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The Quest for Mainstreaming Climate Change Adaptation into Urban Development Planning Of Ambo Town, Ethiopia

G. S.Ogato

Department of Rural Development and Agricultural Extension, Institute of Cooperatives and Development Studies, Ambo University, Ethiopia, Email: gemechushale2005@yahoo.com

A study was conducted during the period 2012/2013 on the quest for mainstreaming climate change adaptation into urban development planning of Ambo town. Though climate change and climate variability are expected obviously to pose threat to Ambo town and its dwellers, no comprehensive study was undertaken previously to understand the state of climate change and its negative impacts on urban development process. The general objective of this study is to assess the quest for mainstreaming climate change adaptation into urban development planning of Ambo town and propose strategic actions for mainstreaming. The methodological tools were chosen in order to best reach the objectives of the study. Both qualitative and quantitative methods of data analysis were employed to analyze the collected data. The findings of the study reveal that climate change has posed physical, geographical, economical, social, environmental, and psychological urban vulnerabilities in Ambo town and the most vulnerable social groups to the negative impacts of climate change are old people, the urban poor, children, the urban handicaps, and women. The climate hazards identified in Ambo town are flash flood, water stress, urban heat waves, wind storms, and dust storms. While it is commendable to appreciate the good start of urban greening and beautification by Ambo town administration and its municipality, the town administration has to take critical and strategic actions to adapt Ambo town and its dwellers climate change and climate variability. This requires mainstreaming climate change into urban development planning process and taking urgent collaborative actions with stakeholders for sustainable urban development of the town.

Key Words: Ambo, climate change, mainstreaming, urban planning, vulnerability

Introduction

Urban environmental sustainability may be defined as "a balance of human activities in urban systems, with their environmental resource base" (Ravetz, 1999; Huang et al., 2007). Pickett et al. (2001) assert that urbanization is a dominant demographic trend and an important component of global land transformation. In other words, as the global population becomes urbanized and human activity is concentrated in urban areas, settlement planning is a key aspect of sustainability. There is a growing emphasis on sustainable development as an integrative concept and indeed integrative device, with its insistence on the need to see economic, social and environmental issues as always inter-related (Haughton and Counsell, 2004). Moreover, the widespread inclusion of the principles of sustainability into urban plans provides an opportunity to place urban climate knowledge at the centre of the planning process (Mills, 2006; Pickett et al., 2001). Naess (2001) asserts that developing and communicating knowledge about what will be sustainable and environmentally friendly solutions and stimulating planning processes that can generate more debate about what values and interests we really want to promote is vital in sustainable urban development planning.

climate change may be defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (United Nations, 1992; IPCC, 2007). Vulnerability to impacts of climate change in this study may refer to the lack of capacity to adapt and to respond to stress as a result of climate variability or change, with a consequent decline in well-being (Adger et al., 2002; Huq et al., 2003; Brooks et al., 2004; Downing, et al., 2004; IPCC, 2007; Huxtable and Yen, 2009; Yaro et al., 2010; Nelson, 2011; UNPEI, 2011). Adaptive capacity in this study may refer to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (Claire et al., 2002; Adger et al, 2003; Huq et al., 2003; Downing, et al., 2004; Ebi et al., 2004; Brooks et al., 2004; Eriksen et al., 2005; Huxtable and Yen, 2009; Nelson, 2011; UNPEI, 2011). Adaptation to climate change in this study may refer to the process through which we focus on building adaptive capacity of the most vulnerable people, reducing exposure or sensitivity to climate impacts, and ensuring that development initiatives don't inadvertently increase vulnerability **(**Adger et al.,

2002; Brooks et al., 2004; Fu¨ssel, 2007; Huxtable and Yen, 2009; UNPEI, 2011). Mainstreaming climate change adaptation in this study may refer to integrating considerations of climate change adaptation into policy-making, budgeting, implementation and monitoring processes at national, sector and sub-national/regional levels (Lebel et al., 2012; Oates et al., 2011; UNPEI, 2011).

Betsill and Bulkeley (2006) affirm that threat of global climate change is one of the most significant scientific and political challenges of our time. In other words, climate change is expected to increase the frequency and intensity of current hazards and the probability of extreme events, and also to spur the emergence of new hazards and new vulnerabilities with differential spatial and socioeconomic impacts (Revi, 2008). For example, based on the most recent information, mainly from simulations of GCMs, it is believed that the average global temperature of the earth will be between 1.4°C to 5.8°C warmer than present by the end of the 21st century (Jones, et al., 2004). Moreover, there is increasing evidence that the warming of the earth over the past 50 years is attributable to increased greenhouse gases resulting from human activities (Jones, et al., 2004).

Review of long-term climate data for Ethiopia shows increasing rainfall for some regions and decreasing rainfall for others with temperature rising for all regions (Energy Group of ECSNCC Network, 2011). Moreover, global circulation models predict a 1.7-2.1ºC rise in Ethiopia's mean temperature by 2050 (EPA, 2012). Climate change and climate variability are claimed to cause food insecurity, outbreak of diseases such as malaria, dengue fever, cholera and dysentery, malnutrition, land degradation and damage to infrastructure **(**Kidanu et al., 2009; Adem and Bewket, 2011; Adem and Guta, 20011; Oates et al., 2011 ; EPA, 2012).

Though climate change and climate variability are expected obviously to pose threat to Ambo town and its dwellers, no comprehensive study was undertaken previously to understand the state of climate change and its negative impacts on urban development process. Moreover, climate change adaptation was not mainstreamed into urban development process of the town though the need to balance economic development of the town with social and environmental considerations was appreciated by the town administration and its municipality. In other words, there is an urgent need for information on the need for mainstreaming climate change adaptation into urban development planning process of Ambo town and strategic actions of mainstreaming. Given the relevance of strategic actions of mainstreaming for sustainable transformation of Ambo town, this study aims to assess the need for mainstreaming climate change adaptation into urban development planning and propose strategic actions for mainstreaming. The specific objectives of the study are: to identify critical environmental problems in Ambo town; to analyze trends in climate change and climate variability (precipitation and temperature) in Ambo town; to assess climate change related physical, geographical, economical, social, environmental and psychological vulnerabilities in Ambo town; to assess adaptive capacity of urban local communities in Ambo town; to identify the most vulnerable groups to climate change related urban vulnerabilities in Ambo town; to SWOT analyze the existing urban development planning process of Ambo town; and to propose strategic measures for mainstreaming climate change adaptation into urban development process of Ambo town. The key research questions for the study are: (1) What are the critical environmental problems in Ambo town? (2) What are the climate change related physical, geographical, economical, social, environmental, and psychological vulnerabilities in Ambo town? (3) Who are the most vulnerable groups to climate change related urban vulnerabilities and why they are vulnerable in Ambo town? And (4) Does the ongoing urban development planning process of Ambo town manifest features of sustainable urban development planning?

The Study Area

Ambo area is known for its different natural resources including the abundant resources and attractive scenery. Its perennial rivers including Huluka (which is originated in Dandi district at a place called Danbal), Taltale, Boji, Burka-Tiko (Chopho) etc are of crucial importance (Ambo Town Administration Office, 2013).

