IMPACT OF URBANIZATION OF *ADDIS ABEBA* CITY ON PERI-URBAN ENVIRONMENT AND LIVELIHOODS

Leulsegged Kasa[1], Gete Zeleke[2], Dawit Alemu[3], Fitsum Hagos[4] and Andreas Heinimann[5]

ABSTRACT

Addis Abeba is one of the rapidly urbanizing cities in Africa. However, empirical evidences on the impact of urbanization of the city on its peri-urban environment and livelihoods are scanty. This study has been conducted in 2011 with the objectives of detecting the land use and land cover dynamics of the city as a driver of changes in the environmental resource base of peri-urban livelihoods, assessing adaptive and copping livelihood strategies of peri-urban communities to urbanization, and evaluating the post-displacement welfare situation of urbanization-induced displaced households in the peri-urban areas. The remote sensing and geographic information system analysis results have shown built-up areas have increased by 120.93 km^2 within 24 years. This expansion was contributed by the conversion of croplands, forestlands, and grasslands in order. This implies the city's built-up area expansion is characterized by horizontal growth, leaving the peri-urban environment and livelihoods at risk. The income data analysis taken from the randomly selected 150 sample households has reveled, agriculture, industry, and service sectors are serving as source of adaptive and coping livelihood strategies to 83%, 45%, and 36% of respondents, respectively. These livelihood strategies, on average, have contributed 58%, 20%, and 17% of the total household income, respectively. A multinomial logit model analysis has revealed, households with relatively older, male and literate heads, whose family received relatively better transfer income and located in nearby of transport stations, have the likelihood of participating in non-agricultural livelihood strategies. Unlike to these factors, size of cropland, livestock asset, and credit were negatively and significantly correlated with participation in the non-agricultural livelihood strategies. Regardless of the diverse livelihood strategies practiced by peri-urban households, the propensity score matching estimation has indicated, fully displaced households received, on average, a per capita income of Birr 2597 and Birr 1547 lower from partially displaced and non - displaced households, respectively. In contrast, their average per capita expenditure exceeded by Birr 970 and Birr 742 from partially displaced and non-displaced households, respectively. This shows, regadless of compensations, fully displaced people have failed to establish a comparable means of income earnings and they are pursuing asset depleting consumption style. This shows for pre-displacement precautionary measures and post-displacement adaptation measures.

Key words: Urbanization; peri-urban livelihoods; multinomial logit; propensity score matching

---

[1]MSc, Socio-economic researcher, Sekota Dryland Agriciltural Research Centre of Amhara Regional Agricultural Research Institute. E-mail: leulseged1979@gmail.com

[2]PhD, Director, Water and Land Resource Centre & Co-Leader, Landscape Transformation Project (RP12) of NCCR North –South - CDE, University of Bern, Switzerland. E-mail: Gete.Zeleke@cde.unibe.ch

[3]PhD, Agricultural Economics, Research Extension, and Farmers Linkage Research Coordinator, Ethiopian Institute for Agricultural Research, Addis Ababa, Ethiopia. E-mail: dawit96@gmail.com

[4] PhD, Development and Resource Economics Researcher, International Water Management Institute (IWMI) Sub Regional Office for the Nile Basin and East Africa, Addis Ababa, Ethiopia. E-mail: f.hagos@cgiar.org

[5]PhD, Co-Leader, Landscape Transformation Project (RP12) of NCCR North –South - CDE, University of Bern, Switzerland. E-mail:

1 INTRODUCTION

Urbanization refers to a growth in the proportion of a population living in urban areas and the further physical expansion of already existing urban centers (Samson, 2009; Alaci, 2010). The level of urbanization in Africa is low (37.1%) when compared with developed countries like Europe (72.7%) and North America (79.1%). However, urbanization in the developing world in general is progressing much faster than in developed countries, which may reach 3% or even 4 % a year (Soubbotina, 2004). The fast rate of urbanization in developing world is attributed to rural–urban migration, economic growth and development, technological change, and rapid population growth (Marshall *et al*., 2009).

Ethiopia is one of the least urbanized countries in the world. It has only 16% of its population living in urban centers (PCC, 2008). However, given the 2.73% total annual population growth rate, high rate of in-migration to towns, and increase in the number of urban centers, the rate of urbanization is increasing at a rate of 4.4% (MoFED, 2006). Furthermore, the country's urban population is expected to grow on average by 3.98% and by 2050, about 42.1% of the total population is expected to be inhabited in urban centers (UN-HABITAT, 2007). Even though there are more than 900 urban centers in Ethiopia, *Addis Abeba*, its capital city, consisted of about 23% of the total urban population in the country (PCC, 2008).

To accommodate the ever-increasing population, industry concentration, and commercial expansion, *Addis Abeba* city has been expanding horizontally towards its peri-urban areas. Abdissa (2005), Melesse (2005), and Gete (2007) have documented the effect of urbanization in terms of forest and soil degradation, water pollution, and overall decline in agricultural production, agricultural community displacement, and squatter settlement. These research outputs were based on process evaluation and qualitative description of observations. Application of GIS and RS techniques in terms of quantitative monitoring of spatial and temporal urban dynamics are becoming the integral part of such evaluations. Tadesse *et al*. (2001) and Amente (2009) have applied these techniques to detect the land use/cover changes in *Addis Abeba* city. However, the former needs updating and the latter was only confined on village level.

In addition, the livelihood impact of urbanization on peri-urban areas is least studied (Tadele, 1999; Abdissa, 2005). In post-intervention impact evaluations different quasi-experimental methods, like propensity score matching technique are becoming recommendable. In Ethiopia, despite the application of such impact evaluation techniques in some other development project evaluations (Bernard *et al*., 2007; Abebaw *et al*., 2010; Fitsum *et al*., 2011) such research undertakings in the context of evaluating urbanization impacts are scanty. Integrating such environmental and livelihood evaluation techniques, this study aims to detect the land use and land cover dynamics of *Addis Abeba* city as a driver of change in the environmental resources base of peri-urban livelihoods, assess adaptive and copping peri-urban livelihood strategies to urbanization, and evaluate post-displacement welfare situation of urbanization-induced displaced peri-urban households.

This study gives feedbacks to concerned development actors of the city to evaluate past development actions of urbanization and identify further intervention areas. It also helps policy makers to draw lessons to sustainable urban, peri-urban, and rural development policy formulation. The paper also helps researchers to strengthen the application of environmental and livelihoods integrated evaluation approaches. Furthermore, it can be used as complementary reference to the hardly existing urbanization evaluation literatures. The remaining part of the paper is organized as follows: the second chapter develops the conceptual frameworks. The third chapter introduces the research methodology employed. The fourth chapter presents the findings of the study. The final chapter concludes and presents recommendations.

2. Conceptual Framework

2.1 Conceptual Framework

The impact of urbanization on peri-urban environment and livelihoods can be seen in two ways: positive and negative. According to Alaci (2010) well planned and managed urban growth and development can serve as a positive development factor. The benefits could be seen in terms of high demand on agricultural produces, access to developed extension services, and opportunities to non-farm employment (Satterthwaite and Tacoli, 2003).

However, unguided urbanization, like in most developing countries, negatively affects the natural environment and livelihoods in peri-urban areas (UN-HABITAT, 2010). This could be attributed to changes occurring in land use, water resources management, waste dumping, and increasing competition between agricultural and residential use of natural resources (Bah *et al*., 2003). As a result, urbanization could bring a dramatic increase in the concentration of poverty and environmental degradation in peri-urban zones (Marshall *et al*., 2009).

Given the experiences of its high correlation with economic development, particularly in developed countries (Henderson, 2003), urbanization is still prescribed to least urbanized countries like Ethiopia (Woldehanna, 2008). In addition to multi-factors driven it, government's policies are considered as key development interventions in promoting urbanization. In this regard, the impact of urbanization on peri-urban environment and livelihoods can be evaluated as like any development intervention effects. Impact evaluation is the systematic identification of these positive or negative effects, which are intended or not, brought by a given development activity on households and environment (WB, 2004). With this concept in mind, evaluation literatures can be seen in to two broad categories: environmental impact assessment, particularly land use and land cover dynamics analysis as a driver of change to peri-urban livelihoods, and impact of urbanization-induced displacement on peri-urban livelihoods.

