Bantering the Contributions of Irrigated Gardens In Filling the Food Availability Gaps Among the Communities of Kavango East Region, Namibia

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ABSTRACT: *The objective of this paper was to banter the contributions of irrigated gardens in filling the food availability gaps among the communities of Kavango East Region, Namibia. This paper was centred on a livelihood based analysis of the contribution of irrigated gardens in filling food availability gap left by the rain-fed harvest in Kavango East Region, Namibia.*

A study was conducted among 200 participants (100 households without gardens and 100 households with gardens) at 20 randomly selected villages and data was collected through the use of Livelihood Analysis framework, Income and Expenditure Pattern, Household Food Insecurity Access Scale Score (HFIAS), and Dietary Diversity Score (DDS). An open-ended and closed-ended questionnaire was used for data collection. The data was analysed by using SPSS, while for Household Food Insecurity Access Scale Score (HFIAS), and Dietary Diversity Score (DDS) data were analysed according to the procedures developed by FANTA. Households with a garden had more ability to fill the food availability gap left by the rain-fed harvest as compared to the households without gardens. Households with gardens were experiencing an improvement in their dietary diversity through irrigated gardening, as compared to households without an irrigated garden. However, the lack of markets and important inputs discourages the willingness to use the irrigated garden. The study recommends that the leadership of the Kavango East Region should promote the establishment of gardens by communities alongside market development, in order to enhance food availability.

Keywords: *Irrigated garden, food security, Climate Change, Food availability, Households*

I. INTRODUCTION

There were 852 million chronically hungry people (chronically 90% and acutely 10% undernourished) in the developing countries including Namibia, this number includes 37 million people living in industrialized countries under extreme poverty conditions (Food and Agriculture Organization [FAO], 2013). The FAO has highlighted a rise in the total number of undernourished over the past years which raise doubt regarding the proudly pronounced Millennium Development Goal No: 1 to halve, between 1990 and 2015, the proportion of people who suffer from hunger. This does not include the 2 billion people who suffer from hidden hunger (micronutrient deficiencies), primarily women with anaemia and iron deficiency, as well as 250 million children affected by iodine deficiency, the most common cause for mental retardation, or 250 million children suffering from sub-clinical Vitamin A deficiency, which decreases their capacity to fight disease and can lead to blindness (FAO, 2013).

According to the Government of the Republic of Namibia (2013), the Kavango East region is facing insufficient food for most of its community, especially in the rural areas since 2012. The same report indicates that this is attributed to climate change which induces in most cases drought and flood. The Government of the Republic of Namibia has been assisting climate change affected rural communities by distributing food consignment, to minimize the negative effects. This program is costly to the national budget and is done at the expense of other development priorities.

According to the Government of the Republic of Namibia (2015), food availability in Namibia is mostly affected by climate change. Farmers lack the resources to invest in irrigation or drought-resistant seeds. The lack of alternative income sources keeps the peasants in this risky activity. The lack of rain leads to harvest failure, which may result to food shortages. Some food assistance or other safety net measures were established, but these are often irregular and inadequate (Government of the Republic of Namibia, 2016). Availability of food means the possibility of feeding oneself and one's family, this can be directly from productive land (agriculture, animal husbandry, horticulture, fruit growing) or other natural resources e.g. fishing, hunting, and food gathering; or from fresh or

processed food obtained in markets and stores coming from sites both nearby and far from its production. Mendelsohn (2009), reports that results from the 1994 Income and Expenditure survey shows that only 17% of all Kavango farmers relied entirely on food that they produced themselves under dryland farming. However, low rainfall over the past years has made it very difficult for Kavango farmers to produce enough food.

Although the Government of the Republic of Namibia has been distributing food consignment to the climate change affected rural communities in the Kavango East Region, many communities have been complaining that the food consignment distributed to them is never enough, hence hunger and starvation still prevail (Government of the Republic of Namibia, 2016). Hunger can be defined in the context of energy-protein deficiency and vitamin-mineral deficiency. Lack of access to one or both of these is food insecurity. Food security has four pillars, which are: food availability; access to food; stability of food supply; and food utilization. However, this study only focused on food availability through irrigated gardening.

II. Literature Review

Understanding Food Security

According to the Government of the Republic of Namibia (2016), harvest prospects for 2015/2016 indicates significantly below average production as drought conditions intensify. The five years' average maize output was 64, 300 Metric Tonne, while the year 2016 maize output was 42, 700 Metric Tonne, which translates to the percentage reduction in the year 2016 to 34%. While the five years' average pearl millet output was 48, 000 Metric Tonne, while the percentage year 2016 maize output was 33, 000 Metric Tonne, which translates to the percentage reduction in the year 2016 to 32%. According to the above-stated report, the communal maize harvest is still expected to decrease by 38 percent below the five-year average of 64,300 MT next year 2017. However, Namibia has the capacity to meet its deficit through commercial imports, which makes it difficult for many rural communities to afford. This has influenced rural communities of Kavango East Region to resort to manual irrigated gardens as a strategy to produce food to compliment the inadequate yield from rain-feed (Government of the Republic of Namibia, 2016).

When combining the four pillars of food security, it gives us two which are an ability food production through own production; and accessibility to markets and ability to purchase food items (Bonti-Ankomah, 2001). Self-sufficiency in food production can be improved through gardening. Gardening refers to small scale cultivation of a range of food plants in gardens (van der Veen, 2005). This study focused mainly on food availability which is the first pillar of food security.

These are a number of regular behaviour responses that people apply to manage household food gap. The higher the index, the more food insecure a household is and as it goes lower this is indicative of an improvement in the household food security.

According to Kawana (2016), the problem identified is this that, rural communities of Kavango East Region have resorted to planting irrigated gardens along the Kavango River due to poor harvest experienced from their rain-fed crops for the past years. Some small villages such as Shighuru have established 101irrigated gardens. However, up to date, there is no scientific study conducted to investigate the role of irrigated gardens in filling the food gap left by the rain-fed harvest.

It is not known yet as to what extent these irrigated gardens contribute to the food gaps of those families in Kavango East Region. Since rain-fed harvests have been falling over the past years in the Kavango East Region, irrigated gardens along the Kavango River could be used as alternative sources of food for the rural drought-affected communities. According to Mendelsohn and Obeid (2006), Namibia viewed the river as a passing resource to be exploited. Thus, the river is perceived as a source of water for irrigation. A number of lodges and campsites have been developed by private individuals and companies, and some conservancies, but the leadership has paid little attention to encourage rural climate change affected communities to use water in the Kavango River to address food availability.

The main objective of this paper is to investigate the role of gardens in the attainment of food security in the Kavango East region of Namibia.