The mean annual temperature of the town over 30 years (1981-2010) is about 18.64ºC. The mean annual rainfall of the town over 30 years (1981-2010) is about 968.7mm. The highest rainfall concentration occurs from June to September. The geographical location of Ambo town is approximately between 8º 56'30'' N - 8º 59'30'' N latitude and between 37º47'30" E - 37º 55'15" E longitude. It is located in the Western Shoa Zone of the Oromiya region (See figure 1). Relatively Ambo town is located 114 kms far away West of Addis Ababa, 60kms North West of Weliso town and 12kms East of Guder town (UN-HABITAT, 2008, Shanmugham &Tekele, 2011; Ambo Town Administration Office, 2013).

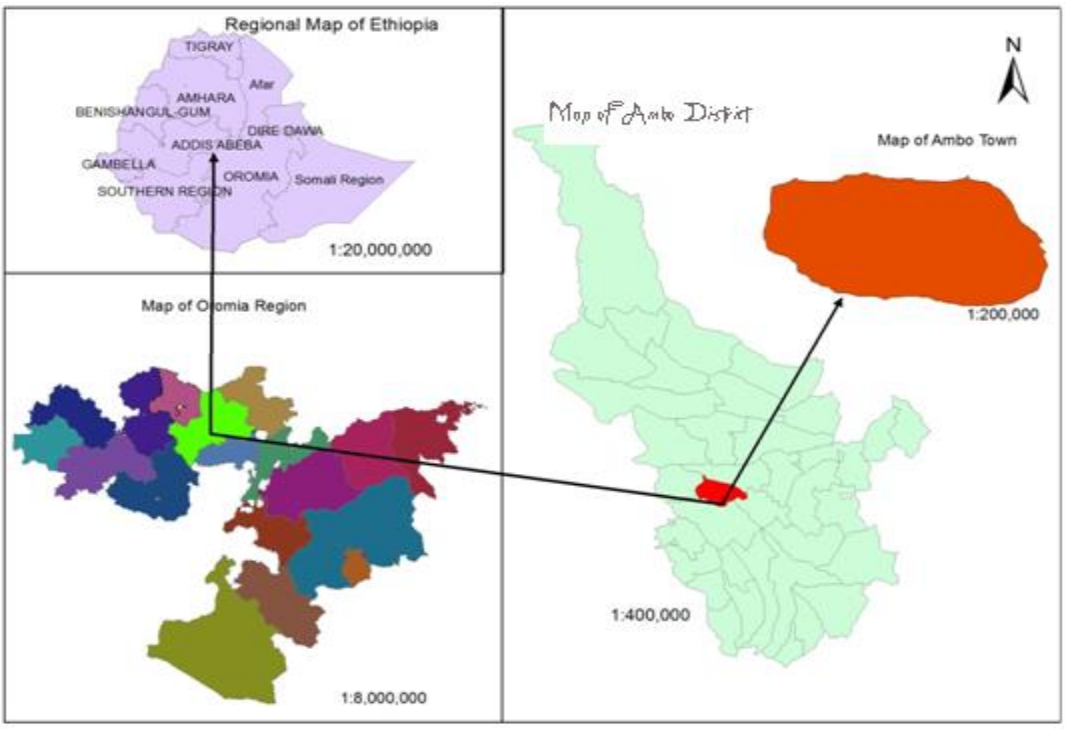

Figure1: Geographic Location Map of Ambo Town.

Established in 1889, Ambo is one of the oldest towns in Ethiopia. The inter-zonal road connecting to Nekemte town passes through this town. The main asphalt road that divides the town into North and South is 6 kilometres. The other asphalt road has length of 2 kilometres stretching from the centre of the town to Ambo Plant Protection Research Centre. Ambo means 'lake', which has salt in it. Even today, it is well known tourist spot attraction for its hot spring called as "AmboTseble" (Shanmugham and Tekele, 2011). Ambo is among a few privileged towns of its time to have its own municipal administration since 1931, and a master plan since 1983 (UN-HABITAT, 2008). Ambo town is governed through the Oromiya region municipal establishment proclamation no. 65/95 and has two tiers of administration. The highest level is the municipal council, which is responsible for service delivery, administering funds and management of the city (UN-HABITAT, 2008, Ambo Town Administration Office, 2013).

Over the past few years the human population of Ambo town has been growing rapidly. According to CSA (2007), the population of the town was 50,267 with the growth rate of 2.5%. The population of Ambo town is expected to reach more than 80, 000 by 2016 with an average growth rate of 5% (UN-HABITAT, 2008). The poor quality of housing and inability of the administration to increase supply could be taken as key indicators that a wide reform is necessary for Ambo town (UN-HABITAT, 2008; Shanmugham and Tekele, 2011).

The area under administration of the town including the adjacent proposed expansion areas is reckoned to be about 8587.58710715 ha (85875871.0715m^2). The compactness index of Ambo town is calculated by dividing the actual area of the town for a circle circumscribing the town. Thus, the area of a circle circumscribing Ambo town is 215256400.01m^2 but the actual area of Ambo is 85875871.0715 m^2 (Ambo Town Administration Office, 2013).

Index of compactness = $\frac{85875871.0715\ m^2}{215256400.01m^2}$=39.89%= 40%

The value of compactness index indicates that the shape of Ambo town deviates from a perfectly compact shape (a circle) by 60%. This means it is difficult to provide different services from a central location of the town. Previous study conducted on the shape of the town recommends that it is necessary to establish different services and growth centres in the southern and northern parts of the town. The study further recommends that the future expansion site of the town should be towards south direction where gentle slope prevails to increase the value of compactness index and the town should not expand to the Northern direction as the northern parts have steeper slopes (Ambo Town Administration Office, 2013).

Most of the existing built up areas of the town are almost gentle slope and undulated while some hill slope and mountain are also seen in the town. For example, along the course of the rivers and streams, steep slope and gullies are also observed. The town's altitude ranges from 1872 meter above sea level (masl) to 2362 masl. Most of the proposed expansion areas are characterized by flat, gentle slopes and undulated plains towards Awaro and

Ilamu Muja in the eastern direction, Odo Liban Kisose in the Northern and Gosu Kora in the southern. But some of the slopes in the Sankale Farisi in Western direction have higher slopes and also has human induced barriers such as Ambo Mineral Water Factory, Sankale Police Training Centre and Sankale Gypsum Factory (Ambo Town Administration Office, 2013).

The land surface terrain of the majority part of the surface of the town has slope gradient less than 20 percent. In other words, the slope classification of Ambo town is largely dominated by terrain with flat to undulating and steep slopes. This study considered eight slope classes in Ambo town to identify areas which are appropriate and difficult for built up environments (See figure 2). The slope with less than 2% is highly dominated in eastern and north eastern parts of the town. These are areas, which are prone to flood inundation and are not recommended for construction purposes. But, slopes with 15%-60% are dominantly found in the northern, western and north western parts of the town. Slopes with 20%- 60% cover small area in the town whereas slopes with 2% -20% cover the majority areas of the town.