Mundia and Aniya (2005) had analyzed the land use and land cover changes and urban expansion of Nairobi city using RS and GIS techniques. They used satellite images for 1976, 1988 and 2000 together with socio-economic data. Their finding revealed that the built-up area of the city had expanded by about 47km^2 against loss of forests. Tadesse *et al.* (2001) had conducted a study in *Addis Abeba* and its surrounding area to detect its land use and land cover change between 1987 and 1999. They employed similar techniques to analyze Landsat Thematic Mapper images of 1987 and 1999. Their finding clearly revealed the loss of forest to urban and residential sprawl within the city limit and the surrounding area. Though it was relatively in a very small area within *Kolfe Keranyo* sub city of *Addis Abeba,* Amente (2009) has assessed the environmental impacts of urban land use changes. His empirical finding revealed built up area of his study site has shown increasing trends at the expense of

agriculture and forestland. These studies showed the importance of RS and GIS analysis techniques for urbanization impact evaluation and pressures on peri-urban livelihoods.

Concerning peri-urban livelihoods, Mandere *et al.* (2010) have conducted a study in peri-urban Nyahururu, Kenya with the objective of assessing the impact of the peri-urban development dynamics to household income. Their finding showed a decline in economic significance of agriculture in these areas due to rapidly shrinking of agricultural land because of the effect of urbanization. They have also indicated households have adopted diverse non-farm activities whose earnings proved to be of varying importance to the annual household income. The infrastructural developments coupled with emerging business enterprises were found to be the main factors that enhanced the opportunities for household engagement in non-farm activities. They then concluded peri-urban development is not only dependent on the infrastructural developments but also on the socio-economic opportunities and government policy. Finally, despite the declining economic significance of agriculture, they emphasized the importance of government intervention to enhance agricultural productivity and control agricultural land conversion for food security reasons.

A study has also been conducted by Tho (2006) in Peri-Urban Area of Ho Chi Minh City, Vietnam. The research aimed to explore livelihoods, especially on agriculture and to identify how household livelihood outcomes were built. Tho used a combination of qualitative and quantitative methods to collect data and employed descriptive analysis. Among his major findings, youth were found to be less engaged in agriculture and diversify more towards non-agriculture activities to earn income. In addition, poor households were found spreading their income source more to rice and non-farm income whereas higher income groups were found specializing on cash crop cultivation. However, depending on the academic background of researchers and area of interest variations were observed in the theoretical arguments of livelihood analysis. For instance, Tadele (1999), a social anthropologist, used the Cernea's Impoverishment Risk Model and Scudder and Colsons's Prosessual Model to explain urbanization-induced displacement and resettlement process. This methodology is more of qualitative description of development-induced displacement and resettlement programs. It also lacks setting objectively measurable indicators for post-displacement welfare situation

evaluation of urbanization- induced displaced households. Abdissa (2005) used the sustainable livelihoods framework (DFID, 1999) to describe the urbanization-induced displacement in the peri-urban areas of *Addis Abeba* city. As Scoones (1998) stated, this framework helps us to answer 'given a particular ***context*** what combination of ***livelihood resources*** result in the ability to follow what combination of ***livelihood strategies*** with what ***outcomes***?'. Even though this framework has been widely used in rural livelihoods analysis, it has becoming applicable for urban livelihoods analysis (Farrington et al 2002). Despite the use of such frameworks to qualitatively explain livelihood situations, application of quantitative analysis techniques seems very rare.

In order to evaluate urbanization-induced displacement on the welfare situation of displaced households, quasi-experimental methods can be used to carry out an evaluation when it is not possible to construct treatment and comparison groups through experimental design. These techniques generate comparison groups which resemble the treatment group, at least in observed characteristics. This can be done through econometric techniques which include matching methods, among others. Among quasi-experimental design techniques, matched comparison techniques are generally considered a second-best alternative to experimental design. In recent years, there have been substantial advances in propensity score matching techniques (Rosenbaum and Rubin, 1983; Jalan and Ravallion, 1999). This method is very appealing to evaluators with time constraints and working without the benefit of baseline data given that it can be used with a single cross-section of data (Baker, 2000). In order to see livelihood strategy participation decisions, the random utility model (Verbeek, 2004) can be employed. This model explains, a particular livelihood strategy alternative is chosen if the utility of that alternative is greater than the utility of other alternatives. In other words, the random utility model is constructed on the premise that the decision maker chooses the choice that maximizes his utility. The most commonly used multinomial models for unordered categorical response variables are multinomial logit (MNL) and multinomial probit models (MNP) (Greene, 2003; Maddala, 1993; Verbeek, 2004). In this research, both MNP and MNL models were tested. The MNP model was executed following *asmprobit* procedure in STATA (STATA Corp, 2007; Kropko, 2010). However, the algorithm failed to converge, and MNL model was used (Keane, 1992; Khan, 2008).

3. RESEARCH METHODOLOGY

3.1 Description of the Study Area

This study was conducted in *Addis Abeba*, the capital city of the government of Federal Democratic Republic of Ethiopia. Administratively, the city is a chartered city having three layers of government: city government, sub-city administrations, and district (*Woreda*) administrations. The total area of the city is about 527 km^2 and the total human population, as of July 2010, was estimated to be 2,917,295 (CSA, 2010). The city serves as social, economic and political centre for the country. About 65% of industries of the country are located in the city (Gebre and Rooijen, 2009). The city accounts for one-fifth of the urban GDP in the country (Alaci, 2010). It is a seat for African Union, United Nations Economic Commission for Africa, and other international organizations. *Bole* is one of the peripheral sub-cities in *Addis Abeba*, which covers a total area of 122.08 km^2. As of July 2010, the total population of the sub-city was 328,900 (CSA, 2010). The sub-city has a considerable number of agricultural communities and it is one of a rapidly expansion zone of built–up areas.

3.2 Methods of Data Collection

In order to assess the land use and land cover dynamics, Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM^+) Landsat images taken in 1986, 2000, and 2010 were accessed from NASA's Global Land Cover Facility (GLCF). The administrative boundary of *Addis Abeba* city was also obtained from urban planning and information institute of Addis Abeba city government. For the livelihoods analysis, the target populations for the livelihood analysis were Urbanization-Induced Displaced People (UIDP) and Non-Displaced People (NDP) in the peripheries of *Addis Abeba* city. The later served as comparison group for post-displacement welfare situation analysis. Qualitative and quantitative data were collected through focus group discussion, key informant interview, and household survey. 150 sample households were drawn by multistage sampling techniques for the household survey. 39 (26%), 52 (35%), and 59 (39%) FDP, PDP, and NDP, respectively were selected from *Summit, Beshalle, Endode and Jarsso* villages.

3.3 Data Analysis

3.3.1 Spatial data analysis

The satellite imageries acquired were already georeferenced and radiometrically corrected. The image processing was then started by image classification within the administrative boundary of Addis Abeba city. Depending on the scope of the study and visual interpretation of the satellite imageries, only four classes were chosen. These were built-up (including any sort of housing construction, road, and bare land), forest (including bushes and shrubs), crop land, and grass lands. There are two methods of image classification. These are, supervised and unsupervised image classifications (Singh, 1989; ERDAS, 1999; Tadesse *et al*., 2001).

Supervised classification involves selecting pixels that represents land cover classes that are recognized by the analyst. This requires, however, prior knowledge of the area by the analyst. Unsupervised image classification is more computer-automated. It enables the analyst to specify some parameters that the computer uses to reveal statistical patterns that are inherent in the data. These patterns are simply clusters of pixels with similar spectral characteristics. This method is usually used when less is known about the data before classification (ERDAS, 1999; Tadesse *et al*., 2001). Due to similar spectral characteristics of grass, crop and bush lands, which were determined to be independent classes before classification, the application of unsupervised classification may not give good results. As a result, in this analysis, supervised image classification was used.

