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Full Length Research Paper

An Assessment Study of the Causes and Impacts of Urban Flooding on Environment and Socioeconomic Activities in Gambella Town, Ethiopia

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ABSTRACT

Urban flooding is particular in the way that the reason is an absence of drainage in urban area or a great deal of the sewerage and drainage network is old and their conditions are unknown. Flood risk in general is higher in cities with a backdrop of high demographic growth, unplanned urbanization trends, improper master plan implementation and land policy and law enforcement, and impact of climate changes, which are general and most frequent causes of urban flooding. Flooding can cause real disturbances in urban areas, and prompt the impact of flooding is driven by a combination of natural and man-made factors. This study sought to assess the causes of flooding and its attendant socio-economic conditions on the livelihoods of the people of Gambella (the hardest hit or flood prone zone, especially between the months of June and September) in the Gambella Municipality. Descriptive survey design was adopted in this study applying both qualitative and quantitative research methodologies. The study also found that, floods in the study area had effects huge effects on individuals, the economy and on environment as well as on social setting. These effects might be exacerbated by climate and socioeconomics changes. Urban floods disturb social systems and cause noteworthy socioeconomics losses of which the economics damages are believed to be substantial as far as housing damages, households' contents being flooded and now and then the houses collapse partially or totally because of intense rains. Furthermore, streets additionally get damages because of extend periods of time of water retention and infrastructure services like electricity sewerage lines and water supply gets disturbed. The study revealed that, floods in Gambella are largely caused by multiple factors. Therefore; it can be suggested that proper drainage system, good planning of structures, proper waste disposal mass education on proper waste disposal practices, early warning education and flood risks management measures and construction of roads and gutters if implemented could avert the incidence of flooding in Gambella.

Introduction

Flooding is a phenomenon which can occur if the amount of precipitation in an area exceeds the evaporation rate and infiltration capacity of the soil and it is said to be the most lethal kind of hydro meteorological and anthropological disaster, floods cause natural threats to life, health and population (Maurice M. Braimah, 2014). Africa urbanization is accelerating and the rate of urbanization began from 15 percent in 1960 to 40 percent in 2010. 40% of Africa's populace lives in urban territory and is anticipated to reach 60 percent in 2050 (UN Habitat 2010) as referred to by Maria et al, with 50 urban communities having more than 1 million inhabitants (Parnell and Pieterse 2014: 4). Africa's rate of urbanization has taken off from 15% in 1960 to 40% in 2010 and is expected upon to top 64% by 2050, making it the world's second most quickly urbanizing landmass following Asia (UNDESA 2015). Africa's urban progress will prompt an intense change in the profile of the region, raising critical difficulties for feasible improvement and any endeavours to manage its destitution emergency and poverty crisis (Friere et al, 2014 as referred to by Maria E. Freire, SomikLall, and Danny Leipziger) (Maria E. Freire, 2014).

Developing countries are most in danger and in spite of the fact that Asia remains the landmass most hit by floods, Africa and Latin American nations are likewise vigorously affected. In the region south of the Sahara, flooding is the most widely recognized common risk. Substantial urban areas are progressively affected: 7 in the 1980s, 27 in the 1990s, 37 in the 2000, and 7 more since 2010. African disasters records, demonstrates that floods have represent half of the disasters in Sub Saharan African and 78 are in the biggest urban communities since 1981 and floods chance is turning into an expanding weight because of environmental change and quick populace development in the urban communities with increasing harms (Tiepolo, 2014). In this context the

study was conducted to identify the reasons of flooding in the town of Gambella the capital of Gambella regional state. The factors studied under this study are (a) frequency of flooding from 2006 -2016 G.C, (b) causes of flooding factors and (c) impact due to flooding factors, (d) Institutional linkages and relationship in responses to flood disaster and to draw forward some adaption and mitigations measures. The study taken up was evidence-based study, where review of flooding incidents of last 5 years (2009-2013), highlighted the significant factors of causes and impacts of flooding whereas primary survey and visual survey has also been conducted which helped in identifying the people's perception of risk and the experts are also interviewed to get most accurate information.

Increasing urbanization, population growth, Improper settlements, Inappropriate master plan implementation and Improper waste management practices in Gambella town and the incidence of flooding in the city are correlated.

Research Objective

The main objective of this research was to assess the causes and impacts of urban flooding on the environment and socio-economic activities in Gambella town since 2006 to 2016 G.C

Specific objectives

- ★ To assess the frequencies and level of urban flooding in the town from 2006 to 2016 G.C
- ★ To assess the consideration of overland flow and sewer network into account in urban planning and constructions scenarios.
- ★ To assess the causes and impacts of urban flooding on the environment and socioeconomic in Gambella town
- ★ To assess the linkages and relation of the institutions in responds mechanisms and decision making.
- ★ To assess the contribution of urban sprawl and illegal settlement on the urban flooding
- ★ To draw forward some adaptations and mitigations measures to flood prevention

Research Questions

1. Is there flooding in Gambella town?
2. How frequently and to what extent does it occur?
3. What are the causal factors and its impacts on the environment and socioeconomic?
4. Are the overland flow and sewer network issues considered during the urban planning and constructions scenarios?
5. What are the institutional linkages of responds?
6. What are the adaptations and mitigation measures put forwards?

In identifying that there has been no research carried out for Gambella town on urban flooding, there become to be a need to conduct study in the town, to point out the overlooked and analyze the causes and impact of urban flooding in Gambella town.

The output of the research will help the city administration, city planners and policy makers and other interested stakeholders to use it as planning tools for the system to apply or to conduct other research in any way possible. The research outputs can also be able to add value on the urban planning mitigations measures toward flooding prevention in the town of Gambella

Materials and methods

Description of the Study Area

The Gambella Region is one of the nine national regional states in Ethiopia. It is located in the south-western part of the country. It is bordered with Oromia to the North and East, SNNPR to the South, and the South Sudan to the West. The region is divided into three zones (namely, Anyuak, Majang and Nuer) and 13 Woredas. The 13 Woredas are: Abobo, Dimma, Gambella, Gog, and Jor (in Anyuaks Zone), Akobo, Jikawo, Lare, Makuety, and Wanthoa (in Nuer Zone), Godere and Mengeshi (in Majang Zone) and Itang Special woreda accountable or answerable to the Region

Research Design

Since the objective of this study was to assess the causes and impacts of urban flooding on environment and socioeconomic activities, descriptive survey design was adopted in this study applying both qualitative and quantitative research methodologies. This was because, in the study, data was collected based on figures which had to be described as the outcome of the study before conclusions were drawn. Also, both quantitative and qualitative research methods were used to collect, interpret, and analyze data because according to Knupfer and McLellan (2001), Descriptive survey design allows for greater degree of accuracy, reliability, standardizations of measurement and the uniqueness of the study; much information can be obtained from individual respondents of the population. One major weakness of descriptive research is that, answers to it do not enable us to understand why people feel or think or behave in a certain way, why programs pose certain characteristic, why a particular strategy is used at a certain time and so forth.

Sampling technique

The sampling techniques used in this study were probability and non-probability sampling. Under the Probability sampling the sampling used was;

Stratified sampling:- this helped in collecting data from different households, service provider institutions, which are in the town. This sampling technique was used in order to classify these different institutions and households in their homogenous group. Specifically, Disproportionate Stratified Sampling was used to provide equal sample size from each stratum, or group.

