

An Agro-Ecological Assessment of Household Food Security in Basso Catchment, Ethiopia

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Abstract

In Ethiopia, subsistence mixed smallholders agriculture in the highlands and pastoral agriculture in the semi-arid lowlands are the main sources of food supply and means of livelihood for more than 85 percent of the population. In Basso catchment, especially households in the highland villages are vulnerable to food shortage and prone to migration due to degraded natural environment, erratic rainfall and agricultural policy shortfalls of successive governments, etc. In the analysis food balance sheet, per capita food availability in kilocalories and multiple regression models were utilized to identify severity of food insecurity in the catchment. Food energy deficiency in Dallo village was more than 47 percent compared to 21.9 percent self-sufficiency in Lante village. This suggests that there is high degree of heterogeneity among the studied agro-ecologies. An analysis of this kind would help the local government to take timely intervention and help planners and donor agencies to include the problems as a priority area of intervention in their programmes.

Introduction

This study was conducted in southwestern highlands of Ethiopia, along the western escarpments of the Great Rift Valley system. Based on elevation, Ethiopia is divided into five similar cropping and rainfall zones or what traditionally are called as agro-ecologies (Hurni, 1995). They are *wurch* (cold highland), *dega* (cool highland), *woina dega* (cool sub-humid highland), *kola* (semi arid lowland) and *bereha* (desert). These spatial units have its own effect on the way of life of the people and food acquisition system, in addition to its impact on climatic and agricultural activities of the area. In Ethiopia subsistence mixed smallholders

agriculture in the highlands and pastoral system in the semi arid lowlands are the main sources of food supply and means of livelihood for more than 85 percent of the population. Climatic variability, deteriorating soil, agricultural policy shortfalls of successive governments, etc are blamed as the main threats of sufficient crop harvest in the country. As a result, similar to most sub-Saharan countries food production (that increases 1.6 percent per annum) cannot feed fast growing population (growth 2.7 percent per annum). Calories requirement, which measures the adequacy of diet, varies from an average 2199 calories in the Sub-Saharan Africa to 3300 calories

per person per day in the USA. While the mean per capita daily dietary intake in Ethiopia is 1888 calories, where medically allowed minimum daily requirement is 2100 calories per adult per day. This figure gave a very high (44 percent) prevalence of under-nourishment for Ethiopia in 2003 compared to 33 percent under-nourishment of the whole Sub-Saharan Africa (Berhanu, 2004). Regarding causation and severity of food insecurity in Ethiopia, various studies have revealed interesting empirical findings. For instance, Webb *et al.* 1994 (drought and war), Diriba 1995 (decline in physical

resources), Kebede 1995 (marketing policy of the Marxist regime) and Dessalegn 1998 (tenure insecurity and insufficient land) are some of many causes of household food shortage in the country. Various authors used different methodologies such as general explanation approach (Markos, 1997), food availability decline and food entitlement decline models (Sen, 1981) to analyze the food security. In this paper, the latter approach has been adopted for the analysis of household food shortage in Basso Catchment. This is because the model tries to consider different variables