After determining the land cover features the next step employed was land cover change detection. Land cover change detection is the process of assessing the spatial and temporal dynamics of a given land cover feature. This was done through overlying the classified satellite imageries and analyzing by image differencing algorithm. ENVI 4.5 and ArcGIS 9.3 softwares were used for analysis. The former employed to image classification and change detection while the later was used to finalize the mapping exercises and layout preparations from the classified images. Furthermore, the outputs of image classification were verified by conducting ground truth.

3.3.2 Livelihoods Analysis

3.3.2.1 Identification of determinants of livelihood strategy participation

Let Y_i be a random variable that indicates the individual *i*'s choice, then the probability of choice *j* in multinomial logit model is given as follows (Maddala, 1993; Greene, 2003).

$$\Pr(Y_i = j) = \frac{e^{\beta'_j X_i}}{\sum_{k=0}^{5} e^{\beta'_k X_i}} \qquad \textbf{(1)}$$

Where *j* indexes the choices, *X* is a vector of individual characteristics, *i* indexes the individuals, indexes the independent variables, *e* is the natural base of logarithms and ß is a vector of unknown parameters. This provides a set of probabilities for the *J + 1* choice for a decision maker with characteristics X_i. However, the model in equation (4) above is indeterminate and needs to be normalized by assuming $ß_1 = 0$. This arises because probabilities sum to 1, so only J parameter vectors are needed to determine the *J + 1* probability. Therefore, the probabilities are

$$\Pr(Y_i = j | X_i) = \frac{e^{\beta'_j X_i}}{1 + \sum_{k=0}^{J} e^{\beta'_k X_i}} \qquad \text{for j} = 1,2,3 \qquad \textbf{(2)}$$

The magnitude of the coefficient estimates of the independent variables in the multinomial choice models describes the relative probability of a choice to a base-choice. However, this gives limited information and only their signs and level of significance are relevant (Khan, 2008; Kropko, 2008; Ntembe, 2009). On the other hand, the influence of an independent variable on the choice decision can be assessed by the size of its marginal effect. The marginal effect is a measure of the instantaneous effect that a change in a particular explanatory variable has on the predicted probability of the dependent variable. The larger the marginal effect, the larger the impact of an independent variable on the probability of an individual choosing a livelihood strategy alternative in response to a change in the independent variable (Ntembe, 2009). Differentiating (**2**) determine the marginal effects of the regressors on the probabilities. This is given as:

$$\delta_j = \frac{\partial P_j}{\partial X_i} = P_j \left[\beta_j - \sum_{k=0}^{J} P_k \beta_k \right] = P_j [\beta_j - \overline{\beta}]. \qquad \textbf{(3)}$$

Description of variables used in multinomial logit model and working hypothesis

The dependent variable used in the multinomial logit model consisted of three livelihood strategy choices. These were agriculture only (Y=0), industry and service sector combination (Y=1), and agriculture, industry and service sector combination (Y=2). Classifying sample households in to each of these categories has been made if they drive 75% their income from that specific category (Ellis, 2000). Adugna (2008) adopted the same cut off point in his livelihood analysis. Definitions and measurements of the independent variables and their working hypothesis are described in Table 1.

Table 1 Definition and measurement of independent variables used in MLM

Variable	Definition	Measurement	Hypothesis
HHage	Age of Household Head	Years	Negative
HHsex	Sex of Household Head	1 if Male, 0 otherwise	Positive
HHedu	Literacy status of the Head	1 if literate, 0 otherwise	Positive
FamilyS	Family Size	Number	Positive
Labor	Labor in the working age (15-65)	Number	Positive
FarmSizeHa	Agricultural land holding	Hectares	Positive
lnSaving	Log of savings of the HH per year	Ethiopian Birr	Positive
lnCredit	Log of loan received by the HH per year	Ethiopian Birr	Positive
lnIncTra	Log of transfer income received per year	Ethiopian Birr	Positive
lnEucSize	Log of Eucalyptus trees possessed	Number	Positive
TLU	Livestock asset holding of the HH	TLU	Negative
DistRoad	Distance to nearby public transport	In Minutes	Negative
DistCropMkt	One way distance to livestock market	In Minutes	Negative
DistLsMkt	One way distance to crop market	In Minutes	Negative
HHSocRes	HH heads social responsibility	1 if leader, 0 otherwise	Positive
SocNET	Social network of the HH	# labor help expected	Positive
VillEndode	Residence village of the HH	1 if *Endode*, 0 otherwise	Positive
VillSummit	Residence village of the HH	1 if *Summit*, 0 otherwise	Positive
VillBeshalle	Residence village of the HH	1 if *Beshalle*, 0 otherwise	Positive

*Village *Jarso* is the reference category

3.3.2.2 Post-displacement welfare situation of urbanization-induced displaced people

Following Roy–Rubin model (Caliendo and Kopeinig, 2008), the impact of UID on the welfare situation of UIDP can be modeled as follows:

$$W_i = Y_{i1} - Y_{i0} \quad \textbf{(4)}$$

Where: W_i is the welfare effect of displacement on household *i*, Y_{i1} is the welfare situation of household *i* if displaced (UIDP), Y_{i0} is the welfare situation of household *i* if not- displaced (NDP), and *i* index of households under study ranging up to N. However, the problem is household *i* will never be displaced and non- displaced at the same time. Meaning Y_{i1} and Y_{i0} cannot be observed for the same individual at the same time. Hence estimating individual W_i is not possible and one of the alternatives available is estimating $W_{ATT,}$ the average welfare effect of UID on UIDP. Let $D_i = 1$ if a given household belongs to UIDP, and $D_i = 0$ if it belongs to NDP. The W_{ATT} is given as follows.

$$W_{ATT} = E(W|D=1) = E(Y_1|D=1) - E(Y_0|D=1) \quad \textbf{(5)}$$

Where: $E(W|D=1)$ is the expected value of the average welfare effect of UID on UIDP, $E(Y_1|D=1)$ is the expected welfare situation of UIDP and $E(Y_0|D=1)$ is the expected welfare situation of UIDP if they had not been displaced. In this case measuring the observed welfare situation, $E(Y_1|D=1)$, is possible but the problem is how to predict the unobserved welfare situation, $E(Y_0|D=1)$. In order to substantiate "what could have happened to UIDP had they not been displaced?'', the available alternative is to use the average welfare situation of comparison of NDP, $E(Y_0|D=0)$. This widely used design defines the post-intervention comparison group as the counterfactual. After incorporating the counterfactual welfare situation in equation **(5)**, the average welfare effect of UID on UIDP is given as:

$$E(Y_1|D=1) - E(Y_0|D=0) = W_{ATT} + E(Y_0|D=1) - E(Y_0|D=0) \quad \textbf{(6)}$$

Given the left hand side terms are observable, W_{ATT} will be determined if and only if the selection bias, $E(Y_0|D=1)-E(Y_0|D=0)$ = 0. This can be granted in pure experimental design, where treatment assignment is random, and treatment effects can be identified. However, in non-experimental studies this holds true if and only if Conditional Independence Assumption (CIA) holds and Common Support Region (CSR) meet (Caliendo and Kopeinig, 2008). If this is rationally accepted, the average impact of displacement on UIDP's per capita income and consumption expenditure (W_{ATT}) can be estimated as:

$$W_{ATT} = \frac{1}{k}\sum_{j=1}^{k}[y_j^{j\in T=1} - y_j^{j\in T=0}] \quad \textbf{(7)}$$

Where: k is number of matched samples, y_j is outcome indicator for household j, T indicates displacement status, T=1 for UIDP, 0 for NDP. The computed PSM estimator in this case indicates the mean difference in per capita income/expenditure over the common support, appropriately weighted by the propensity score distribution of UIDP. The estimation and tests were undertaken following procedures stated by Leuven and Sianesi (2003) psmatch2 routine using STATA 11software.