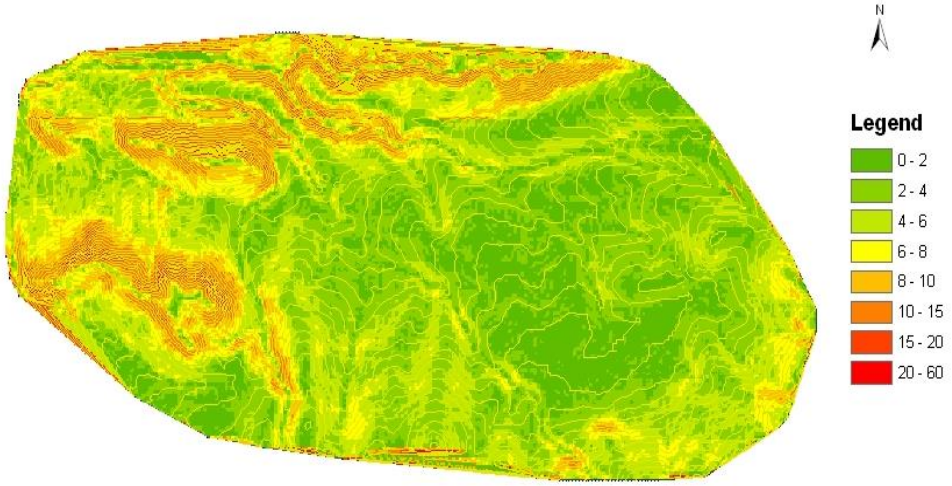

Figure 2: Slope Classification of the land in Ambo town by percentage (Source: Ambo Town Administration Office, 2013).

Research Methodology

Sampling methods and procedures

The study employed purposive non-probability sampling technique to select both the town and respondents. Procedurally, first, three urban villages from Ambo town were selected by employing purposive sampling method since the main purpose of the study is to assess the need for mainstreaming climate change adaptation into urban development planning of Ambo town. Next, respondents were selected from different stakeholders and urban local communities purposively to participate in semi-structured questionnaire, stakeholder analysis, focus group discussion and key informant interview**.**

Sources of data and methods for data collection

This study used both secondary and primary data sources. The secondary sources for the secondary data were reports of urban development sectors in Ambo town, national and regional climate change adaptation policies and strategies, and robust published materials (books, journal articles, reports of national and international organizations, and internet sources) on the issues under investigation. The primary sources for the primary data were urban planners in different urban development sectors of Ambo town, urban households in Ambo town, and stakeholder organizations for mainstreaming climate change adaptation into urban development process of Ambo town.

The methodological tools for data collection were chosen in order to best reach the objectives set out above. The first methodological step was a comprehensive analysis of the existing literature in order to obtain both theoretical insights and secondary data. Review themes include: concepts of climate change vulnerability and adaptation in urban context, concept of mainstreaming climate change adaptation into urban development planning, concept of sustainable urban development planning, environmental problems in urban areas, climate change related urban vulnerabilities in urban areas, vulnerable sectors and groups to impacts of Climate Change in urban areas, and adaptive capacity of urban communities. The second methodological step was collection of primary data from primary sources. Accordingly, data were collected with the

help of semi-structured questionnaire, stakeholder analysis exercise, transect walk and field observation, focus group discussion, and key informant interview as described hereunder.

Semi-structured questionnaire

A semi-structured questionnaire was designed, pre-tested and distributed to 20 different sectors of Ambo town administration and other urban development sectors to assess the need for mainstreaming climate change adaptation into urban development process of Ambo town. Accordingly, respondents were purposively selected from Ambo Town Urban Peace and Security sector, Ambo Town Environmental Protection Agency, Ambo Town Investment Sector, Ambo Town Housing Sector, Ambo Town Municipality, Ambo Town Health sector, Ambo Town Women's Affair Sector, Ambo Town Youth Development Association, Ambo Town Transport Sector, Ambo Town Communication Sector, Ambo Town Small and Micro-Enterprises Sector, Ambo Town Political Affair Sector, Ambo Town Land and Natural Resources Management Sector, Ambo Town Revenue and Tax Collection Sector, Ambo Town Trade Sector, Ambo District Tourism Development Office, Ambo District Energy Development Process, Ambo District Bureau of Agricultural Development, Ambo District Bureau of Natural Resources Management, and Ambo District Health Center.

The questionnaire encompasses data on variables like trends in climate change and climate vulnerability, climate hazards, urban vulnerabilities, mainstreaming climate change adaptation into urban development planning, and stage of mainstreaming climate change adaptation.

Stakeholders' analysis exercise

Stakeholders' analysis exercise was also employed to collect primary data from key stakeholder organizations. Accordingly, about 15 key stakeholders for mainstreaming climate change adaptation into urban development planning process of Ambo town were identified and given stakeholders analysis chart to fill their role and interest in relation to the mainstreaming process.

Transect walk and field observation

Transect walk and field observation were also employed to visually observe and document urban vulnerabilities to climate change and environmental problems in Ambo town. Accordingly, environmental problems and climate change related urban vulnerabilities in Ambo town were observed and documented. The transect walk and field observation were guided by a semi-structured checklist and knowledgeable urban local person in each urban village of Ambo town. The checklist for transect and field observation includes: environmental problems in Ambo town, climatic hazards in Ambo town, urban vulnerabilities in Ambo town, and adaptive capacities of urban local communities in Ambo town.

Focus group discussion

Focus group discussion was also employed to collect data from members of urban local communities' development associations. Accordingly, a total of six focus group discussions (60 participants) were administered in three urban villages of Ambo town. Participants of the focus group discussion were members of the urban local communities' development associations who have lived in Ambo town for more than 20 years and who are expected to be knowledgeable about negative impacts of climate change and climate variability. Each focus group consisted 10 persons and the discussion in each group took about 60 minutes (See figure 3). Each focus group discussion was started and closed with blessings of local elders as per the norm of Oromo culture in each urban village of Ambo town. The checklist for the focus group discussion include: best-practice community-based climate change adaptation experiences, adaptive capacity of urban local communities, community-based appraisal and prioritization of climate hazards, community-based appraisal of seasonal occurrence of climate hazards, community-based appraisal of seasonal occurrence of climate hazards, and climate change related urban vulnerabilities.

Figure 3: Focus Group Discussion at Village 3 of Ambo town.

Key informant interview

Key informant interview was also employed to collect primary qualitative data. Accordingly, in-depth interview was made with 12 key informants from three urban villages (2 men and 2 women from each village) on their personal experiences with climate change and their adaptation measures in Ambo town. The key informants were men and women who have been living in Ambo town for more than 20 years and who are older than or equal to 50 years of age.

Method of data analysis

Both qualitative and quantitative methods of data analysis were employed to analyze the collected data. The qualitative data captured through focus group discussion, transect walk, field observation, and key informant interview were transcribed, interpreted, and analyzed in the form of descriptions and tables. Both quantitative data collected through secondary method of data collection from different organizations and primary data collected from primary sources through questionnaire survey were analyzed in computer with the help of SPSS-Version 20 software. Accordingly, simple descriptive statistics like frequencies and percentages, mean, and standard deviations were employed. Moreover, ArcGIS10 software was employed to prepare different maps and undertake spatial analysis. The results of the analyzed data were presented with the help of line graphs, bar graphs, pie charts, and tables.

