisions that can be summarized as in Figure 1.

Figure 1. Kenyan policy tools



Source: Authors' elaboration.

2.1.1. The 2011 Food and Nutrition Security Policy

The 2011 Food and Nutrition Security Policy (Republic of Kenya, 2011) is the third policy document introduced by the Government of Kenya in the field of food security after the first National Food Policy of 1981 and the second National Food Policy of 1994. It originates from the lessons learned in the previous policy frameworks and decisions, addressing their major limitations. Among these latter, there is the restricted scope and focus on the supply side of the problem (with the majority of the interventions focused on maize) and on the rural areas, the weak linkages between agricultural and health sectors, the limited participation of stakeholders, and a weak institutional framework. Therefore, the 2011 Food and Nutrition Security Policy has been designed as an overarching framework that considers the multidimensional aspects of food and nutrition security; it creates the synergies among the sectoral public and private initiatives and it adopts a holistic life-cycle approach. The passage from a food policy to a food and nutrition policy is coherent with the international

consensus that optimal nutrition and food security is a cornerstone of development (Sassi, 2018). It is achieved using a right-based approach. The Food and Nutrition Security Policy is indeed framed by the Kenyan Constitution redrafted in 2010 where art. 43.1b states that every Kenyan has the right to “be free from hunger, and to have adequate food of acceptable quality”. Art. 53.c reinforces this right indicating that every children has the right to “basic nutrition, shelter and health care”. The Food and Nutrition Security Policy builds also on Vision 2030 where food security and nutrition is one of the priorities of its economic and social pillars (Republic of Kenya, 2007).

The 2011 Food and Nutrition Security Policy sets three broad objectives, referred to all Kenyans at all times, consisting of: (i) achieving good nutrition for optimal health; (ii) increasing the availability, accessibility and affordability of food quantity and quality; (iii) protecting the vulnerable population, linking innovative and cost-effective safety nets to long-term development.

Overall, it intends to address the interconnected issues of chronic food insecurity, poverty-based food insecurity and transitory food insecurity caused by emergencies. Table 1 illustrates the 8 issues, and for each of them the set of challenges that the policy document considers as priority to be faced in order to reach the goal of food and nutrition security.

Table 1. The eight issues of the National Food and Nutrition Security Policy

Issue	Challenge	Issue	Challenge
1. Food availability and access	Domestic production Storage and agro-processing Strategic food reserve Access to and quality of markets Food trade On-farm and off-farm employment Improving food accessibility from urban and peri-urban poor Cultural, social and political factors in accessing food Irrigation and food security	4. School Nutrition and Nutrition Awareness	Micronutrients Diet related non-communicable diseases Nutrition and infectious diseases Nutrition and nutrition education in schools Linking nutrition education with capacity awareness
2. Food safety, standards and quality control	Climate change Food safety and public health	5. Food and nutrition security information	Nutritional data and information system Integrated data/Information system and analysis
3. Nutrition improvement/nutrition security	Maternal and new born nutrition Early childhood nutrition Late childhood nutrition Adolescence nutrition	6. Early warning and emergency management	Transfer-based entitlement schemes Target emergency feeding programmes Public works programmes Emergency response and mitigation livelihood restoration Linking relief, rehabilitation and recovery with development
		7. Institutional and legal framework and finance	Institutional framework Legal framework Financing

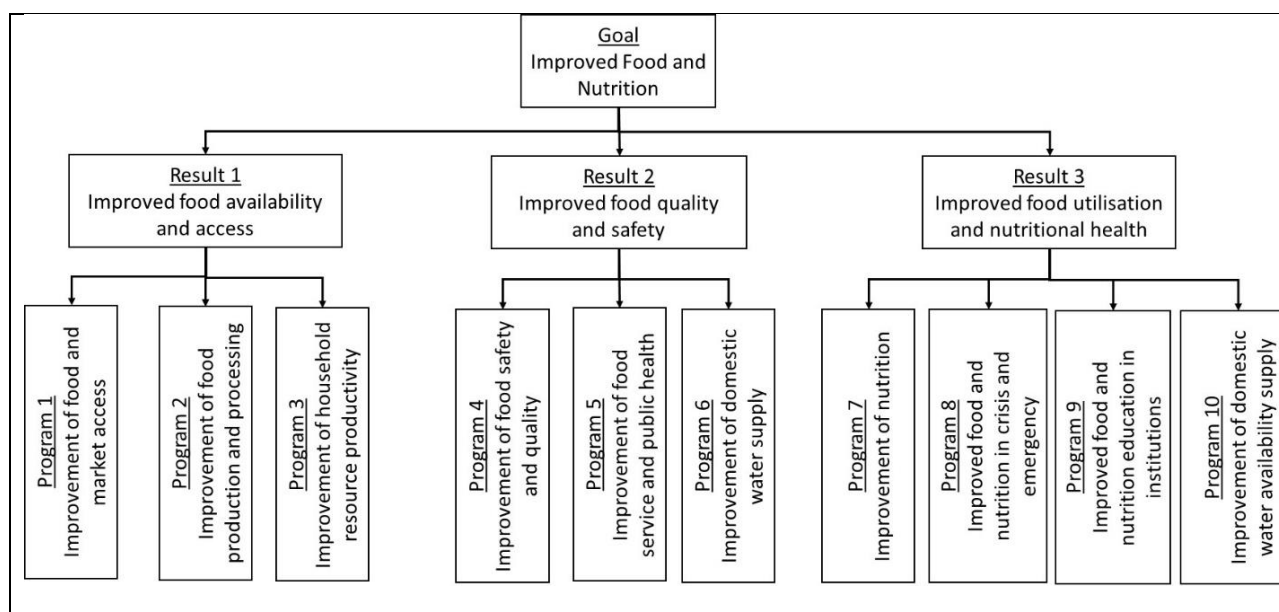
Issue	Challenge	Issue	Challenge
	Adult nutrition Nutrition for older persons	8. Policy implementation, monitoring and evaluation	Policy implementation Monitoring and evaluation

Source: Authors' elaboration based on Republic of Kenya, 2011.

2.1.2. The National Food and Nutrition Security Policy Implementation Framework 2017-2022

The National Food and Nutrition Security Policy Implementation Framework 2017-2022 actualises the 2011 Kenyan Food and Nutrition Security Policy (Republic of Kenya, 2016). For each priority program area, an Implementation Matrix presents the related development objectives, output, priority interventions, approaches to be carried out, results, indicative budget, and responsibility. A Strategic Results Framework illustrates the logical structure to achieve the goal of food and nutrition security. As shown by Figure 2, three are the objectives of this framework and each of them is supported by a set of outcomes that represent specific programmes.

Figure 2. Diagram of the National and Nutrition Security Result Framework



Source: Adapted from Republic of Kenya, 2016.

Result 1 deals with the improvement of food availability and access through the enhancement of (i) food and market access, (ii) food production and processing, and (iii) household resources productivity. Result 2 seeks to improve food quality and safety through the development of (iv) food safety and quality, (v) food service and public health, and (vi) domestic water supply. Finally, result 3 aims to improve utilisation and nutritional health through the improvement of (vii) nutrition, (viii) food and nutrition in crisis and emergency situations, (ix) food and nutrition education in institutions, and (x) domestic water availability supply. The abovementioned programs are the multiple

dimensions of food and nutrition security highlighted as priority areas of intervention in the National Food and Nutrition Security Policy.

In addition, the National Food and Nutrition Security Policy Implementation Framework 2017-2022 provides a set of results and indicators to the purpose of the implementation of an effective Monitoring and Evaluation system.

2.1.3. The Nutrition Action Plan

The Nutrition Action Plan has a similar structure to that of the National Food and Nutrition Security Policy Implementation Framework 2017-2022 (Ministry of Public Health and Sanitation, 2012). This document operationalises the Food and Nutrition Security Policy as far as the nutritional challenges are concerned and is coherent with its implementation framework. It is organised around 11 objectives considered as strategic to realise the goal of promoting and improving nutrition status of all Kenyans. Specifically, the improvement of (i) the nutritional status of women of reproductive age (15-49 years); (ii) the nutritional status of children under 5 years of age; the reduction of (iii) the prevalence of micronutrient deficiencies in the population; to prevent deterioration of (iv) nutritional status and save lives of vulnerable groups in emergencies; to improve (v) access to quality curative nutrition services; to improve (vi) prevention, management and control of diet related non-communicable diseases; to improve (vii) nutrition in schools, public and private institutions; to improve (viii) nutrition knowledge attitudes and practices among the population; to strengthen (ix) the nutrition surveillance, monitoring and evaluation systems; to enhance (x) evidence-based decision-making through research; to strengthen (xi) coordination and partnerships among the key nutrition actors and mobilize essential resources. This action plan is a road map for a coordinate and more effective implementation of the nutrition interventions by the government and stakeholders operating in the specific field.

2.1.4. The Policy Decisions

The lower part of Figure 1 shows the policy decisions taken by the Government of Kenya after 2012 by objective of the National Food and Nutrition Security Implementation Framework using as data source the Food and Agricultural Policy Decision Analysis Tool of the FAO². These measures are further classified in producer, trade and consumer-oriented measures and within each of them by area of intervention. The larger number of areas of intervention is that of food availability and access. In these field, interventions aim at increasing production and productivity, regulate trade and protect consumers, especially the most vulnerable people. The other two policy objectives, the improvement

²<http://www.fao.org/in-action/fapda/tool/index.html#main.html?policydecisionid=18674>. Accessible in April 2018.

of food quality and safety and food utilisation and nutritional health, include trade oriented and consumer-oriented interventions respectively.

2.2 The contribution of traditional food species to food security

The role and nutritional potential of the traditional food species is recognised in the recent policy tools promulgated by the Government of Kenya referring to the issue of food availability and accessibility, and of nutrition improvement and nutrition security.

The National Food and Nutrition Security Policy addressing the issue of food availability and access, in the section dedicated to the domestic production, highlights the significant loss of bio-diversity in areas with relatively high production potential, as well as in arid and semi-arid lands. It also indicates that this situation has negative effects on traditional sources of food in addition to adverse implications on income and other basic needs of many rural communities. In this context, the increase in agro-biodiversity is one intervention for improving a sustainable increasing food production.

In another section dedicated to the cultural, social and political factors in increasing food, the National Food and Nutrition Security Policy reports on the production transition underway in Kenya and the consequent substitution of the production of many traditional crops, among which millet, sorghum, cassava and other tubers, with modern crops. The specific storage characteristics of the traditional species are also recognised as a possible way to smooth access, consumption and food security over time. The policy document provides an example of the tubers storage technique, that consists of leaving the tuber underground until it is consumed. Therefore, the promotion of traditional crops can be a way to improve food affordability and availability.

In the part on the nutrition improvement and security, when discussing the diet related non-communicable diseases, the National Food and Nutrition Security Policy reports on the nutrition transition from traditional food items that are low in fat and rich in fibres, to commercially processed food products, often having high levels of saturated fats and simple carbohydrates and sugars. This trend is at the basis of the increase in the prevalence of non-communicable diseases.

The National Nutrition Security Policy Implementation Framework in the Implementation Matrix indicates the need “to increase food productivity and production of food that is diversified, affordable and able to diverse nutritional requirements of all people” as one of the objectives of the priority programme area “Improving domestic food availability”. One of the output of this objective consists of the increase in nutrient-rich foods produce to be achieved with the promotion of production of traditional high value and nutrient-rich foods. The cost of this intervention is sets at 250 million KSh over the time-period 2007-2022 and the responsibility of this intervention is of the Ministry of Agriculture, Livestock and Fisheries and the County Governments.

In the section on the food security performance indicators, under the objective “Increase overall food production and processing”, the utilisation of traditional high value food crops is one of the projects whose expected output is increasing its utilisation by 10 percent by 2020. The suggested indicator to measure this output is the number of high value traditional food crops, widely consumed, to be verified by the information provided by annual food production and food assessment reports.

2.3 The Nakuru County

Following the devolution process undertaken with the redrafting of the Kenyan Constitution in 2010, the Nakuru County Government prepared the first County Integrated Development Plan (2013-2017) (Republic of Kenya, 2013). This Plan is the reference framework for the allocation of resources to priority projects and programmes described by the document and articulated in sectors of intervention. The 2017/2018 Nakuru County Annual Development Plan is the last one-year development plan that actualizes the first Nakuru County Integrated Development Plan (2013-2017) (Republic of Kenya, 2016).

2.3.1. County Integrated Development Plan (2013-2017)

In the architecture of the County Integrated Development Plan, food insecurity and poverty are part of the agricultural policy, while nutrition of the health policy.

The County plan suggests both answering food insecurity within the agricultural sector and that food security and agriculture are one of the priority areas included in the document. Agriculture is indeed considered the key sector in the provision of food and creation of employment. The Plan highlights that, in light of a food poverty index at 41 percent, a significant proportion of people continue to suffer from hunger in Nakuru. The County Government indicates to address this situation with strategies in the agriculture and rural sector aimed at improving food production and self-sufficiency. The constraints to food security include unpredictable water and erratic rainfall, high costs of farm inputs and lack of off-farm grain storage facilities. In this situation, the County Plan indicates the promotion of the traditional high value crops as one of the strategies to address the issue³ (p. 106). The other strategies are the promotion of green houses and post-harvest technologies, the formation of farmers groups and cooperatives to ensure economies of scale, capacity building of farmer groups,

³ The estimated cost for the promotion of traditional high value crops is 6,000,000 KShs for the period 2013-2017. The monitoring indicators are the number of bulking plots established and the number of farmers involved in seeds multiplication. Progress reports, annual reports, production reports and financial reports are the suggested monitoring tools. The funds are from the National Government, County Government and Development Partners.

for example on safe and responsible use of pesticides, the improvement of food security in urban and peri-urban areas, and the reduction of postharvest losses.

Low agricultural productivity, due to high input prices and low output price in the agricultural sector and to lack of capacity for value addition to local produce, is one of the major factor contributing to the high level of poverty, in combination with the high level of unemployment, an increasing dependency ratio, and land diversion towards quarrying and residential plots. The Plan recognises that poverty is one of the challenges faced by the county and that it compromises access to food to a large share of the population. According to the County Integrated Development Plan, the problem needs to be addressed by investing and using modern technique in the agricultural sector and promoting appropriate skills in order to improve crop and animal sustainable production, encourage entrepreneurship supported by a public-private partnership, and develop income-generating activities. A specific area of concern is the prevalence of stunting and wasting in children under five years to be faced by a health strategy aimed at promoting community-based activities in the area of agriculture, nutrition and health. Broadly speaking, the major causes of the poor state of health and nutrition are attributed to the lack of a balanced diet, poor eating diet, and high cost of nutritious food. These factors combine with low access to health facilities, which, in addition, are inadequate, poor sanitation and access to clean water, water pollution, impassable roads and home-based delivery. These are all policy thrusts areas.

In the health sector, a new project relates to nutrition⁴. It aims at reducing malnutrition and promoting good health and nutrition practices in all life cycle. The entire county population is the target of this project. The indicated activities to be pursued are the promotion of kitchen garden and school feeding programme, encouraging support to groups of people living with HIV, lactating groups and diabetic groups.

Concerning the issue of insufficient food production, among the strategic thrusts, it is indicated the need for promoting and reintroducing orphaned crops⁵ and emerging crops, through a sustainable orphan crops support in the county. In the SWOT analysis related to disaster risk management, these orphan crops in a mixed farming system (crop and livestock) are seen as a strength in the reduction of the underlining risk factors. Other recommended directions of the interventions aimed at

⁴ For the project on nutrition, the estimated cost is 16,000,000 KShs for the period 2013-2017 with the monitoring indicator the reduction of malnutrition. The monitoring tool is the progress reports. The implementation agency is the Ministry of Health and Service and the funds are from the National Government, the County Government and Development Partners.