Fig. 1: Location Map of Basso Catchment, Ethiopia

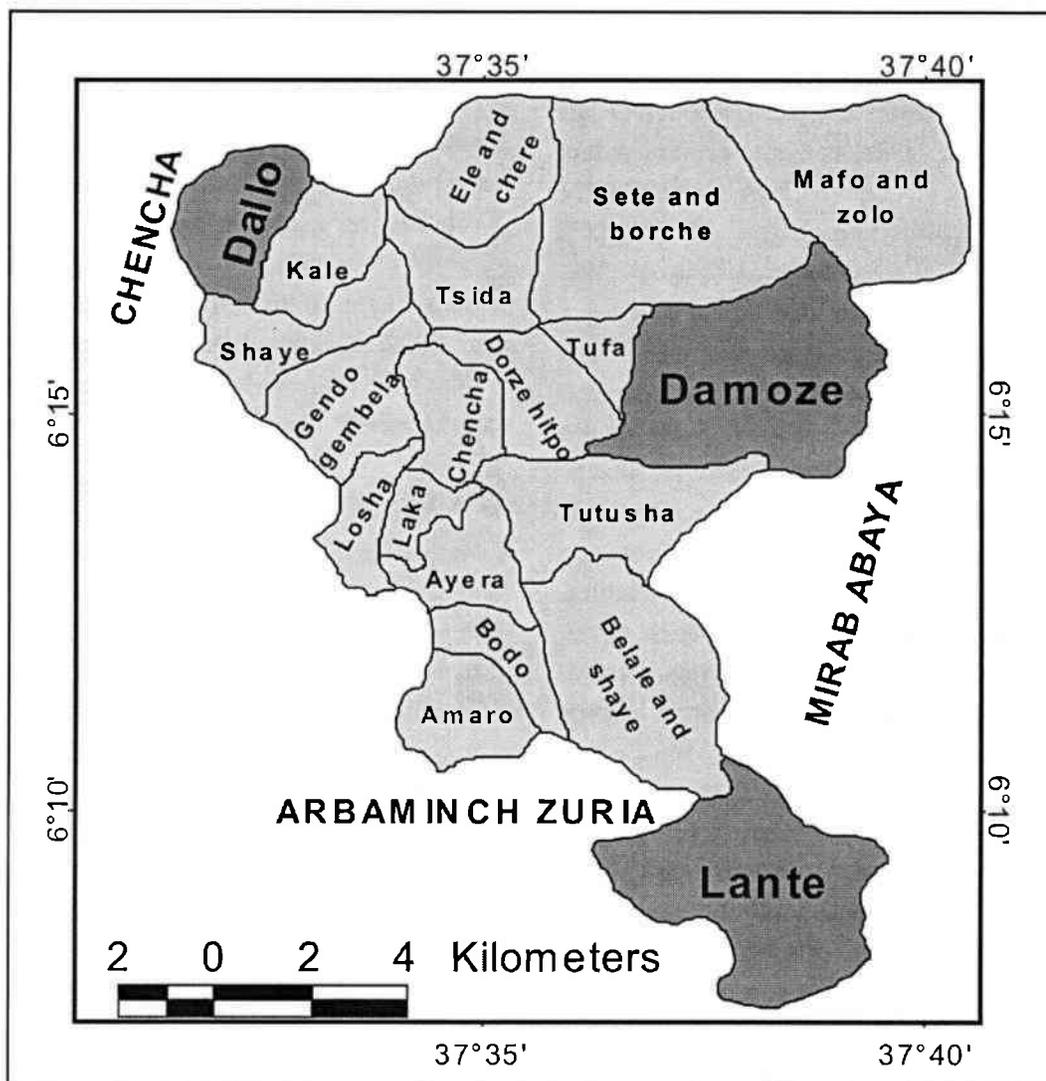


Fig. 2: Location of sample villages

of food security such as household food production, wage labor, transfer, gift, the attitude of people or coping strategies, etc. The study site has a limited spatial coverage. However its diversified terrains has resulted in forming various geographic localities with

contrasting climate, flora and livelihood strategies. An attempt has been made in this paper to explore factors for the regional variation of food insecurity and quantify the extent of household food insecurity among the selected agro-ecologies.

The Study Area

Basso catchment is located in the South-western part of Ethiopia, at about 537 km southwest of the national capital, Addis Ababa. It is located in between 6° 7' 30"N to 6° 19' 00"N latitude and 37° 31' 30"E to 37° 40' 30"E longitude (Fig. 1). The catchment incorporates 20 rural villages from three different agro-ecologies. It has a great geographic diversity, with rugged terrain and rolling plains. Soils in the upland area are volcanic in origin, such as cambisols and nitisols while, in the lowlands and river plains deposited fluvisols are dominant. Except in a few remote localities, the catchment is devoid of forest cover. However, bamboo, podocarpus, acacia, eucalyptus tree and thickets are seen in some pocket areas. The three villages selected for this study belongs to three agro-ecologies, namely cool climate (Dallos), sub-tropical (Damoze) and semi arid climate (Lante) (Fig. 2). The mean annual temperature and rainfall is about 19°C and 1166mm, respectively, but varies considerably within seasons and agro-ecologies. The rainfall distribution is bimodal thus; agricultural production takes place during *belg* (short) and *meher* (main) rainy seasons. The estimated numbers of rural households' are 42,400, with an average family size of seven, while the average farm size is 0.9 hectares.