Simple random sampling - After classifying the households and institutions into homogenous groups or strata; Simple Random

Sampling techniques were used to identify specific institutions and households which were enrolled in the study. Additionally, Non-Probability sampling techniques were used.

Purposive sampling techniques: - this method of sampling technique was used in order to gather data from concerned different government officials, organizations and responsible bodies through interviews, it was mainly used due to the fact that, relevant and valid information should be collected from specific and directly responsible bodies related to the issues in the study.

Population or Universe

According to the CSA; Gambella town has the total population of 39022 with 10152 households. The population this research were the inhabitants of 4 Kebeles of the town which about 8497 since they are the most hit and affected by flooding each year with serious damages on their surrounding environment and socioeconomic activities.

Sampling Frame

The study was conducted in Gambella Town for it was the only town with yearly serious flooding records in the region. It is also the only regional city where fast and unplanned development is taking place with high increase in population and urban sprawl. The study for its data collection took 4 Kebeles (Kebeles, 02, 03, 04 and 05) as participant's sample out of the 5 town Kebeles administration with study population of 8497. They were selected purposively because they are the most victims of the flooding events that took place each year in the town. The population under study includes Households, top managers or professional experts of the responsible institutions to disaster and environmental protection', and the existing streams, river basin and sewerages constructed in the town. Thus, the total 4 Kebeles administration, Households, top managers or professional experts of the responsible institutions to disaster and environmental protection', and the existing streams, river basin and sewerages constructed in the town will make up the population of the study.

Sampling Unit

The sampling units of this study were Households, concerned Institutions (like Health bureau, Town administrations, Municipality, National meteorology office in the region, Disaster Prevention and food security Agency, construction and design Bureau, Road construction Bureau, Land utilization and environmental protection Agency, and the 4 Kebeles administrations), streams and river basins, the constructed sewerage in the town, Service provider institutions (Hospitals, Schools, etc..), Business areas/centres within the sampling frame. The time period was 10 Years (2006-2016) of flooding data of the area.

Sample Size

The sample size determines the number of observations in a sample. The study will use 4 Kebeles Households, since they are the most vulnerable to flooding problem in every year. The household of the 4 Kebeles is about 8497 (CSA Report: 2007). Among the different methods available from literature, Kothari's sampling study of 2004 will be used. According to Kothari, for a total population less than or greater than 10,000 the required sample size is determined by using the following formula in their respective cases.

1. If $N \geq 10,000$, sample size $n = \frac{Z^2 pq}{d^2}$,
2. If $N \leq 10,000$, sample size $n = \frac{Z^2 Npq}{d^2(N-1) + pqz^2}$

Where

N = Target population size (Total households of the town)

n = sample size

Z = standard normal variables at the required confidence level (read from t-table)

P = the proportion of the target population estimated to have knowledge of the being measured; characteristics (maximum of variability or coefficient variation)

q = $1-p$ (q value is an adjusted p value)

d = margin of error at the required level of statistical significance or tolerant of desired level of confidence.

Therefore; for the given total households of the 4 Kebeles which is 8497 numbers known as less than 10,000 the sample size for the population then the sample size (n) is calculated as target population is less than 10000, is used for the appropriate sample determining formula (Kothari, 2004):

$$n = \frac{Z^2 Npq}{d^2(N-1) + pqz^2}$$

$$n = \frac{1.96^2 * 8497 * 0.5 * 1 - 0.5}{0.07^2(8497 - 1) + 0.5 * 1 - 0.5 * 1.96^2}$$

$$n = \frac{3.84 * 8497 * 0.5 * 0.5}{0.0049 * 8496 + 0.5 * 0.5 * 3.84}$$

$$n = \frac{8157}{41.63 + 0.96}$$

$$n = \frac{8157}{42.6}$$

$$n = 191.48 \cong 191 + 10 = 201$$

The study targeted a population of 191 respondents and 10 key informants making up 203 people or households from a population of 8497 households (source CSA-Gambella) living in Gambella. The population of the households in the studied 4 Kebeles of Gambella Municipality is 8497 out of 10152 Gambella Municipality total households (source CSA-Gambella).

Since every Kebele has different population size the sample size for each Kebele was determined by taking the proportion technique. The proportion determination was done by dividing the sample size by the total population (191 / 8497). The result will be 0.022.

Therefore, by multiplying each sub city household population by 0.022 the sample size for each of the sub cities were determined as follows: -

$$S = \frac{n * th}{TH}$$

Where

S = Sample to be taken in each Kebele

n = Total sample size

th = Total households in each Kebele

TH = total households of the town

Which mean;

1. Kebele 02 $S = \frac{191 * 1619}{8497} = 36$
2. Kebele 03 $S = \frac{191 * 2682}{8497} = 60$
3. Kebele 04 $S = \frac{191 * 2040}{8497} = 46$
4. Kebele 05 $S = \frac{191 * 2156}{8497} = 49$

In addition to the above respondents, the total Number of 10 key informants from the concerned institutions and different service providers' institutions were purposively sampled and conducted. These were; 1 from town Administration, 1 from Health Bureau, 1 from National meteorology Agency Gambella center, 1 from Design and Construction office, 1 from land utilization and Environmental Protection Authority Gambella Office, 1 from Disaster Prevention and Food Security Agency, 1 from UNDP, 1 from UNOCHA and 1 from Municipality. The number of the respondents for the interview was 10 officials.

Formula and tests applied

The researcher used the formula of Kothari (2004) According to Kothari, for a total population less than or greater than 10,000 the required sample size is determined by using the following formula in their respective cases.

1. If $N \geq 10,000$, sample size $n = \frac{Z^2 pq}{d^2}$,
2. If $N \leq 10,000$, sample size $n = \frac{Z^2 Npq}{d^2 (N-1) + pqz^2}$

Where

N = Target population size (Total households of the town)

n = sample size

Z = standard normal variables at the required confidence level (read from t-table)

P = the proportion of the target population estimated to have knowledge of the being measured; characteristics (maximum of variability or coefficient variation)

q = 1-p (*q* value is an adjusted *p* value)

d = margin of error at the required level of statistical significance or tolerant of desired level of confidence.

Therefore; for the given total households of the 4 Kebeles which is 8497 numbers known as less than 10,000 the sample size for the population then the sample size (*n*) is calculated as target population is less than 10000, is used for the appropriate sample determining formula (Kothari, 2004):

Therefore by multiplying each Kebele household population by 0.022 the sample size for each of the sub cities were determined as follows: -

$$S = \frac{n * th}{TH}$$

Where

S = Sample to be taken in each Kebele

n = Total sample size

th = Total households in each Kebele

TH = total households of the town

Data and Instrumental data collection Techniques

Instruments of data collection

The study used questionnaire, In-depth interview and observation to collect data. The study used structured close and open-ended questionnaires as the main instrument to collect data alongside with, key informant interviews and observation. These methods

sought to provide an opportunity to have an in-depth knowledge of the research which hitherto was not clear. The researcher conducted a series of in-depth interviews with each of the respondents during the data collection. The interview with the participants focused on sixteen structured questions designed by the researcher. Participants planned to be included in this interview were 10 but due to unknown reasons only 9 participants got to participate in this study and these were GPNRS DPFSA, NMA-Gambella Center, UNDP and UNOCHA Gambella coordination offices, GPNRS – Health Bureau, Gambella Town administration, Gambella Municipality, GPNRS Environmental Protection Authority, GPNRS design and urban plan Agency. Observation tool was made to screen the environment and the ecosystem of the town to be able to cross check the responses of the participants with the observed actual condition on the ground.