The sub-objective of this paper are:

- To investigate the contributions of irrigated gardens in filling the food availability gaps among the communities of Kavango East Region.

Food Security situation in Namibia

Many households in various parts of Namibia were reported to be facing food insecurity as a result of associated with the 2015/2016 El Niño effect which negatively impacted on the livelihoods and quality of lives. The whole agricultural production and water supply are affected by the drought. For the past 5 years, the total cereal production trend has been declining in the Kavango East Region, says the Government of the Republic of Namibia (2016).

Food Security situation in Kavango East Region

According to the Government of the Republic of Namibia (2016) since the start of the 2015/2016 rainfall season, the country received poor and below normal rainfall performance which was also the case in the previous season. The report further revealed that a significant delay in the onset of the rainfall season, erratic and insufficient rainfall patterns, as well as prolonged dry spells, was observed in the

season before the rainfall ended abruptly. The report further said that crop estimates showed a slight improvement on the last season's harvest but were still below the average production. The aggregate coarse grain indicated that the country noted a slight improvement in the harvest of 18% higher than the last season, but 31% below the average production. The slight improvement came as a result of a small increase in the harvest from most of the major crop producing regions, except the Zambezi and Oshana which were the regions most affected by drought during the year. Household food security remained weak in various parts of the country, as the recent agricultural production was too small to provide a significant improvement in the ailing food security.

The importance of irrigated gardens

FAO (2010) reported that a well-developed irrigated garden has the potential, when access to land and water is not a major limitation, to supply most of the non-staple foods that a family needs every day of the year, including roots and tubers, vegetables and fruit, legumes, herbs and spices, small animals and fish. Roots and tubers are rich in energy and legumes are important sources of protein, fat, iron and vitamins. Green leafy vegetables and yellow or orange-colored fruit provide essential vitamins and minerals, particularly folate, and vitamins A, E and C. Vegetables and fruit are a vital component of a healthy diet and should be eaten as part of every meal. Meat, chicken, and fish are good sources of protein, fat, and micronutrients, particularly iron and zinc (FAO, 2010).

Hussain and Clay (1999) said that the maintenance of this form of production, in the long run, is essential for its economic and nutritional merit. Again, the importance of gardens is further affirmed by the fact that in times of emergency, societies have had to return to the use of gardens to improve food security, as, for example, Irish potato gardens during the Great Depression (Hussain & Clay, 1999). Household food availability can be improved by engaging in food gardening like community gardening and irrigated gardening. Food gardening is an age-old tradition that is widely practiced although it is repeatedly undervalued and resisted by generations of public officials. Food gardening can provide a long-term solution to the dietary diversity of less privileged communities (United Nations Development Program [UNDP], 1996). Irrigated gardening is an affordable, sustainable long-term strategy to complement supplementation and food fortification programmes and nutrition education (Faber *et al*., 2007). Irrigated gardening produces crops for household consumption to improve the quality, diversity and nutrient content of diets (Faber et al., 2007).

The vegetables provide immediately accessible sources of micronutrients as they can be cultivated throughout the year, providing vitamins, trace elements and other bioactive compounds (Chadha & Olouch, 2003). Vegetables are a vital dietary component, not just as a side dish to add flavor to meals, but they release and make available bound micronutrients in some staple crops for effective absorption and utilization (Chadha & Olouch, 2003). Seasonal malnutrition accentuates already existing malnutrition. Gardens can help overcome the seasonal fluctuations in the availability of nutrients by staggering the planting of a mixture of early, average and late-maturing varieties. Garden projects need to be complemented with other interventions such as nutrition education and promotion and other development initiatives and basic hygiene (Sikhakhane, 2007).

The impact of climate change on food availability

Climate change threatens to exacerbate existing threats to food security and livelihoods due to a combination of factors that include the increasing frequency and intensity of climate hazards, diminishing agricultural yields and reduced production in vulnerable regions, rising health and sanitation risks, increasing water scarcity, and intensifying conflicts over scarce resources, which would lead to new humanitarian crises as well as increasing displacement (Intergovernmental Panel on Climate Change [IPCC], 2007). Climate change is expected to affect all of the components that influence food security: availability, access, stability, and utilization.

The overall availability of food is affected by changes in agricultural yields as well as changes in arable land. Changes in food production, together with other factors, could impact food prices, which would affect the ability of poor households to access food markets and could reduce dietary diversity. Extreme weather effects disrupt the stability of food supply as well as people's livelihoods. In extreme weather, such as floods and drought, as a result of climate change, would exacerbate this trend and could have a negative impact on livelihoods that depend on climate-sensitive activities such as rain-fed agriculture and livestock rearing (Schmidhuber & Tubiello, 2007).

The impact of climate change on food availability in Africa and SADC

The challenge of reaching sustainable food security and delivering on it through 2050 is daunting with an awkward starting point, in 2010, a world with unacceptable levels of poverty and deprivation, as is clear from the 2010 report on the Millennium Development Goals (Nelson *et al*., 2010). Climate change will affect all four dimensions of food security: food availability, food accessibility, food utilisation and food systems stability with direct impact on human health, livelihood assets, food production, and distribution channels, as well as changing purchasing power and market flows (FAO, 2008). Farmers in developing countries are already

seeing the effects of climate change daily with erratic weather patterns that directly affect food production (Trobe, 2002). In 1991 and 1992, cereal production in the Southern African Development Community (SADC) region was almost halved as a result of drought, and around 20 million out of 85 million people suffered food shortages (United Nations Environmental Programme [UNEP], 1999) Rural households tend to rely heavily on climate-sensitive resources such as local water supplies and agricultural land; climate-sensitive activities such as arable farming and livestock husbandry; and natural resources such as fuel-wood and wild herbs. This implies that climate change can reduce the availability of these local natural resources, limiting the options for rural households that depend on natural resources for consumption or trade (Hunter, 2011). Droughts and floods can also directly impact on health, where polluted water may be used for drinking and bathing, and this could spread infectious diseases such as typhoid, cholera, and gastroenteritis (Trobe, 2002).

Presently, there is little awareness about climate change and its impacts, and climate change issues are given a low priority in the face of competing and urgent priorities (Mitchell & Tanner, 2006). Information about the impacts of climate change on important sectors and systems in developing countries such as agriculture, forestry, fisheries, water resources, human health, human settlements, and ecological systems is inadequate for understanding key vulnerabilities and planning appropriate adaptive strategies (Leary & Kulkarni, 2007). Adaptation will include learning about risks, evaluating response options, creating the conditions that enable adaptation, mobilizing resources, implementing adaptations, and revising choices with new learning (Leary *et al.*, 2007). While climate change is seen as a relatively recent phenomenon, individuals and societies are used to adapting to a range of environmental and socio-economic stresses. In many parts of the world, and especially in semi-arid lands, there is an accumulated experience with phenomena such as drought and the flood.