⁵ Orphan crops are those that are not traded internationally, and therefore tend to get less attention in terms of research of agricultural training and extension. They are typically grown in Africa, Asia, and/or South America and eaten as part of local diets. Because they get less research attention, the breeding technology for orphan crops is lagging way behind modern technology. That means that the seeds farmers' plant are less likely to be resilient to drought, flooding, or extreme temperatures; lower in productivity; and more vulnerable to pests and disease (e.g. millet and cassava) (<http://www.foodinsight.org/october-2015-newsletter-orphan-crops>. Accessible on April 2018).

improving food production are the establishment of a crop management and development program, agro-technology programme, farm input research and supply programme, the intensification of extension services, the promotion of agroforestry and small-scale irrigation, and the support to the environmental conservation efforts.

2.3.2. The 2017/2018 Nakuru County Annual Development Plan

The 2017/2018 Nakuru County Annual Development Plan includes the strategic priority development programmes or projects, and activities to be implemented during the reference year. One of the six County development priorities is the promotion of value addition for agricultural produce, food security and environmental conservation.

The Nakuru County Annual Development Plan is organised into sectors and sub-sectors. Each sector presents the vision, mission and overall goals. Afterwards, a matrix shows for each programme the strategic priority and the related projects with the description of activities. For each activity, there is a short description and the indication of the key objectives and performance indicators, the targets and the budget estimate.

Attaining food security is one of the overall goals of the sector of intervention "Agriculture, Rural and Urban Development". In its sub-sector called "Agriculture" the vision of the interventions is the realization of "A food secure, industrialised and wealthy County". Therefore, food security is one of the strategic goals. The strategic objectives of this sub-sector are: (i) "to increase livestock production, productivity, health and improved livestock products and by products to enhance food security in the county"; (ii) "to increase fish production for enhanced food security, employment creation, income generation and poverty eradication"; (iii) "to enhance dissemination of agricultural information to the farming communities for improved agricultural productivity, food security and farm incomes".

Therefore, the mandate of the "Agriculture" sub-sector is to ensure sustainable development of agriculture, livestock and fisheries for food security and economic development.

The implementation of food security programmes is an activity of the project "Crop Production and Food Security" under the strategic priority of "Promoting drought tolerant food crops like cassava, sorghum and sweet potatoes". The key outcome of this programme is the number of implemented programs. The target is the introduction of six programmes for an estimated budget of 43,775,352.50 KSh.

In the "Education" sector, two projects are in the area of food and nutrition security. The former is a project dealing with a school feeding programme in order to enhance health and nutrition of children of the Education Directorates. The target of this project is the implementation of the school feeding programme in the 850 public Education Directorates of the county with an estimated budget of

21,250,000 KSh. The number of Education Directorates under School Feeding Programme monitors the progress towards this target.

The second project is “Education Directorate health and nutrition” and consists of the construction of hand washing points and the provision of water storage tank in every Education Directorate with the purpose of improving hygiene among students. The target is set at 850 Education Directorates covered by this project to be achieved with an estimated budget of 85,000,000 KSh. The outcome is monitored with the number of the washing points, and water storage tanks established.

In the same sector, under the responsibility of the Directorate of Culture and Gender, cultural preservation and promotion is one of the strategic priorities and one of the projects in this area consists of the exhibition of traditional cuisines and traditional food. The expected outcome is the promotion of traditional food to the community. The target is one event organised per sub-county and one event at the county level. The key indicator to monitor this project is the list of participants to the events and the number of visitors. The estimated budget for this project is 3,000,000 KSh.

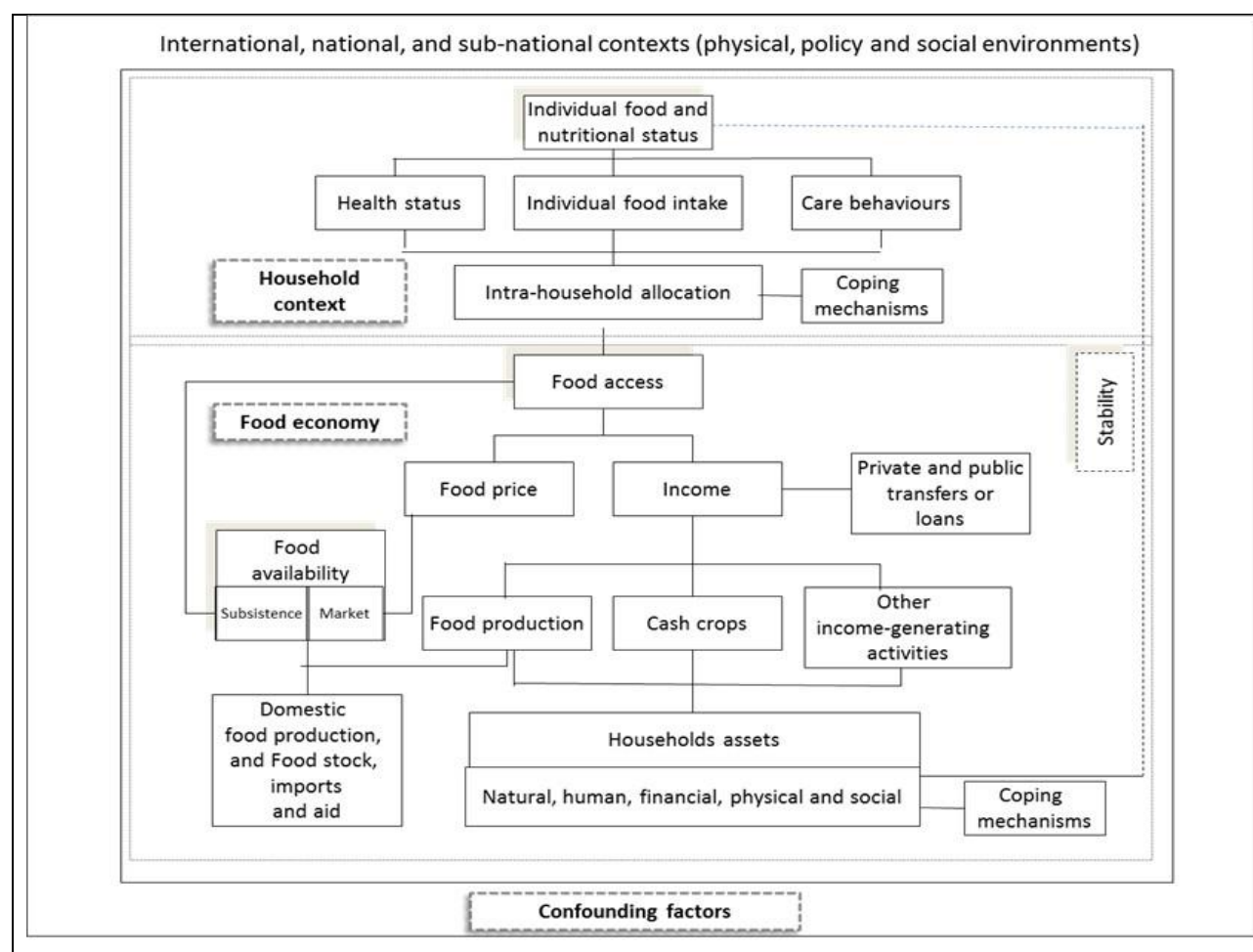
3. THE SURVEY

3.1 Steps in Sample Survey

As suggested by Cochran (1997), we articulated our survey in the following ten steps: objective of the survey; population to be sampled; data to be collected; degree of precision desired; methods of measurement; the frame; selection of the sample; the pre-test; organisation of the field work; summary and analysis of the data.

The objective of our survey was the analysis of the state of food security, their determinant factors and the role of traditional crops in fighting food insecurity among the rural population in the Lake Naivasha Basin. Concerning data collection, we made reference to the food security theoretical framework illustrated in Figure 3 in order to collect only essential information and avoiding an overlong questionnaire and its consequent effects on the quality of the answers.

Figure 3. Food security conceptual framework



Source: Sassi (2018)

The framework is organised into three parts: the food economy, household context and the confounding factors. In the food economy, a household owns a set of assets consisting of five forms of capital: natural, human, financial, physical, and social. They are represented at the bottom of Figure 3. These resources define the set of productive activities that a household can pursue to earn its income, which, integrated with public and private transfers or loans, determines the household's total income availability. The household can also sell the assets owned to cope with short-term food insecurity situations.

The activities performed by a household may include food production, cash crop production, and non-agricultural activities. The household can use the self-produced food as subsistence consumption or can sell it on the market. These two parts of the household's production contribute to the overall food availability with domestic food stocks, commercial food imports, and food aid. The conditions on the food market determine food prices, which, in turns, affect the household's purchasing power and, therefore, its access to food given its level of income.

Household food access is an important component of the individual food and nutritional status. However, this latter depends on the household context, in terms of intra-household distribution of food; health status; and care behaviours. In the short term, coping strategies can affect the intra-household distribution of food in times of insufficient food access. Food and nutrition security is a dynamic concept with feedback effects on human resources. It affects labour productivity and the potential to earn household income. This is the stability pillar of the concept of food security. Finally, the confounding factors outside the control of households frame the diagram. They include the physical, the policy and the social aspects.

In our investigation, we focused on the household food security because the measurement of the individual nutritional status would have requested the use of anthropometric indicators and, therefore, knowledge in the health sector and a greater budget than that provided by the funding agency. However, the household level of investigation finds justification in the literature in the principle that food uncertainty and food insufficiency are household level experiences (Coates, 2013; National Research Council, 2005).

3.2 Method of measurement and pre-test

We used an interviewing process where the interviewer reads a standard set of questions with no discretion. The questionnaire was organized into the following 11 modules:

- A. General Information - to identify the household and the respondent;
- B. Household Characteristics - to collect general information on the components of the household;

- C. Occupation and Income - to collect data on the occupation state of the household members and the sources of household income including the social security schemes;
- D. Household Crop Production – to gather information on crop production, farm inputs and participation to farmer organisations;
- E. Food Security – to collect information suitable to estimate, among others, two food security indicators, the Food Consumption Score and the Food insecurity experience scale;
- F. Food and Non-Food Basket Value – to capture the household eating pattern and its purchase of non-food items;
- G. Livelihood-Based Coping Strategies - to identify the “strategies that households and communities use to buffer themselves against shocks or to moderate the impact of shocks on their livelihoods and basic needs to enable them to continue in their current way of life” (Sassi, 2018);
- H. Household Income Level Assets – to collect data on income by means of the household assets;
- I. Housing and Infrastructure – to investigate the state of housing and infrastructure;
- L. Health – to capture the state of health of the household members;
- M. Perception and Expectation on Food Security and Poverty – to collect information on the major determinants of food insecurity and poverty and changes over a short period of time.

The questionnaire was validated using stakeholders from the National Draught Monitoring Authority, Kenya National Bureau of Statistics in Nakuru County Office, Ministry of Agriculture Naivasha Sub-county Office, University staff, and a group of enumerators. It was translated into Kiswahili and Kikuyu, the two most important vernacular languages by an expert translator.

We adopted the Open Data Kit (ODK) for data collection⁶. This is a free and open-source set of tools that we used to: (i) build the survey in a suitable way to data collection form for the enumerators from their cell phone; (ii) collect the data on their mobile device and send it to a server; and (iii) aggregate the collected data on a server and extract it in useful formats.

In addition to socio-economic surveys, with GPS locations and images, ODK allowed us to control for the accuracy of the submission process and to create a map with the location of the interviewed households. Finally, an IT expert translated the questionnaire into the file format for cell phones.

During the pre-test, we tried out the questionnaire and the field methods on a small scale. This allowed us to improve the questionnaire and eliminate the troubles that will be serious on large scale, such as the misunderstanding of the meaning of the questions.

⁶ <https://opendatakit.org/>. Accessible in April 2018.

3.3 Sample selection and degree of precision

Our sample refers to the methodology adopted by the Kenya National Bureau of Statistics (KNBS) for the selection of the households. The use of this methodology also makes our results comparable with those of other surveys provided by the KNBS.

The KNBS is currently using a master frame known as the fifth National Sample Survey and Evaluation Program (NASSEP V) that was developed in 2012 to conduct household budget surveys. This approach is also used by international organisations such as UNICEF and the World Bank.

The sample frame has 5,360 clusters that are distributed throughout Kenya. These clusters are drawn with a stratified probability proportional to size sampling methodology from 96,251 Enumeration Areas in the 2009 census. A number of properties are observed for the purpose of the sample selection. Among them, there are the population of the Enumeration Area, type of structures, and number of household in each Enumeration Area among others. The maximum number of households in an Enumeration Area is 150. This limitation is due to facilitate access and data collection. In case of more households, the area is segmented into two Enumeration Areas. Nakuru County has a total of 149 clusters which are further sub-divided into rural and urban clusters. We selected the households of the 7 rural clusters around the lake of Naivasha and more precisely in the sub-counties of Gilgil and Naivasha. The other 5 rural clusters of the two sub-counties were not selected because far away from our investigated area.

On the total, we selected 606 households representative of the rural area of the sub-counties of Gilgil and Naivasha. We compute this number using the Cochran's formula (1997) corrected for finite population:

$$n = \frac{\frac{z_{\alpha/2}^2 S_y^2}{t^2}}{1 + \frac{1}{N} \frac{z_{\alpha/2}^2 S_y^2}{t^2}} \quad (1)$$

where n is the sample size, z the critical value of the desired confidence level. We used 1.96 for z corresponding to a level of confidence of 95 percent. In other words, we accepted a 5 per cent probability of error in our estimates. The t is the desired margin of error, in our case 4 percent, S_y^2 is the variance of the sample population and N is the total population corresponding to 28,939 households.

According to this formula, our sample size should include 588 households. We prefer to increase the number of observations to 606 to avoid a possible reduction of the sample below the representative

level due to events such as the migration of a household in another area or their relocation by the floriculture sector for job purposes.

During the pre-test, other randomly selected households replaced those that were not present because migrated, deceased or that refused to answer.

Table 2 presents the number of households interviewed by selected cluster and their percentage share over the sample total population.

Table 2. Sample population by cluster area (absolute values and percentage share)

Cluster	No. of household	% share
Kiburuti	141	23.27
Leleshwa	57	9.41
Ngano-Ini	92	15.18
Gathengera	53	8.75
Lower Nyamathi	71	11.72
Tumaini	50	8.25
Kanjogu	142	23.43
Total	606	100

Source: Authors' elaboration.

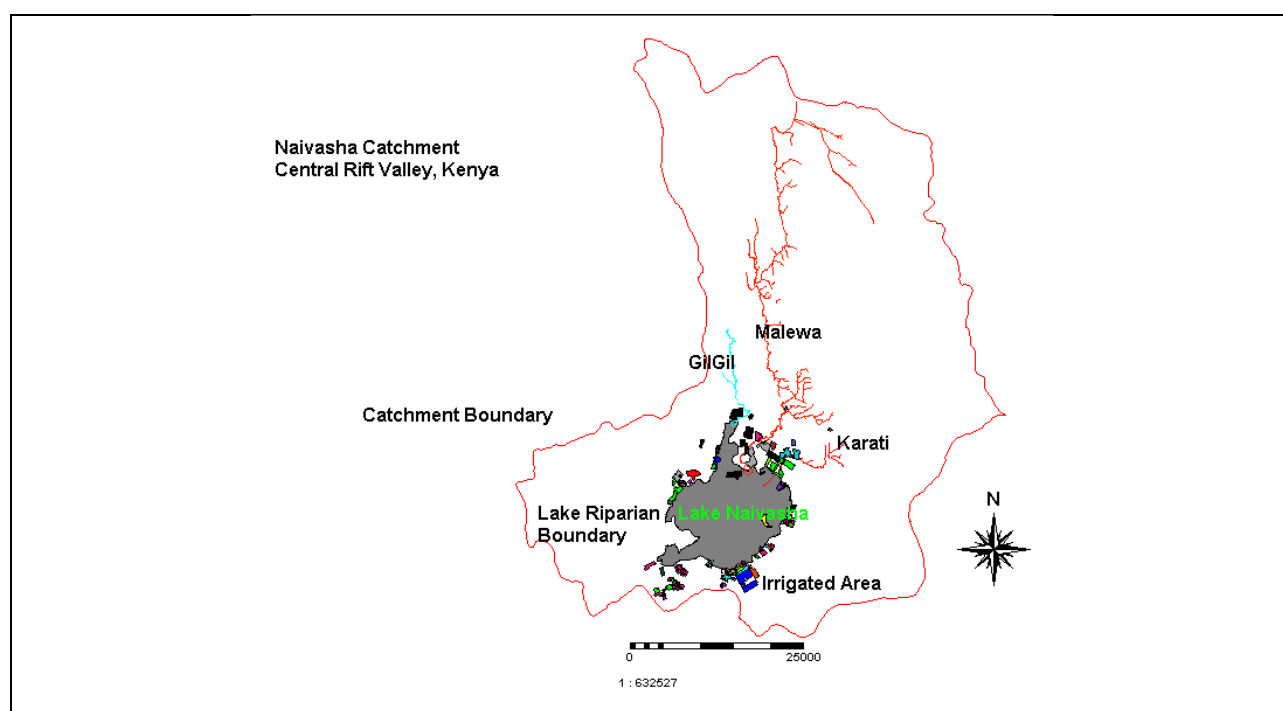
The National Bureau of Statistics in Nakuru, and especially Mr. Peter Kaman head of the County National Bureau of Statistics and his assistant, supported the process of households mapping. We chose to involve this office in this phase because nationally mandated for undertaking census and surveys in the country. They normally participate to the Demographic Household Survey.