Results

Environmental problems in Ambo Town

One of the specific objectives of the study was to identify environmental problems in Ambo town. The environmental problems identified in Ambo town with the help of transect walk, field observation, focus group discussion, and key informant interview were: mixed waste disposal in open spaces and rivers, water stress, urban heat waves, wind storms, dust storms, land slide, soil erosion, flash flood, and deforestation.

Trends in climate variability (precipitation and temperature) in Ambo Town

The trends of mean total rainfall and mean annual temperature for Ambo town over 30 years (1981-2010) were analyzed. The mean total rainfall for Ambo town over 30 years was found to be 968.7mm with the standard deviation of 207. The highest total rainfall was registered in the year 1997(1323.60mm) while the lowest one was registered in the year 1983 (474.20 mm) (see table 2 and figure 4). The mean annual temperature for Ambo town over 30 years was found to be 18.6°C with the standard deviation of 0.90. The highest mean annual temperature was registered in the year 1998 (21.30°C) while the lowest one was registered in the year 1992 (16.40°C) (see table 2 and figure 5).

Table 1: Mean Annual Temperature and Total Rainfall for Ambo Town (1981-2010)

Sr.No	Year	Total Rainfall	Mean Annual Maximum Temperature	Mean Annual Minimum Temperature	Mean Annual Temperature
1	1981	857.00	25.50	11.10	18.30
2	1982	640.80	25.80	11.20	18.50
3	1983	474.20	25.90	11.60	18.80
4	1984	776.80	25.00	11.70	18.40
5	1985	526.60	24.50	10.90	17.70
6	1986	1043.90	24.90	11.50	18.20
7	1987	1097.90	25.80	12.00	18.90
8	1988	1061.50	25.90	11.80	18.90
9	1989	961.40	24.80	10.70	17.80
10	1990	1033.10	25.20	11.80	18.40
11	1991	995.10	24.50	8.90	16.70
12	1992	1223.80	23.90	8.80	16.40
13	1993	1157.80	25.80	11.50	18.70
14	1994	811.70	25.00	11.20	18.10
15	1995	884.60	25.30	11.50	18.40
16	1996	1233.50	25.60	11.30	18.50
17	1997	1323.60	26.50	10.60	18.60
18	1998	1171.10	29.20	13.30	21.30
19	1999	821.60	25.90	10.80	18.40
20	2000	904.10	25.60	11.60	18.60
21	2001	1079.50	25.70	11.50	18.60
22	2002	769.40	26.30	12.00	19.20
23	2003	932.20	25.90	11.80	18.90
24	2004	944.00	25.90	12.00	18.90
25	2005	856.60	26.30	11.40	18.90
26	2006	1103.90	25.80	12.00	18.90
27	2007	1163.10	26.30	11.40	18.90
28	2008	1160.30	26.20	12.53	19.40
29	2009	866.40	26.80	12.80	19.80
30	2010	1186.60	26.20	14.20	20.20

Source: National Meteorology Agency (NMA) of Ethiopia, 2013.

Table 2: Mean Total Rainfall and Mean Annual Temperature for Ambo Town Over 30 Years (1981-2010)

Variables	Minimum	Maximum	Mean	Std. Deviation
Total Rainfall in mm	474.20	1323.60	968.74	207
Mean Annual Temp °C	16.40	21.30	18.64	0.90

Source: NMA of Ethiopia, 2013.

The mean annual temperature computed from data of National Meteorology Agency (NMA) of Ethiopia for the period 1981-2010 shows that there has been a variability in trends of mean annual temperature over the last 30 years in Ambo town though the variability in mean annual temperature is less **(**Std. deviation=0.90). The mean annual rainfall computed for the period 1981-2010 shows that there has been a very high variability of trends in annual rainfall over the last 30 years in Ambo town (Std. deviation=207). The aforementioned analysis coincides with the claim of the local communities in Ambo town that climate change and climate variability is really happening and affecting much Ambo town and its dwellers. For example, all the participants of the focus group discussion and key

informant interview in Ambo town narrated that "Ambo was a highland town but now rapidly changing to a desert like town because of high variability in rainfall and temperature".

Figure 4: Trends in Annual Rainfall for Ambo Town over 30 years.

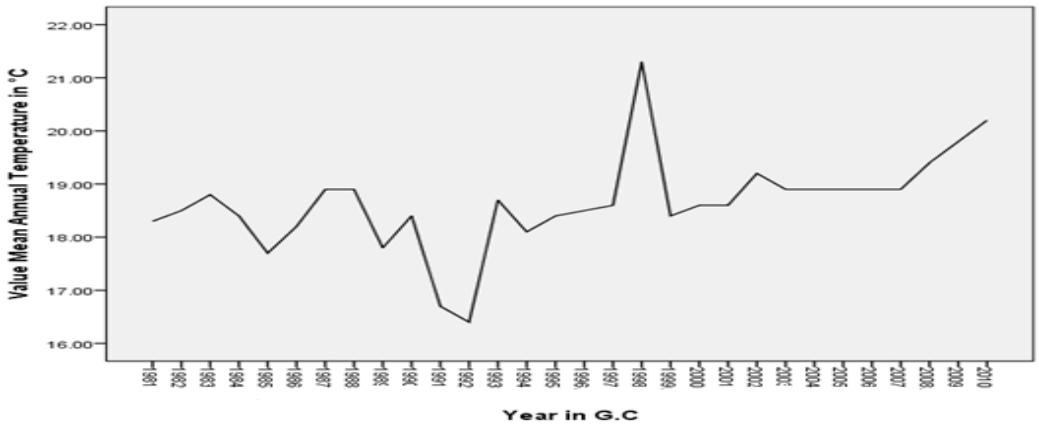

Figure 5: Trends in Mean Annual Temperature for Ambo Town over 30 years

Climate change related urban vulnerabilities in Ambo Town

Respondents from different urban development planning sectors in Ambo town were asked to confirm whether there are changes in trends of climate change and climate variability in Ambo town. All the respondents (100%) confirmed that there are changes in trends of climate change and climate variabilty in Ambo town. They were further asked to identify the type of trends in climate change and climate variability. 65% of the respondents identified variation in teperature and rainfall as a type of trends for climate change and climate variability in Ambo town while 20% and 15% of them identified extended flash flood and extended water stress respectively as the type of trends for climate change and climate variability in Ambo town (See table 3). This shows that variation in teperature and rainfall is the major type of trends in climate change and climate variability in Ambo town which results climate hazards in the town.

Table 3: Type of Trends in Climate Change and Climate Variability

Sr.No.	Type of Trends	Percentage
1	Variation in Teperature and Rainfall	65
2	Extended Flash Flood	20
3	Extended Water Stress	15
4	Total	100

All the respondents (100%) confirmed that increased weather change related diseases; increased incidence of death and serious illness in older age group and urban poor; water stress; decreased water

resource quantity and quality; increased heat stress in human beings, livestock and wildlife; reduced energy supply reliability; increased flood and landslide; increased soil erosion; increased damage to infrastructures like buildings, roads, bridges, transportation systems, water pipelines, drainage and flood defence systems, power and telecommunication infrastructure, hospitals, schools, and police stations; food insecurity; increased air and water pollution, and shift in tourist destinations are the major negative impacts of climate change and climate variability in Ambo town.

