

Full Length Research Paper

Rural households' livelihood assets, strategies and outcomes in drought-prone areas of the Amhara Region, Ethiopia: Case Study in Lay Gaint District

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This study examines rural livelihood strategies and food security outcomes in the drought-prone Amhara Region of Ethiopia by focusing on Lay Gaint district as a case study site. Questionnaire survey, key informants interview and focus group discussions were employed to collect primary data. A total of 210 households were covered by the questionnaire survey, and the questionnaire covered issues related to household level asset ownership, crop and livestock production and engagement in non-farm and off-farm income sources in a mix of closed and open-ended questions. Both qualitative and quantitative methods were used for data analysis and the later included descriptive statistics and regression modeling. A major finding is that despite the low level of productivity related to local environmental constraints, rural livelihoods remain undiversified with small scale rain-fed agriculture providing the primary source of livelihood for the large majority of sample households (~93% of respondents). Only about 25% of respondents participated in some form of non-farm or off-farm activities, but with only little contributions to their total annual incomes. The use of yield-enhancing agricultural inputs such as chemical fertilizers and improved seeds was extremely low, and this was attributed to the severe land degradation and rainfall variability in the area. Food insecurity is a chronic problem in that, on average, households in the study area consume from own production for only about six months. Improving food security of rural households in the study area requires integrated development interventions aimed at improved natural resources management and diversification of livelihood strategies including interventions to create non-farm employment opportunities.

Key words: Smallholder agriculture, food insecurity, livelihoods, Ethiopia.

INTRODUCTION

Ethiopia has about 51.3 million hectares of arable land but only about 11.7 million hectares is currently cultivated, just about 23% of the total cultivable area (MoARD, 2010). This indicates that, given the ecological diversity, Ethiopia has a good potential to produce a wide variety of crops and in large quantities. Despite this

potential however, the country is one of the poorest in the world with annual per capita income of US\$ 392 which is much lower than the sub-Saharan Africa average (US\$ 1,077) in the year 2009 (UNDP, 2012; World Bank, 2011a cited in Tsegaye, 2012). The country also suffers from the lowest average per capita kilocalorie intake of

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1,980 and high incidence of absolute poverty (USAID, 2012). The population living below the poverty line of less than US\$ 2.0 a day accounts for 77.6% (Oxford Poverty and Human Development Initiative (OPHI), 2012). With a low human development index of 0.383, Ethiopia is ranked 174 out of 187 countries in UNDP's human development report of 2011 (UNDP, 2011; Shitarek, 2012). Poverty head count indices and inequality in 2010/2011 showed that 33.6% of the population suffers from food poverty and 29.6% of total poverty (FDRE, 2012). A contributory factor to the widespread rural poverty and food insecurity in Ethiopia is the very low productivity of the smallholder agriculture, which employs over 80% of the country's population (Canali and Slaviero, 2010). Smallholder farmers are the major producers of food through low-input, rain-fed and low-output farming systems (MoARD, 2010).

Drought, erratic rainfall, backward production technologies, small size of farmlands, and land degradation are the major causes for the low agricultural productivity in Ethiopia. Among these, drought is the most significant trigger that often leads to transitory food insecurity; a slight change in rainfall often leading to dramatic declines in crop yields. For example, Oxfam estimated that drought alone costs Ethiopia US\$ 1.1 billion per year (Shitarek, 2012). On the other hand, because of shortage of startup capital, limited skills, weak marketing systems and inadequate policy attention, employment opportunities in non-farm or off-farm activities are extremely rare in rural Ethiopia (Gebrehiwot and Fekadu, 2012). Currently over 10 million people in Ethiopia are either chronically or transitorily food insecure and depend on the government's safety nets program as the main source of income (MoFED, 2007; Ramanaiah and Gowri, 2011). Ethiopia is one of the poor countries that heavily depend on external food support, receiving about 5% of the total food aid given to Africa (EEA, 2009; Berhan, 2010). The aim of this study was to investigate livelihood assets, strategies and food security outcomes of rural households in a drought-prone environment in highland Ethiopia by using the case study research design. The specific objectives were to: (i) Describe rural households' possession of livelihood assets; (ii) Examine livelihood strategies employed by rural households in drought-prone environments and their livelihood outcomes as measured by annual total incomes, and (iii) Explore determinants of livelihood outcomes of households as measured by annual total incomes.

A few studies already exist about household livelihood strategies and outcomes in Ethiopia (e.g., Ellis, 2000; Yared, 2001; Degefa, 2005; Ellis and Tasew, 2005; Ayele, 2008; Beyene, 2008; Josef and Laktech, 2009; Fekadu, 2010; Alebachew, 2011; Chamberlin and Schmidt, 2011; Adugna and Wagayehu, 2012; Gebrehiwot and Fekadu, 2012). This study makes an important addition to the existing literature by investigating livelihood outcomes in the context of the sustainable rural livelihoods framework and by taking into account the spatial dimension of the