3.4 The Lake Naivasha Basin

Our investigation focuses on the households located in the semi-arid middle and lower catchment of the Lake Naivasha Basin, an endorheic shallow freshwater lake located in the Nakuru County. Figure 4 shows the catchment boundaries of the Lake Naivasha. Six of our seven clusters are around the lake and one, Ngano-Ini, is in the Gilgil and Malewa river basins, the two most important inflow river systems of the lake (Otiang'a-Owiti and Oswe, 2007).

Today, the Lake Naivasha is the hub of the Kenya's cut flower industry. This area produces 70 percent of the country's floriculture production, a sector that overall contributes to almost 1.3 percent of the country GDP (Kirigia et al., 2013). It is estimated that in this region there is the concentration of over 50 percent of the country's total flower production (Bolo, 2006). Following Smalley (2013, p. 7), the companies in this sector have the five key characteristics of plantations, they "grow one main cash crop, require capital investment, are larger than an average-sized holding although some land may be left uncultivated, rely on hired resident or non-resident labour, often including migrant labour, and are centrally managed".

Figure 4. Map of the investigated area



Source: Ghawana, 2008

Another important feature is that this cluster, with the characteristics of an enclave, includes not only farmers but also other key actors in the flower industry. Among them, there are research institutions, breeding farms, quality control and regulatory agencies, input suppliers, credit and finance institutions, trade promotion agencies and other intermediary organizations.

Figure 5 shows the geographic location of the six investigated clusters.

We asked support to some informant to have preliminary information on these areas.

Kiburuti is characterised by labour intensive agriculture and includes settlement recently established following the construction of Aquila farms. Aquila is one of the most recently developed project and is located 30 km from Naivasha town on the North Lake Road at an altitude of 2,000 m⁷. It consists of 2,000 acres of mostly flat arable land where 18 hectares of Richel green houses are located.

Tumaini includes the Kasarani informal settlement resulting from the greenhouses established by the Shalimar Flowers Kenya Ltd and Bilashaka flowers Ltd. These companies also result from recent investments. For example, Bilashafa flower Ltd. was established in 2001 and it produces about 40 million roses annually on 29 hectares of greenhouses⁸. Shalimar Flowers Kenya Ltd is a Fair-Trade cut-flower and vegetable farm⁹ part of the East African Growers Group. Employment in this farm is made attractive by the strategy adopted by the farm management that has put interests of workers at

⁷ <http://www.aquilaflowers.com/>. Accessible on April 2018.

⁸ <http://www.zuurbier.com/bedrijf-en.php#>. Accessible on April 2018.

⁹ <https://softkenya.com/directory/shalimar-flowers-kenya-ltd-2/>. Accessible on April 2018.

the heart¹⁰. For example, every child from each household in the farm is entitled to thirty thousand Kenya shillings school fees; workers have the opportunity to be sponsored by the fair-trade project to attain college education; after five years of working, every employee is entitled to a gratuity of thirty percent; housing facility (a two-room household) is provided by the company.

Figure 5. Geographic location of the investigated clusters



Source: Authors' elaboration with Google Earth. Note: the white pin indicates the name of the cluster and the blue polygon is the cluster area.

Leleshwa includes Oserian estate. Established in 1969 as a large cattle ranch, it was a vegetable farm over decades until 1982, when it started to produce a flower called statice¹¹. The farm is innovative and covers a vast area where floriculture is combined with seeds production and the Oserengoni Wildlife sanctuary, encompassing over 18,000 acres of the Oserian estate.

Lower Nyamathi is close to Longonot National Park. The agricultural system is rain-fed, and the area is water-scarce with crop failure. However, people continue to plant.

In Kanjogu agriculture is still rain-fed and is combined with a bit of livestock, dairy farming. The production of Irish potatoes is important with that of maize and other cereals.

¹⁰ <http://hortfreshjournal.com/employees-welfare-at-the-heart-of-the-blossoming-shalimar-flowers/>. Accessible on April 2018.

¹¹ <http://oserial.com/>. Accessible on April 2018.

Gathengera includes the Flower Business Park of Naivasha and the rural areas around the Naivasha city. Land used for rain-fed agriculture was progressively adopted for housing of the middle class mainly working in Leleshwa.

Ngano-Ini is a rural cluster closed to Gilgil town, which is between Naivasha and Nakuru and along the Nairobi-Nakuru highway. It is located at the west of the Gilgil River, which flows towards south to provide water to Lake Naivasha. Small-scale farms producing mainly for subsistence dominate in this area, where there are also private ranches used for wild conservation or livestock farming. This is a semiarid area, but rain is higher than in the lower catchment of the Lake Naivasha Basin because of its higher altitude.

3.5 Organisation of the fieldwork

Enumerators were selected among the staff of the Kenya National Bureau of Statistics (KNBS) of Nakuru for their capacities and knowledge of the area and to stimulate the local economy. A group of former students of the Nairobi University who were job seeking was selected for younger inclusion and capacity building. We also prioritised the graduated students searching for a job for employment creation. We trained enumerators explaining the objective of the research project, the content of the questionnaire and the techniques concerning the questionnaire submission.

Moreover, we introduced them the ODK tool, explaining the collecting data process and the transfer of data to the ODK server. Our aim was to provide the selected enumerators the knowledge, skills and abilities to enable them to act effectively as enumerator, even after their involvement into the project. We visited each group of clusters and measured the distance among them (Table 3).

We also verified the possibility to accommodate the enumerators in Naivasha contacting the local hotels and collecting the price per night.

Table 3. Distance among clusters

Origin	Destination	Km
Nairobi	Naivasha	77
Naivasha	Mirera	10
Naivasha	Ndabibi	37
Naivasha highway	Gilgil	20

Source: Authors' elaboration.

Finally, we trained the Enumerators on February 20, 2018 and we used them to pilot the questionnaire on February 21, 2018. In the same day, the team leader organised the fieldwork with the distribution of households and their address and providing other organisational details.

4. METHODOLOGY

4.1 The qualitative process

In one of the sections of our survey we introduced an open question in order to capture the perception and expectation on food security. We organised these answers into major categories aiming to identify the most relevant food security causes. This allows us to elaborate a first framework of the main critical issues. Successively, we discuss them through a data evidence given by the quantitative questions.

4.2 The adopted indicators

In the following section, we present the indicators used for the empirical analysis in addition to the descriptive statistics. Specifically, we applied: the Food Insecurity Experience Scale (FIES), the Coping Strategy Index (CSI), the Food Expenditure Share, the Gini coefficient, and the Coefficient of price variation.

4.2.1. The prevalence of food insecurity: Food Insecurity Experience Scale

We measure the level of food insecurity in the investigated area asking people directly about their experience of food insecurity using the Food Insecurity Experience Scale (FIES). FIES is one of the indicators adopted to verify the progress towards the Sustainable Development Goal number 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by 2030. The Goal number 2 is organised into eight targets and target 2.1 focuses on ensuring access to food for all: “By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round”.

Both FIES and the prevalence of undernourished people (PoU) are the two indicators of food access used to monitor this target (UN General Assembly, 2017), but we preferred the former to differentiate between the prevalence of moderate and severe food insecurity in the population. Moreover, the prevalence of severe food insecurity measured with the FIES and the PoU in the population is expected to be very similar, since both are indicators of serious food deprivation (Cafiero et al., 2016). The FIES provides estimates of the proportion of the population facing difficulties in obtaining food of sufficient quality and quantity, based on direct interviews with survey respondents who reply to questions about their own experiences (individual FIES), or on behalf of their households as a whole (household FIES) (Ballard et al., 2013).

Following the FAO protocol for the computation of the FIES, we calculated a household FIES based on the answers of the survey respondents to the questions listed in Table 4 and referred to a recall period of 30 days.

Table 4. FIES questionnaire for households and a recall period of 30 days

No.	Short reference	Question wording
1	WORRIED	In the previous month, you or others in your household worried about not having enough food to eat because of a lack of money or other resources?
2	HEALTHY	Still thinking about the previous month, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?
3	FEWFOODS	In the previous month, was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?
4	SKIPPED	In the previous month, was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?
5	ATELESS	Still thinking about the previous month, was there a time when you or others in your household ate less than you thought because of a lack of money or other resources?
6	RANOUT	In the previous month, was there a time when your household ran out of food because of a lack of money or other resources?
7	HUNGRY	In the previous month, was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?
8	WHOLEDAY	In the previous time, was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?

Source: Cafiero et al., 2016, Viviani, 2016

These eight questions refer to a theoretical construct of food insecurity designed for analysis conducted in different regions of the world according to which hunger is a process characterised by three levels. Passing from one level to the other, the severity of food insecurity increases. Initially, there is the anxiety about having enough food, this is followed by dietary changes compromising on food quality and variety, and finally, households reduce the consumption of food and skip meals before experiencing hunger (Radimer, Olson and Campbell, 1990; Radimer et al., 1992).

The FIES assumes that the severity of the household food insecurity is a latent trait that can be inferred from observable evidence through the application of the Rash model (Rasch, 1960; Fisher and Molenaar, 1995), which is based on Item Response Theory. Following this theory, it is postulated that the severity of the food security state of the respondent household and the severity associated with each of the experiences can be located on the same one-dimensional scale; and that higher severity of food security condition of a respondent household will increase the probability of reporting occurrence of experiences associated with food insecurity.

In this model, the probability that a respondent will report a given experience is a logistic function of the distance between the respondent's and the item's position on the severity scale according to the following formula:

$$Prob\{x_{h,i} = 1|\theta_h, \beta_i\} = \frac{e^{\theta_h - \beta_i}}{1 + e^{\theta_h - \beta_i}} \quad (2)$$

where $x_{h,i}$ is the response given by the respondent household h to item i . It is coded 1 for yes and 0 for no. The β_i parameter is the relative severity associated with each of the experiences and is inferred from the frequency with which all the respondents in the representative sample indicate them. The assumption is that, *ceteris paribus*, the more severe experiences are reported by fewer respondents. The θ_h parameter is the severity of a respondent household's condition. The number of items with an affirmative answer computes it because we expect that a respondent will answer: (i) affirmatively to all questions that refer to experiences that are less severe of their food insecurity situation, and (ii) negatively to questions that refer to situations that are more severe. The frequency and magnitude of possible deviations from this expected pattern is admitted if supported by specific tests.

Given that we stratified our sample by clusters and this stratification does not correspond to that of the total population, in the computation of the FIES, we applied a correction technique assigning an adjustment weight to each respondent. The weight adjustment allowed us to make the response in the clusters representative of the corresponding population. As illustrated in Table 5, we calculated the sample weight from stratification of the total and sample population.

Table 5. Sampling weight in the FIES

Cluster	No. of households in the total population	Population stratification ^(a)	No. of households in the sample	Sample stratification ^(b)	Sampling weight ^(c)
Gathengera	1,409	0.0487	53	0.0875	0.5567
Kanjogu	2,807	0.0970	142	0.2343	0.4139
Kiburuti	2,361	0.0816	141	0.2327	0.3506
Leleshwa	1,209	0.0418	57	0.0941	0.4442
Lower Nyamathi	12,953	0.4476	71	0.1172	3.8203
Ngano-Ini	5,355	0.1850	92	0.1518	1.2189
Tumaini	2,845	0.0983	50	0.0825	1.1915
Total	28,939		606		

Source: Authors' elaboration. Note: The sampling weight (c) is computed as the ratio between the population stratification (a) and the sample stratification (b).

We computed the FIES following four steps (for technical details see Viviani, 2016). First, we prepared the data for the analysis with the exclusion of missing responses from the analysis. Second, we estimated the level of food insecurity severity associated to each question and to each respondent household. Third, we validated statistically the dataset and household food insecurity severity based on the Infit, Outfit, Residual correlation and Rasch reliability tests. Finally, we calculated the FIES

by level of severity using the standard thresholds set along the scale of severity: ATELESS and WHLDAY (see Table 4) define the moderate and severe food insecurity classes respectively (FAO, 2017). In other words, we computed two indicators, the proportion of the population experiencing severe food insecurity and the proportion of the population experiencing the moderate and severe food insecurity. We made our scale comparable with that at the country level using the FIES global standard scale defined by the FAO based on the computation of the FIES in the 149 countries covered by the Gallup World Poll from 2014 to 2016.

4.2.2. Coping Strategy Index

We investigated the behaviour that people follow when they cannot access enough food with the livelihood-based Coping Strategy Index (CSI). It is a measure of the long-term household coping capacities to preserve its livelihood and economic security. The literature uses this index also to assess the degree of food insecurity; the higher is the value of the index, the more severe is the level of food insecurity (Maxwell and Caldwell, 2008).

As highlighted by Christaensen and Boisvert (2000), people normally introduce these strategies before a shortfall of food, when they foresee this possibility. Therefore, the CSI can be used not only to assess the response to the current situation, but also to predict how households will be able to address future challenges.

The CSI is based on the answers to the following question: “During the past 30 days, did anyone in your household have to engage in any following behaviours due to a lack of food or a lack of money to buy food?”.

In our questionnaire, we selected the possible answers referring to the coping strategies master list provided by the WFP (2015). We adapted to the situation of the investigated area through focus group discussion within eight gender-balanced group of people purposely selected. We also used them to attribute the severity weightings to each livelihood coping strategy. In details, the livelihood-based CSI is computed summing up the product between the frequency of the adopted strategy and the associated severity weight to each answer.

The weights allowed us to classify the strategies into three broad groups consisting of stress, crisis and emergency strategies (WFP, 2015).

Households not using any of these strategies were included in group 1 and classified as food secure. We also took into consideration the cases of households that could not introduce a coping strategy because they had already exhausted that option. Table 6 indicates the adopted questions and severity weights.

Table 6. *Questions and severity weights of the Coping Strategy Index*

	Coping strategy	Level weight	Level of severity
1	Sold household assets or goods (radio, furniture, chairs)	2	Stress
2	Spent savings.	2	Stress
3	Borrowed money/food from a formal lender/bank	2	Stress
4	Sold more animals (non-productive) than usual	2	Stress
5	Reduced non-food expenses on health (including drugs) and education	3	Crisis
6	Sold productive assets or means of transport (sewing machine, wheelbarrow, bicycle, etc.)	3	Crisis
7	Withdrew children from school	3	Crisis
8	Piecework/sell labour	3	Crisis
9	Contemplated to withdraw from participating in professional organisations	3	Crisis
10	Sold house or land	4	Emergency
11	Sold previous female animals	4	Emergency
12	Begging	4	Emergency
13	Skip the meals	4	Emergency
14	Eat traditional species or increase their consumption	4	Emergency
15	Engaged in betting/gambling	4	Emergency
16	Prostitution	4	Emergency

Source: Adapted from WFP, 2015

A household is classified as marginally food insecure when adopts stress strategies; it is moderately food insecure when uses crisis strategies; and severely food insecure when introduces emergency strategies.