Respondents from different urban development planning sectors in Ambo town were asked to identify the principal climate hazard in Ambo town. 55% of the respondents identified flash flood during heavy rainy season as the principal climate hazard in Ambo town while 20%,15%, 5%, and 5% of them identified water stress,urban heat waves, wind storm, and dust storm respectively as the principal climate hazard in Ambo town (See figure 6). This shows that More than half of the respondents agree that the principal climate hazard for Ambo town is flash flood during heavy rainy season.

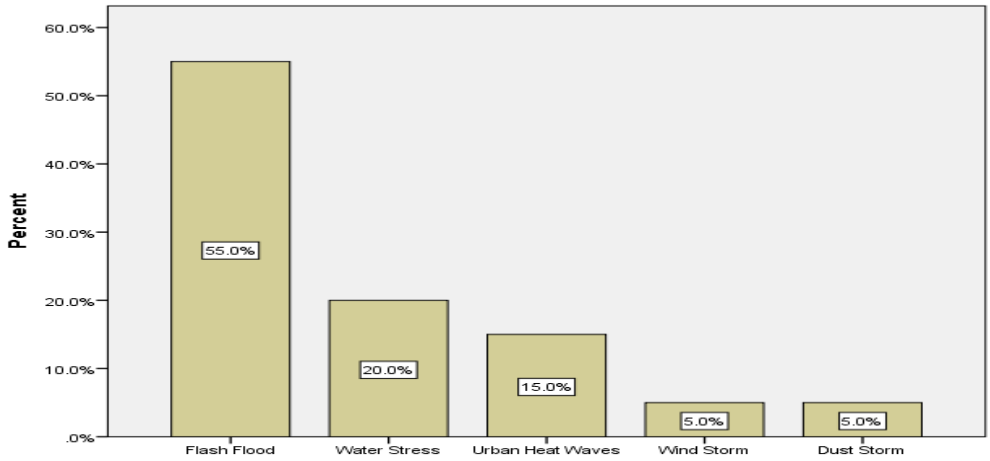

Figure 6: Respondents Perception on Principal Climate Hazards in Ambo Tow.

Participants of the focus group discussion were asked to discuss on the major impacts of climate hazards, groups of the population which are most vulnerable to these hazards, and why they are most vulnerable. They identified flash flood, water stress, heat waves, wind storm, and dust storms as the five critical climate hazards in Ambo town (See table 4). The local criteria used in the ranking process include: duration of occurrence, current negative impact of the hazard, future negative impact of the hazard, severity of the hazard, possibility of planned adaptation to the negative impacts of climate hazards. They also indicated in which months of the year these hazards occur (see table 5). They identified increased risk of damage to a number of crops, reduced energy supply reliability, increased incidence of death and serious illness in older age groups, children and urban poor, Shift in tourist destinations, increased soil erosion, decreased crop yields, increased damage to building foundations caused by ground shrinkage, decreased water resource quantity and quality, food shortages, famine, loss of livelihoods, rural-urban migration, and economic losses as the major impacts of climatic hazards in their system. They identified the urban poor, old people, the urban handicaps, children, and women as the most vulnerable groups. They identified poor access to five capitals (social, natural, human, physical, and financial) by these groups as the main reason for their vulnerability to climate hazard.

Table 4: Community-based pair-wise ranking chart for climate hazards in Ambo town

	Flood	Water Stress	Wind storms	Heat Waves	Dust Storms	Score	Rank
Flood		F	F	F	F	4	1
Water Stress			WS	WS	WS	3	2
Wind storms				HW	WST	1	4
Heat Waves					HW	2	3
Dust Storms						0	5

F=Flood, WS=water stress, WST=Wind Storm, HW=Heat Waves, DS=Dust storms

Source: Focus Group Discussion, 2013.

Table 5: Community-based appraisal of seasonal occurrence of climate hazards in Ambo town

Climate Hazards	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Flood												
Water Stress												
Heat Waves												
Wind Storms												
Dust Storms												

Source: Focus Group Discussion, 2013.

Respondents from different urban development planning sectors in Ambo town were asked to identify different types of climate change induced urban vulnerabilities in Ambo town. 60% of the respondents identified physical vulnerability as a type of climate change induced urban vulnerability while 15%,10%, 5%, 5% and 5% of them identified geograhical vulnerability, environmental vulnerability, social vulnerability, economic vulnerability, and psychological vulnerability respectively as a type of climate change induced urban vulnerability (See figure 7). This shows that the majority of respondents agree that physical vulnerability is the major type of climate change induced urban vulnerability in Ambo town.

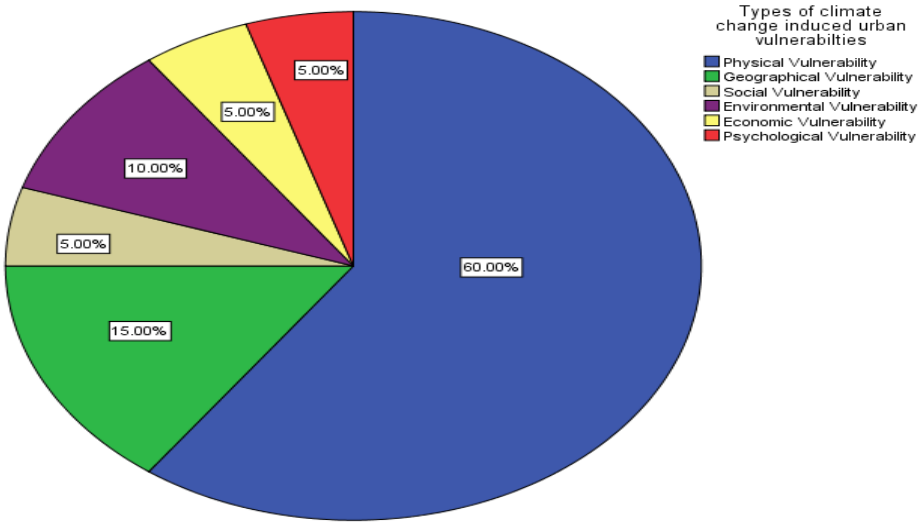

Figure 7: Respondents Perception on types of climate change induced urban vulnerabilities in Ambo town (Source: Questionnaire Survey, 2013).

The focus group discussions conducted in the three urban villages of Ambo town and the field observations in these villages also confirmed that physical vulnerability, geographic vulnerability, economic vulnerability, social vulnerability, environmental vulnerability and psychological vulnerability are the types of climate change induced urban vulnerabilities in Ambo town. Members of the focus group discussion attributed the physical vulnerability in Ambo town to variability in temperature and rainfall which results in climate hazards like flash flood, water stress, wind storms, urban heat waves, and dust storms. They attributed the geographical vulnerability in the town to dominance of slope with less than 2% in eastern and north-eastern parts of the town and drainage of the town by perennial and seasonal rivers and streams. Moreover, participants of the focus group discussion expressed their fear that the town and its dwellers may be critically affected with flash flood in the future due to geographical factors and they suggested that proper flash flood management measures should be taken. They attributed the economic vulnerability in the town to the negative effects of climate change and climate variability on individual, community or national economic reserves and a very low degree of access to credit, loan, and insurance by the vulnerable groups in the town. They attributed the environmental vulnerability in the town to deforestation, degradation of natural resources, low infiltration of rain water, storm water occurrence, and inundation of low gradient areas and incidence of sheet and gully erosion in the town and surrounding areas.