Data Analysis and Interpretation

Data gathered was analysed and presented as percentages in tables, bar graphs, pie charts and Map using computer software SPSS (Statistical Package for Social Sciences) and Arc GIS software.

Limitations

Absent of technology and technological materials (laboratory and the meteorological materials) to collect enough secondary data in the surrounding area to conduct some water volume and quality tests and reviews.

Results

Response Rate

In this study, one hundred ninety-one (191) questionnaires were prepared and distributed to the 191 selected respondents in Gambella town, and all the questionnaires (100%) were filled and returned back. Interview also was made with the 9 heads and expert of the selected offices. The total number of interviewees was four 9 participants. Hence, interview was carried out so that the researcher could get extra information in addition to questionnaires and field observation being made.

The respondents' sex composition data showed that out of 191 respondents, 116 (60.7%) of them are females. The rest 75 (39.3%) of the respondents is males. This means to be concluded that 60.7% constitutes the majority of the respondents. From this data, it can be understood that female are the most significant participants of this study.

As it is clearly shown in table 1 above, out of total 191 respondents, 1 percent of the respondents are in the age group of 15 - 19 years, 5.8 percent belongs to the age group of 20 –29 years, 45.5 percent of the respondents are in 30 - 39 years of age category. Besides, 42.9 percent are in 40 - 49 years of age, and the remaining 4.7 percent of them are in 50 and above year's category. Accordingly, 88.4 percent which is the combination of age group from age 30-39 and 40-49 made up the majority number of the household's respondents. Based on this, it can be generalized that the participants of this study are the middle-aged groups.

Marital status of respondents

It showed that majority (83.8%) of the respondents are married. This implies that parents who are married are the most vulnerable to the flood risks in the town as compared to households who are divorced, separated and widow/widower.

Education level of respondents

The result obtained from the data shows that 53.8%, which are the sum of the percent of the respondents who are in category of illiterate, read and write, primary school, secondary school, and certificate. Whereas 46.1%, which are the combination of the percent of the respondents who are categorized under diploma, bachelor and master degree holders. In this case, the less educated households' percent constitute the majority of the respondents. Based on this data, it can be realized that households' who has low level of education are always paid less and are more affected by flood as compared to households' who have high level of education. This is due to lack of getting job opportunity or having good paying job.

Monthly income categories of respondents

The result obtained indicated that 65.4% which is the sum of the percent's of the respondents whose monthly incomes are less than or equal to 2000 birr are more compared to 34.6%, which is the combination of the percent's of the respondents whose monthly incomes are above 2000 birr. Hence, by taking the responses of the respondents into account, it can be easily understood that Households with low level of monthly incomes are more vulnerable and economically affected by the flood occurrence in each and every year as compared to the households with high level of monthly incomes in the study area

Occupation of the respondents

It indicated that 72.8% which is the sum of the percent's of respondents who farmer, housewife, government workers and daily laborers of which most of them are categorized under less paid are the major respondents in this study in contrast to 27.2%, which is the combination of the percent's of the respondents who are traders or commercial and private workers who are better paid majority of the respondents. Hence, by taking the responses of the respondents into account, it can be easily understood that Households who are farmers, housewife, and government workers with less paid are more vulnerable and mostly affected by the flood impacts occurring every year.

Family size of the respondents

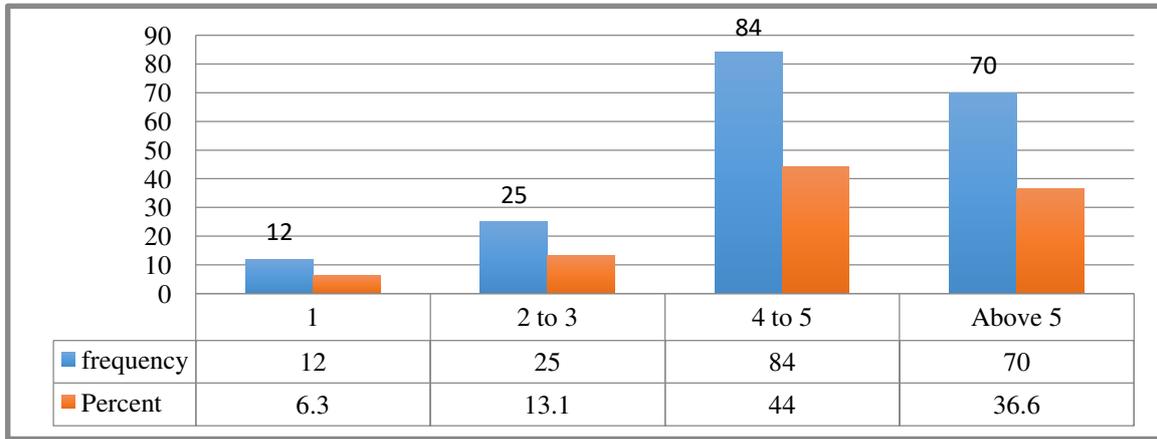


Fig 1. Family size of the respondents *Field Survey (Source: Researcher 2018)*

The result obtained from the data analyzed in figure 1 above indicated 80.6% which is the sum of the percent of respondents who have 4-5 and above 5 family size is greater than 19.4%, which is the combination of the percent of the respondents who have 1 and 2-3 family size which is concluded that 80.6% constitutes the majority of the respondents. Hence, by considering responses of the respondents, it can be easily understood that Households who are having 4 and above family size are more vulnerable and mostly affected by the flood incidents occurring every year.

Kebele of the respondents

Data shows that 60 (31.4%), 49(25.7%), 46(24.1%), and 36(19.8%) percent of the total respondents are from 03, 05, 04 and 02 Kebeles respectively. This shows that the total selected sample from Kebeles has filled and responded to the questionnaires designed and distributed by the researcher for this study. Additionally, as the data above indicated Households families in 03, and 05 are the most vulnerable and the most affected Kebele households by the flood incidents occurring every year in the town, followed by 04 and 02 Kebeles respectively.