4.2.3. *Food expenditure share and poverty*

The food expenditure share is a measure of the household economic vulnerability based on the Engel Low: the greater the importance of food within the overall budget of a household, the more economically vulnerable is the household (Timmer et al. 1983, p. 43).

To this purpose, a section of our questionnaire was dedicated to the collection of food expenditure by item and another to the non-food expenditure by item referring to a recall period of 30 days. We collected data on quantities and prices. Among the food expenditure, we asked the households to report not only the purchased items but also the quantity of the non-purchased foods. Both were taken into account in the computation of the food expenditure share in order to consider households with different food access situations similarly. To the purpose of the computation of the share of food expenditure, we quantified in monetary terms the non-purchased foods with the cluster-level median price where the respondents were not able to give us information on the market price of the specific purchased item. When this value was not available at the cluster level, we used the median price of the overall area. We used the median price to reduce the sensitivity of consumption aggregate to outliers that are inevitable in household survey data (Deaton and Zaidi, 2002).

We selected the items to be included in this section of the questionnaire referring to the food and non-food basket adopted by the KNBS. This list was adapted to the local context discussing among the groups used for the Livelihood-based CSI and adjusting some aspect during the validation and piloting of the questionnaire. Moreover, we let space for the enumerators to include other food and non-food items not present in the specific section of the questionnaire.

To the purpose of the computation of the share of food expenditure we used the following formula:

$$\text{Food expenditure share} = \frac{\text{purchased foods spending} + \text{non purchased food at the market price}}{\text{purchased foods spending} + \text{non purchased food at the market price} + \text{non food spending}} \quad (4)$$

The food and non-food expenditure shares were computed as per adult equivalent using the following weights: 1 for the first adult, 0.7 for any other adult member, 0.5 for each household members below 15 years old, i.e. those not in the labour force according to the KNBS (Haughton and Khandker, 2009).

Based on the total spending, we classified households also in terms of level of poverty using the food poverty line threshold for rural areas set by the KNBS of 1,954 KSh and the overall poverty line for the rural areas fixed at 3,252 KSh (KNBS, 2018) (Table 7).

Table 7 Food insecurity severity level by food expenditure share

Food insecurity severity level	Poverty status thresholds
Food Secure	> 3,252
Moderately food Insecure	1,954 - 3,252
Severely food Insecure	< 1,954

Source: WFP, 2015.

4.2.4. Gini coefficient

We used the different sources of labour income to determine income inequality and its decomposition. We adopted the Gini coefficient to analyse income inequality and we decomposed this coefficient by income source to compute the impact that a marginal change in a particular income source will have on inequality.

Following Shorrocks (1982) and Lerman, and Yiatzhaki (1985), the Gini coefficient for total inequality (G) can be written as:

$$G = \sum_{k=1}^K S_k G_k R_k \quad (5)$$

The component S_k is the share of source k in total income and, therefore, it describes its importance in the overall income. G_k is the distribution of income from source k , its Gini index. In other words, this component informs whether the k source of income is distributed equally or unequally. Finally, R_k is the Gini correlation of income from source k with the distribution of total income.

We used these three components to estimate the effect that a marginal (1 percent) change in income from source k will have on total income inequality (PC). The following formula gives this effect:

$$PC = \frac{S_k G_k R_k}{G} - S_k \quad (6)$$

We used the following categories of occupation: Agriculture, Livestock, Fishing, Craftsman and industry, Casual works, Merchant and trade, Transport and services, Civil servant, Teaching works, Pension, and Other. In particular, the casual workers are those employed in the commercial farms, whilst agriculture occupation is related to small-scale farms.

4.2.5. *Coefficient of price variation*

According to the “Law of One-Price”, in all locations a good must sell for the same price. If this is not true, the arbitrage mechanism performs by the supply and demand side resulting in a single and equal price in all locations.

The existence of transport costs and economic barriers between locations or of market inefficiency produce variations in the price of homogeneous foods.

We used the coefficient of price variation (CV) of the most consumed food items to have a preliminary information on market efficiency. CV is the ratio of the standard deviation (s) of price of food i to its mean (m) multiplied by 100:

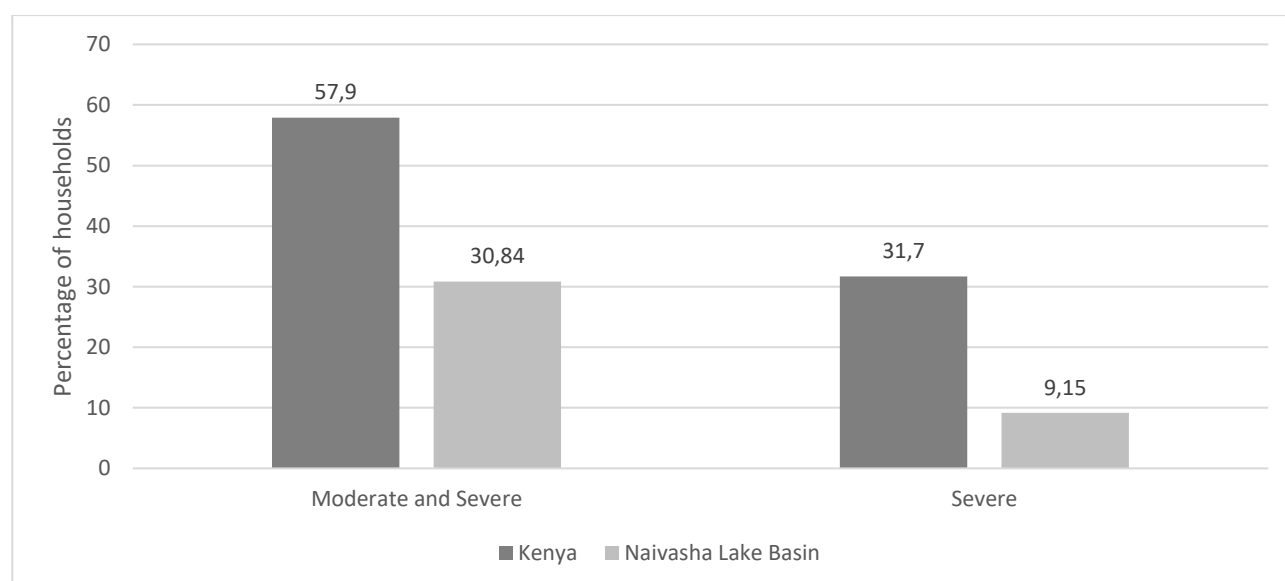
$$CV = \frac{s}{m} * 100 \quad (7)$$

The higher the CV , the greater the dispersion in the specific food price. We computed this coefficient across clusters and markets, considering the main food consumed items, i.e. maize, rice, sweet potatoes, cabbages, tomatoes and kales.

5. THE FOOD INSECURITY STATUS

In the rural area of Lake Naivasha Basin, the zero hunger target sets by the Sustainable Development Goals is not achieved, despite the level of food insecurity is lower than the national status (Figure 6). In February 2018, more that $\frac{1}{4}$ of the population is moderate and severe food insecure with almost 9.15 percent of them severely food insecure. This means that over a 28,939 households representing the total population of the investigated area, 8,925 of them are moderate and severe food insecure of which 2,648 are severe food insecure.

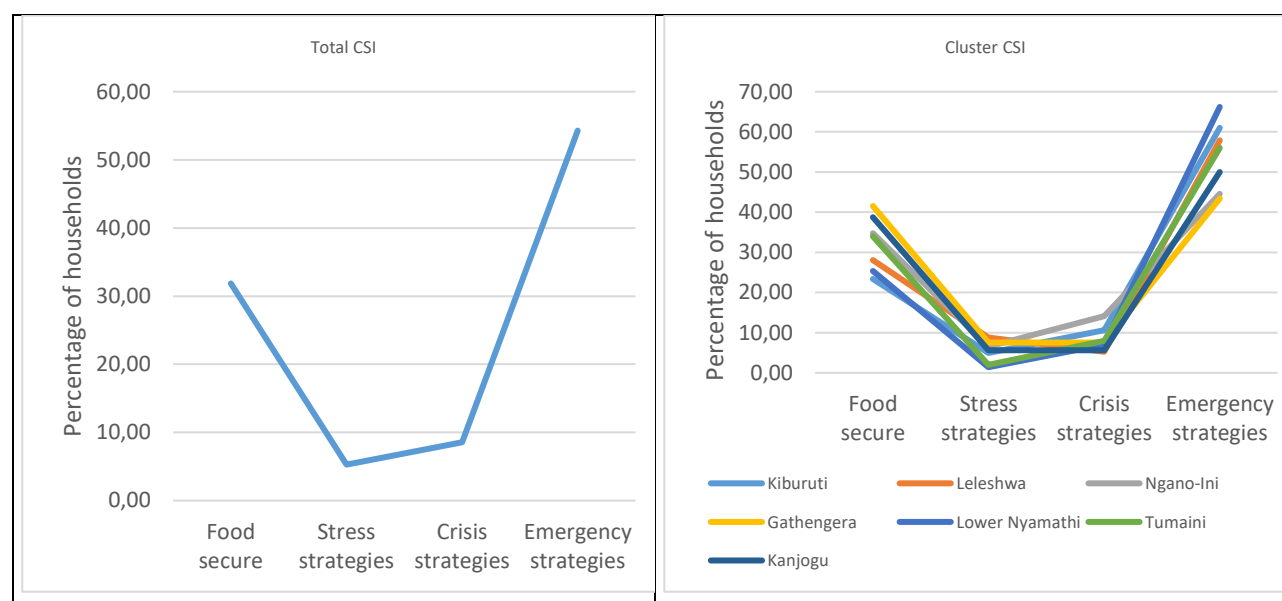
Figure 6. Food Insecurity Experience Scale



Source: Authors' elaboration

When households cannot access enough food, they introduce the coping strategies. According to our estimates the index representing these strategies has a “U” shape (Figure 7). On one extreme, a high percentage of households, 31.85 percent, are in a state of food security without using coping strategies and, on the other, a higher share of households (54.29 percent) adopting emergencies coping strategies (Table 8). We found the same “U” shape in all investigated clusters.

Figure 7. Coping strategy index



Source: Authors' elaboration

Table 8. Coping strategy index (percentage of households)

Cluster	Food secure	Stress strategies	Crisis strategies	Emergency strategies
Kiburuti	23.40	4.96	10.64	60.99
Leleshwa	28.07	8.77	5.26	57.89
Ngano-Ini	34.78	6.52	14.13	44.57
Gathengera	41.51	7.55	7.55	43.40
Lower Nyamathi	25.35	1.41	7.04	66.20
Tumaini	34.00	2.00	8.00	56.00
Kanjogu	38.73	5.63	5.63	50.00
Total	31.85	5.28	8.58	54.29

Source: Authors' elaboration

The share of population adopting emergency coping strategies is higher than the prevalence of severe food insecure households indicated by the FIES in Figure 6. This means that a large number of households introduces these mechanisms to keep an adequate level of food security. Therefore, in the Lake Naivasha Basin we observed food insecurity combined with high levels of vulnerability to food insecurity.

6. THE CAUSES OF FOOD INSECURITY

Table 9 summarised the most important factors affecting food insecurity, as reported by the interviewed households. They are organised by food security dimensions.

Table 9. Factors affecting of food insecurity by dimension

Food Availability	Economic access to food
- Drought and lack of rain	- High food prices
- Poor and lack of land	- Low income
- Human and wild animal conflicts	- Lack of jobs, unemployment or laziness
- Lack of inputs and their poor quality	- Household composition
- Lack of capital and Knowledge	Physical access to food
- Poor farming techniques, methods and strategies	- Far away markets
- Poor infrastructure especially roads	Utilisation
- Poor market access, transportation and relationship with brokers	- Diet composition
	- Health and House environment

Source: Authors' elaboration.

6.1 Food Availability and its determinants

One of the most important reasons of food insecurity reported by the survey's respondent households was the lack of food due to the unavailability of agricultural products, the sale of households' production to cover other needs, instead of saving. The lack of food was reported as a problem of rural areas only. According to the perception of our survey respondents, households in towns do not suffer from this shortages.

The lacking food items declared were:

- Maize, Potatoes, cabbage, beans, and traditional vegetables in Lower Nyamathi;
- Vegetables, rice, fruits and cabbages in Ngano-Ini;
- Maize, vegetables, potatoes, beans and kales in Gathengera;
- Green bananas, rice, meet, flour, vegetables and kales in Leleshwa.

Overall, we observed a lack of traditional species, especially kales, as well as of some important staple foods like maize and potatoes or vegetables that are an important in terms of micronutrients supply.

6.1.1. Drought, lack of access to water for irrigation and land

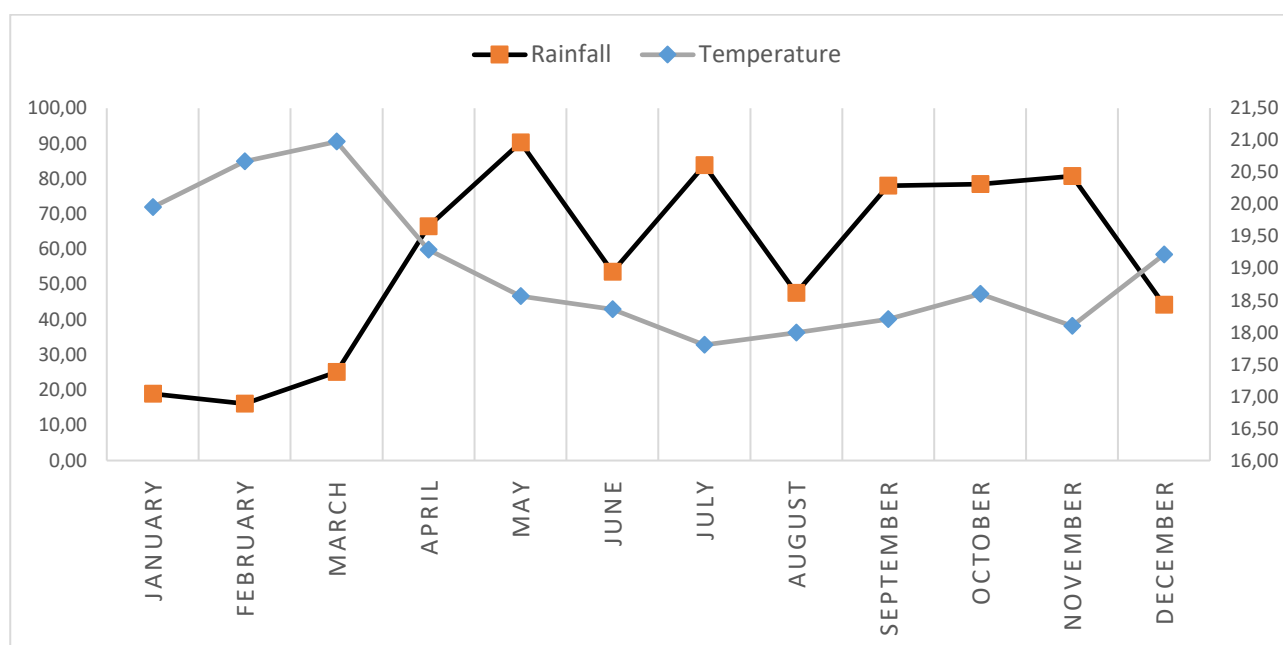
Drought, lack of rain and water were indicated as the most important determinants of food unavailability in the seven considered areas. The respondents highlighted the negative effect on subsistence agriculture of little rainfall, due to the prologue dry season, unpredictable weather and climate change. With no rain, the planted crops fail, contributing to food shortage. The respondents

in all areas highlighted the need for water to produce food, included the commercial production, and that lack of water, especially piped water, makes farming strongly dependent on rain and, therefore, highly vulnerable to the seasonal drought and the registered unpredictable weather conditions. In this situation, planning farming has been declared as difficult.