As climate extremes are predicted to increase in frequency and intensity in future, it is important to understand and learn from relevant past adaptations and indigenous knowledge systems (Intergovernmental Panel on Climate Change [IPCC], 2007). However, changes in climate variability and mean values will bring additional complications to many, especially those dependent on food systems that are particularly vulnerable to these additional stresses (Guijit, 2007).

Understanding the specific impacts of climate change on food security is challenging because vulnerabilities are unevenly spread across the world and ultimately depend on the ability of communities and countries to cope with risks. In the context of food security, some regions of the world might experience gains under climate change, but developing countries are likely to be negatively affected. Projections suggest that the number of people at risk of hunger will increase by 10–20% by 2050 due to climate change, with 65% of this population in Sub-Saharan Africa. The number of malnourished children could increase by up to 21% (24 million children), with the majority being in Africa (Parry *et al.*, 2009).

Meteorological droughts (resulting from insufficient rainfall) are expected to increase in duration, frequency, and intensity (Burke & Kuylenstiema, 2006). Droughts result in agricultural losses and are a major driver of food insecurity. Similarly, drought has been the primary cause of interannual yield variations in some regions of the world (Hlavinka *et al.*, 2006). Globally, the areas sown for the major crops (barley, maize, rice, sorghum, soya bean and wheat) have seen an increase in the percentage of area affected by drought since the 1960s, from approximately 5–10% to approximately 12–25% (Li, Ye, Wang & Yan, 2009). This is especially problematic in the context of population growth. For example, in Africa alone, 650 million people are dependent on rain-fed agriculture in the environment that is affected by water scarcity, land degradation, recurrent droughts and floods, and this trend is expected to exacerbate under climate change and population growth (FAO, 2008).

Climate change affects food production in complex ways. Direct impacts include changes in agro-ecological conditions; indirect impacts include changes in economic growth and distribution of incomes, which in turn affect demand for agricultural produce. Empirical evidence suggests that increases in temperature in the period 1980–2008 have already resulted in average global maize and wheat yield reductions of 3.8% and 5.5% respectively, compared to a non-climate scenario (Lobell *et al.*, 2011). To date, climate trends have been largely offset by gains derived from technology, carbon dioxide fertilization, and other factors (Lobell *et al.*, 2011). Future changes in climate patterns coupled with population dynamics could result in a higher vulnerability.

III. Methodology

This quantitative study made use of the case study design to assess the role of gardens in filling the food gap in the Kavango East Region. The study entailed a detailed and intensive analysis of a single case. The study was a single location (one Region) study. A quantitative method was used to assess the numeric part of the study. The data was collected in May 2018, which was just a few weeks after the community of Kavango East Region has completed harvesting from their rain-fed harvest. The population of this study consisted of 140 villages in the Kavango East Region.

Sample

The sample consisted of 20 randomly selected villages out of the 140 villages. Stratified random sampling was done to form two strata, one comprises of households without irrigated gardens while the other one comprises with irrigated gardens. For each village, there were five households of community member without manually irrigated gardens and five households with manually irrigated gardens i.e. 200 households, were selected and from which data were collected.

Research Instruments

The research made use of the Household Food Insecurity Access Scale (HFIAS) and Diet Diversity Score (DDS) which were developed by Food and Nutrition Technical Assistance (FANTA) (2005), in order to measure the food insecurity prevalence. This allowed the researchers to explore the factors that determine food security in the villages of Kavango East Region. The instrument is a structured questionnaire as a research instrument for data collection.

Household interview as a pilot study

Eight households were selected to pilot the study. The researcher conducted household interviews by using a standardized, open-ended and closed-ended questions approach were asked to all participants. Standardized open-ended and closed-ended questions facilitated the discussions, which could be more easily analyzed and compared. Interviews enabled participants to elaborate on their responses they have provided. The purpose of piloting the household interview was to check that each question measures what it is supposed to measure and if the questions on the questionnaires give responses that are consistency. The piloted study participants and respondents were not part of the actual survey of this study.

Household Interviews

The researcher requested approval from Kavango Regional Council, informing Regional Leaders that he was in the region to conduct research. After that, a meeting was held with the village headmen to explain to them about the research and its processes was convened and then make appointments with selected households on different dates and time at the 20 randomly selected villages interviews; participants were asked questions concerning the role of gardens in filling the food gap in the Kavango East Region. The standardized open-ended and closed-ended questions had 16 sub-questions to answer the three research objectives.

Data analysis

Data analysis from questionnaires

After the households' interviews, the quantitative data were coded, on which the data dictionary was created to explain the meaning of each code. Then the Data was entered, using Statistical Packages for Social Scientist (SPSS). Bivariate and multivariate analysis were used to test associations and relationships. The analysis included both parametric and non-parametric techniques such as correlation, Chi-square Tests, Independent sample T-tests and Kruskal Wallis H-Tests. The parametric techniques such as Chi-square and T-Tests made a number of assumptions about the population from which the sample was drawn, such as normally distributed scores and an interval level scale or continuous data. While, non-parametric techniques like the Kruskal Wallis H-Test, do not have such stringent assumptions, and were more suitable techniques for the categorical data measured at the ordinal (ranked) level (Pallant, 2010).

The ranked food sources were analyzed by running a correlational analysis to determine the significant relationships the choice of rank and the food source, with those having a smaller correlation coefficient ($r < 0.3$), having weaker relationships. While those with higher coefficients ($r > 0.5$) having strong relationships. Moreover, a negative correlation implies that the ranks were at opposite sides. The study then used the frequency mode and median values of the ranks, as well as the percentages of the respondents who ranked them to interpret the results.

Data analysis from HFIAS and DDS

HFIAS questionnaire used consisted of nine occurrence questions that represent a generally increasing level of severity of food insecurity (access), and nine "frequency-of-occurrence" questions were asked as a follow-up to each occurrence question to determine how often the condition occurred. The frequency-of-occurrence question was skipped if the respondent reported that the condition described in the corresponding occurrence question was not experienced in the previous four weeks (30 days). Some of the nine occurrence questions inquired about the respondents' perceptions of food vulnerability or stress (e.g., did you worry that your household would not have enough food?) and others ask about the respondents' behavioral responses to insecurity (e.g., did you or any household member have to eat fewer meals in a day because there was not enough food?). The questions addressed the situation of all household members and did not distinguish adults from children or adolescents. All of the occurrence questions asked whether the respondent or other household members either felt a certain way or performed a particular behavior over the previous four weeks.