problem by looking at the role of local scale agro-climatic factors in household food security outcomes. In other words, it attempts to identify local scale opportunities and constraints faced by smallholder farmers because of the varying geographical space (Chamberlin and Schmidt, 2011) and households' possession of livelihood assets. Livelihood and food security studies at the household level facilitate identification of most appropriate livelihood improvement strategies that could be implemented by the government and communities to improve local livelihood outcomes. Thus, the study has practical significance for designing a more targeted and effective food security related development interventions in the study area, and in other similar environments in the country.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Lay Gaint district in the Amhara Region (Figure 1). It is one of the 64 food insecure districts in the Amhara Region (out of the total of 126 districts). Lay Gaint covers a total area of 1320.3 km² and has a population density of 185 persons per km² (CSA, 2010), which is one of the highest in the Region. Topography of the area is rugged with elevations varying between 1200 m asl and over 4000 m asl. The area receives annual rainfall of 898.3 mm. June, July and August are the rainy months. The mean annual temperature ranges from 4°C (on top of Guna Mountains) to 28°C (in the Tekeze river valley). The dominant soil types are Vertic Cambisols (Birhanu, 2009). Based on the traditional agro-ecological classification system, three agro-climatic zones are found in the area: Kolla (hot tropical), Woina-Dega (temperate) and Dega (cool), with an elevation of 500-1500, 1500-2300 and 2300-3200 m asl, respectively (Chamberlin and Schmidt, 2011). Small scale mixed agriculture is the dominant source of livelihood to the local people. Barely, wheat, tef and potatoes are the principal crops, and from the livestock cattle, sheep and goats are dominant.

Data collection and analysis

The study employed purposive, cluster and random sampling methods to select the specific sample sites and households. Selection of the study district was purposive based on the researchers' prior knowledge of the area. The specific Rural Kebele Administrations (RKAs¹) were selected in a cluster sampling approach where all the RKAs in the district were first clustered into the three major agro-ecological zones (Dega, Woina-Dega and Kolla) and then three RKAs were selected, one each from the three zones, in a random sampling procedure. The assumption was that in similar agro-ecological zones households share similar livelihood opportunities and constraints. Households in each RKA were further grouped into wealth categories based on information obtained from focus group discussions (FGDs), key informants (KIs), authors' prior experience and secondary sources. It was assumed that livelihood risks and shocks have different impacts on households of different wealth groups. Finally, a total of 210 households were sampled for a questionnaire survey from the three RKAs using proportional stratified random sampling technique based on the sampling frames obtained from the RKA offices (Table 1). In addition to the household survey, a total of six key informant interviews and three focus group discussions were conducted in each of the three RKAs. The fieldwork was conducted

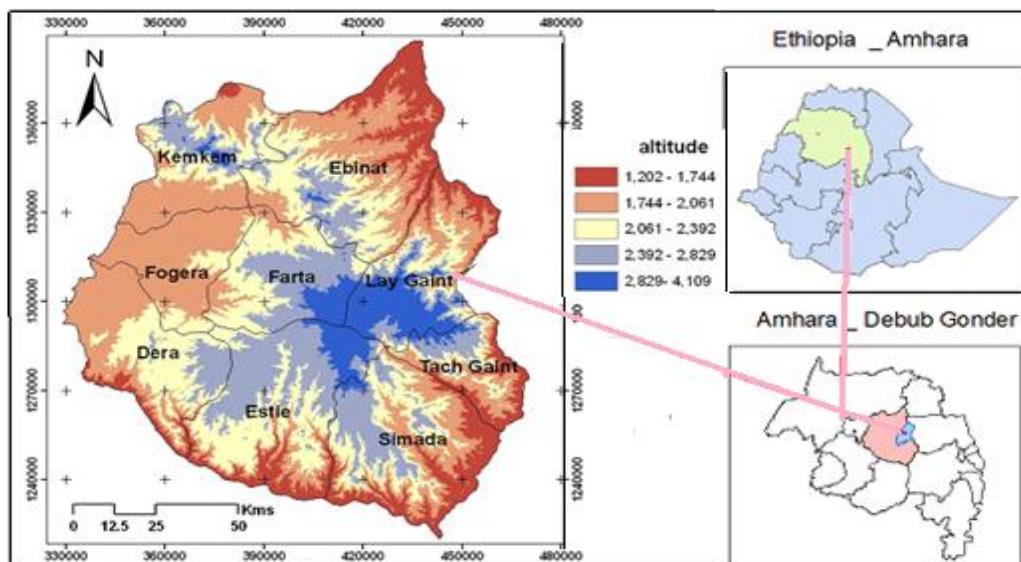


Figure 1. Location map of Lay Gaint district in the Amhara Region, Ethiopia.

Table 1. Sample size by agro-ecological zone and wealth categories of the study area in the Amhara Region.

RKAs	Agro-ecology	Wealth category	Population	Sample households	Questionnaire returned
Akbet	Dega	Better-off	202	10	10
		Middle	481	24	24
		Poor	740	36	36
Mesqench	Woina-Dega	Better-off	188	9	9
		Middle	403	20	20
		Poor	820	41	41
Safda Giorgis	Kolla	Better-off	175	10	9
		Middle	301	20	16
		Poor	790	40	36
Total			4100	210	201

between March and April 2011.

The survey questionnaire covered issues related to households' livelihood assets, crop and livestock production and engagement in off-farm and non-farm activities. In-depth interviews with key informants and focus group discussions covered issues related to perceptions of future food security; major sources of income of households, assets owned, and required government interventions to improve household level food security. The data generated by the structured questionnaire were entered into the statistical package SPSS (Statistical Package for Social Scientists) and analyzed using descriptive statistics and linear regression. The information collected through key informant interviews and focus group discussions were analyzed contextually to substantiate and supplement the quantitative results from the structured questionnaire.