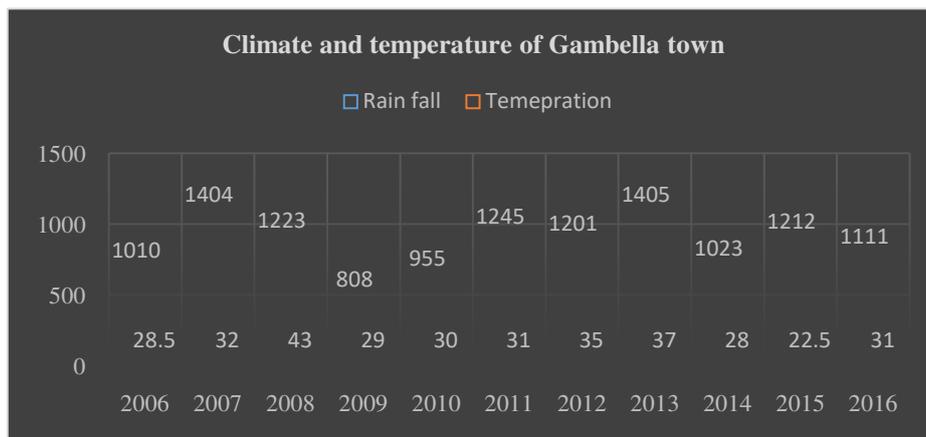


Fig 2. Climate and temperature of Gambella Town Secondary data *Source: NMA: Gambella meteorology center*

Floods in Gambella are being associated chiefly with changing rainfall patterns, resulting from climate change in major policy circles.

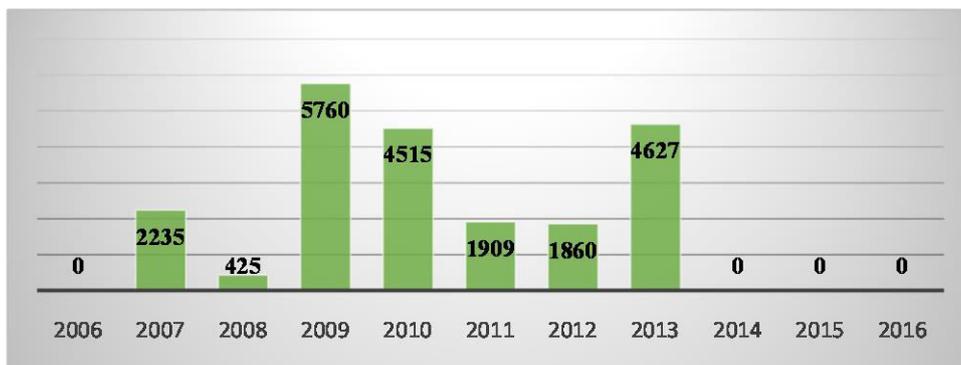


Fig 3. Frequency of flooding and population affected by floods Hazard in Gambella town from 2006-2016. *Secondary data (Data Sources: DPFS, UNDP and UNOCHA)*

The summary in the figure3 above indicates that flooding has been occurring in the Gambella town every year ten years from now except for some few years. The data summarized in the above figure shows that flooding had been occurring from 2007 – 2013 G.C constantly and it affects a greater number of populations of the town. It was also so serious in 2009 followed by 2013 and 2010 respectively. The flooding in 2009, 2010 and 2013 were the serious flood which has affected almost all the population inhabiting in Gambella town. As according to the interview with DPFSA expert, flood disaster had never absented in Gambella town each year. Therefore; remaining years of 2006, 2014, 2015 and 2016 are missing data. Therefore; the town witnessed severe floods when the entire town got completely submerged under water after it rained for a few days. ‘It was observed that some of the dwelling houses had collapsed after flood situation in 2013 with some individuals either being seriously injured and loss of children lives (Wolde, 2018).

Months of flooding in Gambella town.

Data shows 84.8% of the respondents said they had experienced flooding between June – September, and 15.2% of the respondents not responded. Showing that, they are flooding period in June to September where most of the people are flooded during those months.

Frequency occurrences of flooding in Gambella town.

Results show that 111(58.1.6%) and 42(22%) of the total respondents reported that they are flooded twice and more than two times a year. Whereas 38(19.9%) stated that they are flooded once a year. As the data shows 80.1 percent’s which is the combination of the respondent flooded twice are or more than that a year is greater than those who are flooded once a year. This means any time it rains it their areas are flooding. This implies that most of the households’ areas in the town are flood prone areas and are always affected by any flooding occurring in the town. In addition to, the number of those affected by flooding is higher than those who are not.

Types of flooding affecting the community in Gambella town

Data shows that 128 (67%) of the respondents are affected by flash flooding whereas 63(33%) of the responds are affected by river over flows. This indicate that, the town is more affected by the flash flooding causes by heavy rain and most households’ in the town are mostly affected by the flash flooding occurring and caused by rain. In addition to this, most of the households are affected since the flash flooding most of the time shows no sign of warning which lead to non-preparation of the affected population. Hence, urban flooding is a direct, quick and localised consequence of rainfall, making it difficult to predict. In fact, it often happens with little warning and in areas not normally prone to flooding.

Natural causes of flooding in Gambella town

Result shows that 117 (61.3%) and 64 (33.5%) of the respondents responded that natural causes of flooding in the town are rainfall and river overflow and only 10(5.2%) of the respondents reported that the natural causes of flooding is heavy rainfall. Since the significant number of the respondents reported that the natural causes of flooding in the town is rainfall and river overflow, it can therefore be concluded that the natural causes of flooding in the Gambella town is both rainfall and river overflow. This is because the town is located and separated by the Baro River and has a number of tributaries or streams which has season overflow. This shows that people in Gambella town are affected by both rainfall and river overflow.

Anthropogenic causes of flooding in Gambella town.

Table 1. Anthropogenic causes of floods

Valid		Frequency	Percent
	Lack of or Inadequate of drainages system	32	16.8
	Improper waste or refuse disposal	32	16.8
	Lack of proper planning of structures	31	16.2
	Concrete and compact soil	31	16.2
	Fast growing population	33	17.3
	Encroachment around the water bodies in the town.	32	16.8
	Total	191	100.0

Field data (Source: Researcher 2018)

Respondents have similar views on anthropogenic causes of flooding in Gambella town. Results are shown in above table. This is in conformity with Rosenberg, that floods are caused by single or multiple factors that are either natural or anthropogenic as a result of inappropriate development in flood plains, building on water course and impermeable materials that prevents water filtration (Rosenberg, 2008 as cited by Law & Your Env,2012). Unmanaged urban sprawl is a clear indication of failure to accommodate the actual pace of a city's growth, placing undue stress on land. And, with the absence of mechanisms for plan implementation and enforcement, cities end up with encroachments and violations that block natural drainage systems, resulting in urban flooding. (Joost Buurman (2015). Most planning policies and decisions do not come under their control, which raises the larger question on the state government's reluctance to devolve planning responsibilities to the city government as envisioned. (Joost Buurman (2015). It is also said that; land use and other human activities also influence the peak discharge of floods by modifying how rainfall are stored on and run off the land surface into streams. Construction of roads and buildings often involves removing vegetation, soil, and depressions from the land surface (Debu Mukherjee 2016). Sushmita also stated that, urban sprawls have not paid adequate attention to the natural water bodies that exist in them but just built over many of these water bodies, blocking the smooth flow of water. He also added that, people and planners forgotten the art of drainage; but only see land

for buildings, not for water (Sushmita Sengupta 2016). In the context of Gambella Municipality construction was permitted on the wetland and streams, this can show that, wetlands and streams are rarely recorded under municipal land laws. Planners see only land, not water, and builders take over the water bodies. In addition to that, it was contented that urban flooding is a relatively serious problem in the city, especially in the dense parts of the city and in the areas located along the river flood plains (NehaBansal, Mahua Mukherjee and Ajay Gairola 2015). The fundamental issue behind recurrent urban flooding can be traced to the lack of a comprehensive master plan that is properly implemented and enforced, lack of or inadequate drainage systems, improper waste or refuse disposal, lack of proper planning and the fast population growth in the town.