Percent of households that responded, "yes" to a specific occurrence question in the better or good category. For example: "Percent of households that ran out of food." Example: Number of households with response = 1 to Q7 divided by Total number of households responding to Q7 multiply by 100.

Percent of households that responded "often" to a specific frequency of occurrence question in the middle category. For example: "Percent of households that ran out of food often." Example: Number of households with response = 3 to Q7a divided by Total number of households responding to Q7 multiply by 100.
Percent of households that responded "yes" to any of the conditions in a specific domain or worse category. For example: "Percent of households with insufficient food quality." Example: Number of households with response = 1 to Q2 OR 1 to Q3 OR 1 to Q4 divided by a Total number of households responding to Q2 OR Q3 OR Q4 multiply by 100.
For the Dietary diversity scores were calculated by summing the number of food groups consumed in the participating household or by the individual respondent over the 24-hour recall period.
The following steps were included in creating either the HDDS or WDDS:
1. Created new food group variables for those food groups that need to be aggregated. For example, in the WDDS the food group "Starchy staples" is a combination of "Cereals" and "White roots and tubers". A new variable termed "Starchy staples" should be created by combining the answers to "Cereals" and "White roots and tubers". This can be done using the following type of logical syntax:
Starchy staples = 1 if q1 (Cereals) =1 or q2 (White roots and tubers) = 1 Starchy staples = 0 if q1 (Cereals) = 0 and q2 (White roots and tubers)=0
As a check, I run a "frequencies" test on all newly created variables and make sure that all values are either 0 or 1. There should be no values > 1 for the newly created variable.
2. Created a new variable termed either HDDS or WDDS.
3. Computed values for the dietary diversity variable by summing all food groups included in the dietary diversity score (either 12 food groups for household or nine for women - see above for food group definitions).
As a check on the creation of the variables, all scores were within the following range:
•HDDs (0-12)
•WDDS (0-9)
Table 3.1 show the food types/variables and quantity which was consumed by the communities of Kavango East Region during the period of the investigation.

Logistic regression

According to Moran *et al.*, (2012), logistic regression was developed in the early 1950s by David Cox. Many sectors have used the models in trying to predict the probability of occurrence of a certain condition or issue. Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary) (Moran *et al.*, 2012). The binary logit was used to find the determinants of participating in river-bed irrigated gardens using the number of months a household consumed vegetables it produced as a proxy for food security.
The logistic regression model is specified as follows:

$$L_n = \beta_0 + \beta_1 X_1 + e$$

Where Ln = 1 if a household is participating in irrigated garden or 0 if households are not participating in an irrigated garden, e is the error term, $\beta_1 X_1$ are parameter estimates (coefficients) and are independent variables.

Table 1: Food types/ variables tested in Kavango East Region

Food Types/Variables	The quantity of food consumed per month	
	HH with Garden	HH without Garden
Millet	50 Kg	50Kg 2Kg
Potatoes	10Kg	- 15Kg
Cassava	2 Kg	1Kg 3Kg
Cabbage	35Kg	10Kg
Onions	5Kg	4Kg 2Kg
Tomatoes	10 Kg	0.5Kg 2Kg
Beef (fresh)	20 Kg	1Kg 1litre
Goat (fresh)	10 Kg	0.75 Litres
Chicken	10Kg	1 Kg
Eggs	2kg	
Fish (fresh)	10Kg	
Beans	5Kg	
Milk	15Kg	
Cooking oil	2 liters	
Sugar	5 KG	

Research ethics

Permission to conduct the study was sought from the Kavango Regional Council and the Ministry of Agriculture, Water and Forestry. The researcher applied for ethical clearance from the University of KwaZulu-Natal on which it was granted. The researcher ensured that all questionnaires were accompanied by a statement of intent, where the researcher assured the respondents that the information and data collected was to be used solely for the research and the respondents were accorded open access to results once published. Informed

consent after the explanation from the respondents was finally sought before the necessary information was collected. During the entire investigation, anonymity and confidentiality was maintained by not recording any names and not disclosing any information between participants. The data is being stored in a locked cabinet and will be destroyed by shredding and burning after 5 years.

IV. Results and Discussions

Composition of Households

The household composition was assumed to be an indicator of how the food is consumed, this was to determine if food availability for the household member was enough or not. The study revealed that for households without gardens, the category with the highest record was that between eight household members and above, which recorded 66%, followed by the category 7 household members, with 31% and the last category 3, with only 3%. This result shows that the majority of households have a high number of household members in the Kavango East Region and demand more food. The study also revealed that, for households with gardens, the highest category between eight household members and above recorded 67%, while the category7 household members contributed 29%, 4% was for the last category which was that for 3. This also confirms that the Kavango East Region's household's composition is dominated by at least eight members and above. This call for more food to be available by the head of the households to their household members (Table 2).

Table 2: Households size and percentage for households with and without a garden in the Kavango East Region

Households Size / Category	Percentage for households with garden	A percentage for households without a garden
3	4	3
7	29	30
8	67	67
Total	100	100

Employment rate

Respondents were asked to indicate the number of employed people in their households. This question was raised based on the assumption that the number of employed people in a household influence a particular household's ability to make food available, as well as making garden inputs available (FAO, 2003). If a household has a large number of employed people, their ability to purchase food is high, and therefore likely to be more food secure. The study revealed that for households without gardens, under category zero for a number of household members' formal employed had 76%, while 16% of households had only one person employed, and 5% of households had at least two employed members of their households. An additional, 3% had at least three persons and above employed. For the households with gardens, 65% of households indicated not having a single employed person in their household, 21% of the households had at least one person employed, followed by 10% for households with at least two persons employed, while 4% was for households having at least three and above-employed persons (Table 2).

The study also revealed that from all the groups, the level of unemployment in the Kavango East Region was very high especially in the rural areas. This also confirms the recorded symptoms of unemployment which already manifested itself by the manner in which the Kavango East Region is rated with 56% poverty according to the Government of the Republic of Namibia (2013).

Table 3: Household Employment level

Number of household members who are formally employed	Percentage of formally employed household	
	With garden	Without garden
0	21	76
1	65	16
2	10	5
3and above	4	3

X^2, P level = 0.032

Findings in Table 3 indicated that the Chi-square test result had a significance level of P= 0.032. This shows an association between having a garden and a number of people in formal employment. Households which are not employed may find it difficult to start up a garden due to lack of capital. This is in line with Milburn and Vail, (2010), who stated that it is worth to note that, advantages of community gardening are usually countered by the constraints such as poor leadership; knowledge and skills, start-up capital, insecure land tenure, and poor water supply.