These holdings are fragmented and scattered, thus in the uplands it is uncommon to see a minimum of five parcels per household. Due to the influences of terrain, hillside rain-fed farming in the northern

and indigenous irrigation based farming in the southern part is the dominant means of livelihood in the area. Perennials (ensete and banana) and cereal crops (barley, maize and wheat) dominate the cropping pattern that is subsistence in nature, and meant only for home consumption. In responses to the degraded natural environment and erratic rainfall, the rural population in the uplands is vulnerable to food shortage and prone to seasonal migration.

Data Base & Methodology

To investigate the status of household food security both primary and secondary data sources were used. The primary data includes sample survey and key informants discussion. A household survey was conducted between May 2007 and April 2008 in proportionally selected three sample villages. In these villages, 255 (10.2 percent) households were selected using proportional and systematic random sampling techniques. Then the sample units were interviewed using structured survey questionnaires on different aspects of household livelihood. Secondary data was also collected from Central Statistical Agency (CSA), and Disaster prevention and preparedness commission, Ethiopia. To estimate household net food availability, food balance sheet was computed by using the formula, $N_{ij} = (P_{ij} + B_{ij} + F_{ij} + O_{ij} - (H_{ij} + M_{ij}))$ (Negatu, 2005). Where N is net food available for household, P is total grain produced, B is total grain purchased, F is total grain obtained through food for work

and O is other sources of food year. H is post harvest losses in a year. S is total crop utilized for seed from home. M is marketed output. The 'i' refers to the individual house hold 'j' refer to the year. Furthermore, to convert the available food in the household into equivalent kilocalories, conversion factor by Agreeen et.al. (1968) were employed. To examine the statistical association of fourteen household variables with household food availability multiple regression models were used. Other statistical measures such as standard deviation and coefficient of variations were also used.

Food Security Status of Farm Households

The major food types used are cereal, enset and root crops, while animal products and vegetables are rarely consumed. As shown in Table 1, farmers in the study area had access to food from three sources, namely own farm production, food purchased from market and grains obtained from Food for Work Programme (FFW). In the study period between March 2007 and February 2008, of the total food availability, purchased food from market contributed the highest proportion (60.3 percent) followed by own production (33.5 percent) and food for work programme (6.2 percent).

At village level, the contribution of purchased food to the total households' food availability was found to be 86.6 percent, 24.3 percent and 20.9 percent in Lante, Damoze and Dallo, respectively. This

Table 1: Source of total food available for consumption at household level

Village	Source of food available			Total net food (Kg)
	Own production	Purchase	Food for Work	
Dallo	62.8	20.9	16.3	94080
Damoze	62.5	24.3	13.2	54240
Lante	13.4	86.6	-	214620
Total	33.5	60.3	6.2	362940

simply reveals that in semi arid lowlands, households have shifted to cultivate high value cash crops instead of cereal crops that worth low price and hence have to purchase cereals from market.

Based on the data collected from household survey, food balance sheet for the year 2007/08 was computed and has been presented in Table 2. As can be seen from the table, of the three sample villages, Dallo and Damoze have a per capita food availability of less than 2100 calories per adult person. Medically allowed per capita minimum daily dietary intake for adult person is equivalent to 2100 calories (Ethiopian Nutritional Agency, 1990). Thus, the study result indicates a high level of food insecurity among the households in the highland agro-ecologies. However, Lante village with the per capita food availability of more than 2100 calories was found to be the food secure part of the catchment. The foregoing analysis clearly reveals that food energy deficiency in Dallo village was more than 47 percent compared to 21.9 percent self sufficiency in Lante