In the investigated areas, the interviewed households also reported the broken communities' boreholes and the lack of storage tanks as factors limiting water access.

In the interpretation of the feedback provided by the survey respondents, we need to consider that the questionnaire was submitted in February, during the drought season that lasts from December to March and is characterised by high temperature and low rainfall (Figure 8).

Figure 8. Average five-year rainfall and temperature in Nakuru County



Source: Authors' elaboration of the NOAA (National Oceanic and Atmosphere Administration) - US National Centers for Environmental Information data of Nakuru station¹².

The vulnerability of the agricultural sector is reported to be accentuated by lack of water for irrigating crops, especially piped water. The lack of water makes the farming sector strongly dependent on rain. Food availability is also compromised by lack of land to farm, or its low acreage, its infertility and lack of money to lease land.

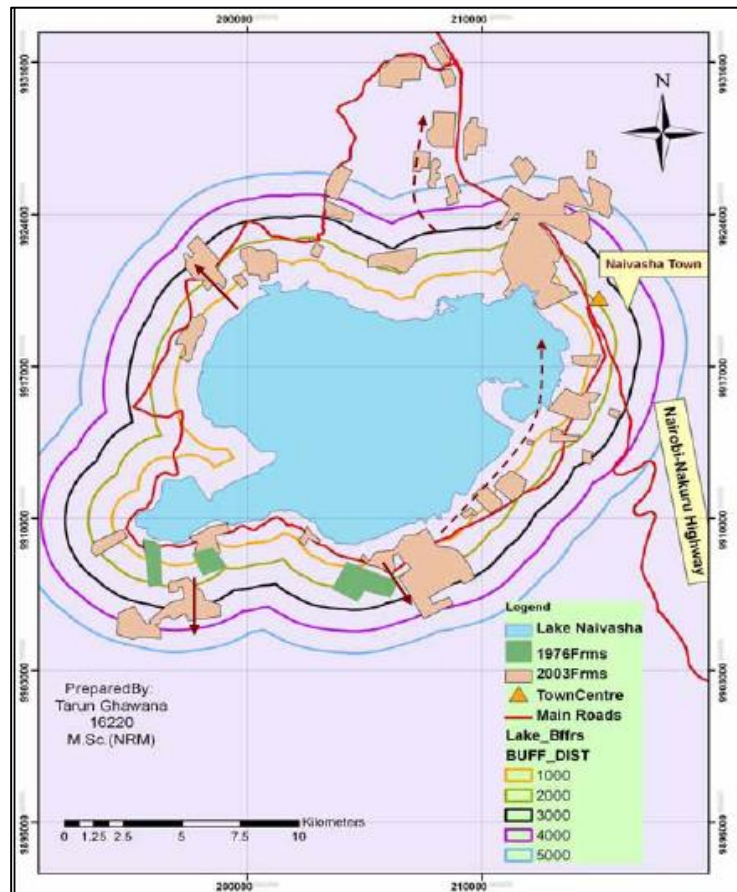
The lack of land and water for irrigation is strongly rooted in the evolution of the floriculture, which provides a first indication of the impact of the sector on food security and livelihoods. In 1930-40s, farming for fodder crops was the only activity and, by the late 1950s, the dominant crop was Lucerne. The flower farm sector in Naivasha was born in 1975 with Sulmac that became the largest world

¹²<https://www7.ncdc.noaa.gov/CDO/cdo>. Accessible on April 2018.

producer of Carnation. However, the boom of this sector started in 1980s, with its expansion in the in Southern area around the lake, where land close to its shore was available (Odada, 2006). Availability of and easy access to fresh water resources for irrigation, the possibility of large farms for large-scale commercial production, the soils and climate conducive for horticultural production and the proximity to Jomo Kenyatta International Airport are among the major factors that stimulated the establishment and growth of the sectors.

Over time, the sector shows three different expansionary paths (Ghawana, 2008). The solid lines in Figure 9 shows a movement from the lake shores to the inner territory, that might be due to lack of land around the lake. More sophisticate production techniques, such as the greenhouses, facilitated this movement. The dotted arrows indicate the other two directions of expansion, up towards North-East and South- East side. Two are the possible reasons of these movements. Both results from lack of land around the lake, a situation that promoted a movement towards the Nairobi-Nakuru Highway, with the advantage of a fast and easy transportation of the produce to Nairobi, and another towards the Naivasha town, with the improvement of the access to supermarkets, fuel stations and banks in addition to the proximity to the Nairobi-Nakuru Highway.

Figure 9. Floriculture expansionary paths in Naivasha lake



Source: Ghawana, 2008

The expansion of the floriculture investments combined with other private investments in tourism and other sectors progressively closed down water access corridors forcing the original land users to search for alternative livelihood opportunities. A study by Kigingia et al. (2016) describes the case of Maasai. In the 1970s, the Government forced off this pastoral community from the today Hell's Gate Park for conservation reasons. Outside the park area, the abovementioned investment limited the access to the Lake Naivasha water to the Maasai animals.

Moreover, the cultivation of flowers competes with local food production not only due to the process of conversion of land, but also due to the access to water which is the most important factor to make land arable and productive. To this purpose, some companies started to combine floriculture with horticulture as business idea in an area where land acquisition persists and people are struggling to produce and access adequate food. However, land, water and labour are the only used local factors of production, whereas all the other inputs are imported from Europe, Middle East and Asia and almost the totality of the production is exported. This factors makes the floriculture sector an enclave.

Concerning competition over resources, a final aspect underlined by the survey's respondents as a factor affecting food availability is the human and wild animal conflict over land and water.

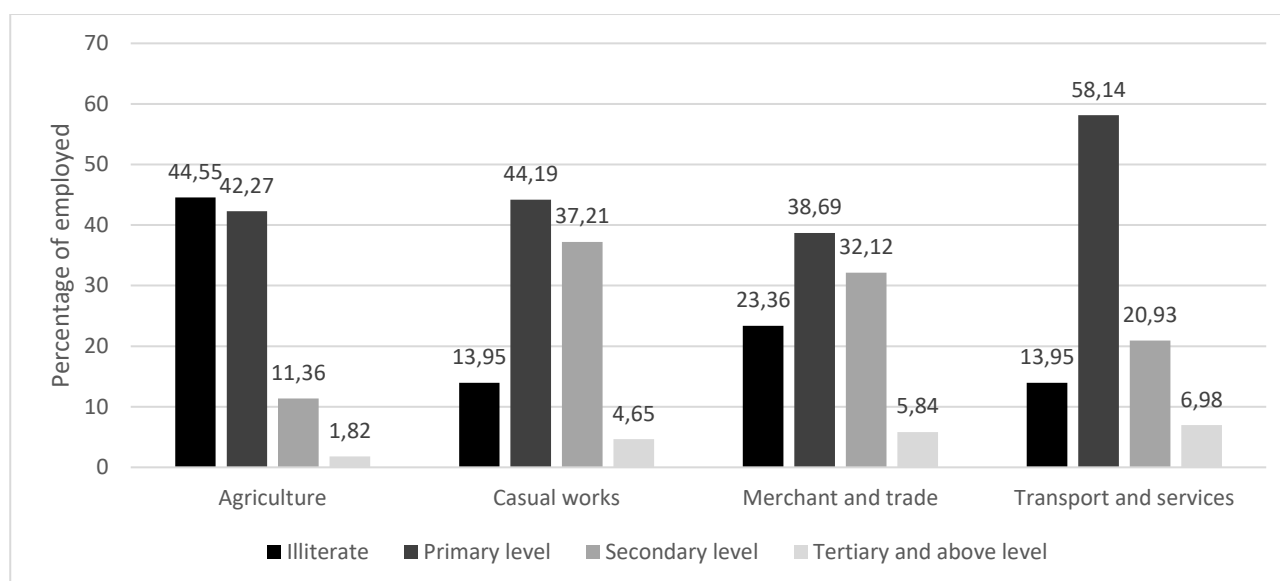
6.1.2. Lack of factors of production

Lack of access to inputs, especially to seeds and fertilisers, is another problem at the basis of food production and productivity reported by the survey respondents. This is due to lack of money or because they are not available on the market or because their price is too high. The households also indicated the low quality of the available inputs as a factor limiting agricultural productivity. This is an important aspect not only because the investigated area is semi-arid and exposed to climate change, but also because pest attacks and crop diseases are frequent. To this purpose, the survey respondents declare that diseases affect especially maize in some areas such as Lower Nyamathi and Kanjogu, where this issue lets the areas without maize produce for many households.

This situation combines with lack of capital and especially of human capital. The educational level of the household head is generally low in the investigated area, where 35 percent of them are illiterate and 40.90 percent have achieved the primary level, that is the currently mandatory educational level. Only 19.00 percent of the household heads possess a secondary level education, while 5.10 percent of them have a tertiary education or above.

Figure 10 shows that agriculture engages the less educated people compared to the other sectors such as casual works, merchant and trade, and transport and services.

Figure 10. Educational level by sector



Source: Authors' elaboration.

The interviewed households reported illiteracy, lack of enough or proper education as the most important factor at the basis of lack of ability for better farming and, more broadly, lack of business ideas. These limitations combined with lack of capital and investment capability, are at the basis of the adoption of poor farming techniques, methods, and strategies, among which lack of diversification in farming and low quantities of food stored by the poor households.

6.1.3. Poor Market and Infrastructure

Poor markets for food products and infrastructures are another problem reported by our respondents concerning food availability. Limited or lack of access to markets, especially for the high distance from them, poor roads, lack of electricity, fuel and transportation challenges are among the most indicated problems.

In particular, the survey respondents' view converged towards the fact that the underdeveloped secondary road network does not allow to connect the area where they live and work to the main roads. This latter issue makes the access to markets for selling product limited, compromising a possible additional source of income.

Market access, and more precisely too distant markets, was indicated as a constraint also to physical access to food.

In addition, in Leleshwa, it was also reported the role of business people who exploit monopoly in the area and set their own prices to benefit themselves. In Kanjogu, households reported the fear of

being connected by middlemen when selling and of being exploited by brokers as a limitation to access to market and therefore to improve their income and food security.

The market conditions and lack of production due to the dry season are the two most important factors affecting food price volatility we reported in the investigated area (Table 10).

Table 10. Market efficiency price

Cluster	Maize	Rice	Sweet potatoes	Cabbages	Tomatoes	Kales	Cluster efficiency
Kiburuti	0.35	0.15	0.72	0.61	0.28	0.46	0.43
Leleshwa	0.25	0.2	0.60	0.53	0.19	0.46	0.37
Ngano-Ini	0.25	0.12	0.60	0.56	0.23	0.33	0.35
Gathengera	0.31	0.11	0.33	0.48	0.21	0.42	0.31
Lower Nyamathi	0.28	0.13	1.15	0.44	0.28	0.57	0.48
Tumaini	0.22	0.14	0.49	0.67	0.12	0.49	0.36
Kanjogu	0.16	0.12	1.25	0.69	0.23	0.52	0.50
Crop efficiency	0.26	0.14	0.73	0.57	0.22	0.46	

Source: Authors' elaboration. Note: values are the coefficient of variation of the average price for each crop.

We found a relatively higher market price variability is in Kanjogu (0.50) and Lower Nyamathi (0.49). This variability is particularly influenced by the sweet potatoes price. Concerning crops, also cabbages and kales show a high price variability with respect to the other food items. In other words, the list of food items indicated by the survey respondent as lacking in February are those with the highest price volatility. As we previously noted they are important staple foods. Therefore, the vulnerability of households to food insecurity is fuelled not only by lack of food but also by the exposure to food price volatility.

6.2 Access to food

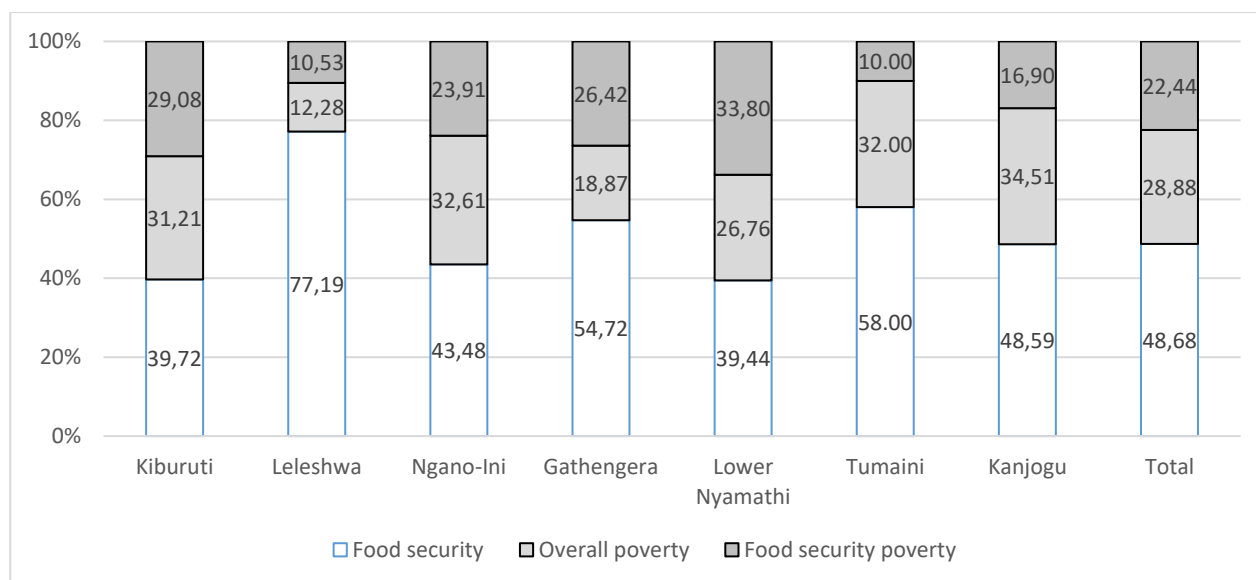
According to the survey's respondents, household economic access to food is compromised by high food prices, poverty, and low income exacerbated by the state of the labour market where jobs are lacking and unemployment is high. In addition, in some areas laziness was indicated as a cause of lack of income and therefore of food insecurity.

6.2.1. Poverty status

According to the adult equivalent household expenditure, 48.68 percent of the households in our sample are above the poverty line (3,252 KSh) and can, therefore, be considered with an adequate access to food; 28.88 percent of the households of our sample is between the overall poverty line and the food poverty line (1,954 KSh). These households can be considered moderately food insecure. They have an income adequate to access enough food, but food absorbs the majority of their income

and exposes them to price and income shocks. Finally, 22.44 percent of the households have an income below the food poverty line, meaning that their income is not adequate to guarantee food security, or, in other words, are severely food insecure (Figure 11).

Figure 11. Poverty status



Source: Authors' elaboration.

This situation deteriorates in Kiburuti, where we have 29.08 percent of the households below the food poverty line and in Lower Nyamathi with 33.8 percent of the households in this state. On the contrary, more than half of the households are above the poverty line in Leleshwa (77.19 percent), Tumaini (58 percent) and Gathengera (54.72 percent).

In these three clusters we also noted a lower gap between the first and the fifth quintile of income (Table 12).