Linear regression modeling was used to identify significant factors influencing household annual incomes (dependent variable for the regression modeling). Annual income of households was

taken as a proxy for the livelihood outcome of households from their diverse livelihood strategies, as annual incomes broadly determine food security status and wellbeing of households (Babu and Sanyal, 2009). Hence, the major sources of income for the households included small-scale agriculture (crop and livestock production, and sale of trees and fruits), engagement in off-farm and non-farm activities, participating in public works programs and receiving remittances. Explanatory variables for the regression modeling included selected socio-economic and biophysical factors that are assumed to influence annual incomes of households in the study area.

Conceptual framework

The sustainable livelihoods framework (SLF) captures what people possess as assets, do in order to make a living, risk factors and institutions, and policy context that enhances or hinders peoples

livelihood outcomes. The SLF is used to identify vulnerable groups of people to improve their livelihood outcomes and eliminate poverty (Farrington et al., 1999; Kollmair and Juli, 2002). In other words, it helps to understand how people cope with stresses and shocks through their capabilities, assets and strategies to secure livelihood outcomes (Ellis and Allison, 2004). It also describes factors affecting household livelihoods (Kappel et al., 2010). The five components constitute SLF are vulnerability context, livelihood assets, livelihood strategies, structures and processes and livelihood outcomes. The vulnerability context describes the external environment that people live in. This includes critical trends (population trends or technological trends), shocks (natural disasters or economic inflation), and seasonality (the way prices, employment opportunities and production might shift with the seasons) (Ellis, 2000; Kollmair and Juli, 2002). Livelihood assets are the resources on which people draw in order to carry out their livelihood strategies (Ellis and Allison, 2004; Farrington et al., 1999). Baumann (2002) pointed out that the single most important factor in determining the success of livelihood strategies is probably access to sufficient capital assets although the vulnerability context and the constraints and opportunities posed by wider institutional processes also play a critical role for livelihood outcomes. Transforming structures and processes include institutions, organizations and policies that frame the livelihoods of people, and they are found at all levels – from the household to the international level (Kappel et al., 2010).

As Baumann (2002) stated the SLF appreciates policies, institutions and processes that operate at all levels- from the household to the international arena. Livelihood strategies comprise a combination of activities and choices that people undertake in order to achieve their livelihood goals (Ellis and Allison, 2004). Livelihood strategies are complex, subjective and not necessarily related to short-term material gains (Baumann, 2002). Livelihood outcomes are achievements of livelihood strategies such as more income, increased well being, reduced vulnerability and improved food security (Shahbaz, 2008).

RESULTS AND DISCUSSION

Livelihood assets among the sample households

Livelihood assets owned by households represent the basic building blocks with which households undertake production, engage in labour markets and participate in reciprocal exchange with other households (Ellis, 2000). These include skills and experience of household members (human capital), their relations within wider communities (social capital), their natural environment (natural capital), and physical and financial resources (Gebrehiwot and Fekadu, 2012). In the study area, possession of these capital assets varies among households and by agro-ecological zones, as presented in the following paragraphs. This reflects the fact that different geographic locations provide different resource endowments, and hence people face different constraints and employ different strategies to achieve livelihood outcomes (Barrett and Webb, 2001).

Human capital

Household size, age, education and health status,

experience in farming activities are important human capital assets for households livelihoods. Among these, skilled work force is considered a vital human resource to bring about development. In the study area, about 89% of children were enrolled in primary and secondary schools during the field survey, but 61% of sampled household heads were illiterate. Only about 7% of them had some level of formal education. Of the total female-headed households, only about 8% were able to read and write. An assessment was made to see the influence of education on households' vulnerability to food insecurity. The result revealed that 60% of the illiterate households were vulnerable to food insecurity. The average family size was 5.2 and the dependency ratio was 92%. Malaria was identified as a major health problem in the Kolla zone, while water borne diseases were reportedly common in the Dega zone of the study area.

Social capital

Local informal institutions such as religious institutions, self-help groups, small credit schemes and cooperatives were found to be the important social capital assets in the study area. The different institutions are known by different local names: idir (mutual support particularly related to loss of a family member due to death), equib (local savings groups), and mahiber (an association for feasts and labour sharing). These institutions offer mechanisms for the people to help each other in times of need, solve internal conflicts, and thus reducing powerlessness and mitigate adverse effects of immediate social problems. These informal institutions therefore support the formal political structures such as RKAs in providing services to communities. During the field survey, about 94, 58 and 21% of sample households were involved in idir, mahiber and equip, respectively. Twigg (2001) noted that poor societies who are well organized and cohesive are able to cope with disaster events better than divided communities by race, religion, class or caste. In other words, people that share strong ideologies or beliefs and possess good experiences of cooperation are more likely to help each other during times of crises than people who feel fatalistic or independent to each other. The more memberships a household has the more possibilities for it to have social networks to promote positive livelihoods.