The available existing physical planned features to help in management of flooding

The respondents have differently viewed the availability or the existing physical planned features to help in flood management. Results show that 117 (61.3%) responded that there are street trees available in the town to help in managing floods, 70(36.6%) of them responded that the town has public green space and business park and 4 (2.1%) of the responds reported that there is (are) city forest(s). This indicates that, the city has street trees to help to manage the flooding and very few public green space and business parks. It can therefore be concluded that, the existing physical planned in the town are few and not enough to help in managing the flood risks.

The existing condition of storm drainage

The main objective of storm water drainage is to mitigate the flood problem and storm water problem of the area by providing efficient drainage network and flood protection structures (FDRE Ministry of urban development in its Report “Integrated Development plan of Gambella). As Debu Mukherjee stated; in urban areas, flood effects can be exacerbated by existing paved streets and roads, which increase the speed of flowing water. The flood flow in urbanized areas constitutes a hazard to both the population and infrastructure Accumulation of water on roads, railway tracks and even at airports because of the improper and inadequate stormwater drainage capacity in the drainage system within the city (Debu Mukherjee 2016).

Results show that 102(53.4%) of the total respondents reported that the existing conditions of the storm drainage in Gambella town is that, storm drainage didn’t cover all Kebeles of the town but only some and 89(46.6) stated that, the existing conditions are worsens or bad. This is because the town development of Gambella is not well planned to have storm drainages systems included all Kebeles and next to that the condition worsening the existing condition of the storm drainages is the improper waste management in the town. People uses storm drainages systems as a waste disposal sites which causes blockages of the rain water and led to over and street flow. As Clifford Amoako stated, the challenge is enormous and appears to have overwhelmed all stakeholders, especially city authorities. Coupled with this is the conspicuous lack of an integrate d urban flood risk management that takes into consideration the rapid urbanization of the city and its susceptibility to climate variability and change (Clifford Amoako (19 January 2015) and Canedo added that, urban drainage planning must consider a broad set of aspects and has to be integrated with land use policy, city planning, building code and legislation. Marcelo Gomes Miguez, Luiz Paulo (Canedo de Magalhães 2010). Moreover, the storm water drainage is a major flood causing factor, never the less to say about narrow streets and in efficient maintenance of whatever small infrastructure exists (NehaBansal, Mahua Mukherjee and Ajay Gairola 2015). As according to the interview with Gambella Municipality vice Mr. Omod Ojwato the provision of storm drainage line to every access road does not seem feasible because of limitation in resources, particularly finical constraint and he added that, natural water ways (earthed channel), are not properly working due to natural as well as man-made factors like disposal of solid as well as liquid wastes in the natural water ways resulting in the closure of drainage lines. Moreover, due to siltation the water ways are blocked or lose their depth and in turn result in over flooding and hence inundation of the surrounding areas. But currently the government is doing it level best in constructing a channels’ as a measure to the areas known to be at risk of drain or sewer to reduce flooding risks (Ojwato, 2018). Hence, this can be concluded that the non-covering of storm drainages system of all Kebeles and worsened conditions or mismanagement or the of the available one led to over and street flows causing flooding every time it rains and damages of roads in the town.



Pic 1. The blocked storm drainages system by wastes and damaged roads in Gambella town.

Seriously affected kebele by floods: Result shows that 76(39.8%) of the total respondents reported that the most affected kebele in Gambella town is Kebele 03, 59(30.9%) of the respondents stated that 02 Kebele is the second Kebele seriously affected by

flooding and 56(29.3%) reported that Kebele 05 is the third affected Kebele among the sampled Kebeles. It can be concluded that 03 and 05 are the most seriously affected Kebeles because sewer network and streams are silted due to inappropriate waste disposal and refuses.

Impacts of the flooding in Gambella town

Responses of respondents for their temporary accommodation during floods in the town shows that 56(29.3%) of the respondents are homeless, 67(35.1%) of the respondents are accommodated in their friends or relatives' homes where 64(34.6%) rented from private houses. As the responses indicated significant number of the affected community during flooding in the town are accommodated in their friends or relatives. This led to having them being a burden on their friends or relatives which in addition can causes high rate of sharing resources of their friends and relatives and disorganization of feeding or club schedules. The second majority of the respondents are those who rented from privates' houses. This is another way of having unplanned extra expenses which causes economic crisis in the family leading to shortage of buying food and non-food items for the family and reducing the life standard of the households. The economic damages are seen to be heavy in terms of housing damage, household contents being flooded and sometimes the kuccha houses collapse partially or completely due to intense rains. Not only this but the roads also gets damage due to long hours of water retention and infrastructure services like electricity and water supply gets disrupted (NehaBansal, Mahua Mukherjee and Ajay Gairola2015). Therefore, it can be concluded that flooding in the town causes displacement of the community, increases in responsibilities, unplanned expenses in the household family due to renting of houses and high sharing of resources among the affected and non-affected community.

Length of time out of home during flood incidents

Results indicates that 107 (56%) of the respondents reported that they, stayed out of their home during flooding in the town for 1 – 7 days and nights, and 34(17.8%) stated that they have stayed for 8 – 28 days and nights out of their home during flooding periods in the town, where 50(26.2%) has reported that they have stayed for 1 – 3 months out of their homes. As the majority of people responded that they stayed out of their home during flooding periods for a week, it can mean that the flooding in Gambella town displace people for a short period of time.

Moved or considering moving homes due to flood impacts

It indicates that 145(75.9%) have moved and had considered to move their home to other places and 46(24.1%) of the respondents had never think of moving their home to other places in the town. Considering the responses above the majority of the people had displaced and on considering moving their homes. It can therefore be concluded that flooding has displaced and disorganize social closeness and interactions in Gambella town.

Decision and causes of moving home.

Data shows that 97(50.8%) have responded that they have decide to moved their home to other places because of fear of another flood where 37(19.4%) of the respondents reported that since they don't want to live alone without their friends or relatives they have decided to move their home because their friends or family have moved out of their area, and 17(8.9%) of the total respondents reported that living in the same house bring back or remind them of negatives feeling about flooding and 40(20.9%) reasoned that their decision of moving their home to another place have nothing to do with flooding. This implies that, flood in Gambella town had cause displacement of people, led people to moved their homes out of their interest and causes stresses and fear in the community of not to be flooded again.

Major impacts of floods on social services institutions

Table 2. Major impacts of floods on social services institutions in Gambella town.

What were the major impacts of flooding on social services institutions in the town?		
Valid		Percent
	Educational facilities or infrastructure damage	7.3
	Health facilities damage	5.8
	Road infrastructure damage	43.5
	Market Dysfunction	43.5
	Total	100.0

Field data (Source: Researcher 2018)

The above presented data in the table shows that 166(87%) which is the combination of road infrastructure damage and market dysfunction, where 14 (7.3%) stated that educational facilities damage is also one among the impacts of floods on social services institutions and 11(5.8%) of the respondents said that floods have impacts of damaging health facilities. In considering the responses of the respondents, the first major impacts of flooding on social services institutions in Gambella town is damage of road infrastructure and market dysfunction. During floods in the town the roads were overflowed, closed up and break up water passages crossing the roads making it difficult for the vehicles and human difficult to move during flooding time. The second major impacts that follow road infrastructure damage is the dysfunction of the markets and markets activities which can lead to shortage of market items and increase in prices of the items in the market. As Christopher put it clear that roads and buildings constructed in flood-prone areas are exposed to increased flood hazards, including inundation and erosion, as new development continues. (Christopher P. Konrad November 2003). Hence, it can be concluded that the flood in Gambella town has impacts on roads and markets than on education and health.