They attributed the social vulnerability in the town to the poor access of the vulnerable groups like elders, the urban poor, women, and children to productive resources. They attributed the psychological vulnerability in the town to the negative effect of climate hazards on the psychology of the vulnerable groups.

The key informant interviews conducted with male and female local residents also confirmed that dwellers of Ambo town are vulnerable to negative impacts of climate change and climate variability. Key informants (residents) were asked to explain their personal experience with climate change and their adaptation measures and they narrated properly their experiences (see Box 1, Box 2, Box 3, and Box 4).

Box 1: Experience of Female Resident in Village 3 of Ambo town

"I have been living in Ambo since 1990. I do believe that the existence of climate change and climate variability in Ambo town is a reality. There is increase in temperature during dry season and irregular rainfall during rainy season. Water stress and interruption of electric power are serious problems resulting from climate change in Ambo town. There are extreme cold and extreme hot weathers in Ambo these days. We have been adapting to negative impacts of climate change like water stress by harvesting rainwater during rainy season and fetching water from Huluka river during dry season. The harvested rain water is used for washing clothes and cooking purpose. I suggest that the local urban government should be able to provide the available social services efficiently and effectively and mobilize urban local communities' resources to enable Ambo town and its dwellers adapt to negative impacts of climate change and climatic variability".

Box 2: Experience of Female Resident in Village 2 of Ambo town

"I have been living in Ambo town since 1943. I do believe that there are climate change and climate variability in Ambo town. It has affected our livelihood very much. There is extreme hot weather, water stress, and flash flood resulting from climate change. The urban poor and women are much vulnerable to negative impacts of climate change and climate variability in Ambo town. For instance, women are much affected by water stress as they are the ones to travel long distances in searching for water to be used for domestic purpose. The negative impacts of climate change and climate variability in Ambo town should be adapted to with joint efforts of different stakeholders in the town. This should include active participation of male and female dwellers of the town and demonstration of good governance from the urban local government side".

Female resident of Village 2; Age : 70.

Box 3: Experience of Male Resident in Village 1 of Ambo town

"I have been living in Ambo since 1943. There are climate change and climate variability in Ambo town. Some of the negative impacts of climate change we are feeling are increased water stress, increased dust storm, flash flood and wind storm. Our livelihood is much affected by negative impacts of climate change and climate variability. Ambo was different 30 years ago. There were forests in and around Ambo town. The major reason for high vulnerability of Ambo town to negative impacts of climate change and climate variability is the ongoing deforestation. The adaptation measures should include participatory planting of indigenous and eco-friendly trees and management both in urban and rural villages. This requires demonstration of effective environmental leadership and good governance. There is an urgent need to plant indigenous tree species in and around Ambo town. Coordination of adaptation efforts and collaboration among stakeholders for urban development also matters for successful adaptation in Ambo town".

Male resident of Village 1; Age: 70

Box 4: Experience of Male Resident in Village 2 of Ambo town

"I have been living in Ambo town since 1927. I do believe that there are climate change and climate variability in Ambo town. These negative changes much affect the urban poor than other social groups in the town. The urban poor have no money to look for adaptation measures. The town is exposed to extreme hot weather during dry season and flash flood during rainy season. Both heavy rainy season and absence of timely rainfall affects agricultural production in Ambo area. For instance, farmers in Ambo area could not plant sorghum and maize at their right time due to absence of timely rainfall. The urban poor who have no access to productive resources are much affected by negative impacts of climate change and climate variability. The negative impacts on the urban poor in the town is much aggravated by uncontrolled urbanization and resulting eviction from their land without being paid appropriate compensation money. The urban local government may have prominent role in properly governing the resources of the town and the urban local communities. This will have significant role in Adapting Ambo town and its dwellers to the negative impacts of climate change".

Male resident of Village 2; Age: 86

Planning sectors in Ambo town were asked to rate the ongoing stage of mainstreaming climate change adaptation into urban development planning in Ambo town from the ranking levels of red, yellow, and green. 75% of the respondents rated the ongoing stage of mainstreaming climate change adaptation into urban development planning as red stage while 20% and 5% of them rated it as yellow stage and green stage respectively (See figure 8). This shows the majority of respondents agree that the ongoing stage of mainstreaming climate change adaptation into urban development planning has red stage. The key informants and participants of focus group discussion also confirmed the red stage of mainstreaming climate change adaptation in Ambo town. Nevertheless, the respondents appreciated some of the progresses made at the red stage progressing to yellow stage like greening the town, learning about climate change and its impacts on the urban development sectors, and identifying tools and resources for mainstreaming climate change adaptation.

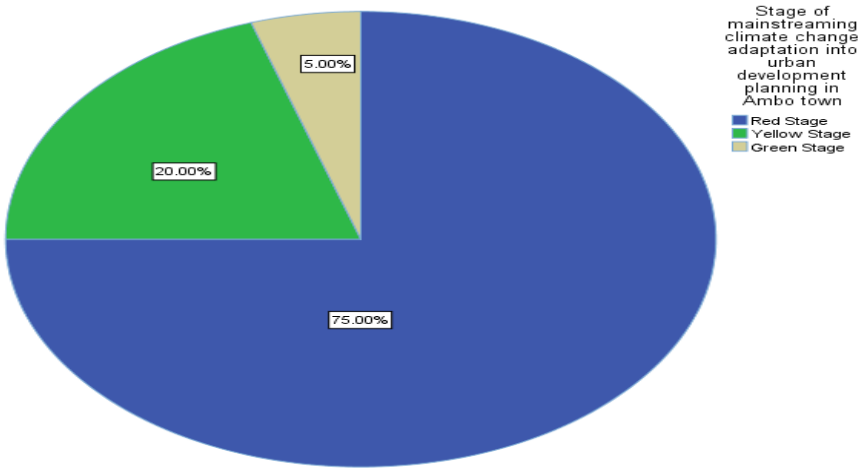

Figure 8: Respondents Perception on Stages of Mainstreaming Climate Change Adaptation into Urban Development Planning in Ambo Town.

Adaptive capacity of urban local communities in Ambo town

One of the specific objectives of the study was to assess adaptive capacity of urban local communities in the town. To this end, six focus group discussions were made with members of urban local communities' development associations in three urban villages with the help of a group discussion checklist.

Participants were asked to discuss on what measures would reduce the vulnerability of the most vulnerable groups, the factors that determine whether these measures are taken, and if they can assess these factors in order to measure the capacity of the system population to implement these measures.

They identified developing adaptive capacity of urban local communities, disseminating information on successful adaptations, improving access to credit and insurance, preventing maladaptation through regulation, enforcing environmental regulations, assessing adaptation needs (including technological needs) through stakeholder engagement, improving access to five capitals, developing alternative livelihood strategies for the urban poor, and relocating vulnerable people as measures that would reduce vulnerability of the groups. They identified political will and commitment, good governance, awareness of climate change risks, willingness of people to move, and availability and affordability of housing in less exposed areas as factors that determine whether these measures are taken. They also come to the consensus that these factors can be assessed in order to measure the capacity of the system population to implement these measures.