Physical capital

Roads, markets, schools, health centers, shelter, access to information, water harvesting and soil conservation structures were identified as vital physical capital assets by KIs and FGD participants. The study district's education office expert pointed out that the distribution of schools was relatively better in the Dega zone compared to the other zones. The district as a whole was served by

94 primary schools, 2 secondary schools and 1 preparatory school. It was also found out that in every RKA, there was one health post but there was a serious shortage of trained professionals; for instance, the ratio of health extension workers to the population was 1:3,000. From the sampled households, about 83% of the poor lived in grass-thatch-roofed houses. In general, infrastructure is considered an essential element to reducing poverty, and this is not adequately available in the study area.

Natural capital

In the study area, farmland was considered by the rural households as the most important natural capital. Availability of water, grazing land and fuel wood were also mentioned as important natural assets by respondents. All of these resources were reportedly very scarce in the study area. It was found that 92% of the sample households did not own any grazing land. Landholdings were in general small, and varied between the agro-ecological zones. The average landholdings in Dega and Woina-Dega were 1.06 and 0.72 ha, respectively, and the average landholding of the entire sample households was 0.88 ha. By wealth categories, better-off, middle and the poor owned on average, 0.92, 0.88 and 0.80 ha of land, respectively. One-way ANOVA confirmed that these differences were statistically significant (at $p < 0.01$).

About 57% of respondents had access to piped water, while 26% used unprotected springs and the rest obtained their waters from nearby rivers and streams. The study found that availability of water in the Kolla zone was a serious problem and on average women in this zone traveled a round-trip of about four hours a day to fetch water. Almost all households (98.9%) used fuel wood as their primary source of energy for cooking and lighting. The sampled households traveled on average a round-trip of more than three hours a day to collect fuel wood.

Financial capital

These refer to financial resources such as cash, liquid assets (livestock, jewelry), pension, and remittances and the like (Kollmair and Juli, 2002). In the study area, the major sources of finance include agricultural products (crop and livestock production, fruits, eucalyptus trees), engagement in food-for-work/cash-for-work activities, remittances and non-farm and off-farm activities. As shown in Table 8, estimated average annual incomes from the different sources were Birr 43,824.7 per household. From this, annual incomes from agricultural products were dominant and accounted for 88.5% of total. Annual incomes from off-farm and non-farm

activities were low (7.3% of total). Livestock as financial assets contribute to household livelihoods in many ways. They provide cash income through sale of animals and animal products, which enables purchasing of food and agricultural inputs as necessary. Meena and O'Keefe (2007) added that livestock can be considered as liquid assets that can be turned into other forms of financial capital relatively quickly. As it can be seen in Table 6, average annual income from the livestock sector was Birr 15,753, which is the second largest following income from crop production (Table 4). The other sources, food-for-work/ cash-for-work, remittances and equip, accounted for estimated average annual incomes of Birr 301.8, 243.0 and 282.0, respectively, to the sample households.

Livelihood strategies among the sample households

Crop production

Crop production is the major source of incomes and consumption for the majority of the sample households (Table 2). The major crops grown in the Dega zone in order of importance include wheat, barley, triticale, faba bean, tef and field peas. Wheat, maize, barely, tef, triticale and sorghum are the dominant crops in the Kolla zone and almost all the crops listed are grown in the Woina-Dega agro-ecological zone. Among the different types of crops, barley and wheat account for about 50% of the total crop production in the three agro-ecological zones. As it can be seen in Table 2, the percentage contributions of pulses such as faba beans and field peas in 2010/11 were low. A previous study (Aklilu et al., 2000) in the study area indicated that total production of the major pulses such as beans and peas was declining mainly due to recurrent drought, hail damage, soil degradation and diseases.

As it is shown in Table 3, about 70% of sample respondents produced below ten quintals. Those who produced above twenty quintals per year accounted for only about 14%. Agro-ecologically, about 90% in Kolla and 77% in Woina- Dega zone produced below ten quintals per year. One-way ANOVA showed that the differences among the three zones were statistically significant (at $p < 0.001$). The mean crop production of the entire sample households was 11 quintals. The survey result from the three zones on the other hand indicate that households need on average 20 quintals of crops per year to meet the minimum food requirements of households. The study found out that households consume from own produce on the average for six months.

Table 4 shows estimated annual income of the sample households from crop production at averages of Bega (dry season) and Kiremt (wet season) prices for the year 2010/11. The produces were expressed in terms of

Table 2. Crop production by agro-ecological zones of the study area in the Amhara Region (in Quintals; 1 Quintal \approx 100 kg).

Crop	Dega	Woina-Dega	Kolla	Total	% of total	Production per HH*
Barely	166.5	40.5	64.0	271.0	13.2	1.3
Wheat	544.0	123.8	74.0	741.8	35.9	3.7
Triticale	115.0	76.5	12.0	203.5	9.9	1.0
Tef	60.0	50.0	90.0	200.0	9.8	1.0
Faba beans	84.8	9.0	18.0	111.7	5.5	0.5
Field peas	53.0	35.5	31.0	119.5	5.6	0.6
Maize	0.0	11.0	115.0	126.0	6.1	0.7
Sorghum	0.0	72.1	53.0	125.1	6.1	0.7
potatoes	127	28.8	7.0	162.8	7.9	0.8
Total	1159.3	447.3	464	2070.3	100	10.3
Total production per HH	14.7	6.4	7.6	10.3		

*HH = Household.