Monthly Income of households in the Kavango East Region

The study used the independent sample t-test to compare the different monthly incomes of the two sample groups, that is, those with gardens and those who do not have gardens. The results are presented in Table 4.

Table 4 Difference in Monthly Income

Income	Group	N$	Mean Difference	P-Value
Monthly Income Formal Employment	Without Gardens [A]	180	1585	0
	With Gardens [B]	1765		

Monthly Income Entrepreneurship	Without Gardens [A]	230	-110	0
	With Gardens [B]	120		
Monthly Income Casual/Part Time Employment	Without Gardens [A]	315	-155	0.271
	With Gardens [B]	160		
Monthly Income Family Remittances	Without Gardens [A]	250	15	0.599
	With Gardens [B]	265		
Monthly Income Social Grant	Without Gardens [A]	675	1155	0.7
	With Gardens [B]	1830		
Monthly Income Irrigated Garden	Without Gardens [A]	100	565	0
	With Gardens [B]	665		
Monthly Income Other -	Without Gardens [A]	100	5	0.045
	With Gardens [B]	105		
Total Average Monthly Income	Without Gardens [A]	1850	2355	0.005
	With Gardens [B]	4910		

Table 4 shows that there was a significant statistical difference ($p<0.05$) between the two groups' monthly income for those with formal employment (Mean difference (M.D) of 1.34, $p = 0.001$), in entrepreneurship (M.D = 0.15, $p = 0.001$), irrigated garden (M. D=0.56, $p = 0.001$) and other income (M. D=0.005, $p = 0.045$). Moreover, the findings show no significant difference ($p>0.05$) between the two groups' monthly incomes for those in casual/Part time employment (M.D =0.77, $p = 0.271$), or receiving Family remittances (M.D = 0.31, $p = 0.599$) and those receiving social grants (M.D =0.56, $p = 0.700$). Overall, the findings in Table 4 indicated that there was a significant difference between the monthly incomes of the two groups (M.D = 4.025, $p = 0.005$) and that these differences emanated from incomes from formal employment, entrepreneurship, having an irrigated garden and other sources. These other sources exclude incomes from casual/Part time employment, family remittances, and social grants. These findings suggest that having an irrigated garden is inferentially comparable to having formal employment or entrepreneurship. Thus, implying that having an irrigated garden can be a source of livelihood at par with formal employment and entrepreneurship. Therefore, irrigated gardens can enhance the food security of the respondents by providing a sustainable monthly income.

Participants' Rankings of their Food Sources

The four main sources of food were ranked by the respondents in the order of 1 to 4, with 1 being the main source and 4 being the least source. The four main sources of food were from purchasing, from irrigation garden, from dry land harvesting and from food aid or donations.

Findings from the respondents in Table 5 indicated the respondents' ranks for the individual food source were significantly different with all having significant mean differences at the 95% confidence interval (p-value < 0.05). In addition, the results show that no relationships exist between food from dry land harvest and food purchased ($r = 0.131$, $p = 0.66$) or food from irrigated gardens ($r = 0.060$, $p = 0.398$). While dryland harvest had a significant negative relationship with Food aid donation ($r = -0.167$). The dry land harvest findings indicated the respondents who did not have irrigated gardens and do not purchase food (76%). These respondents would represent subsistence farmers whose primary source of food from dry land harvest and are vulnerable and susceptible to droughts, hence their association with those on food aid or donations (27%).

Table 5 Source of Food Ranks

Pair	Source of food	Rank	Count	%	Mean	Std. Dev	Correlation	t-test	Mean Diff.
Pair 1	Purchasing	2	124	62	2.16	0.64	-0.289	.000	1.87
	Food aid donation	1	54	27	0.29	0.49			
Pair 2	Purchasing	2	124	62	2.16	0.64	0.386	.000	1.23
	Irrigated garden	2	45	23	0.92	1.06			
Pair 3	Purchasing	2	12151	62	2.16	0.64	0.131	.066	1.04
	Dryland harvest	1		76	1.12	0.62			
Pair 4	Dryland harvest	1	151	76	1.12	0.62	-0.167	.019	0.83
	Food aid donation	1	54	27	0.29	0.49			
Pair 5	Dryland harvest	1	151	76	1.12	0.62	.060	.398	0.20
	Irrigated garden	2	45	23	0.92	1.06			
Pair 6	Irrigated garden	2	45	23	0.92	1.06	-0.516	.000	0.64
	Food aid donation	1	54	27	0.29	0.49			

Additionally, the findings indicated a strong negative relationship between food from food aid or donation and food from irrigated gardens ($r = -0.516$, p

=0.001), which implies that for 23% of the respondents' food from irrigated gardens had to substitute the need for Food Aid or donation. While, the positive medium relationship between food from irrigated gardens and food purchased (r = 0.386, p =0.001), would imply that the irrigated gardens provided a sustainable food choice for 23% of the respondent farmers, in the way that was comparable to those whose food source was purchasing (62%). Moreover, those with irrigated gardens can also sell some of the food from their irrigated gardens and purchase other food pieces of stuff.

Lastly, the findings indicated that the more food secure households, whose main source of food is purchased have a negative but weak relationship with Food aid or donations (r = -0.289, p=0.001). Thus, implying that the food secure households (62%) purchased their food, while the food insecure households (27%) relied on Food Aid or donations. As such, having irrigated gardens (23%) is a key food security invention approach to households that primarily depend on dry land harvest food and do not purchase their food (76%).

Dry Land Harvest Consumption patterns

Pallant (2010) notes that non-parametric techniques do not have stringent parametric assumptions, and are thus more suitable techniques for categorical data measured at the ordinal (ranked) level. Therefore, the study used the non-parametric independent samples Mann-Whitney U-test, instead of an independent sample t-test because the continuous or interval scale data for dry land harvest quantity in kilograms was converted to an ordinal scale or categorical data. Therefore, to violating some of the T-test assumptions, the study used a non-parametric test to assess the significant differences in the ordinal dependent variables by a single dichotomous independent variable of the garden grouping. The Mann-Whitney U-test is the appropriate analysis to use for analyzing dryland harvest consumption variables that were on an ordinal scale. Table 4.5 presents the findings.