Impacts of floods on social services

Table 3. Impacts of floods on social services

How do the floods impact on social service institutions affect the service provision?			
		Frequency	Percent
Valid	School attendance	14	7.3
	Disruption in access to health services	14	7.3
	Road impassability	83	43.5
	Disruption in markets functioning days	80	41.9
	Total	191	100.0

Field data (Source: Researcher 2018)

The above presented data in the table indicates that 83(43.5%) of the total respondents reported flood affects road service provision as the first floods impacts in the town, 80 (41.9%) of the total respondents reported that disruption in markets functioning days follows the road impassability, where 18 (14.6%) stated that flood affected school attendance of the children and disruption access in health services. In considering the results of the respondents, road impassability and disruption in markets functioning days are the major affected social services in the town. It can therefore be concluded that, the floods in Gambella town more affects roads and markets days functions compared to that of school attendance and Health services.

Specific problems caused by floods

Table 4. Specific problems caused by floods

What are the specific problems causes by flooding on school attendance?			
		Frequency	Percent
Valid	Road impassability	55	28.8
	Schools Surrounded by water	136	71.2
	Total	191	100.0

Field data (Source: Researcher 2018)

According to the responses responded by the respondents about the specific problems caused by floods on the school attendance 136(71.2%) of the respondents reported that during the flooding the school is surrounded by water leading to the impossibility of teaching learning process and 55(28.8%) of the respondents reports that road impassability is another specific problem caused by floods. Therefore; flooding in the Gambella town disrupts teaching and learning process during flooding periods.

Health problems affecting the households during flooding

Table 5. Types of health problems affecting the households during flooding period

What are the specific types of health problems you face in your household during flooding period?			
		Frequency	Percent
Valid	Diarrhoea	73	38.2
	Cough or ARS	64	33.5
	Malaria and Yellow fever	54	28.3
	Total	191	100.0

Field data (Source: Researcher 2018)

The above presented data in the table shows that 71(38.2%) of the respondents responded that the specific types of health problems they face in their households during flooding periods is diarrhoea, 64(33.5%) reported that cough or ARS is the specific types of health problems they faced during the floods times in Gambella town and 54(28.3%) of the total respondents stated that the specific types of health problems they faced during the floods times is malaria and yellow fever. This implies that the leading and the major specific types of health problems that affected the Households in Gambella during floods are Diarrhoea, cough/ARS and Malaria & yellow fever sequentially. To conclude floods raises the diseases and affected people health.

The most affected individuals in households

Results shows that 89(46.6%) respondents reported that, most of the individual affected in their households are aged people, 60(31.4%) of the total respondents reported that children are the most affected part of the community in their household and 42(22%) reported that females are the most affected individuals in their households. Sequentially, we can see from the responses that floods mostly affect the aged groups followed by children and Female. This is because they are the most vulnerable community in the society which are easily affected by any natural and man-made disaster.

Effects of disruptions of market functioning days on the town community

Table 6. Effects of disruptions of market functioning days on the town community

What are the disruptions of market functioning days causes on the town community?			
		Frequency	Percent
Valid	High price selling of items	57	29.8
	Few items and choices in the markets	95	49.7
	Conflicts among the community due to scarcity in items	39	20.4
	Total	191	100.0

Field data (Source: Researcher 2018)

The above data presented in table shows that 95(48.7%) of the respondents reported that during disruption of market functioning days caused by flooding led few items and choices in the market occurs, 57(29.8%) of the total respondents reported that the prices of items increases, and 39(20.4%) reported that there arose conflicts among the community due to scarcity of items This

implies that the majority reported the scarcity of items as caused by floods due to disruption in market functioning days, followed by an increases of items prices in the markets and the scarcity of items lead to competition in buying with high prices that led to conflicts among the community members. To concluded this the disruption of markets functioning days by floods can also let the poor with less income to starved due to the lack of financial to buy the food items in the market meaning that the price are too high for the poor to buy

Common sources of drinking water

The results shows that 82(43.9%) of the respondents reported that their common sources of drinking water is boreholes, 88(47.1%) stated their common sources of drinking water as river or spring and 17(9.1. %) reported that they drink from dug well. This implicated that most of the people in town are drinking unsafe water is easily exposed to any flooding taking place in the town. In conclusion, most of the drinking water sources are at risk and vulnerable to contamination during flooding.

Main sources of drinking water

149 (78%) of the total respondents accepted that their drinking water sources are affected during the flooding period and only 42(22%) of the total respondents reported that their main sources of drinking water are not affected by floods. Considering the responds of the respondents the majority of the respondents accepted that their main sources of drinking water are affected during flooding. However, the most serious consequence of flooding is large-scale contamination of drinking water (surface water, groundwater, and distribution systems). Depending on location and sanitation conditions, flood water can contaminate drinking water (surface water, groundwater, and distribution systems). Groundwater wells can be rendered useless from inundation of water laced with toxins, chemicals, animal carcasses, septic seepage, and municipal sewage. Surface water sources are impacted in similar manners. Infectious diseases can also be spread through contaminated drinking water (AGES, 2008)

State of drinking water during flooding in the kebele

Results shows that 147(77%) of the total respondents reported that their state of drinking water during floods were contaminated and 44(23%) reported that their state of drinking water was not contaminated. As Hugo Osterkamp, Oxfam Water and Sanitation Emergency Coordinator put it, “Whenever a flood hits, a lack of clean water and sanitation facilities reaches dangerous levels in a matter of days, if not hours. Access to both will become farther and farther out of reach and could lead to a widespread health crisis as flood waters continue to rise,” it can therefore be concluded that since most of the people during flooding period can stay without having clean drinking water either for hours or days. Additionally, Cholera and Typhoid are going to be more common in lower income households

Causes of water contamination

The below graph shows that 74(38.7%) reported that their causes of contaminating their sources of drinking water is debris or streets refuses, 66(34.6%) of the total respondents reported that their drinking water is contaminated by pet wastes and 51(26.7%) stated that their drinking water is or are contaminated by combined sewer overflow. It has been said that, Flood is typically an event of very high discharge in a body of water and along with it comes the high momentum that causes destruction and is capable of carrying a lot of sediment and other floating material. The flooding will lead to inundation of flood plains, geographical regions through which the flood water flows, and because of the momentum, soil erosion will take place. These eroded particles will be floating in the flood water and carry them in to the drinking water sources (eNotes, 2015). It can be stated that, most of the causes for drinking water contamination are debris or streets refuses followed by pet wastes since cattle are living together with human in the same environment.