Table 3. Crop production by the sample households of the study area in the Amhara Region in 2010/11 (% respondents).

Crop production (Quintal)	Dega	Woina-Dega	Kolla	Total
Below 10	44.3	77.1	90.2	69.7
10-20	31.4	8.6	8.2	16.4
21-30	15.6	5.7	1.6	8.0
31-40	2.9	1.5	-	1.5
41-50	2.9	2.8	-	2.0
Above 50	2.9	4.3	-	2.4

Table 4. Estimated average incomes of the sample households from crop production of the study area in the Amhara Region (in Birr) in 2010/11 (Birr 17.67 = US\$ 1.0).

Crop	Dega	Woina- Dega	Kolla	Total	% of total
Barely	1,660.0	405.0	734.4	2,799.4	13.1
Wheat	5,828.6	1,317.9	909.8	8,056.3	37.3
Triticale	1,314.3	874.3	-	2,188.6	10.1
Tef	857.1	714.3	1,475.4	3,046.8	14.1
Faba beans	771.4	128.6	265.6	1,165.6	5.4
Field peas	758.7	500.0	609.8	1,868.5	8.6
Maize	-	39.3	471.3	507.6	2.3
Sorghum	-	741.6	625.6	1,367.2	6.4
Potatoes	457.1	102.9	26.2	586.2	2.7
Total	11,647.2	4,823.9	5,118.1	21,586.2	100
% of total	54.0	22.3	23.7	100	

monetary equivalents to enable comparisons and for a better understanding of the situation. Prices of crops in Ethiopia are generally lower during Bega (December, January and February); and increase from the Belg (spring) season onwards to the Kiremt season (when it is often highest). KIs and FGDs unanimously agreed that in Kiremt prices of crops peak and often become unaffordable for the poor who always face scarcity of cash. Informants further noted that Kiremt is the period when majority of the poor are unable to feed their

families. For that reason, estimated average prices of crops produced in 2010/11 were taken during the field survey. As shown in Table 4, Dega agro-ecological zone accounts for the largest share of the average annual incomes from crop production (54% of total) followed by Kolla zone (23.7% of total). From the different crops grown in the study area, wheat was a good source of income for the entire sample households (37.3% of total) followed by barley (13% of total). From the total annual income of households from wheat, Dega alone

Table 5. Number of livestock by agro-ecological zones of the study area in the Amhara Region in the year 2010/11.

Livestock	Dega	Woina-Dega	Kolla	Total	Per household
Cows	94	44	46	184	0.9
Oxen	101	57	56	214	1.06
Calves	130	40	45	215	1.1
Sheep	397	98	141	636	3.2
Goats	19	53	85	157	0.8
Mules	19	4	8	31	0.2
Horses	31	4	0.0	35	0.2
Donkeys	52	38	55	145	0.7
Total	843	338	436	1617	8.0
Livestock/ HH	12.0	1.7	2.2	8.0	-
Total in TLUs ²	336.7	128.8	156.2	621.7	-
TLUs/ HH	4.81	1.84	2.56	3.1	-
Chickens	151	81	126	358	1.8

accounted for 72% of total followed by Woina-Dega (16% of total). Tef was dominant in Kolla (48% of total). Triticale, a newly introduced crop in the study area has become a good source of income for the Dega zone (60% of total).

The majority of respondents (85% of total) perceived a declining trend of crop production over the past years, which was also supported by available data. For instance, total cereal production was 409,877 quintals in 2001 and declined to 341,400 quintals in 2011 (Lay Gaint Woreda Office of Agriculture, 2011). The reasons for the decline, as perceived by the sampled household heads included soil degradation (60.7%), erratic rainfall (94%), land tenure insecurity (89.9%) water logging (29%), land scarcity (89.7%) and the rugged topography (67%). Measures taken to maintain and improve crop production by the households include use of compost (91%), terracing (92%), crop rotation (74%), use of chemical fertilizers (48%) and tree planting (58%). The use of chemical fertilizers among the sample households was generally low; households used on average 75 kg of chemical fertilizers and 20 kg of improved seeds per ha in 2010/2011. The surveyed households grew five to twelve different types of crops either in combination in the same field or in small separate plots. They did not think in terms of either market values or land suitability in their choice of crops, but for self sufficiency and mitigation of risks from crop failure. That is, if one or more of the crops fail due to unexpected weather conditions, it might be possible that other crops will survive. Specialization in terms of crop choice, in the words of respondents, was equivalent to 'storing all of one's eggs in one basket'. Diversification was therefore a preferred livelihood strategy to specialization among farmers of the study area.

Livestock production

The total livestock of the sample households was 1617

composed of cattle, small ruminants and equines (Table 5). The sample households owned on average 8 animals. The total number of chickens among the surveyed households was 358, with 1.8 per household. Among livestock, small ruminants were dominant (48%) followed by cattle (about 40%) and the fewest were equines (12%). Equines (mules and horses) accounted for only about 4% of the total livestock population. The study revealed that 35.3% of the sample households were without ox and was highly vulnerable to food shortage. Households who own less or equal to one-ox accounts for about 67% and having one ox or no ox is a serious constraint in the farming process. Key informants noted that priority was given to cattle, shoats and donkeys than mules and horses due to their economic value and scarcity of feed. In the study area, equines (which serve as pack animals) were dominantly owned by better-off and middle households. The poor without equines carry goods on their heads or backs from remote areas to market places.