4. RESULTS AND DISCUSSION

4.1 Impact of urbanization on peri-urban environment

Peri-urban environment in this context refers to the physical environment, encompassing the forest, land, and water. In order to satisfy the ever-increasing demand of land it has become mandatory to displace peri-urban communities from their land holding. Land as the major factor of crop, livestock, and eucalyptus production, which are the mainstay of peri-urban livelihoods, its dispossession is one of the contributing factors for the prevailing vulnerable livelihoods in these areas.

4.1.1 Land conversion

Following the land use and land cover dynamics analysis, Figure 1 consists of the 1986, 2000 and 2010 classified land use and land cover maps of *Addis Abeba* city. The darker color indicates built-up areas and the darkness decreases consecutively for forest cover, grasslands, and croplands. If we see the 1986 land use and land cover map of the city, there was forest dominated cover land in the Northern and Northwestern part while crop and grasslands dominated the Southern, Southeastern, and Northeastern part. The built-up area was only concentrated on the central part. The 2000 and 2010 land use and land cover maps clearly show the expansion of built-up areas and shrinkage of forest lands.

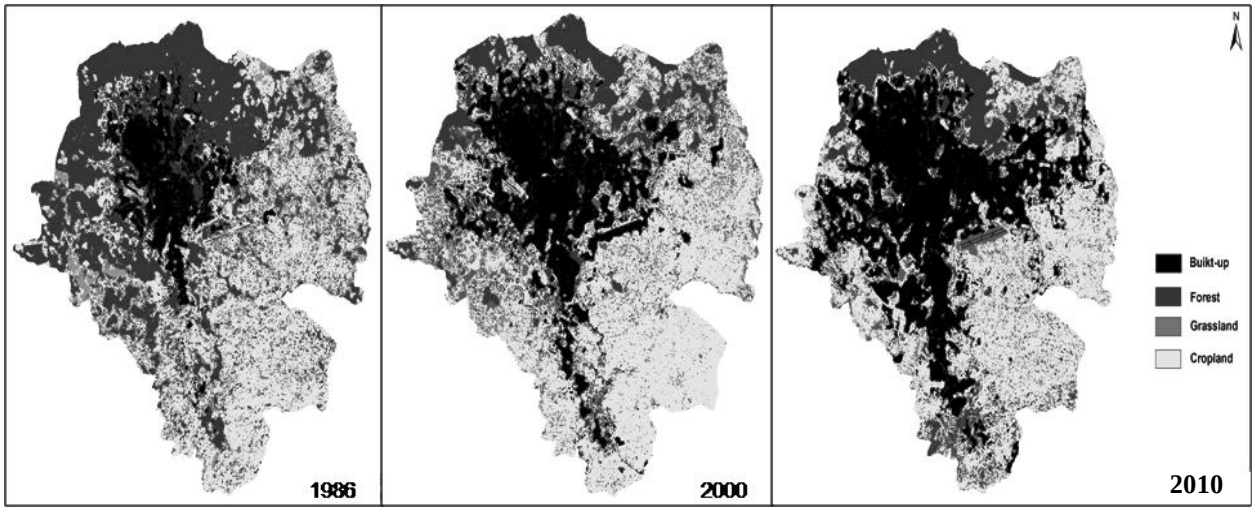

Figure 1 Land use/land cover maps of Addis Abeba city in 1986, 2000 and 2010

Following the classification of land use and land cover features of each satellite images independently, the land use and land cover change detection was employed using post-classification comparison approach. This involves comparative analysis of independently produced classifications for different dates. The summary statistics of land use and land cover changes occurred in Addis Abeba city between 1986 and 2010 is given in Table 2.

Table 2 Land use and land cover changes of *Addis Abeba* city, 1986–2010

	1986		2000		2010	
LULC Type	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**
Built-up areas	67.08	12.95	124.61	24.06	188.01	36.28
Forest cover	192.54	37.16	80.82	15.60	67.86	13.10
Grassland	25.21	4.87	28.55	5.51	23.69	4.57
Cropland	233.25	45.02	284.02	54.83	238.63	46.05
Total	518	100.00	518	100.00	518	100.00

Source: Extracted from analysis of Landsat images of 1986, 2000, and 2010

In the first analysis period (between 1986 and 2000), the built-up area expansion was contributed by 35.8 km^2 (55%), 27.05 km^2 (42%), and 1.91 km^2 (3%) conversion of croplands, forest, and grasslands, respectively. In the second analysis period (between 2000 and 2010), the built-up area expansion was contributed by 59.28 km^2 (80%), 10.65 km^2 (15%), and 4.29 km^2 (5%) conversion of croplands, forest, and grasslands, respectively. Cropland areas have shown a net gain of 50.77 km^2 in the first analysis period and reached 284.02 km^2 in 2000. This was majorly contributed from the conversion of 89.74 km^2 (82%) forestlands, 13.53 km^2 (12%) grasslands, and 6.34 km^2 (6%) bare lands (in built-up areas). However, in the second analysis period the coverage of croplands have declined and reached 238.63 km^2 in 2010. Similarly, forest areas were 192.54 km^2 in 1986. However, it declined to 80.82 km^2 in 2000 and 67.86 km^2 in 2010, showing a total loss of 124.68 km^2 within 24 years. Grasslands on the other hand have shown little increment by 3.34 km^2 in the first analysis period while it declined by 4.86 km^2 in the second analysis period.

The rate of change of land use and land cover in *Addis Abeba* City

Over the study period, built-up area has increased by 5.04 km^2 per annum against 5.20 km^2 per annum decrease of forest cover areas. However, the rate of the declining trend of forest cover was reducing significantly between 2000 and 2010. This could be attributed to the improved tree plantation activities conducted in the city. Even though grass and cropland showed a little growth in the first analysis period, both had a declining trend in the second analysis period. Particularly croplands showed a significant negative growth (see Table 3).

Table 3 Rate of change (%) of land use and land cover in Addis Abeba (1986 to 2010)

LULC Class	years		
	1986 - 2000	**2000-2010**	**1986-2010**
Built-up	4.11	6.34	5.04
Forest	-7.98	-1.30	-5.20
Grassland	0.24	-0.49	-0.06
Cultivated	3.63	-4.54	0.22

Source: Computed based on data extracted from own image analysis, 2011

The findings revealed that built-up areas are expanding at the expense of crop and forestlands. Tadess *et al.* (2001) who detected the land use/cover change of *Addis Abeba* city in line with the first analysis period had reported similar results. They reported forestlands have converted in to urban and residential sprawl within the city limit and the surrounding area. Fekerte (1991) reported, the forest resource depletion of the city was attributed to ownership arrangement and the growing demand of wood for construction and domestic purposes. Amente (2009), who did his thesis research on the land use/cover change detection of *Selti* area of *Kolfe-Keranyo* sub-city of *Addis Abeba,* has reported the conversion of agriculture land and forest to built-up areas. He further noted informal land transactions and formal land allocations for built-up areas as the main reason for agricultural land conversion. This horizontal physical expansion has leaded them a complete dispossession of agricultural land or farm size reduction. This in turn forced them shift in their livelihood strategies.

4.1.2 Waste accumulation and inappropriate disposal

Solid and liquid waste generation in *Addis Abeba* city is directly related with population growth, industrial expansion and economic status of its residents. The daily per capita solid waste generation of the city is estimated to be 0.4Kg. Of the total solid waste generated per day, about 80% is collected (SWMA, 2010). The remaining 20% of the waste is disposed off on an open sites, drainage channels, rivers, valleys, and on the streets. Even the collected solid waste is dumped in open dumping site with no daily cover with soil, leachate containment or treatment, rainwater drain-off, odor or vector control, and fence. The *Repi* open dumping site of the city is already full and surrounded by residential houses and institutions.