Participants were also asked to discuss on the external and internal barriers to the implementation of climate change adaptation measures, and mechanisms to remove capacity constraints from key barriers to adaptation. They identified economic policies that affect the price of inputs and outputs, lack of new land available for relocation, or limitations placed on local authorities by central government, preventing the introduction and enforcement of building regulations as external barriers. They identified unwillingness of people to move away from hazard-prone areas due to the nature of their livelihoods, the high prices of properties, and a lack of awareness of the risk of hazards anticipated as internal barriers to adaptation. They identified awareness creation on impacts of climatic variability and climate change, the provision of social housing, loans or grants, awareness-raising (education), supporting alternative livelihoods that do not require proximity to hazard-prone areas, and developing adaptive capacity of local communities as mechanisms to remove capacity constraints from key barriers to adaptation.

Strengths, weaknesses, opportunities, and threats of Ambo town urban development planning process

One of the specific objectives of the study was to analyze the strengths, weaknesses, opportunities, and threats of urban development planning process of Ambo town from sustainable urban development planning perspective.

The major strengths analyzed were (Review of official documents, Focus group discussion, field observation, and Key informant interview): comprehensive town profile developed, good start in urban greening through street tree plantation and management; construction of coble stone roads in the town, the creation of a strategic plan and management (SPM) programme and undertaking Business Process Re-engineering activities and providing balanced score card–based urban development services, and promoting investment through the establishment of an industrial zone. The major weaknesses analyzed were: Some industries established in residential areas are threats to human health (e.g. Village1 of Ambo

town), poor sanitation and lack of proper sewerage system in the town, no research and documentation on slum and housing, poor data base and data management, limited participation of community in local projects planning and implementation, climate change is not mainstreamed in urban development planning process of the town, and poor management and misuse of urban green areas and spaces (Review of official documents, focus group discussion, field observation, and key informant interview).

The major opportunities analyzed were (Review of official documents, Focus group discussion, field observation, and key informant interview): very good political will and high level of commitment to mainstream climate change adaptation into urban development, existence of different economic development policies and strategies like growth and transformational plan, existence of informal and formal institutions and structures promoting adaptation to climate change at different levels, and technological advancement like internet service and telecommunication in the town. The major threats identified were: dependence of the adaptation efforts on external financial sources, an alarming population growth rate, inadequate information exchange system with different stakeholders, difficulty in securing climate change adaptation fund, and poor public responsibility for sustainable environmental management (Review of official documents, focus group discussion, field observation, and key informant interview).

Stakeholders' analysis for mainstreaming climate change adaptation into urban development planning process of Ambo Town

One of the specific objectives of the study was to analyze stakeholders for mainstreaming climate change adaptation into urban development planning in Ambo town. Stakeholder Analysis Chart was distributed to key stakeholders for the mainstreaming process. The stakeholders were asked to fill their interest, and role in the mainstreaming process. The key stakeholders identified were: Ambo University, Ambo Plant Protection Research Center, Ambo Town Administration, Ambo District Bureau of Natural Resource Management, Ambo District Bureau of Agricultural Development, Ambo Town Water and Sanitation Office, Ambo District Energy Development Office, Ambo District Culture and Tourism Development Office, Ambo District Health Center, National Meteorology Agency, Ambo Town Villages Administration Offices (3 offices), Ambo District Education Office, and Oromia Urban Planning Institute (See table 6).

Table 6: Stakeholder Analysis Chart: Stakeholder Analysis for Mainstreaming Climate Change Adaptation into Urban Development Planning in Ambo town

Stakeholder	**Interest and Roles in the Mainstreaming process**
Ambo University	Provision of research, education, and community services in relation to adaptation to climate change
Ambo Plant Protection Research Center	Developing climate change responsive agricultural research outputs, provision of climate data, and participation in climate adaptation community services
Ambo Town Administration	Mainstreaming climate change into urban Development Planning Process
Ambo District Bureau of Natural Resource Management	Mainstreaming climate change into management of urban natural resources
Ambo District Bureau of Agricultural Development	Mainstreaming climate change into urban agriculture in Ambo town
Ambo Town Water and Sanitation Office	Adapting the urban water supply and sanitation system to impacts of climate change
Ambo District Energy Development Office	Promotion of Sustainable Energy Options in Ambo town and rural villages
Ambo District Culture and Tourism Development Office	Promotion of climate change responsive tourism services in Ambo town and Ambo district
Ambo District Health Office	Provision of climate change responsive health services
National Metrological Agency	Provision of urban climate data for adaptation and participation in community-Based adaptation activities
Ambo Town Villages Administration Offices (3 offices)	Mainstreaming climate change adaptation into Village level urban development Planning process
Oromia Urban Planning Institute	Mainstreaming climate change adaptation into urban planning process of cities and towns in Oromia
Ambo District Education Office	Mainstreaming climate change adaptation into school programmes

Discussion

Previous assessment conducted by Ambo town Administration identified: low infiltration of rain Water, storm water occurrence, inundation of low gradient areas, incidence of sheet and gully erosion, inefficient and uncoordinated utilization of potential site and resources; sanitation problem associated with lack of waste collection system and disposal site for both solid and liquid waste, growing water and air pollution, and unplanned quarrying and deforestation as critical environmental problems in Ambo town (Ambo Town Administration, 2013). Moreover, UN-HABITAT (2008) affirm that the environment of

Ambo town has been in a constant decline characterized with most of the solid waste not properly collected, lack of environmental regulations and sanitation, absence of sewerage system in place, lack of sanitary dumping site, and half of all houses without toilet facility. The municipality is not seen as in a position to address the problem due to resource and capacity limitations (UN-HABITAT, (2008). The aforementioned discussion confirms that Ambo town is affected by different environmental problems.

The findings of the study confirmed that Ambo town and its dwellers are vulnerable to the negative impacts of climate change and climate change has seriously affected the urban development process in Ambo town. Vulnerability to climate change is the degree to which groups of people and livelihood systems are susceptible to, and unable to cope with, adverse impacts (Claire et al., 2002; Adger et al, 2003; Huxtable and Yen, 2009; Yaro et al., 2010). Vulnerability specifically to climate change is commonly defined as being a function of exposure, sensitivity and adaptive capacity (Eriksen et al., 2005; Nelson, 2011). Scholars of climate change research contend that the vulnerability of a system includes both an external dimension, represented by its exposure to climate change and variability, and an internal dimension, represented by its sensitivity to these factors and its adaptive capacity (USAID, 2004; Eriksen et al., 2005; Fu¨ssel, 2007**;** ECE, 2009; Heltberg et al., 2009; Nelson, 2011; UNPEI, 2011). There are also scholars who contend that vulnerability has not only physical aspects but also geographical, social, economic, environmental and psychological aspects that need to be taken into account **(**Tompkins and Adger, 2003**;** Downing, et al., 2004; Malone and Rovere, 2004; USAID, 2004; Eriksen et al., 2005; Haines et al., 2006; ECE, 2009; Kidanu et al., 2009; Nelson, 2011).