Table 12. Quintile distribution of income

Cluster	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	Ratio of
						1 st quintile/5 st quintile
Kiburuti	1,245	2,369	3,289	4,614	11,785	10.56 %
Leleshwa	1,491	2,618	3,356	4,724	16,377	9.11 %
Ngano-Ini	1,300	2,486	3,201	4,308	8,449	15.38 %
Gathengera	1,277	2,309	3,434	4,444	16,450	7.76 %
Lower Nyamathi	1,060	2,319	3,158	4,342	9,637	11.00 %
Tumaini	1,190	2,458	3,047	4,518	22,386	5.32 %
Kanjogu	1,252	2,331	3,222	4,513	11,532	10.86 %
Total	1,240	2,375	3,241	4,524	13,139	9.44 %

Source: Authors' elaboration. Note: values are in KSh.

We investigated the possible reasons of the different income situation at the cluster level analysis.

6.2.2. *The labour income*

In the overall sample, workers are mainly involved in agriculture (46.64 percent) or in casual works in the commercial farms (26.39 percent) (Table 17). They are also engaged, to a less extent, as merchants and traders (7.75 percent), and in the transport and service sector (7.18 percent).

However, this picture change among clusters. In Leleshwa and Tumaini there is a notable prevalence of casual workers because of the rural settlements created by the floriculture, whereas in Gathengera people are distributed around agriculture and casual works. In the remaining clusters, the agricultural engagement prevails on casual works (Table 13). Therefore, agriculture, especially small-scale farming, and casual works are the two most important sector in terms of employment.

Table 13. Percentage of people employed by sector

Sector	Kiburuti	Leleshwa	Ngano-Ini	Gathengera	Lower Nyamathi	Tumaini	Kanjogu	Total
Agriculture	57.39	-	60.94	42.11	46.67	2.78	63.51	46.64
Livestock	2.27	2.47	-	1.32	2.50	-	1.42	1.50
Fishing	-	1.23	-	-	-	11.11	-	1.04
Craftsman and industry	2.84	3.70	8.59	2.63	7.50	-	2.84	4.17
Casual works	24.43	65.43	12.50	32.89	19.17	52.78	14.22	26.39
Merchant and trade	4.55	3.70	8.59	9.21	10.00	16.67	6.64	7.75
Transport and services	5.68	12.35	3.91	7.89	6.67	11.11	7.11	7.18
Civil servant	-	3.70	-	1.32	0.83	1.39	-	0.69
Teaching works	-	1.23	2.34	-	1.67	1.39	1.42	1.16
Pension	-	-	0.78	-	0.83	-	0.47	0.35
Other activities	2.84	6.17	2.34	2.63	4.17	2.78	2.37	3.13

Source: Authors' elaboration.

Despite the importance of the agriculture in terms of employment generation, the income provided by the sector is not enough to ensure an adequate level of food security. It is generally low compared to those of other sectors (Table 14). Gathengera is the only cluster where the adult equivalent labour income provided by agriculture is higher than those provided by casual workers.

However, when the adult equivalent labour income from the casual labour is below the food security line, households compensate it with the agricultural income, making this activity strategic in terms of food security, particularly for the most vulnerable households. This situation is verified especially in Kiburuti, Ngano-Ini, Lower Nyamathi and Kanjogu. In the first three clusters, the total adult equivalent labour income is below the overall poverty line. On the contrary, in Lower Nyamathi this threshold is overcome due to income diversification.

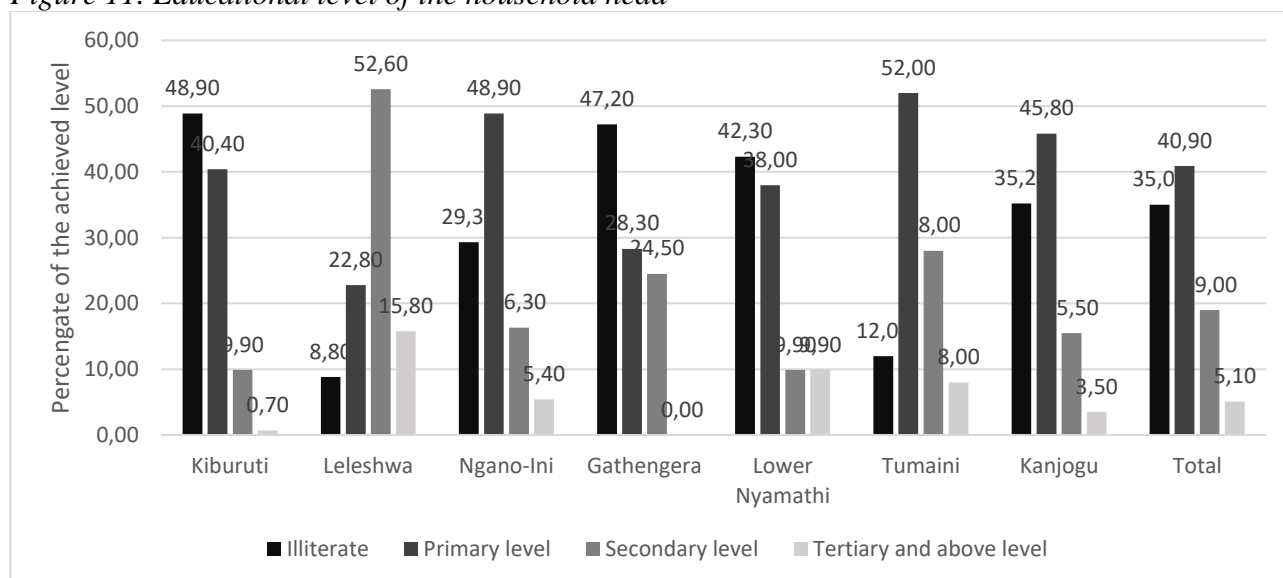
Table 14. Average adult equivalent household labour income for each sector (KSh)

Sector	Kiburuti	Leleshwa	Ngano-Ini	Gathengera	Lower Nyamathi	Tumaini	Kanjogu	Total
Agriculture	1,067	-	609	1,602	545	90	1,148	821
Livestock	133	357	33	124	217	-	127	135
Fishing	-	1,132	-	-	-	1,134	-	200
Craftsman and industry	90	157	515	75	378	-	47	176
Casual works	571	4,007	520	1,106	672	2,191	598	1,085
Merchant and trade	85	366	665	444	743	1,239	434	485
Transport and services	350	931	182	322	522	855	297	426
Civil servant	-	268	-	71	74	260	-	62
Teaching works	-	-	247	-	69	-	62	60
Pension	-	-	-	-	-	-	25	6
Other activities	73	588	132	129	67	91	-	119
Total income	2,368	7,807	2,903	3,872	3,286	5,861	2,738	3,575

Source: Authors' elaboration.

Table 14 also shows that, despite the flower sector provides a at least the compulsory minimum salary to the casual workers, when it is computed as adult equivalent it is below the food poverty line with the exception of Leleshwa. In Leleshwa we also found more than 50 percent of the household heads with a secondary level of education (Figure 11).

Figure 11. Educational level of the household head



Source: Authors' elaboration.

This fact highlights the link between the educational level and income. Illiterate workers meet a greater difficulty to enter in the better paid jobs, such as casual labour. On the contrary, the most educated workers (tertiary level and above) could further diversify their income in sectors such as merchant and trade, and transport and services, where they could even develop their own small business.

6.2.3. *The income gender gap*

According to the survey's respondents, households headed by female are more vulnerable to food insecurity than those headed by man.

On this aspect, we noted that in our sample female employment dominates in two sectors, i.e. agriculture and teaching works (Table 15).

Table 15. Percentage of male and female employed in each sector

Sector	Male	Female
Agriculture	36.48	63.52
Livestock	92.31	7.69
Fishing	100.00	-
Craftsman and industry	97.22	2.78
Casual works	65.35	34.65
Merchant and trade	59.70	40.30
Transport and services	74.19	25.81
Civil servant	66.67	33.33
Teaching works	40.00	60.00
Pension	100.00	-
Other activities	66.67	33.33

Source: Authors' elaboration.

In terms of labour income, female are therefore mainly involved in the less paid sector, namely agriculture (Table 16).

Moreover, in all sectors female workers are paid less than male workers (Table 16).

Table 16. Average labour income by gender

Sector	Total				Male				Female			
	<i>Average</i>	<i>St. dev.</i>	<i>Min.</i>	<i>Max.</i>	<i>Average</i>	<i>St. dev.</i>	<i>Min.</i>	<i>Max.</i>	<i>Average</i>	<i>St. dev.</i>	<i>Min.</i>	<i>Max.</i>
Agriculture	2,420	6,669	0	80,000	3,253	8,837	0	80,000	1,941	4,978	0	50,000
Casual works	10,579	11,601	0	50,000	11,675	12,684	0	50,000	8,956	9,784	0	32,000
Merchant and trade	7,212	5,119	0	34,000	7,378	5,717	0	34,000	6,898	3,751	0	15,000
Transport and services	9,134	11,026	0	60,000	8,724	9,581	0	45,000	10,313	14,732	0	60,000

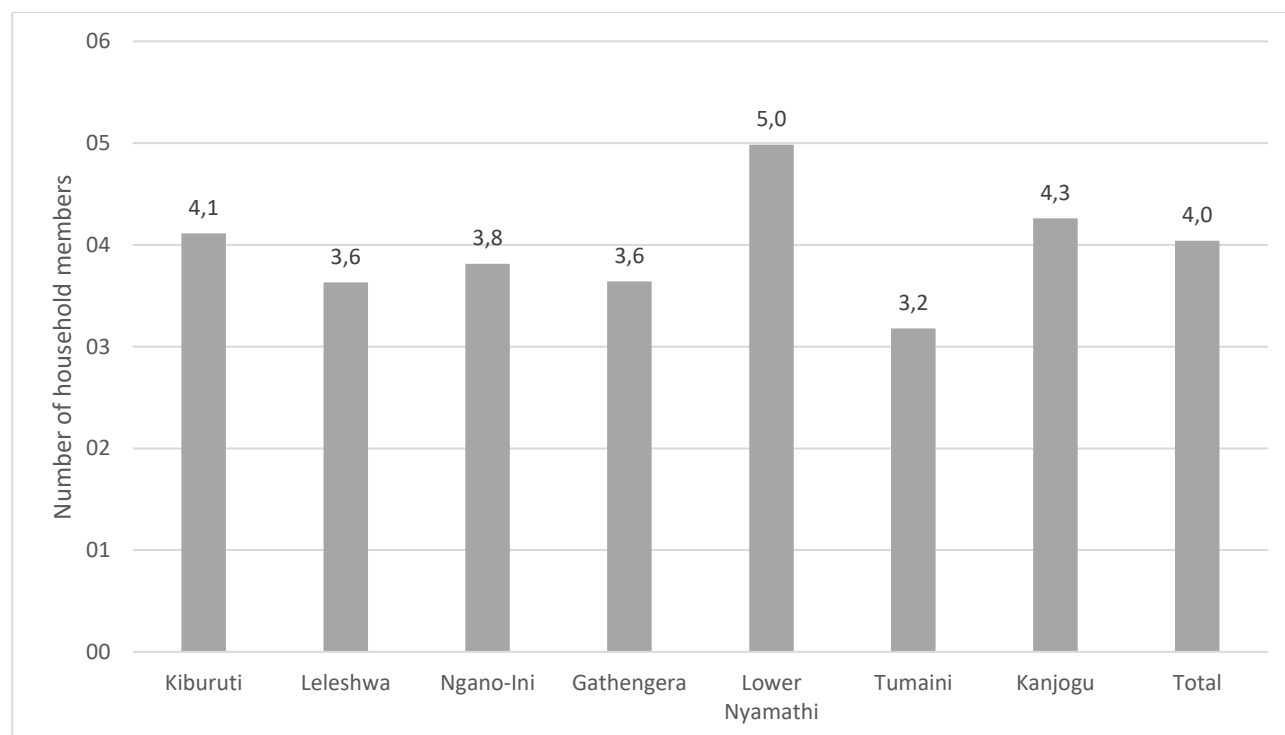
Source: Authors' elaboration.

Only the female workers engaged in the transports and services sector earn more than male workers, but, as shown by Table 19, their participation in this sector is around 25.81 percent. Thus, when in the household the percentage of female workers is high, the household labour income is relatively low.

6.2.4. *The household composition and unemployment*

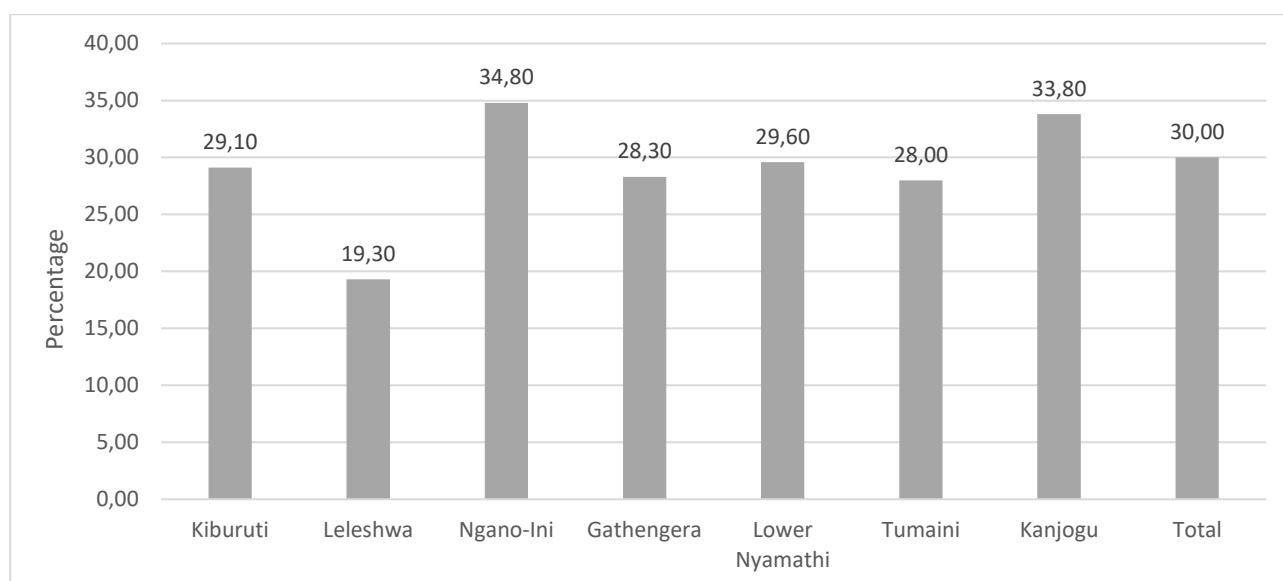
The average household size in the investigated area is of 4 members (Figure 12) and the household head is mainly male, around 70 per cent, except for Leleshwa, where the number of households with a male head is around 79 per cent (Figure 13). Moreover, on average, the household head is 51 years old, but in the areas of Leleshwa and Tumaini this age is lower than the average (Figure 14).