In addition to the solid waste, liquid waste is important source of pollution in *Addis Abeba* city. Only 7.2% of the liquid waste is disposed in appropriate way and the remaining 92.8% is disposed inappropriately in to rivers and rainwater channels (WSA, 2010). Excluding the recently constructed condominiums and real estates, the number of sewerage line customers is estimated to be only 4000 households. Furthermore, industrial wastes are important source of river water pollution. According to Gebre and Rooijen (2009) among 2000 registered industries in Addis Abeba, most of them were located along riverbanks. About 90% of these industries lack on-site treatment facilities for some degree, and subsequently discharge any effluents into adjacent streams.

River and spring water are important source of domestic and irrigation water sources to peri-urban communities. However, inappropriate solid and liquid waste disposal is polluting urban and peri-urban water, soil, and the air. Based on the discussions made with peri-urban communities in the study area, due to such poor waste disposals, some peri-urban water sources become out of use. Human and livestock health problems were also reported. Gebre and Rooijen (2009) reached similar conclusions. They undertook water quality test in Great and Little *Akaki* rivers, which is important source of irrigation agriculture in the city. They found the rivers were very/badly polluted. This shows peri-urban communities and their livestock are highly vulnerability to various health problems. As a result, some households reported they either destock or cease livestock production.

4.2 Adaptive/Copping Livelihood Strategies of Peri-Urban Households in *Addis Abeba*

Given pressures created by urbanization, peri-urban households had different adaptive and /or copping livelihood strategies. Following the macro-economic classification, these were broadly categorized in to agriculture, industry, and service sector related livelihood strategies.

4.2.1 Agriculture based livelihood strategies

Agriculture gives employment opportunity to more than 80% of the respondents (see Table 4). Among agricultural subsectors crop, livestock and eucalyptus production stood in order as the top three livelihood strategies of all sample households. However, livestock, poultry, eucalyptus and crop production were found important in terms of providing alternative employment opportunities to fully displaced households.

Table 4 Agricultural livelihood strategy participation (%) by displacement status

	Displacement Status				
Sub sector	**FDP (N=39)**	**PDP (N=52)**	**NDP (N=59)**	**Total (150)**	χ^2
Crop	20.5	78.8	86.4	66.7	51.24***
Livestock	35.9	65.4	79.7	63.3	19.51***
Eucalyptus	23.1	69.2	66.1	56.0	23.29***
Poultry	23.1	17.3	30.5	24.0	2.67
Renting	00.0	7.7	11.9	7.3	4.88*
Grass	5.1	30.8	50.8	32.0	22.61***
Fattening	5.1	9.6	8.5	8.0	.64
Total	51.3	94.2	93.2	82.7	36.25***

Source: Computed from own survey data collected in 2011
Note: ***, ** and * stand for significance at 1%, 5% and 10% level

Agriculture contributes more than half (58%) of the total household income. A given household receives, on average, Birr 15036 per annum from agriculture. However, there was significant variability among comparison groups in terms of the percentage share of this sector. Obviously, NDP were the highest share recipients of agricultural income, who

received about 71% of their total household income. This is followed by PDP (66%) and finally the least recipients were FDP, who gets on average 26% of their total income**.** If we see the income contribution of agricultural sub-sectors to total agricultural income of the sample households, crop, livestock, eucalyptus, poultry productions, renting (labor, land, and oxen), grass production, and fattening shared 47%, 23%, 4%, 3%, 2%, 2%, and 1%, respectively.

4.2.2 Industry sector related livelihood strategies

In this sector the construction (daily labor, masonry & carpentry, quarry extraction & cobblestone making and block production), manufacturing (metal & woodwork and employment), and Local Brewer (LB) & Handcraft (HC) were included. About 45% of sample households were involving in this sector. If the samples are disaggregated 48.9%, 36.5% and 49.2% of FDP, PDP, and NDP, respectively had participated in this sector.

Table 5 Industry related livelihood strategy participation (%) by displacement status

Sub sector	Displacement Status				χ^2
	FDP (N=39)	PDP (N=52)	NDP (N=59)	Total (150)	
Construction	23.1%	21.2%	25.4%	23.3%	.284
Manufacturing	5.1%	5.8%	5.1%	5.3%	.030
LB and HC	25.6%	13.5%	20.3%	19.3%	2.183

Source: Computed from own survey data collected in 2011

The mean income contribution of the industry related livelihood strategies to total household income of the sample households was estimated to be 19.57%. A given household receives, on average, Birr 4060 per annum from industry related livelihood strategies. This sector contributes the highest mean income share to FDP (25.7%) followed by NDP (18.9%) and PDP (18.8%).

4.2.3 Service sector related livelihood strategies

As indicated in Table 6, in terms of participation 36.0% of sample households were involved in the service subsectors at various degrees. Unlike the industry sector, the service sector has

shown participation deviation among comparison groups. Relative to the corresponding sample sizes the FDP has shown high rate of participation (51.3%) followed by PDP (38.5%) and NDP (23.7%).

Table 6 Service sector related livelihood strategy participation by displacement status

Sub sector	Displacement Status				
	FDP (N=39)	PDP (N=52)	NDP (N=59)	Total (150)	χ^2
Transport	7.7	13.5	6.8	9.3	1.63
Trade	12.8	5.8	8.5	8.7	1.40
DL and PL	7.7	15.4	6.8	10.0	2.59
House rent	25.6	9.6	1.7	10.7	14.22***
Total	51.3	38.5	23.7	36.0	7.95**

*** and ** stand for significance at 1% and 5% levels, respectively

The total household income share of service sector, on average, is 17%. A given household receives, on average, Birr 3483 per annum from service related livelihood strategies. However, the average percentage share showed greater variability among comparison groups. To the FDP this sector contributes on average 34% of their total household income whereas its share to PDP and NDP was 16% and 8%, respectively.

4.3 Determinants of livelihood strategy participation in the peri-urban areas

The MNL model analysis results are given in Table 10. The results revealed, among human capital indicators, age, sex, and educational status were found to affect the probability of involving in industry and/or service sector related livelihood strategies positively. The effect of age, sex, and educational status were statistically significant at 10%, 10%, and 5% significance levels. The positive and significant effect of household head's age towards participation in non-agricultural livelihood strategies imply that older household heads are expected to be involved in non-agricultural livelihood strategies other than agriculture related livelihood strategies. However, this was in contrary to the expected signs as it was assumed households whose age is relatively younger, ceteris paribus, could be pushed to engage more in non-farm activities than agriculture alone. Peri-urban youth may not have sufficient farm

land to engaged in agriculture and they would be forced to involve in non-agricultural practices like in the construction sector, at least as daily laborers. Despite such assumptions hypothesized driven by rural livelihood strategy assessment literatures (Adugna, 2005; Adugna, 2008), the results revealed the reverse. This may be attributed to the nature of livelihood strategies available in the peri-urban areas. The majority of these livelihood strategies in this category were guarding in the construction sector and house renting out in the service sector. Old aged household heads mostly occupied these livelihood strategies. Block and Webb (2001) and Khan (2008) have reported the same.