From the small ruminants, sheep alone accounted for some 39% of the total number of livestock. The Dega zone with 62% of the sheep population was the suitable area for these animals, while 54% of the total goats were found in the Kolla zone. According to key informants, low risks, less feed requirement, and rapid reproductive cycle and speedy returns to investment make the small ruminants the most preferred among the surveyed households. The survey data revealed that about 20% of the poor had no livestock at all, while all of the better-off owned more than six livestock and 97% of the middle households owned one or more livestock. One-way ANOVA indicated that the differences were statistically significant (at $p < 0.01$).

Annual incomes of the sample households from sale of livestock in 2010/11 are presented in Table 6. Small ruminants accounted for 50% of annual incomes of households from the livestock sector, with sheep as income sources accounting for about 33% of annual

Table 6. Estimated average incomes of the sample households from sale of livestock (in Birr) in 2010/11 (Birr 17.67 = US\$ 1.0).

Livestock	Agro-ecological zone			Total	% of total
	Dega	Woina-Dega	Kolla		
Cows	1,142.9	3,000.0	196.7	4,339.8	27.5
Ox	392.9	714.3	344.3	1,451.5	9.2
Calves	400.0	228.6	170.49	799.1	5.1
Sheep	2,857.1	2,008.7	295.1	5,160.9	32.8
Goats	-	142.9	2,655.7	2,798.6	17.8
Mules	71.4	-	131.14	202.5	1.3
Horses	428.6	-	0.0	428.6	2.7
Donkeys	142.9	101.4	3,27.9	572.2	3.6
Total	5,435.8	6,195.9	4,121.3	15,753	100
% of total	34.5	39.3	26.2	100	

income. Agro-ecologically, Dega accounts for 55.4% and Kolla was the least (about 7% of total income). On the other hand, goats were the major sources of income in Kolla zone (95% of total). In general, sheep in Dega, cattle in Woina-Dega and goats in Kolla were the important financial resources, which together constituted about 80% of the annual income of the sample households from the livestock sector.

Sample household heads were asked to mention major challenges faced by the livestock sector in the study area. Accordingly, poor nutrition (45% of respondents), scarcity of forage and grazing land (92% of respondents), shortage of water (56% of respondents), poor management practices (23% of respondents) and diseases (85% of respondents) were listed as the major constraints to livestock production. A previous study (Rami, 2002) reported that in Lay Gaint district no fodder was left, the landscape was barren and full of gullies and livestock were emaciated. Ellis and Tasew (2005), in their study close to the present study area, also reported similar results in which the poorest and most vulnerable groups in rural Ethiopia suffered from scarcity of livestock due to animal diseases and shortage of grazing resources.

Non-farm and off-farm incomes

In the study area, non-farm and off-farm activities include casual labor, selling of fuel wood and charcoal, petty trading, handicrafts, grain milling and selling of local drinks. As it is shown in Table 7, the total off-farm/non-farm income per household was Birr 1075.9 (US\$ 1.0 = 17.67 Birr by that time) for the year 2010/11. On per capita basis, it was Birr 205.6. Josef and Laktech (2009) found an average income per capita of Birr 194 in their study for the whole of Ethiopia. It was found that the largest source of income from the total was engagement in casual labor (25.2% of total), followed by that of income from grain milling (23.5%), sale of charcoal and

fuel wood (19%) and grain trading (8.7%) (Table 7). Key informants indicated that lack of employment opportunities, shortage of start-up capital, limited skills, and weak marketing systems were the major reasons for the poor performance of non-farm activities in the study area.

By wealth categories, average incomes from non-farm and off-farm activities of the better-off, middle and poor households were Birr 2,634, 688 and 990, respectively. This suggests that the poor were more likely to be engaged in non-farm/off-farm activities than the middle-income groups in the study area. However, the activities in which the largest number of the poor households were engaged were food-for-work or cash-for-work (85%) followed by casual labor (81%). While for the better-off, grain milling and grain trading accounted for 98 and 87% of employment in non-farm/off-farm activities, respectively. It appears therefore that, as Ellis and Allison (2004) argued, the better-off as opposed to the poor have greater freedom to choose among a wider range of non-farm activities. Overall, about 25% of the surveyed households were engaged in non-farm/off-farm activities in 2010/11, which was much lower even by standards of Sub-Saharan Africa (SSA) average at 42% (Ellis, 2005).

Household annual incomes as livelihood outcomes

As it is shown in Table 8, the major sources of income for the sample households were categorized as agricultural production (sale of trees, fruits, crops and livestock), off-farm and non-farm activities, public works programs and remittances. The results indicated that income from agricultural production was the dominant, distantly followed by non-farm/off-farm incomes sources (7.3%). Non-farm/off-farm income sources had reached to 74% in some countries of Africa (Tasie et al., 2012) and 46% in Latin America (Sanchez, 2005). However, agricultural production in the study area is constrained by scarcity of farmland, land degradation, frequent drought, erratic

Table 7. Non-farm/off-farm incomes by agro-ecological zones (in Birr) in 2010/11 (Eth. Birr 17.67 = US\$ 1.0).