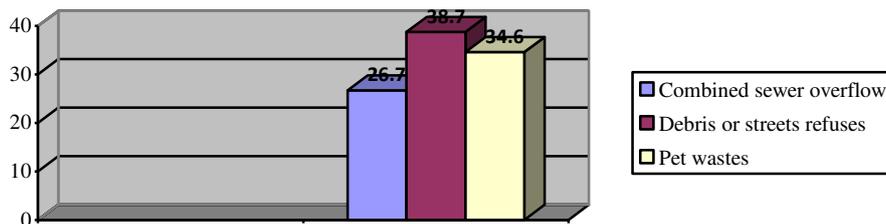


Fig. 4. Causes of water contamination. *Field data (Source: Researcher 2018)*

Type of sanitary facility

104(54.5%) of the respondents responded that, their type of sanitary are traditional pet latrine, 63(33%) reported that they use open defect and 24(12.6%) of the total respondents responded that they have sanplat sanitary facilities. This indicates that the majority of the respondents uses traditional latrines followed by those who uses open defect compared to those who uses sanplat sanitary facilities. In conclusion it can be said that, whenever the flood affected their sanitary facilities the chance of streets flowing debris and refuses are obvious.

Affected sanitary facility

The above presented data in the table 30, shows that 156(81.7%) of the total respondents responded that their sanitary facilities were affected during flooding and 35(18.3%) of the total respondents reported that their sanitary facilities are not affected during the floods times. This means that the majority of the people will have, inadequate sanitation and lack of hygiene that affect their

health, safety, and quality of life. It can also be concluded that poor sanitation and hygiene after flood occurrences will be obvious which affects households' health conditions and lives.

Environmental status during or after flooding

Table: 7. Environmental status during or after flooding.

If "Yes", what is the environmental status or outlook during and after flooding?			
		Frequency	Percent
Valid	Overland flow	49	25.7
	Streets flooding	47	24.6
	Stagnant water and Refuses	49	25.7
	Air pollution	46	24.1
	Total	191	100.0

Field data (Source: Researcher 2018)

Table above show 98(51.4%) of the total respondents reported that, their environmental status or outlook during and after the flooding due to sanitary facility affected is that there was overland flow, stagnant of water and refuses, 47(24.6%) state that, their environmental status during flooding is affected by streets flooding, 46(24.1) reported that there were air pollutions after the flood occurrences. this means that there was dispersal of Nutrients and Pollution. Flood water can contain debris, pollutants and nutrients. Pollutants in flood water, such as bacteria and pesticides, can be carried far distances. Sedimentation and turbidity can result in the growth of algae and phytoplankton blooms that jeopardize water and environmental quality. Thus, it can be concluded that there is environmental degradation after a flood occurs in Gambella town affecting the negative eye views of the environment and health conditions of the households.

Urban drainage systems integration with urban planning

Results indicates 163(85.3%) of the total population of the respondents have reported that the urban drainage systems are not integrated with urban planning and 28(14.7%) agree that the urban drainage systems are integrated with urban planning. See the responses of the respondents the majority report indicates that there is no integration of the urban drainage systems with the urban planning. This means that absent of integrating urban drainage with the urban planning cause fail the town not to collect and convey storm and wastewater away from urban areas leading to a high run-off of water, overflow and pill over of water causing flooding in the town.

Sources of Livelihood

Table: 8. Sources of Livelihood

What is (are) the sources of your livelihood?			
		Frequency	Percent
Valid	Crop production	3	1.6
	Trading	36	18.8
	Livestock production	5	2.6
	Fishing	2	1.0
	Charcoal burning	53	27.7
	Wage labour	6	3.1
	Government employee	86	45.0
	Total	191	100.0

Field data (Source: Researcher 2018)

The data summary in the above table reveals that 86(45%) who responded to this study are government workers having their sources of income from the government, 53(27.7%) of the respondents live their living on charcoal burning, 36(18.8%) are traders or merchants, 6(3.1. %) are wage laborer, 5(2.6%) are livestock producers 3(1.6%) are crop producers, and fisheries account for 2(1%). This means that most people live their life with low incomes and under poverty condition. It can therefore, concluded that poor people are the most victims and the most affected by floods incidents and impacts.

Major effects or impacts of floods during flooding periods

Table 9. Major effects or impacts of floods during flooding periods

What are the effects (majority impacts) of floods you have experienced during the flooding periods?			
		Frequency	Percent
Valid	Financial losses	10	5.2
	Business interruptions	27	14.1
	Transport services disruptions	31	16.2
	Loss of house and properties	29	15.2
	Disruption of electricity supply	27	14.1
	Damage of crop stocks	5	2.6
	Death of livestock's	5	2.6
	Loss of lives	2	1.0
	Health related problems	28	14.7
	Water accessibility and water quality related problems	27	14.1
	Total	191	100.0

Field data (Source: Researcher 2018)

Above table summarized the major effects of floods experienced during the flooding period. The data shows that 81(42.3%) of the total respondents reported that they experience business interruptions, disruption of electricity and water accessibility and water quality related problems, 31(16.2%) stated that, transport services disruptions was their major impact of flood, 29(15.2%) stated that they experience loss of houses and properties, 28(14.7%) indicate their experience as health related problems, where 10(5.2%) of the respondents said that they experience damage of crop stocks and death of livestock only 2(1%) reported that they have or experienced loss of lives. Therefore; the most or the major impacts of floods that people experienced are business interruptions, transport services disruptions, disruption of electricity and water accessibility and water quality related problems. It will be concluded that those impacts lead to economic crisis of the households in business, lead to decreases in markets activities and market items, polluted drinking water and spoils of some households' materials and decrease in some public services.

Intangible immediate losses during floods time.

Table 10. Intangible immediate losses during floods time.

What are the intangible immediate losses you experience during floods times?		Frequency	Percent
Valid	Discomfort or inconvenience due to flood	36	18.8
	Stresses of floods	97	50.8
	Displacement of people	58	30.4
	Total	191	100.0

Field data (Source: Researcher 2018)

Flooding has intangible losses whenever it occurs. To find out what are the intangible losses during flooding in Gambella town the following data have been collected and the data in the table above shows that, 97(50.8%) of the total respondents reported their intangible immediate losses as stresses of floods, 58(30.4%) as a displacement of people and 32(18.8%) stated their intangible immediate losses they experienced as discomfort or inconvenience due to flood. This can mean that flood causes high stresses rate among the households' affected and it does also displace people disorganizing the social togetherness, supports and communication.

Intangible lasting losses experienced

Table 11. Intangible lasting losses experienced

What is the intangible lasting losing you experience?		Frequency	Percent
Valid	Time and effort to return home	38	19.9
	Worrying about future flooding	38	19.9
	Strains between family	36	18.8
	Losses of community spirit	42	22.0
	Deterioration to physical health	37	19.4
	Total	191	100.0

Field data (Source: Researcher 2018)

Flooding has intangible losses whenever it occurs. To find out what are the intangible lasting losses during flooding in Gambella town the following data have been collected and the data in the table above shows that, 76(39.8%) the combination from total respondents reported their intangible lasting losses during floods were time and effort to return home and worrying about future flooding. Following that, 42(22%) reported losses of community togetherness and spirit where as 37(19.4%) reported that their intangible lasting losses they experienced was deterioration to physical health and 36(18.8%) reported strains between families. This implies that floods are time and effort consuming, loss community togetherness spirit and support which mostly felt by the low-income households' families, and cause high tension among the household families with low income of how to transport back home their home materials as put by Siefu Wolde one of the key informants (Wolde, 2018) because those households with low incomes are not economically fit to all things in paying cash.