Table 7 Multinomial Logit Estimated Coefficients, P-values, and Marginal Effects

	Industry & Service			**Agri, Industry, & Service**		
Variable	**Coefficient**	**P-value**	**Marginal Effect**	**Coefficient**	**P-value**	**Marginal Effect**
HHage	.0829765	0.098*	1.01e-07	-.0249288	0.325	-.0059071
HHsex	2.080549	0.080*	1.52e-06	.7022954	0.294	.1585588
HHedu	2.670935	0.026**	4.62e-06	-.0027469	0.997	-.0006526
FamilyS	.2102041	0.535	2.89e-07	-.1403235	0.470	-.0332509
Labor	-.7875661	0.124	-1.10e-06	.5796189	0.063*	.1373456*
FarmSizeHa	-4.397497	0.001***	4.24e-06	-1.344231	0.008***	-.3185242***
lnSaving	.1550253	0.274	1.63e-07	.0153748	0.814	.0036431
lnCredit	-.7647778	0.007***	-8.43e-07	.0194988	0.891	.0046207
lnIncTra	.3105959	0.087*	2.78e-07	.1453426	0.133	.0344399
lnEucSize	-.1557762	0.541	-1.89e-07	.0450004	0.672	.0106633
TLU	-3.205887	0.003***	-3.41e-06	-.2058941	0.030**	-.0487869**
DistRoad	.0663267	0.039**	7.89e-08	-.0153473	0.232	-.0036367
DistCropMkt	-.01932	0.149	-1.61e-08	.0118175	0.058*	-.0028002*
DistLsMkt	-.0196582	0.276	-2.67e-08	.0123426	0.103	.0029247
HHSocRes	2.624743	0.115	6.91e-06	.3088917	0.732	.0743576
SocNET	.0189838	0.601	2.67e-08	-.014103	0.519	-.0033418
VillEndode	2.948324	0.096*	8.67e-06	-.6609945	0.422	-.1512501
VillSummit	.4779772	0.792	1.31e-06	-1.471195	0.138	-.2929967*
VillBeshalle	1.203798	0.514	1.82e-06	.203092	0.800	.0487309
Constant	-3.061246	0.359		2.047533	0.236	

Log-likelihood = -73	
Number of obs	= 150
LR chi2(38)	= 167
Prob > chi2	= 0.0000
Pseudo R2	= 0.5319

Source: Computed from own survey data collected in 2011

Note: ***, ** and * stand for significance at the 1%, 5% and 10% levels, respectively

Male and literate household heads had also positive likelihood of participation in non-farm livelihood strategy participation. Barrett *et al.* (2001), Lanjouw *et al.* (2001) and Khan (2008) have reported similar results. In addition, households who receive transfer income, relatively access public transport stations in nearby, and reside in village *Endode* were positively related with involving in non-agriculture livelihood strategies. If distance to public transport stations is far away from residence people tend to stay in the agriculture relate livelihoods and will have less incentive to involve in non-agricultural related livelihood strategies. Compared to *Jarso*, the reference village, *Endode* village is in nearby to condominium construction site to involve in the construction sector at least as a daily laborer. Unlike to these factors, size of farmland, amount of credits received, and livestock asset holding (TLU) were found significantly and negatively affecting participation in non-agricultural livelihood strategies. As the size of farmland, livestock holding, and credits received by the household increase, it is more likely to these households to derive their livelihood from agriculture related livelihood strategies and it is less likely to involve in non-agricultural livelihood strategies. This implies those households with relatively larger farm size and livestock holdings will have production and productivity incentives to stick on agriculture instead of diversifying their means of earning. The results are in line with Khan (2008) and Adugna (2008).

As suggested by Simtowe (2010), access to credit enables households to increase agricultural productivity and helps to produce sufficient food production. As a result, such households with better access to credit may not want to involve in non-agricultural livelihood strategies.

Overall, though such factors have shown significant effects on non-agriculture livelihood strategy participation, the marginal effect analysis (see Table 11) shown their effects were minimal. With respect to diversified livelihood strategy participation (agriculture, industry, and service combination), the most important factors were households labor endowment, farm size, livestock holding, and distance to crop markets. As expected, farm size and livestock possessions have negatively correlation with diverse livelihood strategy participation. These were statistically significant at 1% and 5% significant levels. These results were similar with the findings of Adugna (2008). However, those households with relatively large number of labor in the working age class tend to participate in diverse livelihood strategies. The same effect has been observed with distance to crop market.

4.4 Estimation of average effect of UID on PCI and PCE of UIDP (ATT)

The estimates of the average effect of urbanization-induced displacement (UID) on PCI and PCE of UIDP are summarized in Table 12. The bootstrapped standard errors are also provided wherever appropriate. The estimated results revealed, the mean PCI of FDP was, on average, lower by Birr 2597 and Birr 1547 from the average PCI of PDP and NDP, respectively. These mean differences were statistically significance at 1% and 10% significance level. This lower PCI of FDP may not be a surprise as they were dispossessed farmland, which is the major source of income for peri-urban communities. Even though they have received compensations, given the absence of parallel business and skill development interventions, most of FDP could not engaged on alternative livelihood strategies that can grant them comparable income. However, the PCI of PDP was nearly equivalent with that of NDP. This is due to their advantage in terms of owning cash from the compensation to use production and productivity enhancing inputs like accessing land through mortgage in addition to their remaining farmland and fertilizers. In fact, crop production has been found the lead to take the highest share from total household income in the study area followed by livestock production, accounting 36% and 16%, respectively. The other lesson, which we can infer from the results is that, the observed significant income difference between FDP and PDP indicates treating the two groups as independent groups was rational.

Table 8 Mean PCI and mean PCE impact estimates by displacement status

Category	Outcome	FDP	NDP	ATT	SE	t-stat
FDP vs. NDP	PCI	3444	4991	- 1547	786	-1.97*
	PCE	5826	5083	742	579	1.28
FDP vs. PDP	PCI	3382	5979	-2597	1282[+]	-3.63***
	PCE	5855	4884	970	685[+]	2.14*
PDP vs. NDP	PCI	5106	5048	58	987	0.06
	PCE	4717	4821	-104	754	-0.17

[+] Bootstrapped Standard Errors with 100 iterations

** and * stand for significance at the 1%, 5% and 10% levels, respectively

Unlike the PCI scenario, the PCE of FDP was the highest of all comparison groups. It exceeds by Birr 742 and Birr 970 from the mean PCE of NDP and PDP, respectively. The later was statistically significant at 10% significance level. This income–expenditure unparallel spending behavior of FDP can be justified due to their failure to earn comparable income with their expenditure. In addition, it can be said they turned from producers to buyers as only 21 % had involved in crop production. This shift to urban lifestyle in itself becomes a challenge as it needs relatively higher cost of living. The question here is how they finance it and how they fill the income – expenditure gap. Based on our assessment FDP engaged on less paying jobs and they are leading a survival livelihood strategy. A considerable portion of the compensation money went in to their daily consumption bills.

5. CONCLUSION AND RECOMMENDATION

The land use and land cover dynamics analysis results have shown the increase in built-up areas in Addis Abeba city is characterized by horizontal physical expansion against crop, forest and grasslands. Even though this phenomena is inevitable, the highest rate of built-up area expansion against highest rate of forest and cropland decline entails the sustainability of the provisioning, regulating, and supporting services of the ecological resources in peri-urban areas is in question. Despite agriculture takes the highest share in terms of labor force

participation and household income contribution, regardless of such pressures exerted on its resource bases, urbanization-induced industry and service sectors are also playing a vital role in this regard. The multinomial logit model analysis, however, has shown variables like gender, education, and location have created disparities in accessing such employment opportunities. Furthermore, the welfare situation discrepancy observed between urbanization-induced displaced households and their comparison group indicates, financial compensation and replacement land provision for residential house construction alone do not secure livelihood sustainability of urbanization-induced displaced households.

Obviously, urbanization in Ethiopia is in its infant stage. Given the direct relation of urbanization and economic development, the country still deserves promoting urbanization. In order to maximize the benefits of urbanization and minimize its negative externalities in peri-urban environment and livelihoods, the following actions need to be considered. The promotion of urban greeneries needs to be strengthened. This may include checking the conversion of agricultural land in to urban land use by introducing land saving construction designs and enhancing the effective utilization of inner city land, and protecting and developing greeneries. Even though this may help to some extent, due to internal and external factors farm size reduction along the peripheries seems inevitable. As agriculture still plays important economic role, agricultural extension service focusing on promoting agricultural intensification and high value crop productions need to be strengthened. Parallel to this, pre-displacement precautionary measures and post-displacement adaptation measures need to be taken. The former helps to reduce livelihood vulnerability of urbanization-induced displaced people while the later enhance their resiliency. This may include, despite compensations, devising pre-displacement skill development program, encouraging participation in cooperatives and micro and small-scale enterprises, and facilitating joining alternative livelihood strategies. As sex, education and access to road were significant in determining participation decisions in non-agricultural livelihoods, these needs to be considered in future intervention planning.