According to Revi (2008), the most vulnerable populations and elements in urban areas are: Slum and squatter populations resident in traditional and informal settlements, which are often located in the most vulnerable locations; Buildings, especially traditional and informal housing that is especially vulnerable to wind, water and geological hazards; Industrial units, their in-house infrastructure, plant, machinery and, raw materials; Lifeline public and private infrastructure like roads, bridges, and other transportation systems, water pipelines, drainage and flood defence systems, power and telecommunication infrastructure; critical social infrastructure such as hospitals, schools, and police stations; and ecosystems and the natural environment, especially surface and groundwater systems.

Huxtable and Yen (2009) contend that climate change impacts sectors that form the basis of livelihoods for which women are responsible, for example, agriculture, nutrition, water and energy supplies. Klein et al. (2003) assert that climate change poses a threat to important development issues such as water supply, food security, human health, natural resources and protection against natural hazards. Moreover, because of gender differences in property rights, access to information and social and economic roles, the effects of climate change will affect men and women differently (Kok et al., 2008; Huxtable and Yen, 2009; Elasha, 2010; Nelson, 2011). The most vulnerable households are those with assets and livelihoods exposed and sensitive to climatic risks and who have weak risk management capacity (Aalst and Burton, 2008; Heltberg et al., 2009; UNPEI, 2011). While all households are exposed to risks associated with climate change and could potentially be rendered vulnerable, the poorer households are the most at risk (Denton, 2002; Heltberg et al., 2009). This is because their assets and livelihoods tend to be highly exposed and sensitive to the direct and indirect risks associated with climate change, and because they lack access to formal and informal risk management arrangements (Heltberg et al., 2009).

This study identified important measures that would reduce the vulnerability of the most vulnerable groups, the factors that determine whether these measures are taken, the external and internal barriers to the implementation of climate change adaptation measures, and mechanisms to remove capacity constraints from key barriers to adaptation. According to Ebi et al. (2004), adaptive capacity is the property of a system to adjust its characteristics or behaviour, in order to expand its coping range under existing climate variability, or future climate conditions. Access to capital assets (physical, natural, social, financial, human) directly affects society's capacity to respond to climate change (Claire et al., 2002; Tompkins and Adger, 2003; Brooks et al., 2004; Downing, et al., 2004; Haines et al., 2006; Nelson, 2011).

This study identified important stakeholders with their role and interest to mainstream climate change adaptation into urban development planning in Ambo town. Stakeholders are individuals or groups who have the current and past experience of coping with, and adapting to, climate variability and extremes (Ebi et al., 2004; Turnpenny et al., 2005). They are those who have interests in a particular decision, either as individuals or as representatives of a group. This includes people who influence a decision, or can influence it, as well as those affected by it. The principal resource for responding to climate change impacts is people themselves, and their knowledge and expertise (Conde et al., 2004; Ebi et al., 2004; Thomasa and Twyman, 2005; Turnpenny et al., 2005). Few and Tompkins (2006) assert that inclusion of a broad range of stakeholders is frequently promoted in policy responses to climate change. For instance, calls for public participation in the formulation of adaptive responses are explicit, if not always prominent, in several major policy documents on climate change (Denton, 2002; Conde et al., 2004;

Betsill and Bulkeley, 2006; Few and Tompkins, 2006; Fussel, 2007 Measham, et al., 2011; UNPEI, 2011).

The authors of this study strongly believe that urgent and strategic actions must be taken to adapt Ambo town and its dwellers to the negative impacts of climate change. This requires good political will and commitment and strategic urban development planning. Planned adaptation to climate change means the use of information about present and future climate change to review the suitability of current and planned practices, policies, and infrastructure (Fussel, 2007). Huxtable and Yen (2009) contend that a strategy to integrate climate change concerns into programming must be accompanied by a strategy to ensure that the working environment is sensitive to climate change issues (e.g. consideration of climate related issues in budgets), and sufficient technical capacity and human resources to successfully mainstream climate change adaptation must be made available. Essential elements for successful strategic mainstreaming includes (Huxtable and Yen, 2009; Chinvanno, 2011): Staff and financial resources, leadership, skills and knowledge, and time.

Empowerment of communities—particularly women and other vulnerable groups—so that they can actively participate in the planning and implementation of adaptation programs is a priority, both for their own well-being as well as to ensure that adaptation programs are based on local knowledge, a key for their success (Betsill and Bulkeley, 2006; Elasha, 2010; Measham, et al., 2011). The mainstreaming of climate change adaptation strategies within national development plans and efforts needs to be fostered, as does the incorporation of climate-sensitive policy components into sectoral, national and regional policy frameworks (Elasha, 2010; UNPEI, 2011).

The following strategic actions of mainstreaming are proposed to adapt Ambo town and its dwellers to the negative impacts of climate change and climate variability in the years to come:

- Awareness of urban local communities and other stakeholders on the benefits of mainstreaming climate change into urban development planning should be created and increased for achieving sustainable urban development in Ambo town;
- Community participation should be mainstreamed in the vulnerability assessment and adaptation planning to motivate them for active participation and benefit sharing from the urban development process;
- Vulnerable sectors, most vulnerable groups, and adaptive capacity of urban local community should be assessed to mainstream climate change into different urban development activities in the town;
- Training and education opportunities on mainstreaming climate change adaptation into urban development planning should be provided for urban development planners to improve planning, implementation, monitoring and evaluation activities of mainstreaming;
- Telecommunication, information communication technologies, electrification, transport, water, and health related infrastructures should be well develop to support vulnerability assessment and adaptation measures;
- Stakeholders should be well informed about their roles and responsibilities in vulnerability assessment and adaptation process;
- Urban investment permits should include mainstreaming adaptation to climate change into urban development activities as key criteria;
- Mainstreaming climate change adaptation into urban development planning should reduce the negative social, economic and environmental impacts of urban development and enable the most vulnerable groups like women, children, physically handicapped groups, and elderly adapt to climate hazards;
- Collaborative relationship among actors participating in urban development process in Ambo town should be strengthened to properly achieve shared goals and secure technical and financial support;
- Rural-Urban linkage in managing watersheds in rural villages should be strengthened to adapt Ambo town and neighboring rural villages to negative impacts of climate change and climate variability;
- Each urban development sector should start mainstreaming climate change adaptation with existing policies, plans and institutions, as these often embody important experiences and may already address key development issues; and
- Ambo town administration and each urban development sector should properly monitor and evaluate climate adaptation projects in its development sector to check whether they meet their climate adaptation objectives, and what other benefits or adverse impacts they may have on the environment.

Conclusion

The study assessed the quest for mainstreaming climate change adaptation into urban development planning of Ambo town and proposed strategic actions of mainstreaming climate change adaptation into urban development planning. More specifically, it identified critical environmental problems in the town; assessed climate change related physical, geographical, economical, social, environmental, and psychological vulnerabilities in the town; identified old people, the urban poor, children, the handicaps, and women as the most vulnerable groups to impacts of climate change in the town; analyzed strengths, weaknesses, opportunities, and threats of existing

urban development planning practices of Ambo town from sustainable urban development planning perspective; and analyzed stakeholders' interest and roles in the mainstreaming process. While it is commendable to appreciate the good start of urban greening and beautification by Ambo town administration and its municipality, the town administration has to take critical and strategic actions to adapt Ambo town and its dwellers to the negative impacts of climate change and climate variability. This requires mainstreaming climate change adaptation into urban development planning process and taking urgent collaborative actions with stakeholders for sustainable urban development of the town.

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