Figure 12. Average household size



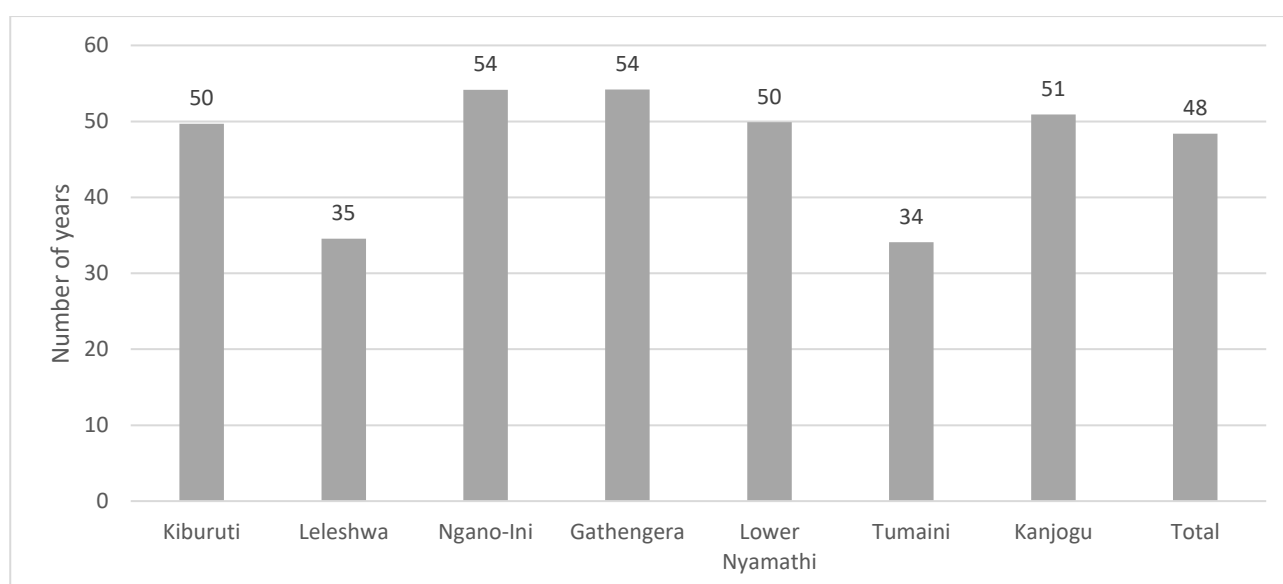
Source: Authors' elaboration

Figure 13. Percentage of female household head



Source: Authors' elaboration

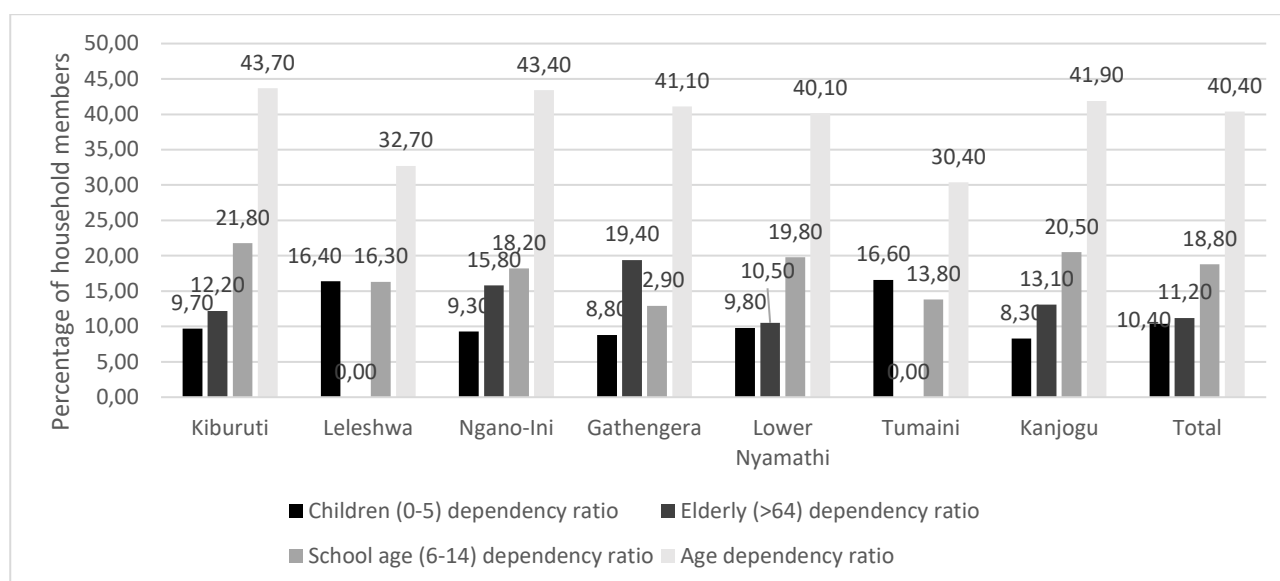
Figure 14. Average number of years of household head



Source: Authors' elaboration

Therefore, the settlements in Leleshwa and Tumaini are characterised by younger households than those in the other clusters and, for this reason, they have a smaller average size. More precisely, we noted that the households in Leleshwa and Tumaini are without elderly people. On the contrary, they include a relatively higher number of children (Figure 15). The lower household size in Leleshwa and Tumaini explains, at least in part, the higher adult equivalent labour income.

Figure 15. Percentage of the average dependency ratio



Source: Authors' elaboration

Turning to the dependency ratio, we noted that the high share of dependent members in the households (around 40 percent) is due to the high prevalence of school age youth. Therefore, in the investigated area, we expect an increase in labour supply in the forthcoming years setting the problem of the absorption capacity of the commercial farms, a sector that, despite its labour-intensive feature, is not employing all the working population and due to its enclave structure is not stimulating the local economy. Therefore, we might expect an increase in the current level of unemployment at 24.51 percent in the overall area¹³ and a pressure on the level of poverty and food insecurity.

Finally, survey's respondents indicated the high demographic pressure indicated in Kanjogu and Tumaini as a determinant of food insecurity. In particular, in Tumaini the issue was related to the high number of early pregnancies where most of these women are single mother and they are not able to provide for their children.

6.2.5. The GINI index and its decomposition

According to our estimate, the level of inequality in the rural Lake Naivasha Basin is higher than at the national level: 0.6571 against 0.368¹⁴.

¹³ We calculated the unemployment rate referring to our sample as the rate of the working age population (15-64 years old) that declared to be employed. At the cluster level the unemployment rate resulted: 31.44 percent in Kiburuti; 22.95 percent in Leleshwa; 25.00 percent in Ngano-Ini; 22.81 percent in Gathengera; 21.84 percent in Lower Nyamathi; 17.65 percent in Tumaini; 22.89 percent in Kanjogu.

¹⁴ <http://inequalities.sidint.net/kenya/abridged/gini-coefficient/>. Accessible on April 2018.

We used the GINI decomposition of the adult equivalent labour income to understand which sectors mainly affect the income inequality. In this respect, Table 17 confirms the primacy of the casual and agricultural sectors. An increase by 1 per cent of income in these sectors produces a reduction of the level of inequality by 0.0049 and -0.0582 respectively. However, also an increase in income of the craftsman and industry and pension can contribute to the reduction of income inequality. At the opposite, despite merchant and trade, and transport and services are two important economic sectors in terms of income diversification, an increase in income raises inequality.

Table 17. GINI decomposition of the adult equivalent labour income

Source	Sk	Gk	Rk	Share	% Change
Agriculture	0.2297	0.9054	0.7102	0.2247	-0.0049
Livestock	0.0379	0.9845	0.7613	0.0432	0.0053
Fishing	0.0560	0.9942	0.8996	0.0762	0.0202
Craftsman and industry	0.0491	0.9724	0.6338	0.0461	-0.0031
Casual works	0.3035	0.8175	0.6498	0.2454	-0.0582
Merchant and trade	0.1356	0.9488	0.7861	0.1540	0.0183
Transport and services	0.1192	0.9565	0.7561	0.1312	0.0120
Civil servant	0.0172	0.9923	0.7615	0.0198	0.0026
Teaching works	0.0168	0.9949	0.7786	0.0198	0.0030
Pension	0.0016	0.9983	0.3025	0.0007	-0.0009
Other activities	0.0333	0.9878	0.7773	0.0389	0.0056
Total income		0.6571			

Source: Authors' elaboration.

6.3 Food utilisation

6.3.1. Food and non-food expenditure

Table 18 shows the food and non-food basket by item and category of income defined by the overall poverty line and food poverty line. The average adult equivalent household expenditure is 7,873 KSh for the food secure households, 2,674 for the moderately food insecure, and 1,306 for the severely food insecure. The expenditure of this last category of households is 16.6 percent that of the food secure households. In other words, there is a big gap between the expenditure capacities of the food secure and insecure category of households.

Table 18. Average adult equivalent household expenditure in KSh and percentage share of total expenditure in brackets

Expenditure item	Food secure	Moderately food insecure	Severely food insecure
Cereals	916 (11.63)	684 (25.58)	390 (29.85)
Tubers	267 (3.39)	227 (8.48)	140 (10.74)
Legumes and nuts	29 (0.37)	7 (0.27)	4 (0.31)

Expenditure item	Food secure	Moderately food insecure	Severely food insecure
Vegetables	402 (5.11)	206 (7.72)	122 (9.33)
Fruits	34 (0.43)	17 (0.62)	7 (0.56)
Animal protein (meat, fish, eggs, milk and dairy products)	9 (0.12)	0 (0.01)	
Traditional species	266 (3.38)	153 (5.74)	94 (7.19)
Total food expenditure	1,924 (24.43)	1,294 (48.41)	757 (57.97)
Soap and HH items (e.g. toothpaste, cutlery)	613 (7.79)	346 (12.96)	155 (11.83)
Transport	574 (7.29)	128 (4.78)	62 (4.77)
Fuel(wood, paraffin, etc.)	412 (5.24)	202 (7.54)	86 (6.56)
Communication (phone)	121 (1.54)	15 (0.57)	19 (1.44)
Airtime (money transfer)	394 (5.00)	171 (6.38)	75 (5.75)
Radio	47 (0.60)	11 (0.42)	1 (0.11)
Medical expenses and health care	1,084 (13.77)	95 (3.56)	31 (2.34)
Clothing and shoes	161 (2.05)	44 (1.66)	12 (0.92)
Education, school, fees, uniform	1,936 (24.58)	291 (10.90)	78 (6.00)
Celebrations and social events	81 (1.03)	5 (0.20)	2 (0.18)
Constructions and house repairs	366 (4.65)	2 (0.08)	2 (0.16)
Electronics (fridge, micro waves)	13 (0.17)		
Water purchase	3 (0.04)	1 (0.03)	0 (0.03)
Housing rent expenditure	143 (1.81)	67 (2.51)	25 (1.95)
Total non-food expenditure	5,950 (75.57)	1,379 (51.59)	549 (42.03)
Total household expenditure	7,873 (100)	2,674 (100)	1,306 (100)

Source: Authors' elaboration.

Our results confirm the Engel law, in the sense that the food expenditure share raises at the increase in the poverty status. This share is 24.43 percent for an average food secure household and becomes 48.41 percent for a moderate food insecure household and reaches the 57 percent for a severely food insecure household.

In comparison to the food secure, the share of food expenditure of the severely food insecure households strengthen around cereals, tubers, vegetable, and traditional species. In addition, the animal proteins dramatically reduce at the increase in the food insecurity status of the household till being eliminated from the diet of those severely food insecure.

Moreover, with respect to the other household typologies, the severely food insecure households reduce significantly the share of expenditures in human capital (health and education), housing (construction, house repairs, electronics, and radio) and social capital (Celebrations and social events).

6.3.2. *The traditional species*

There is no official definition and common understanding of traditional species in the investigated area¹⁵.

According to some households, traditional species are foods associated to a certain tribe or community and the majority of them are staple foods.

Others suggest that the term traditional species in some instances is a misnomer. In most cases, it refers to indigenous species that were mostly “undomesticated” and could therefore be “foraged”. Over time, most of these species' germplasm has been harnessed and multiplied to the extent that the seeds can be bought and planted. Even under such circumstances, the vegetables retain the tag “traditional vegetables” since they retain their original characteristics and require very little (if any) complex agronomic husbandry. Some other traditional vegetables remain as “wild” vegetables and only spontaneously sprout when it rains.

We decided to consider as traditional species those crops that have been identified with this denomination by the respondents.

Table 19 provides the list of traditional species consumed in the investigated area with some of their features. In the first column we have reported the name of the items consumed indicating the different names in vernacular language provided by the survey respondents. In the second column, we provided the food groups and in the third if the species is wild or cultivated. In the fourth column we have indicated the reference ethnic group. The households in our sample are from 13 ethnic groups, despite the majority of them are Kikuyu (around 83.2%). The last column reports on some comments provided by the respondents.

¹⁵Jaenicke and Höschle-Zeledon (2006) defines them as neglected underutilized species: “those species with under-exploited potential for contribution to food security, health (nutritional/medicinal), income generation, and environmental services”.

Table 19. List of the traditional species consumed on February

Item	Food group	Wilde (W) or cultivated (C)	Ethnicity	Comments
Amaranth or Terere	Vegetable	WC	Kikuyu - Luhya - Kalenjin – Luo	Staple-food seasonal
Black Jack	Vegetable	W	Kikuyu - Luhya	
Black night shade or Managu or Night shade or Manawa	Vegetable	WC	Kikuyu - Kalenjin - Luhya - Luo – Kamba	Staple-food
Dhania or Ndania	Condiment	C	Urban people	Introduced crop
Hoho or Cuscutum	Condiment	C	Urban people	Introduced crop
Kahurur or Kahurura	Vegetable	WC	Kikuyu	Staple-food
Kales	Vegetable	C	Every community both rural and urban	Introduced crop
Kunde or Thoroko	Vegetable	C	Luhya - Luo – Kikuyu	Staple-food
Mathoroko	Vegetable	C	Kikuyu	Staple-food
Minji	Legume	C	Kikuyu mainly - Luhya - Luo – Kalenjin	Staple-food for kikuyu
Mrenda	Vegetable	WC	Luhya - other	Staple-food for Luhya
Nderemia or Nderema	Vegetable	WC	Luhya - Luo – Kikuyu	Staple-food
Nduma	Root	C	Luhya - Luo – Kikuyu	Staple-food mostly in rural area and wetland areas
Ngwache or Sweet potatoes	Tuber	C	Luhya - Kikuyu	Staple-food for Luhya
Njahi	Legume	C	Kikuyu mainly	Staple-food for kikuyu
Omena	Fish		Luo community	Fish from Victoria lake and not from Naivasha lake. Originally was for Luo but now It is one of the cheapest source of protein for the urban poor. It is easy to store because it is sun-dried; it has long shelf life compare to other fishes.
Pumpkin leaves or Pumpkin	Vegetable	WC	Kikuyu - Luhya - Luo – Kalenjin	Kikuyu use it to make Mukimo that is a staple-food for them
Saga or Saget or Sageti or Sagetti	Vegetable	WC	Luhya and Kalenjin	Staple-food
Thafi or Thafai or Stinging nettle	Vegetable	W	Kikuyu mainly	
Wandering jew or Wondering dew	Vegetable	W		
Viazi	Tuber, local variety of potato	C	Every community but mainly Kikuyu	Staple food

Source: Authors' elaboration.

The majority of households in our sample consumes Kales. They are more than 90 percent in Leleshwa, Tumaini and Kanjogu (Table 20). Overall, the households in Ngano-Ini show the most diversified consumption of traditional species (13).