village, suggests that marked regional imbalances exist in food availability in the studied villages. At the catchment level, the estimated average daily per capita food available was 1785.6 calories (which makes up 85 percent of the minimum recommended allowance). The food data at the aggregate level reveals the prevalence of under-nourishment as 62.4 percent compared to 46 percent under-nourishment for Ethiopia in 2007/08 (UNDP, 2008). However, in one of the most food insecure village (Dallo) the prevalence of under- nourishment rate was 100 percent. Most of the population in the area is on poverty line of 0.5 kg daily per capita consumption requirement. Therefore, taking consumption of less than 0.62 kg of cereal food per adult equivalent per day as an indicator of food insecurity, daily per capita requirement of 0.5kg makes the study area in a severe situation of food shortage. Further investigation of the data depicts that variation of food availability among the households with in the agro-ecologies seems very wide as shown by the coefficient of variation. The coefficient of variation for Dallo, Damoze and Lante villages were

32.2 percent, 72.6 percent and 44.9 percent, respectively.

Determinants of food security at household level

In traditional community like Basso catchment, numerous farm variables do influence household food production and availability. For instance, size of farm and labor, number of oxen, livestock, and the use of modern farm inputs are critical factors that strongly influences households' livelihood. In rural community, the sex of household plays an important role in the food security status of the household. This is related with the traditional division of labour that male heads are considered as a breadwinner in the household. Furthermore, in such society under which farm economy and consumption tends to be farm-centred, per capita food availability declines with the increase of family member. But, for a number of social and economic reasons, farm communities do encourage large family size. The availability of large farm size, livestock number and the use of modern farm inputs do increase farm production

Table 2: Average Net Food Available for Consumption (2007/08)

Village	Mean total per year		Food Availability (Cal_per capita_per day)					
	Kg/Hh	Cal/Hh	Mean	% MRA	minimum	maximum	SD	CV
Dallo	1039	3927.4	1112	53	509.4	1939.3	358.1	32.2
Damoze	895	3482.9	1665	79.3	624.9	5488.6	1208.4	72.6
Lante	1774	7174.5	2560	121.9	752.3	5729.7	1149.5	44.9
Average	1236	4861.6	1785.6	85	509.4	5729.7	1138.9	63.8

Note: SD: Standard Deviation; MRA: minimum required allotment; CV: Coefficient of Variation

and thereby ensure sustainable livelihood of the households. However, as revealed in table 3, all these variables are insufficiently available among the studied households, thus it negatively influences household food requirement in the catchment. To examine the statistical association and variation in between the fourteen independent variables and per capita food availability (dependent variable) a hypothesis was drawn. It states that per capita food availability does increase with the increase of all thirteen variables

except family size. The findings from multiple regression models reveal statistical relationship as presented in table 3.

In this report, the multiple correlation (the correlation between per capita food availability and fourteen independent variables) is $R = 0.742$. The R-value of 0.742 suggests that there exists a strong positive relationship between the variables considered in the analysis. The percentage of fourteen independent variables (that is due to a combination of factors such as

Table 3: Result of multiple regression analysis

Independent Variables	Beta (B)	t' Significance	
Family size	0.019	-0.343	0.732
Farm size	0.034	0.629	0.53
crop harvest	-658	-8.005	0
livestock	0.178	2.171	0.031
Farm oxen	0.17	2.288	0.023
Off-farm activities	0.04	0.678	0.499
Farm credit	-0.22	-0.467	0.641
Chemical fertilizer use	-0.113	-0.198	0.843
Improved seed	0.194	3.255	0.001
Irrigation use	0.113	1.534	0.126
Extension service	0.11	2.262	0.025
Fertility of farmland	0.164	3.406	0.001
Education of household head	0.176	3.218	0.001
Age of the head	0.178	3.117	0.002
Constant	1.575		
R	0.742		
R square	0.55		
Adjusted R square	0.522		
F change	19.481		

farm size, fertilizer use, crop harvest, etc) is then $R^2 = 0.550$. Hence, in this study, 55 percent of the variance of per capita food availability is explained by fourteen independent variables. Because $1 - R^2$ is 0.45, 45 percent of per capita food availability may be attributed to other factors such as weak infrastructural development, unfair agricultural and land tenure policies, unstable market situation, errors in data collection, etc.