Sources of non-farm/off-farm incomes	Dega	Woina- Dega	Kolla	Total Birr	% of total
Grain trading	14,760	500	3,500	18,760	8.7
Livestock trading	3,000	4,300	5,000	12,300	5.7
Selling local drinks	380	1,250	6,807	8,437	3.9
Weaving	2,300	-	5,850	8,150	3.8
Selling commodities/petty trading	1,000	600	-	1,600	0.7
Carpentry	-	280	-	280	0.1
Blacksmith	5,000	-	2,300	7,300	3.4
Grain milling	48,000	-	3,000	51,000	23.5
Causal labor	35,047	14,150	5,605	5,4802	25.2
Sale of dung cakes	6,000	-	3,270	9,270	4.2
Sale of charcoal and fuel wood	12,145	9,630	17,000	38,775	19.0
Sale of grass	3,080	300	2,200	5,580	2.6
Total income	1,30712	31,010	54,532	216,254	100
Total annual income per household	1,867.3	443.0	894.0	1,075.9	

rainfall, scarcity of farm oxen, and low use of yield enhancing inputs. It was investigated that total annual income from the different sources varied by agro-ecological zones. Dega zone was relatively better than the other two because of more favorable environmental circumstances such as a good intra-annual distribution of rainfall. KIs and FGD participants informed that Woina-Dega and Kolla zones were frequently affected by drought and farmlands were extremely degraded. In addition, households in these two zones suffered from asset poverty and overall household incomes from the different sources were low (Table 8).

Mediating factors in livelihood outcomes of households

The livelihood portfolio of the surveyed households was influenced by covariate, idiosyncratic and institutional factors. For example, access to credit, communication systems, market facilities and extension services are institutional factors that affect livelihoods of the rural poor. This means that institutions assist rural poor households to employ particular adaptive strategies to mitigate food insecurity outcomes. Targeting safety nets beneficiaries and creating household assets for graduation from the program are also important institutional factors in the study area. The study revealed that 56% of sample households were covered by the safety nets program of the government. However, 82% of the sample households expressed dissatisfaction with the services the safety nets program; for instance, the majority of respondents in the 'poor' income category for this study (61.1% of the total) had no clear idea about the beneficiaries targeting and selection criteria. This suggests that lack of transparency and accountability in targeting safety nets beneficiaries is a limitation of the

local institutions. Similarly, respondents also mentioned high interest rate (18%) of local microfinance institutions, and poor infrastructure as major institutional constraints to their livelihoods. Land tenure insecurity, the resettlement program and unfair distribution of food transfer handouts were also important institutional factors to households' livelihood outcomes as cited by KIs and FGD participants. Degefa (2005) also indicated that inappropriate tenure system, inefficient and unstable rural policies, marginalization of some groups of people and lack of participation in decision-making process are power and policy bottlenecks that could result in negative livelihood outcomes.

Determinants of household livelihood outcomes

Rural households' livelihood outcomes are generally influenced by a range of biophysical, socioeconomic and institutional factors. In this study, annual total income of households was taken as a proxy to their livelihood outcomes and hence the dependent variable for the regression modeling. Explanatory variables considered include a range of biophysical and socioeconomic factors, a total of 12 variables (Table 9). The maximum likelihood estimates of the multiple regression model showed that livestock ownership, fruits and trees production, access to credit, agro-ecology and engagement in non-farm activities were the important factors influencing annual incomes of households, and thus their livelihood outcomes. The coefficient of multiple determination is 0.828, indicating that about 83% of the variation in total annual income of the sample households was captured by the model.

As it is shown in Table 9, Agro-ecology as a variable captures influence of locational factors on household annual incomes. It was found that households in the

Table 8. Estimated average incomes from different sources by agro-ecological zones of the study area in the Amhara Region (in Birr) in 2010/11 (Eth. Birr 17.67 = US\$ 1.0).

Source of income	Dega	Woina-Dega	Kolla	Total income	% of total
Crops produced and consumed	11,647.2	4,823.9	5,118.1	21,589.2	49.3
Stored for seed reserve	435.0	332.4	349.0	1,116.4	2.5
Selling of eucalyptus tree	200.0	86.0	-	286.0	0.7
Selling of fruits (highland apple)	311.9	-	-	311.9	0.7
Selling of livestock production	5,435.8	6,195.9	4,121.3	15,753	36.0
Off-farm and non-farm incomes	1,867.3	443.0	894.0	3,204.3	7.3
Public works	417.1	280.4	254.1	951.6	2.2
Gift/remittances	545.1	22.9	44.3	612.3	1.3
Total income per year	20,859.4	12,184.5	10,780.8	43,824.7	100
% of total	47.6	27.8	24.6	100	

Table 9. Multiple linear regression results.