Table 6: Dry Land Harvest Consumption patterns

Variables	p-value	Decision	Mean
The distribution of dry land harvest, what was the harvest (estimated Kg) is the same across categories of with/without gardens	0.625	Retain the null hypothesis	268.25
The distribution of dry land harvest, how long to consume (estimated Month) is the same across categories of with/without gardens.	0.555	Retain the null hypothesis	4.64
The distribution of dry land harvest, how many meals consumed per day (times) is the same across categories of with/without gardens.	0.408	Retain the null hypothesis	1.83

Findings in Table 6 indicated that the differences between the two groups of respondents (with gardens and those without) were not statistically significant, in relation to what the dry land harvest was in Kg (p = 0.632), how long they consume it in months (p = 0.555), or how many meals would be consumed per day (p = 0.408). Thus, on average the respondents had a dry land harvest of 268.25 kg that lasts them four and a half months while eating two meals a day. This would imply that the households eat 1 kg of harvested food per meal, which would mean they need 2 – 3 kg per day and between 700 – 1000 kg per year to be food secure eating 2 – 3 meals a day. While the food insecure households would those that do not have enough food to last them a year (less than 700 kg).

Expenditure on food

The study used the non-parametric independent samples Kruskal Wallis H-test, instead of one-way Analysis of variance (ANOVA) in order to avoid violating parametric assumptions. However, the interpretation of the Kruskal Wallis test is used to assess the effect of total income on expenditure patterns. The Kruskal Wallis was an appropriate technique given that the total monthly income was computed from the respondents' sources of income data. Table 4.6 presents the findings.

The results in Table 4.6 show that four of the six expenditures were the same across categories of the total monthly income when tested at a significant level. The expenses include medical expenses (M= 68.13, p=0.30), transport expenses (M= 88.13, p=0.55), school expenses (M = 117.11, p=0.5) and other expenses (M=0.60, p=0.96). These results suggest that the expenditure patterns for transport, school; medical and other were not influenced by the level of monthly income. While, the expenditure patterns for food (M=582.07, p=0.00) and garden inputs (M=71.65, p=0.00) are affected by the

categories of total monthly incomes. The findings suggest that monthly expenditure patterns for food are reliant on how much income is available, as having lower income would make it difficult for the respondents to purchase food. On the other hand, the results also show that having a garden would result in the purchasing of less food since they would be consuming food from the garden. Contrastingly, it also means that they would need to use some of their income for purchasing garden inputs instead of food.

Table 7: The Mean of the Effect of Total Income on Respondents' Expenditures between gardeners and non-gardeners

Variables of the effect of total income	Test	Mean	p-value
Amount spent on food for participants across all Monthly Income levels	Kruskal Wallis H-Test	582.07	0.00
The amount of spent on medical for participants across all Total Monthly Income levels	Kruskal Wallis H-Test	68.13	0.30
Amount spent on school is the same across all categories of the Monthly Income.	Kruskal Wallis H-Test	117.11	0.50
Amount spent on transport is the same across all categories of the Monthly Income.	Kruskal Wallis H-Test	88.30	0.55
Amount spent on garden inputs is the same across all categories of the Monthly Income.	Kruskal Wallis H-Test	71.65	0.00
Amount spent on other expenditure is the same across all categories of the Monthly Income.	Kruskal Wallis H-Test	0.60	0.96

Table 7 results show the variables in the logit equation and information about the contribution or importance of each of our predictor variables. The logistic regression uses the Wald test statistics for each predictor to determine the variables that had a statistically significant ($p<0.05$) predictive contribution to the model. Table 4.8 shows four significant variables (Food Purchasing, p =000; Food from Harvest from Dry Land, p = .001; Food Aid/Donations, p =.008). Therefore, the major determinants to whether a person reports having an irrigated garden are sources of food with the Food Purchasing, Food Aid/Donation and Food from Harvest from Dry Land. As well as, the number of meals consumed per day from Dryland harvested food. As more meals would mean that the food stored will finish quicker and less meal may lengthen the time it takes to finish the store of the Dry Land Harvest.

The results show regression beta (B) values. With, the positive or negative B values showing the direction of the relationship or which factors increase the likelihood of a yes answer (having a garden) versus factors which decrease it (do not have a garden). The negative B values indicate that an increase in the independent variable score will result in a decreased probability of the case recording a score of 1 in the dependent variable (indicating those without gardens). Table 7 showed a significant variables negative B value included, Food Aid/Donation (–1.508, p = 0.008) and the number of meals consumed per day from Dryland harvested food (-6.49 to -7.686, p = 0.000 to 0.002). The negative B values indicating that the more the farmers rely on food aid/donation or consume more food per day, the less likely, they will report having a garden.

For the two other significant categorical variables (Food Purchasing, Food from Harvest from Dry Land), the B values are positive (3.701, 2.636). This suggests that farmers sourcing their food through purchasing or from the dryland harvest are more likely to answer yes to the question of whether they consider they have a garden. As the surplus garden harvest can be sold for income to purchase other food to supply multiple nutrients. Low-income households in the Kavango East Region, relying on dry land harvested food are more likely to benefit from a garden. This is because gardens will bring both food security and financial security as they may start selling their produce.

Findings in Table 7 also shows the results for the exponent of the B values (Exp(B)) and represents the odds ratios (OR) for each of the independent variables. Tabachnick and Fidell (2007), notes that the odds ratio represents 'the change in odds of being in one of the categories of the outcome when the value of a predictor increases by one unit' (p. 461). As such, the odds of a farmer answering Yes, they have a garden is 40.495 times higher for those purchasing food for consumption than for a person who does not have a garden, all other factors being equal. Thus, food purchasing is a significant predictor (p=.007), with the odds ratio of 40.495, followed by Food from Harvest from Dry Land (odds ratio=13.985) and Food Aid/Donations (odds ratio = 0.221).

The reason behind this is that household in the Kavango East Region, which are having gardens have food security and diversity, as they are able to sell their vegetables and use the money to buy other food to diversify their dietary intakes resulting in diverse sources of food, from purchasing, dryland harvest and irrigated gardens. Hussain and Clay (1999), agree with this finding, saying that, the

maintenance of this form of production, in the long run, is essential for the household's economic and nutritional merit. Again, the importance of gardens is further affirmed by the fact that in times of emergency, societies have had to return to the use of gardens to improve food security, as, for example, Irish potato gardens during the Great Depression. This is also in line with, Faber et al. (2007), who found that irrigated gardens can create income and improve food availability for the poor.

Household food security status

The results under this section focused on investigating the contributions of irrigated gardens in filling the food availability gaps among the communities of Kavango East Region. Table 4.9 presents the findings.

Table 8: Comparison of prevalence of household food insecurity (access) levels in Kavango East Region.