Similarly, food availability variation with an ANOVA (analysis of variance) F-ratio of 19.481 was also statistically significant. In the study area among the independent variables, size of harvest, livestock population, farm oxen, use of improved seed, provision

of extension service, fertility of the farmland, education and age of the household head were found to be the major determinants of food availability at household level (the significance of 't' in table 3).

However, contrary to our expectation the increase in food availability has resulted in a similar increase in family size. The finding is congruent to the perception of traditional community to the increased family size. The positive relationship between the two variables may be explained by the use of women and child labor to agricultural activity in the area. Furthermore, the inverse relationship between independent variables (such as farm size, use of credit, chemical fertilizer, use of irrigation facility and off-farm activities) and food availability was unexpected situation, because these variables can have a positive contribution to the household food security.

Household responses during food shortage might be varied for different areas and people according to the local circumstances. In the study area, the most commonly practiced responses to food shortage are engaging in the sale of forest products, which is rated by 89.6 percent of the total population. A considerable size of population (87.4 percent) reported causal labor as a means of supplementary income during the period of food deficit. In the study area, this occurs during the period of critical food shortage or cultivation time (usually between March and July); when each household is working on his/her farm. Thus, it may result in bad consequences, because it pulls active labor force from own farm and further aggravates the condition of food insecurity.

In the study area, weaving is an alternative livelihood strategy next to farming that supports a great deal of population. Most weavers (adult males) spend part of their life

Household's coping strategies

Table 4: Households Coping Mechanisms for Seasonal Food Deficit

Strategies	Respondents by Villages (%)		
	Dallo	Damoze	Average
Engage in self employing activities	90	77.3	87.4
Sale of forest products	78.3	94.7	89.6
Receiving food for work	35	60	48.9
Remittance	71.7	82.7	77.8
Growing draught resistant crops	68.3	72	70.4
Purchasing food stuffs	8.3	10.7	9.6
Engaging in small business	70	65.3	67.4
Fattening livestock	25	16	20
Share cropping/ land renting	35	37.3	36.3

away from their home and reside in urban areas by abandoning children and wives in the home village. Thus, the remittance sent from them cover part of the household's income as rated by 77.8 percent of the total respondents. Using traditional agronomic practices such as cultivating fast maturing and drought resistant crop varieties (such as enset, sweet potatoes, cassava, etc.) are the other responses of addressing the problems of food shortage as reported by 70.4 percent of the population. Engaging in small businesses as a means of coping the period of food gap was also rated by 67.4 percent of the studied population. As a part of small business, from highland villages' girls and women usually visit lowland markets at least twice a week and purchase food grains and root crops for sale, back in the highlands. Therefore, as revealed in table 4 different coping responses were used by the households to overcome the period of food shortage.

Conclusion

Vulnerability to food insecurity is a common phenomenon along the semi-arid lowlands and degraded highlands of Ethiopia where rural households rely on rain-fed agriculture. This paper has assessed the possible causation and severity of food shortage across three agro ecologies in Basso catchment. It tries to show agro-ecology as a topographic element has influenced the level of food production and households' livelihood strategies through environmental

factors. As revealed in the paper that household factors played an immense role in determining food security status of the catchment. The analysis of food shortage shows that the household food production during the survey period, especially in the two highland villages, is lower than annual food requirement. This implies that there is a considerable stress of food insecurity in those localities. The argument made in this study is that if sustainable policy measures are not taken in areas, particularly with reference to population pressure, environmental protection, soil depletion and household income diversification, the food shortage in the catchment will persist. Thus, in order to alleviate the problems of food security in the upper catchment, many factors need to be addressed. For instance, the major problems of the catchment such as forest depletion, erosion, traditional rain fed farming and flooding. These must get remedial measure. In addition, it is necessary to encourage commercially oriented small holder farming activity, extension support and the development of infrastructure. For fair food transaction these are some important focus areas that need due attention in the national and local policy measures.

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