Flood warning

Data shows that 182(95.3%) reported that they didn't received any flood warning from any source and 9 (4.7%) of the total respondents reported that they have received flood warning. This means that those who received flood warning are less compared to those who don't receive flood warning. As according to the interview with DPSFA expert Siefu Wolde, "there is a forum for disaster preparedness including the UNDP, UNOCHA, NMA Gambella center, DPSFA, Gambella town Administration and others where they are updated by the NMA Gambella center about the weather forecast and the mean of communicating the weather forecast to the community was through EBC Local languages media program, but this program is not followed by most of the people in the town (Wolde, 2018). This implies that the communication measures or early warning systems are very poor putting of the households at risk to be affected by the floods. Additional most of the people or households in Gambella town are affected by flood because of not receiving early flood warning.

Sources of flooding warning.

Sources of getting early flood warning and the data shows that only 9(4.7%) received early flood warning from their neighbours whereas the rest of the 182(95.3%) of the total respondents reported that they have no sources to received any warning from. This

implies that only very few people are aware of flood occurrence whenever it happens to occur. This can be concluded that most people are affected because they don't have sources of information to get warning from and they are not well prepared whenever flood occurs.

Actions taken by both households and government prior to the flood

The summary of Data shows that 179(93.7%) of the total respondents reported that neither they nor the government took no actions prior to the floods and 12(6.3%) reported that they have evacuated households' members. As according to the interview with DPFSA expert, "All the actions the government took are after the floods", (Wolde, 2018) the implication of this is that all actions are after the flood had occurred and after households are affected by the flood.

Sources of assistance received during flooding.

Data shows that 100(52.4%) got their support from the community during flooding time and 91(47.6%) got their assistance from their friends during flooding time. This can mean that there are no prepared teams by the government to assist the vulnerable community during the flood. This can be concluded that most of the households suffer a lot during flooding because of no immediate supporting teams to reduce their vulnerability.

Perception of being flooded in the next years

Data shows that 108(56.5%) of the total respondents reported that, they very likely percept that they will be flooded in the coming years, 56(29.3%) stated that they likely will be flooded in the next years and only 27(14.1%) report they are not going to be flooded. This means that most of the people do have fear of being flooded again in the coming years if there are no flood management actions being taken by both individuals households' and the government or town administration office. It can therefore; said that people live with of another flooding occurring incidentally.

Taken Measure actions to alleviate the future flood risks

For the measure's actions taken to alleviate the future flood risks results shows that 150(78.1%) reported that they had taken no measures to alleviate future flood risks and 41(21.9%) of the total respondents reported that they have try to take measures in alleviating future flood risks. As according to the interview with Gambella Municipality, "the government have started building a trench over the encroached streams in the town to prevent or minimize the flooding. This is done because the streams due to anthropogenic activities have lost their water caring capacity and their water caring bed became very shallow which made them not carry rain or river water", (Ojwato, 2018). This can be concluded that most of the people are not trying to take some measures to alleviate future flooding which in turn will causes them high vulnerability to flood.

Type of flood alleviation measures taken

Complied data shows that 149(78%) of the respondents report no measures taken to alleviate the flood but 42(22%) have indicated that the government is on building the trenches around properties on the stream banks to alleviate floods impacts. This can mean that, the properties around built trenches will be safe from harm and impacts of floods but majority of the will still be affected by the floods.

Reasons of not undertaking any flood alleviation measures

Table 12. Reasons of not undertaking any flood alleviation measures

If "No" what are the reasons of not undertaking any flood alleviation measures?			
		Frequency	Percent
Valid	I don't know about measures to take	113	59.2
	I couldn't afford taking measures	26	13.6
	Have not got around to organize these measures	30	15.7
	Others	22	11.5
	Total	191	100.0

Field data (Source: Researcher 2018)

The above presented data in the table shows that 113(59.2%) of the respondents reported that they don't know measures to take to alleviate flood whereas 26(13.6%) of the total respondents reported that they couldn't afford taking measures to alleviate flood in their home and 30(15.7%) responded that they know the measures to take to alleviate flooding in their home but have got no ground to organize these measures. The last respondents' 22(11.5) stated that they didn't take measures to alleviate flood because of other reasons. This implies that, the majority of the people don't know measures to take to alleviate the flood risk in their home. The low-lying areas are most subjected to effects of urban flooding especially when these people are incapable of taking pre-mitigation measures for their households (NehaBansal, Mahua Mukherjee and Ajay Gairola 2015). This means that the government and the responsible institutions to respond to the natural and human disaster are not well aware of building capacity of the community to respond to the disasters like flood as it is put clear by one of the key informants. Therefore; most people are seriously affected by flood because no awareness of how to takes measures. They have not been given a training of how to cope up with flood

Conclusion

The study revealed that, floods in Gambella are largely caused by multiple factors. This stemmed from human causes such as building on water ways, inappropriate disposal of waste, soil compaction due to vehicular and human movements. Again, hydro-meteorological causes such as excessive rain fall, poor drainage system, high rate of soil water holding capacity, especially between June-September also contributed to flooding. It is therefore evident that, floods are caused by human and hydro-
International Journal of Environmental Sciences

meteorological factors that, in turn, have disastrous effects on the people. The study also found that, floods in the study area had effects huge effects on individuals, the economy and on environment. These effects might be exacerbated by climate and socioeconomics changes. Urban floods disturb social systems and cause noteworthy socioeconomics losses of which the economics damages (costs) are believed to be substantial as far as housing damages, households' contents being flooded and now and then the houses collapse partially or totally because of intense rains. Furthermore, streets additionally get damages because of extend periods of time of water retention and infrastructure services like electricity sewerage lines and water supply gets disturbed.

Recommendations

According to the findings, the following recommendations are forwarded;

- Proper drainage system, good planning of structures, proper waste disposal mass education on proper waste disposal practices and construction of roads and gutters if implemented could avert the incidence of flooding in Gambella.
- Financial support by government and technical assistance by the departments of civil and urban engineering to extend skills on rainwater harvesting to the people could also not be underestimated.
- An integrated flood risk management approach will be important steps towards building resilience against the perennial urban flooding in Gambella
- Urban planners must provide integrated sound and efficient design alternatives.
- Measures to better cope with current climate variability such as well- maintained drainage systems and early warning systems need to be implemented and exercised.
- Measures to manage non-climate drivers of risk such as limiting building in exposed areas by law, to managing erosion and increasing permeability of urban areas
- Measures to reduce systemic vulnerability or resilience to shocks insurance systems, emergency response planning before and after need to be planned.
- Some measures with strong co-benefits such as natural ecosystem flood storage systems need to be protected by law.
- City administration must take into consideration the causes and early warning systems, types of flood events, impact areas, characteristics of victims, evacuation and humanitarian procedures and local involvement in reducing exposure and vulnerability to flood events.
- Flood risk management requires some legal and regulatory, institutional and structural changes in urban governance and land use planning.
- Ensure that city development rules include a comprehensive list of water bodies and their catchment.

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