6. REFERENCES

Abadie, A. and G.W. Imbens, 2006. Large Sample Properties of Matching Estimators for Average Treatment Effects. *Econometrica*, 74:235- 67.

Adell, G., 1999. Theories and Models of the Peri-Urban Interface: A Changing Conceptual Landscape, Literature Review. Draft for Discussion, DPU-UCL.

Adugna, E.B., 2008. Livelihood Strategies and Food Security in Wolayta, Southern Ethiopia: The Case of Boloso Sore District. A Thesis Submitted to School of Graduate Studies, Haramaya University.

Adugna, L., 2005. The Dynamics of Livelihood Diversification in Ethiopia Revisited: Evidences from Panel data. Available at SSRN: http://ssrn.com/abstract=817104, accessed on July 31, 2010.

Alaci, D.S.A., 2010. Regulating Urbanization in Sub-Saharan Africa through Cluster Settlements: Lessons for Urban Mangers in Ethiopia. Theoretical and Empirical Researches in Urban management 5(14).

Alemu, T., 2010. Impact Assessment of Input and Output Market Development Interventions by IPMS Project: The Case of Gomma Woreda, Jimma Zone, An MSc Thesis Presented to the School of Graduate Studies of Haramaya University. 97p.

Alviola, P., 2009. Essays on Choice and Demand Analysis of Organic and Conventional Milk In The United States. A Dissertation Submitted to the Office of Graduate Studies of Texas A&M University

Ashley, C. and K. Hussein, 2000. Developing Methodologies for Livelihood Impact Assessment: Experience of the African Wildlife Foundation in East Africa. Working Paper 129, Overseas Development Institute.

Bah, M., S. Cissé, B. Diyamett, G. Diallo, F. Lerise, D. Okali, E. Okpara, J. Olawoye and C. Tacoli, 2003. Changing Rural-Urban Linkages in Mali Nigeria and Tanzania, Environment & Urbanization 15 (1): 1-24

Baker, J. (2000). Evaluating the Poverty Impact of Projects: A Handbook for Practitioners. The World Bank, Washington, D. C. http://www.worldbank.org/poverty/library/impact.htm

Bamberger, M., 2006. Conducting Quality Impact Evaluations under Budget, Time and Data Constraints. IEG and PREM Network, The World Bank.

Bamlaku Amente , 2009. Environmental Impacts of Urban Land-Use Changes in Kolfe Keranyio Sub-City, Kebele 04 *Selti* Area, Addis Abeba Using RS and GIS Techniques. Thesis submitted to the School of Graduate Studies of Addis Abeba University, Ethiopia.

Barrett, C.B. and T. Reardon, 2000. Asset, Activity, and Income Diversifications among African Agriculturalist: Some Practical Issues, project report to USAID BASIS CRSP.

Barrett, C.B., T. Reardon and P. Webb, 2001. Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications. *Food Policy*, 26 (5): 315-331

BCA (Bureau of Communication Affairs – Addis Abeba City Administration), 2010. Addis Abeba from 1991-2010. Addis Abeba, Ethiopia.

Becker, S.O. and M. Caliendo, 2007. Sensitivity Analysis for Average Treatment Effects. *Stata Journal*, 7(1): 71–83.

Bernard, T., G. Eleni, and S.T. Alemayehu, 2007. Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia. IFPRI Discussion Paper 00722

Bernard,T., Spileman,D.J., Alemayehu Seyoum and Eleni Gabre-Madhin, 2010. Cooperatives for staple crop marketing: evidence from Ethiopia. IFPRI research monograph; 164.

Block, S. and P.Webb, 2001. The dynamics of livelihood diversification in post-famine Ethiopia. *Food Policy*, 26(4): 333-350.

Caliendo, M., and Kopeinig, S., 2008. Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 22 (1):31–72

Chambers, R. and G. R. Conway, 1992. Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. Discussion Paper 296. Brighton: IDS.

Chilot Yirga and Hassan, R.M., 2008. Multinomial Logit Analysis of Farmers` choice Between Short and Long- Term Soil Fertility Management Practices in the Central Highlands of Ethiopia. *Eth. J. Agrc. Econ.* 7 (1): 87-107

Conroy, C., 2002. PRA tools used for research into common pool resources. *Socio-economic Methodologies for Natural Resources Research. Best Practice Guidelines*. Chatham, UK: Natural Resources Institute.

Corbetta, P., 2003. *Social Research: Theory, Methods and Techniques.* SAGA Publications, London.

CSA (Central Statics Agency), 1999. The 1994 Population and Housing Census of Ethiopia: Results for Addis Abeba. Vollum II Anlysis Report.

Abebaw, A., Yibeltal, F., and Belay, K., 2010. The Impact of a Food Security Program on Household Food Consuption in Northwestern Ethiopia: A matching estimator approach, Food Policy 35 (2010): 286-293

Dehejia, R. H. and Wahba, S., 2002. Propensity score matching methods for nonexperimental causal studies. *The Review of Economics and Statistics*, 84(1):151-161.

DFID, 1999. *Sustainable Livelihoods Guidance Sheets.* London: DFID

Ellis, F., 2000. *Rural Livelihoods and Diversity in Developing Countries*, Oxford: Oxford University Press

ERDAS, 1999. ERDAS Field Guide, Fifth Edition, Revised and Expanded, ERDAS, Inc., Atlanta, Georgia

FAO, 2000. Land Cover Classification System (LCCS): Classification Concepts and User Manual.

Farrington, J., T. Ramasut, and J. Walkker, 2002 Sustainable Livelihoods Approaches in Urban Areas: General Lessons with Illustration from Indian Cases, ODI.

FDRE (Federal Democratic Republic of Ethiopia), 1995. The Constitution of the Federal Democratic Republic of Ethiopia.

Fekerte Haile 1991 Women Fuelwood Carriers in Addis Abeba and the Peri- Urban Forest. Report to IDRC and NUPI, International Labor Organization, Geneva.

Tadele, T., 1999. The Impact of Urban Development on Peasant Community in Ethiopia: The Case of *Yeka Tafo* Peasant Association, a Community in the Vicinity of the Ethiopian Capital, Addis Abeba, Disposed by the *Ayat* Real Estate Development Project. MA thesis in Social Antropology, Addis Abeba University.

Abdissa Abdissa, 2005. Urban Expansion and the Livelihood of the Peri-Urban Agricultural Community: The Case of Addis Abeba. MA Thesis, Addis Abeba University.

Fitsum, H., G. Kruseman, Z. Abreha, V. Linderhof, A. Mulugeta and G/Samuel, 2006. Impact of small scale water harvesting on household poverty: evidence from Northern Ethiopia PREM Working Paper: 07/01

Fitsum, H., F., Jayasinghe, G., Awulachew, S. B., Loulseged, M. and Yilma, A.D., (forthcoming). Impact of Agricultural Water Management Technologies on Poverty in Ethiopia. Journal of International Agricultural Economics.

Gebre, G. and D. Van Rooijen, 2009. Urban water pollution and irrigated vegetable farming in Addis Abeba. Paper presented for 34th WEDC International Conference, Addis Abeba, Ethiopia

Gete, Z., 2007. Draft conceptual framework of RUL thematic research area of GMP. pp. 27-44. Proceedings of a Planning Workshop on Thematic Research Area of the Global Mountain Program (GMP) held in Addis Abeba, Ethiopia, August 29-30, 2006.

Gete, Z., A. Dawit, B. Woldeamlak, A. Betre, A. Yemesrach, and P. Trutmann, 2008. Poverty Gradient along the Rural-Urban Transect in Ethiopia: the Case of Addis Abeba- Bahir Dar Gradient, GMP Working Paper 2.

Girma T. Kassie, Woldie Asfaw, Gete Zeleke, and Drimie Scott, 2008. The Nexus of Migration, HIV/AIDS and Food Security in Ethiopia, GMP Working Paper 3.