HFIA CATEGORY	HH without Garden (n=100) (%)	HH with Garden (n=100) (%)
Food Secure	1	12
Mildly Food Secure	1	9
Moderately Food Insecure	3	43
Severely food Insecure	95	36
Total	100	100

X^2, p= 0.001

Table 8 revealed that only 1% of households without gardens were Food Secure, while 12% of households with gardens were Food secure, which was quite high compared to 1% of the former. The percentage is attributed to the fact that irrigated gardens really assist the rural community of the Kavango East Region in filling the food availability gaps left by the rain-fed harvest. The one percent for the households without gardens could be attributed to the fact that they sorely depend on rain-fed harvests which have been reducing for the past years due to climate changes resulting in lower levels of rainfall. The study further revealed that only 1% of households without gardens were Mildly Food Secure, while 9% of households with gardens were found to be Mildly Food Secure. For the Moderately Food Insecure category, households without gardens had 3%, while, the households with gardens had 43%. The 43% for households with gardens is attributed to the fact that due to them having gardens, at least they are moderately food insecure if they did not have the gardens this group could also have recorded a low percentage of moderately food insecure.

For the severely food insecure, the study revealed that households without gardens had 95%, while for a household with gardens it was 36%, which is low compared to the rate of the severely food insecure. The rainfed harvest has been falling in recent years, this is in line with a report by the Government of the Republic of Namibia (2016), which states that household food security remained weak in various parts of the country, as the recent agricultural production is too small to provide significant improvement to the ailing food security. 36% for households with gardens is attributed to the fact that with them having gardens, at least they are less likely to be severely food insecure, if they did not have the gardens, and this group could also have recorded a high percentage. This means that gardens play a very vital role in filling the gap left by the rain fed harvest among the communities of the Kavango East Region. Gardens help villagers fight hunger; it is a solution to fight against the prevalence of hunger in the rural areas.

The Chi square test has an asymptotic significance of P = 0.000 which is less than 0.05 0r 95% confidence interval. The hypothesis is households with gardens are independent of household without gardens. This shows an association between having a garden and food security situations. This association can be attributed to the fact that gardens increase the chances of a diverse diet; they also improve households' income through marketed surplus. This is in line with FAO (2010), which stated that, a well-developed irrigated garden has the potential, when access to land and water is not a major limitation, to supply most of the non-staple foods that a family needs every day of the year, including roots and tubers, vegetables, fruit and legumes. Gardens play a role in filling the food availability gaps left by the rain fed harvest in the Kavango East Region. This is also in line with a research by Milburn and Vail (2010), which showed that no country can assure food security for its population if rain-fed agriculture is not coupled with significant investments in manual irrigation farming.

Consumption frequencies per week

Dietary diversity

Household Dietary Diversity Scores were used in this study to show the difference in levels of dietary intake between two different categories of households that is the households with irrigated gardens and households without irrigated gardens. The dietary diversity was high with an average of 8.51 in households with irrigated gardens, while the dietary diversity was low with an average of 3.17 in households without irrigated gardens during the week of the study.

This means that for households to have a better Dietary intake in the rural areas of the Kavango East Region, they need to have irrigated gardens to supplement their Dietary Diversity. This also means that the issue of food insecurity in terms of dietary intake among the communities of the Kavango East Region can be a thing of the past if the communities are motivated and assisted to have irrigated gardens.

This is in line with a study by Faber et al., (2007), which found that, irrigated gardens empower households to take ultimate responsibility for the nutritional quality of their diets by growing their own nutrient-rich food and making informed consumption choices. Rogerson, (2003), also found that, irrigated gardening assists in lifting people out of poverty by improving their health and nutrition.

Table 9: Comparison of Food Types consumed in Kavango East Region.

Food Types	Frequency in percentage	
	HH with Garden	HH without Garden
Porridge made from millet	100	100
Potatoes and cassava	21	2
Vegetables	97	52
Fruits	99	12
Beef, goat, and chicken,	91	47
Eggs	6	1
Fresh	99	25
Foods made from beans	87	11
milk or other milk products	40	1
Foods made with oil	99	15
Sugar	95	15
Coffee and tea	22	3

Table 9 indicates, the food types and the frequency of consumption by the households of Kavango East Region. For households with a garden, had a frequency of less than 50 for coffee and tea, eggs, milk and potatoes, while for households without a garden had porridge made from millet and vegetables with a frequency of more than 50.

Table 10: Monthly Quantity of Food types consumed and Kilocalories' percentage contribution to the to the food needs of Households in Kavango East Region.

Food Types	Quantity of food consumed per month		Kilocalories percentage of food consumed	
	HH with Garden	HH without Garden	HH with Garden	HH without Garden
Millet	50 Kg	50Kg	48.14	48.14
Potatoes	10Kg	2Kg	1.98	0.4
Cassava	2 Kg	-	0.80	-
Cabbage	35Kg	15Kg	4.44	1.90
Onions	5Kg	1Kg	0.63	0.13
Tomatoes	10 Kg	3Kg	0.53	0.15
Beef (fresh)	20 Kg	10Kg	12.43	6.22
Goat (fresh)	10 Kg	4Kg	7.67	1.53
Chicken	10Kg	2Kg	3.67	0.73
Eggs	2kg	0.5Kg	0.83	0.21
Fish (fresh)	10Kg	2Kg	2.51	0.50
Beans	5Kg	1Kg	4.50	0.89
Milk	15Kg	1litre	2.53	0.17
Cooking oil	2 litres	0.75 Litres	4.76	1.78
Sugar	5 KG	1 Kg	5.29	1.05
Total			100.72	63.80

The findings from Table 10, reveals that Kilocalories percentage of food consumed in a month by Household without gardens is 63.8%, while the Kilocalories percentage of food consumed in a month by Households with gardens is 100.7%. This means that the percentage of food availability gap filled by the presence of gardens is 36.9%.

Factors contributing to filling of the above stated food availability gap for the households with gardens is that the consume produce from their garden, the second part is that they sell some of their produce, on which they spend income from their produce sales to access some other food stuffs which they don't normal produce in a required quantities such as beef, goat, chicken, fish, beans, milk, cooking oil and sugar.

V. Conclusions and Recommendations

Irrigated gardening contributes to filling the food availability gaps left by the rain-fed harvests in the Kavango East Region, in other words it contributes to the food security of the households having gardens. Irrigated gardens compliment the dietary intake of the households, at the same time enhances their income, and reduces expenditure on food, since food is available from the irrigated gardens. However, there is a need for the gardeners operating irrigated gardens to adopt commercial vegetables that they can grow throughout the year and sell for more income. Some traditional pumpkin leaves are good, but, not good enough for commercial purposes, since they are only cultivated seasonally.