Table 20. Percentage of households consuming traditional species by category

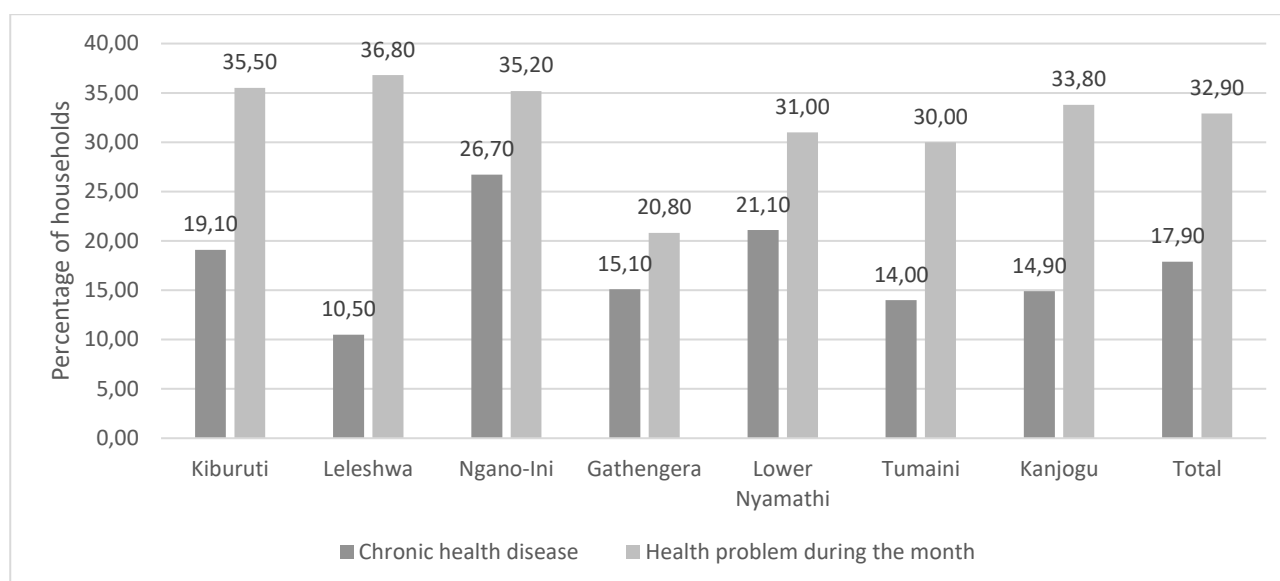
Crop	Kiburuti	Leleshwa	Ngano-Ini	Gathengera	Lower Nyamathi	Tumaini	Kanjogu	Total
Amaranth	4.26	5.26	3.26	1.89	2.82	10.00	3.52	4.13
Black jack	-	-	1.09	-	-	-	-	0.17
Black night shade	7.09	7.02	11.96	1.89	1.41	12.00	7.04	7.10
Dhania	-	-	-	1.89	-	-	-	0.17
Hoho	-	-	-	-	-	-	0.70	0.17
Kahurur	0.71	-	1.09	1.89	-	-	1.41	0.83
Kales	75.89	96.49	83.70	73.58	85.92	96.00	90.85	85.15
Kunde	0.71	5.26	1.09	-	-	12.00	-	1.82
Mathoroko	-	-	-	-	-	-	0.70	0.17
Minji	-	-	1.09	-	-	-	-	0.17
Mrenda	-	-	-	-	-	2.00	-	0.17
Nderemia	0.71	-	-	-	-	-	-	0.17
Nduma	-	1.75	1.09	-	1.41	2.00	1.41	0.99
Ngwache	0.71	1.75	1.09	-	1.41	2.00	2.82	1.49
Njahi	-	-	-	-	1.41	-	0.70	0.33
Omena	-	-	-	1.89	-	-	-	0.17
Pumpkin leaves	-	1.75	-	-	-	2.00	0.70	0.50
Saga	0.71	1.75	2.17	-	-	8.00	-	1.32
Thafai	0.71	-	1.09	-	-	-	-	0.33
Wandering jew	-	-	1.09	-	-	-	-	0.17
Viazi	-	-	1.09	-	-	-	-	0.17

Source: Authors' elaboration.

6.3.3. Health status

Another cause of food insecurity indicated by the survey's respondents is the health status of the household members. Moreover, when the sick people need to be hospitalised, the bill is reported to be so high for their income that in order to afford it, the quality of diet is reduced. According to our data, the health problem is relevant in the Lake Naivasha Basin. 17.90 percent of the households have a member with a chronic disease and 32.90 percent of the households declared that at least one member was affected by a transitory health problem during February. This poor health status increases in Kiburuti, Leleshwa and Ngano-Ini (Figure 16).

Figure 16. Health status



Source: Authors' elaboration.

Another negative aspect highlighted concerns water quality. Lack of clean water was reported in Tumaini, Lower Nyamathi and Kanjogu. Especially in this latter area, some households indicated the presence of fluoride in water and its negative effect on bones and teeth problems as factors contributing to nutrition insecurity.

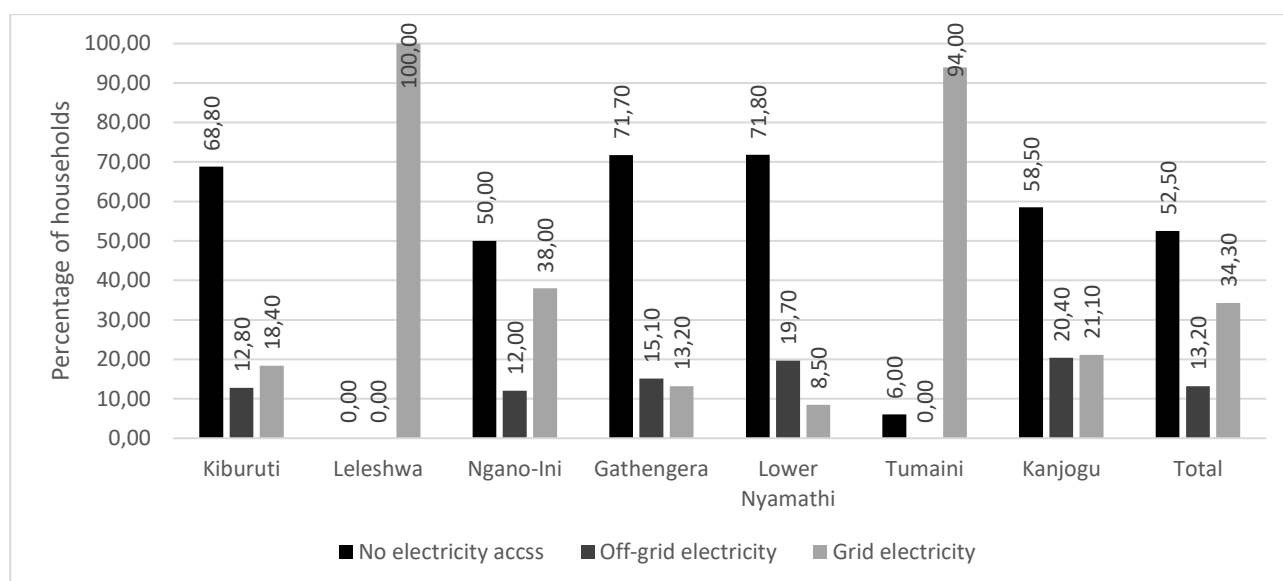
6.3.4. The Housing Infrastructural Status

As reported by respondents, the housing infrastructural status is overall poor with notable consequences on food security. Furthermore, our evidence confirms the objective sets by the Kenyan policy framework in terms of improvement of public health and domestic water supply¹⁶.

More than half of the population in the investigated area reported no access to electricity. This share increases to around 70 percent in Kiburuti, Gathengera and Lower Nyamathi. Only in Leleshwa and Tumaini more than 90 percent of the households have access to grid electricity (Figure 17). However, in these two clusters a large number of households does not own the house, which is mainly provided by the flower company.

¹⁶See the result 1 and 2 of the National Food and Nutrition Security Policy Implementation Framework 2017-2022.

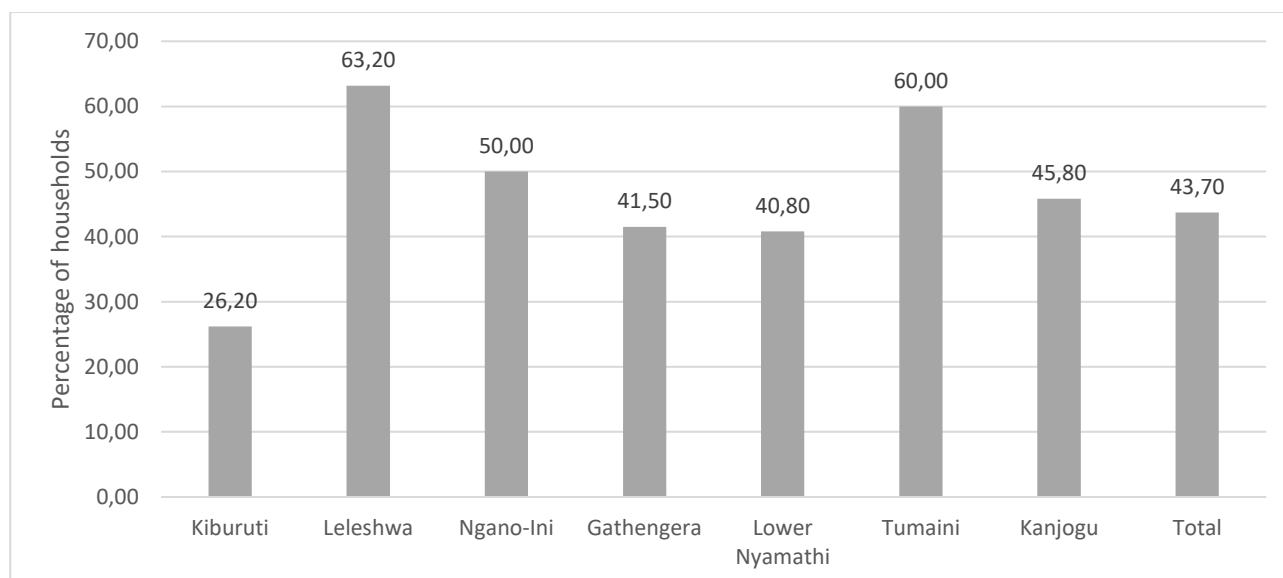
Figure 17. Percentage of households with access to electricity



Source: Authors' elaboration.

Similarly, less than half of the sample households has access to water (Figure 18). This share increases in Leleshwa and Tumaini, where it reaches the 60 percent of the households. The lowest access to water is in Kiburuti (26.20 percent of households).

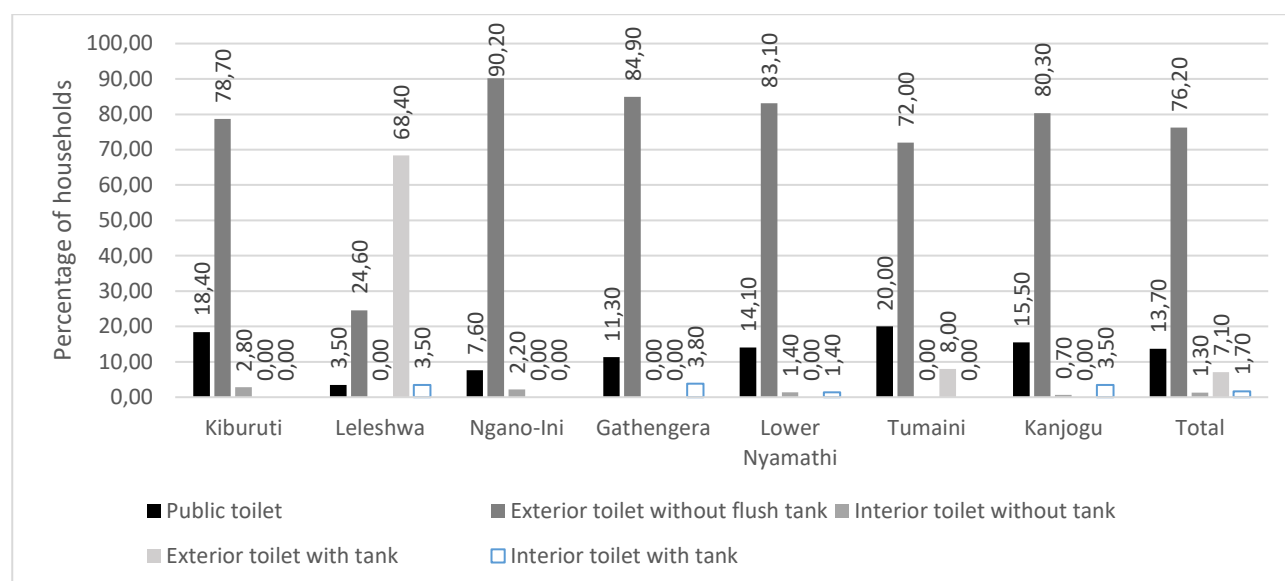
Figure 18. Percentage of households with access to water



Source: Authors' elaboration.

The sanitation facilities shows the worst situation. 76.20 percent of households live with an exterior toilet without tank and this is confirmed in all clusters, except in Leleshwa, where households have a tank in the exterior toilet but as previously highlighted, the houses are provided by the flower company (Figure 19).

Figure 19. Percentage of households with access to toilet facility



Source: Authors' elaboration.

7. CONCLUSIONS AND POLICY RECOMMENDATIONS

Our analysis, conducted on February 2018, shows that, despite the presence of an important economically flower cluster, food insecurity is a problem in the Lake Naivasha Basin. In addition to an important share of moderate and severely food insecure households, we noted a significant level of vulnerability to food insecurity among food secure households.

Our evidence indicates that this situation is the result of the effect of multiple factors, including the enclave structure of the commercial farming sector with limited linkages and positive spillover effects in the local economy, drought weather conditions combined with lack or limited access almost all production factors in the agricultural sector, a poor market for both agricultural produce and labour, and the household characteristics. The negative impact on households is transmitted in different ways, including economic and social factors, and on the production side, creating important barriers towards the achievement of food security. This confirms the priorities issues identified by the policy frameworks introduced in Kenya and in Nakuru County.

This situation calls for three typologies of actions referred to different time lengths. In the short term there is the urgent need to assist the food insecure households, especially the severely food insecure; within a mid-term horizon, interventions should prevent the households, primarily those vulnerable, to fall into the hunger state; finally, assuming a long term perspective, household's resilience of the vulnerable and food insecure households should be reinforced.

Our results also suggest the need for a new social contract for the Lake Naivasha Basin with which all the stakeholders, public and private, for their specific capacity and role, contribute to address the problem of food insecurity and vulnerability in order to reach the zero hunger target sets by the Sustainable Development Goals, starting from the development of the small-scale agriculture. From our results, it is evident that this sector is strategic to improve food security and poverty. In the Lake Naivasha Basin, agriculture is indeed not only a food supply sector, but it is also an important source of income, and creates the majority of the employment positions available in the area. The link between agriculture, food production and self-sufficiency is notable observed. Specifically, the interviewed households enter into the small-scale agricultural production when the adult equivalent labour income from the casual labour is not sufficient to achieve the household food security target and this is a widespread phenomenon. The labour demand from commercial farms alone is not sufficient to guarantee a high level of household income and consequently a food security status in the area. Small-scale agriculture is the only sector where, especially, the high share of illiterate people with limited or lack of access to production factors and infrastructure can easily find job opportunities. Therefore, this segment of agriculture can enter into a poverty trap process that might negatively affect a virtuous sustainable development process of the investigated area.

Therefore, the political objective of increasing the agricultural production and productivity of small-holder farmers find justification and the need for urgent actions.

Concerning possible interventions, our paper suggests some preliminary directions that should be carefully evaluated and designed.

As far as drought is concerned, the existing technological, policy and institutional measures to manage the risks connected to this phenomena should be strengthened in the area in order to avoid the ex-post negative effects for vulnerable households. Even more urgent is the repairing of the broken infrastructures, such as the damaged communities' boreholes and the creation of an adequate water storage capacity to improve water access.

Training farmers in soil and water conservation practices, supporting the introduction of tolerant varieties and a better exploitation of landscape variability based on improved knowledge of land and land use, appears to be another key option to strengthen farmers' capacity to adapt to and cope with drought.

Training farmers is of special importance also concerning how to do business. In this respect, a coordination between the flower-farming sector and the extension workers can be successful to strength farmers' capacity to adapt to and cope with drought and diversify their production and income. Some households in our sample reported the need for a more deep intervention by agricultural extension workers to allow farmers to adopt new methods of farming and to advise them on animal production. However, the involvement of the private sector is also important and should go beyond training to include supervision during the production phases favouring the technological transfer to local communities, till the evaluations of possible forms of out-grower floriculture or vegetable by small-holders farmers.

Our paper also highlights the need for policy interventions to address food price volatility for a better food and nutrition security. To this purpose, in addition to investing in agriculture production and productivity growth, other measures should be evaluated. Among them, there is the establishment of a system of protection of vulnerable consumers, market monitoring mechanisms, and market-base ensuring systems; the improvement of market efficiency and of the local food processing capacities. A final observation is related to traditional species. Our results show that they are important in the diet of the most insecure households. However, there is no common understanding on these species. Therefore, their promotion requires first of all the provision of a clear definition and the identification of the species on which to invest, underlining their contribution to achieve food security as well as ecological and social sustainability.

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