Green, W. H., 2003. Econometric Analysis, 5th edition, Pearson Education, Inc. 1026p.

Gujarati, D. N., 2004. Basic Econometrics, 4rd edition, MacGraw, Hill, New York. 1002p.

Hackett, S. C., 2006. Environmental and Natural Resources Economics: Theory, Policy, and the Sustainable Society, 3rd edition, M.E. Sharpe, Inc. 524p.

Heckman, J.J., Ichimura, H. and Todd, P., 1997. Matching as an econometric evaluation estimator: evidence from evaluating a job training programme, *The Review of Economic Studies*, 64:605-654.

Iiyama, M., 2006. Livelihoods Diversification Patterns among Households and their Implications on Poverty and Resource Use: A Case Study from a Kerio River Basin Community. LUCID Project Working Paper No. 51. Nairobi, Kenya: ILRI.

Jalan, J., and M. Ravallion, 1999. Income Gains to the Poor from Workfare: Estimates for Argentina's Trabajar Program. *Policy* Research Working Paper 2149, The World Bank.

Kahan, M.A., 2007. Factors Affecting Employment Choices in Rural Northwest Pakistan. Goettingen, Germany

Khandker, S.R., G.B. Koolwal, and H.A. Samad, 2010. Handbook on Impact Evaluation: Quantitative Methods and Practices. The World Bank.

Kropko, J., 2010. A Comparison of Three Discrete Choice Estimators. University of North Carolina, Chapel Hill.

Lanjouw, P., J., Quizon, and R., Sparrow, 2001. Non-Agricultural Earnings in Peri-Urban Areas of Tanzania: Evidence from Household Survey Data. *Food Policy*, 26(4): 385-403.

Leuven, E. and B. Sianesi, 2003. "PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing and covariate imbalance testing". http://ideas.repec.org/c/boc/bocode/s432001.html. Version 1.2.3.

Lillard, L. A. and Constantijn W.A. Panis. 2003. aML Multilevel Multiprocess Statistical Software, Version 2.0. EconWare, Los Angeles, California.

Løvendal, R.C., Knowles, R., and Horii, N., 2004. Understanding Vulnerability to Food Insecurity: Lessons from Vulnerable Livelihood Profiling, ESA Working Paper No. 04-18.

MA (Millennium Ecosystem Assessment), 2005. Ecosystems and Human Well-being: Current State and Trends, Volume 1, The Millennium Ecosystem Assessment Series. Island Press, London.

Maddala, G.S., 1993. Limited-dependent and qualitative variables in econometrics, Cambridge University Press.

Mandere, N. M., B. Ness and S. Anderberg, 2010. Peri-urban development, livelihood change and household income: A case study of peri-urban Nyahururu, Kenya. *Journal of Agricultural Extension and Rural Development* 2 (5): 73-83.

Marshall, F., L. Waldman, H. MacGregor, L. Mehta and P. Randhawa, 2009. On the Edge of Sustainability: Perspectives on Peri-urban Dynamics, STEPS Working Paper 35, Brighton: STEPS Centre.

Melesse, M., 2005. City Expansion, Squatter Settlements and Policy Implications in Addis Abeba: The Case of Kolfe Keranio Sub-City, Working papers on population and land use change in central Ethiopia, nr. 2, Serie A, Nr. 9, Trondheim.

MoFED (Ministry of Finance and Economic Development), 2006. Ethiopia: Building on Progress. A Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2005/06-2009/10). Volume I: Main Text, Addis Abeba, ETHIOPIA.

Mundia, C. and M. Aniya, 2005. Analysis of land use/cover changes and urban expansion of Nairobi city using remote sensing and GIS, Int'l Journal of RS, 26 (13): 2831-2849.

Ntembe, A. N., 2009. User Charges and Health Care Provider Choice in Cameroon. *International Review of Business Research Papers*, 5(6): 33-49.

PCC (Population Census Commission), 2008. Summary and Statistical Report of the 2007 Population and Housing Census: Population Size by Age and Sex. PCC, FDRE Addis Abeba, Ethiopia.

Rosenbaum, P., 2005. Sensitivity Analysis in Observational Studies. In: S.B. Everitt and D. C. Howell (eds.). Encyclopedia of Statistics in Behavioral Science, 4: 1809–1814, John Wiley & Sons, Ltd, Chichester.

Rosenbaum P.R. and D.B. Rubin, 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika* 70(1): 41-55.

Samson, K., 2009. Squatter Settlement and the Issue of Regulation: A case of Dire Dawa, Ethiopia. *Local Governance & Development Journal* 3 (1): 55-66.

Satterthwaite, D. and C. Tacoli, 2003. The urban part of rural development: the role of small and intermediate urban centres in rural and regional development and poverty reduction, IIED.

Schmidt, P., and R. Strauss, 1975. The Prediction of Occupation Using Multiple Logit models. International Economic Review, Vol. 16, No. 2, pp. 471-486.

Scoones, I., 1998. Sustainable Rural Livelihoods: A Framework for Analysis. Working Paper 72. Brighton: IDS.

_____,2009. Livelihoods Perspectives and Rural Development. *Journal of Peasant Studies 36 (1).*

Senait Regassa, 2005. Determinants of Choice of Land Management Practices: the case of

Ankober District. Ethiopian Journal of Agricultural Sciences, Vol. 18.

Shanko, M., and J. Rouse, 2005. The human and livelihoods cost of fuel-switching in Addis Abeba, Boiling Point No 51.

Shiferaw, B., H.A. Freeman, and S.M. Swinton (eds), 2005. Natural Resources Management in Agriculture: Methods for Assessing Economic and Environmental Impacts, CABI Publishing.

Simtowe, F.P., 2010. Livelihoods diversification and gender in Malawi. African Journal of Agricultural Research, 5(3): 204-216.

Singh, A., 1989. Digital change detection techniques using remotely-sensed data. Int.J.Remot Sensing, 10(6):989-1003.

Solomon Abebe, 2005. Land-Use and Land-Cover Change In Headstream Of Abbay Watershed, Blue Nile Basin, Ethiopia. A Thesis Submitted To The School Of Graduate Studies Of Addis Abeba University, Ethiopia.

Soubbotina, P. T., 2004. Beyond Economic Growth: An Introduction to Sustainable Development. Second Edition, The World Bank. 205p.

Stata Corp. 2007. *Stata Statistical Software: Release 10*. College Station, TX: StataCorp LP.

SWMA (Solid Waste Management Autority - Addis Abeba City Administration), 2010. Overview of Addis Abeba City Solid Waste Management System.

Tacoli, C, 1998. "Rural-urban Interactions: a Guide to the Literature", *Environment and Urbanization*, 10 (1): 147-166

Tadesse W., Tsegaye, T. D.and Coleman,T.L., 2001. Land use/cover change detection of the city of Addis Abeba, Ethiopia using remote sensing and GIS technology

Tho, N., 2006. Livelihoods of People Living in a Peri-Urban Area of Ho Chi Minh City Case study Hung Long commune, Binh Chanh district, Ho Chi Minh City, Vietnam. Master Thesis No 34, Swedish University of Agricultural Sciences.

UN HABITAT, 2007. State of the World Cities 2010/2011: Bridging the Urban Divide. United Nations Human Settlements Programme, Nairobi, Kenya.

_____, 2010. Cities without Slum; Situation Analysis of Informal Settlements in Addis-Abeba, A Slum upgrading program United Nations Human Settlements Program Nairobi, Kenya.

Verbeek, M., 2004. *A Guide to Modern Econometrics*, 2nd edition, John Wiley & Sons Ltd, West Sussex, England.

Vinha, K., 2006. A Primer on Propensity Score Matching Estimators, CEDE Documentation.

Wassie, B., D. Colman and B. Fayissa, 2008. Diversification and Livelihood Sustainability in a Semi-arid Environment: A Case Study from Southern Ethiopia. *Journal of Development Studies*, 43(5): 871-889.