The households with irrigated gardens in the Kavango East Region are recommended to decrease their level of reliance on external stakeholders for job opportunities and use their irrigated gardens for self-employment and to enhance socio-economic benefits associated with irrigated gardens. On food security perspectives, leaders of the Kavango East Region, should motivate, and provide leadership and support to the inhabitants of the Kavango East Region to use gardens to fill the food availability gaps left by the rain-fed harvest, in this way the level of food insecurity in the Kavango East Region would be mitigated.

References

[1] Burke, J.J. & Kuylenstierna, J. (2006). The Water Variable – producing enough food in a climate insecure world.

[2] Bonti-Ankomah, S. (2001). Addressing Food Insecurity in South Africa. The National Institute for Economic Policy. SARPN conference on Land Reform and Poverty Alleviation

in Southern Africa, 4th and 5th June, 2011. Pretoria South Africa.
[3] Chadha, M.L., & Olouch, M.O. (2003). Home-based vegetable gardens and other strategies to overcome micronutrient malnutrition in developing countries. Food, Nutrition and Agriculture: FAO 32/2002: 17-23.
[4] Government of the Republic of Namibia (2016). Namibia's Crop Prospect, Food Security and Drought Situation Report, Windhoek, Ministry of Agriculture, Water and Forestry.
[5] Faber, M., van Jaarsveld, P.J., & Tauscher, R.,(2007). The contribution of dark-green leafy vegetables to total micro-nutrient intake of two to five year old children in a rural setting. Public Health Nutrition. http://www.wrc.org.za (Accessed on 3 August, 2017).
[6] Food and Agriculture Organisation (2008).The state of food insecurity in the world, 2008.Rome: FAO.
[7] Food and Agriculture Organisation (FAO) (2010). Household food security and community nutrition: Improving Nutrition through home gardening. URL: http://www.fao.org/ag/agn/nutrition/household_gardens_en.stm (Accessed on 6 August 2017).
[8] Food and Agriculture Organization of the United Nations, (2013). The State of Food and Agriculture: Food Systems for Better Nutrition. Rome: FAO.
[9] Food and Nutrition Technical Assistance (FANTA) (2005). Potential uses of food aid to support HIV/AIDS mitigation activities in sub-Saharan Africa. Draft Paper. Washington, DC: Academy for Educational Development
[10] Guijit, T. (2007), 'Climate change vulnerability assessment: Review of agricultural productivity' CSIRO Climate Adaptation Flagship Working Paper No.1. Web-ref http://www.csiro.au/resources/CAF-Working-Papers.
[11] Hlavinka, P., Trnka, M., Semeradova,D.,Dubrovsky, M., Zalud, Z. & Mozny, M.(2006) ,Effects of drought on yield variability of key crops in Czech Republic.Agricultural Forest Meteorology. 149, 431-442.
[12] Hussain, M. A., & Clay, W.D. (1999). Effective nutrition and health programmes. In: Kracht, U and Schulz, M (Eds), Food security and nutrition: the global challenge. New York: St Martin's Press.
[13] Hunter, M. L. (2011). Climate Change, Rural Vulnerabilities, and Migration. URL: http://www.prb.org/Articles/2007/Climate Change in Rural Areas. (Accessed June 10, 2017).
[14] Intergovernmental Panel on Climate Change (IPCC) (2007). Climate change 2007:impacts,adaptation and vulnerability.Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on climate Change. Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (eds), Cambridge University Press, Cambridge, 976pp.
[15] Kawana, R.K. (2016). An Investigation into the role of Leadership in Water Technology Innovations in Enhancing Job Creation in Kavango East, Namibia, Ph.D. Thesis,University of Namibia.
[16] Kirkland, D., (2011). Harvest of hope: A case study: the sustainable development of urban agriculture projects in Cape Town, South Africa. Unpublished Master's Thesis: Cape Town: University of Cape Town.
[17] Laing, M.D., (1996). The epidemiology and control of liptosphera maculans cause of crucifer blackleg,in KwaZulu-Natal.Unpublished Ph.D. thesis, University of Natal,Pietermaritzburg.
[18] Leary, N., & Kulkarni, J. (2007).Climate Change Vulnerability and Adaptation in Developing Country Regions. Draft Final Report of the AIACC Project. A Global Environment Facility Enabling Activity in the Climate Change Focal Area Project No. GFL-2328-2724-4330. URL: www.aiaccproject.org (Accessed May 18, 2017).
[19] Leary, N., Adejuwon, J., Bailey, W., Barros, V., Caffera, M., Chinvanno, S., Conde, C., De Comarmond, A., De Sherbinin, A., Downing, T., Eakin, H., Nyong, A., Opondo, M., Osman Elasha, B., Payet, R., Pulhin, F., Ratnasiri, J., Sanjak, E., von Maltitz, G., Wehbe, M., Yin, Y., & Ziervogel, G. (2007). For Whom the Bell Tolls: Lessons about Climate Change Vulnerability from the AIACC Project.
[20] Leary, N. & Kulkarni, J. (2007). Climate Change Vulnerability and Adaptation in Developing Country Regions. Draft Final Report of the AIACC Project. A Global Environment Facility Enabling Activity in the Climate Change Focal Area Project No. GFL-2328-2724-4330. URL: www.aiaccproject.org (Accessed June 20, 2017).
[21] Mendelsohn, J., & El Obeid, S. (2006). A digest of information on key aspects of the Kavango's geography and sustainable development prospects. Research and Information Services of Namibia. 5-19.
[22] Mitchell, T., & Tanner, T. (2006). Adapting to climate change: Challenges and opportunities for the development community. Institute of Development Studies URL: www.ids.ac.uk/ids (Accessed August 16, 2017).
[23] Nelson, G., Rosegrant, M., Palazzo, A., Gray, I., Ingersoll, C., Robertson, R., Tokgoz, S., Zhu, T., Sulser, T., Ringler, C., Msangi, S., & You, L. (2010). Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options. International Food Policy Research Institute, Washington, D.C.
[24] Rogerson, C.M. (2003). South Africa: creating new spaces?, in R. Kloosterman and J.Rath (eds), Immigrant Entrepreneurs: Venturing Abroad in the Age of Globalization, Oxford, Berg, 79-99.
[25] Sikhakhane, B.P. (2007). Garden Projects within the integrated nutrition programme. Proceedings of the Orange-fleshed sweet potato Symposium, Pretoria. 3 October.
[26] Schmidhuber, J., & Tubiello, F.N. (2007). Global food security under climate change. Prooduction national acad Science104(50):19703-19708.
[27] Trobe, S. (2002). Climate Change and Poverty. A discussion paper. Tear fund, Middlesex, UK.
[28] United Nations Environmental Programme (UNEP). 1999. Global Environmental Outlook 2000, Earthscan Publications Ltd. p.56.