Explanatory variable	Unit of measurement	Unstandardized coefficient		Standardized coefficient	t	P value
		B	Std. error	Beta		
(Constant)		849.892	438.292		0.591	0.555 ^{NS}
Agro-ecology	Categorical (1=Dega, 2= Woina-Dega, 3=Kolla)	-409.078	69.228	-0.269	-5.234	0.000 ^{***}
Family size	Number	236.387	22.346	0.112	1.932	0.055 [*]
Sex of HHHs	Dummy (0=F, 1=M)	605.832	42.504	0.050	0.943	0.347 ^{NS}
Age of HHHs	Number	-8.748	15.989	-0.027	-.547	0.585 ^{NS}
Education of HHHs	Dummy (0=illiterate, 1= literate)	94.243	38.575	0.011	.215	0.830 ^{NS}
Farm size	ha	-144.396	90.648	-0.014	-.294	0.769 ^{NS}
Number of plots	Number	352.539	72.824	0.115	2.04	0.043 ^{**}
Engagement in non/off-farm activities	Dummy (0=yes, 1= no)	0.151	0.061	0.141	-2.489	0.004 ^{***}
Livestock ownership	Number of livestock in TLU	145.827	30.603	0.338	4.765	0.000 ^{***}
Access to credit services	Dummy (0=yes, 1=no)	1.008	0.202	0.242	4.981	0.000 ^{***}
Membership in <i>equip</i>	Dummy (0=yes , 1=no)	0.345	0.573	0.038	.601	0.548 ^{NS}
Fruits and trees production	Income from sale of produce in Birr	0.565	0.093	0.311	6.068	0.000 ^{***}

^{**}Significant at 0.05; ^{*} significant at 0.1; ^{***}Significant at 0.01; ^{NS} not significant; HHHs = household heads; F = 22.5; df (12, 188); p < 0.001; R = 0.91; R² = 0.828.

Kolla and Woina-Dega areas earned less annual incomes compared to those living in the Dega agro-ecological zone. This could be explained by their inaccessibility and poor infrastructure. Livestock ownership was strongly and positively correlated to annual income of households (at P < 0.001). A unit increase in livestock ownership (in TLU) increases annual household income by a factor of 0.33. Previous studies in different parts of the country have reported similar results that livestock possession positively and significantly influenced household incomes (Deressa, 2010; Devereux et al., 2003; Million, 2010; Mesay, 2009).

Access to credit showed positive and significant correlation with annual income of households (at p < 0.001). As credit availability increases by one unit, annual income of households increases by a factor of 0.242. A similar, positive and significant credit-household income, relationship was reported by Beyene (2008). In the drought-prone areas of Ethiopia where crop production is highly affected by amount and temporal distribution of rainfall, access to credit fills food gaps of households and helps households to diversify their livelihood options. Among the surveyed households, some 40% had actually taken credit from different sources, while almost all

agreed that credit service was available in their area but did not take themselves. Non-farm/off-farm incomes were positively and significantly correlated with annual income of households (at $p < 0.001$). Other variables held constant, engagement in non-farm/off-farm activities increases households' annual incomes by a factor of 0.059.

Growing of fruits and trees was found to be important in livelihood outcomes of households in the study area. It was found that fruits and trees production increases households' annual incomes by a factor of 0.204. A similar finding was reported by an earlier study that selling and trading of eucalyptus tree had become a main source of income along the main road that connects Gondar to Mekele (Rami, 2002). Number of farm plots owned was positively and significantly correlated with annual income of households; other variables held constant, a unit increase in number of plots owned increases households' annual incomes by a factor of 0.077.

Family size showed positive and significant correlation with household annual incomes (at $p < 0.1$). This result was consistent with the findings of Tasie et al. (2012), but contradicts those of Chukwuemeka et al. (2011) and Fausat (2012) who reported negative and significant correlation between family size and household annual incomes.

Conclusions

This study explored livelihood assets, strategies and food security outcomes of rural households in a drought-prone environment in highland Ethiopia by using Lay Gaint woreda as a case study site and the sustainable rural livelihoods (SRL) framework as a guiding conceptual frame. A major finding is that despite the low level of productivity related to local environmental constraints, rural livelihoods remain undiversified with small scale rain-fed agriculture providing the primary source of livelihood for the large majority of sample households (~93% of respondents). Very few households were engaged in off-farm/non-farm activities. Lack of access to non-farm and off-farm activities is perhaps a major cause for the low coping and adaptive capacities of households in times of food security crises. Rainfall variability was found to be a major contributor for the poor performance of the agricultural sector in all agro-ecological zones in the woreda but the problem was more severe in the Woina-Dega and Kolla agro-ecological zones, where some 94 and 62%, respectively, of the food insecure households reside. The use of yield-enhancing agricultural inputs such as chemical fertilizers and improved seeds was extremely low, and this was attributed to the severe land degradation and rainfall variability in the area. Food insecurity is a chronic problem in that, on average, households in the study area consume from own production for only about six months,

and depend for the remaining period on the safety nets programme and other casual income generating activities.

Linear regression analysis identified livestock ownership, fruits and trees production, agro-ecology/location, access to credit and engagement in non-farm/off-farm activities as significant determinants of annual incomes of households. Improving food security of rural households in the study area requires integrated rural development interventions aimed at improved natural resources management and diversification of livelihood strategies including interventions to create access to credit and non-farm employment opportunities. In addition, geographically differentiated development interventions will improve household livelihood security in the study area, and in other similar environments in the country.

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Notes

1. The lowest tiers in the administrative structure of Ethiopia.
2. Tropical Livestock Unit is equivalent to a livestock weight of 250 kg, and the conversion factors vary according to the type of livestock. Accordingly, ox = 1.0 TLU, cow = 1.0 TLU, sheep/goat = 0.13 TLU, calf = 0.2 TLU, horse/mule = 1.1 TLU, donkey = 0.7 TLU (Fekadu, 2010).

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