Full Length Research

Assessment of Green Infrastructure Provision and Management: In the case of Debre Berhan Town, Ethiopia.

Zenebe Reta [1], Temam Awol[2], Girma Alemu[3] Zelalem Birhanu[4] and Assefa Ayele[5]

[1].Mettu University ,Mettu ,Ethiopia
[2.]Urban Development and construction office head, worabe,Ethiopia
3.Jimma University ,College of social science and Humanities ,Jimma ,Ethiopia
[4..]Road and Transport office ,DebreBerhan ,Ethiopia
[5.] Secondary school office head, Kembata Zone ,Kembata,Ethiopia

Green infrastructure is one of the basic urban infrastructures of the city. It is the network of green elements which can play a significant role in improving urban environmental conditions, social inclusion and economic development. Even though green infrastructure plays indispensable role in the overall development of urban area socially, environmentally, culturally and economically in most of the cities and towns, they lacked attention to consider during plan preparation and consequently in implementation. As critically challenge, the major Green infrastructure that is lacking sufficient and standardized in Debre Berhan town. Hence, this study was conducted to identify the existing coverage, quantity, condition, perception of communities about use, participation and challenges in the provision and management of green infrastructure in Deber Berhan town. To achieve these objectives, the study employed both qualitative and quantitative research approaches and used descriptive survey methods to gather relevant data from primary and secondary sources through questionnaires, interviews and observations. Stratified random sampling techniques were used to select 369 sample households .Additionally 6 key informants were selected by purposively in four different sectors. The result of the study indicated that green infrastructure development was not implemented as proposed on structural plan of the town and lack of proper management. There were also low level of public awareness about the values of green infrastructure in general, low level of community participation, lack of budget, lack of skilled man power, chilling injuries and lack of co-ordination among different stakeholders towards the development and management of green infrastructure. To solve the challenges: create awareness of the communities as well as officials and leaders, improve participation of all stake holders, assign qualified professionals from woreda to kebele level, improve financial capacity through revenue generation and allocation of budget, establish nursery site and integration among different stakeholders were some of the recommendations.

Key words: green infrastructure, coverage, condition, perceptions, challenges

INTRODUCTION

Urban infrastructure is the basic physical and organizational structure needed for the operation of society and economic functions typically the term infrastructure refers to physical structure such as roads , social infrastructure (education , health, prison etc) ,water supply ,sewers ,power grids, telecommunications, and the like. Traditionally, infrastructure definition appears skewed to those gray infrastructure .this is why people think of infrastructure they think like that of water, road ,power station, and the like excluding green infrastructure as one part of basic urban infrastructures (Senbeta ,2009).

Thus, the lack of understanding about the very nature of green infrastructure and its benefits made communities and government do not give good emphasis to green infrastructure provision and management like other basic infrastructure Green infrastructure is prepared differently to different scholars depending on the context in which it is used. Accordingly, in this research, urban green infrastructure refers spaces that are located in the urban center which includes recreational park, road sides, medians, roundabout, sport fields, and cemeteries, urban forest, urban agriculture and other greenery area with a significant amenity and recreational values contributing towards quality of urban life. GI attracts inward investment and generates employment; reduce environmental cost and providing health benefits among others. And it is also a key component for sustainable growth of communities and critical public investments (Benedict and Mahon, 2002).

The current global census over a significance of urban green infrastructure recognizes the multiple environmental, social and economic benefits they provide to societies. A high quality of urban green infrastructures and around an urban center can significantly reduce costs for individuals business and public bodies while enhancing the quality of life and health of the residences, workers and visitors. Furthermore well managed green infrastructures in urban centers are expected to provide for biodiversity conservation and mitigation of adverse impact of climate change and environmental pollution (MUDH, 2016).

In Ethiopia, Green infrastructure provision and management process involves different stake holders among which municipality takes the largest share including managerial process. Because of semi autonomous nature of the various local authorities, the implementation level and structure of infrastructure provision responsibilities has tend to vary from place to place (WB, 2001).

In Ethiopia, as stated in amenity green space manual No.15 (2016) the provision and management across the urban center have not been uniform and there is a great deal of variation among the urban center. Some urban centers have provided some components of green infrastructure and others yet not started. Furthermore , the provision and management of urban green infrastructure across the urban country have not been standardize and the urban dwelling communities in the country have not been receiving the goods and services that well planned developed and managed urban green infrastructure supposed to provide.

Debreberhan town is one of the urban centers in Ethiopia experiencing rapid population growth and requires greater infrastructure provision and management. Unfortunately green infrastructure appears not have been given right full attention. Therefore an attempt to increase the coverage and higher the status of green infrastructures as well as improve institutional capacity of the town towards the provision and management of urban green infrastructure. Although insufficient and improper managed, patches of the urban park, planted trees in median, Cemetery and road side plantations are the stuff that created habitable condition. Moreover, urban parks and other different green infrastructures can play a significant role in improving urban environmental conditions, social inclusion and economic development (EPOSZ, 2015). However, due to lack of proper attention to and improper management of green infrastructure, its components generally are not sufficient, well developed, well managed and protected in Debre berhan town. Hence the study was designed to assess the provision and management of green infrastructure in the town and forwarded strategies to overcome the provision and management challenges related to green infrastructure.

STATEMENT OF THE PROBLEM

Most cities in developing countries, especially those in sub–Saharan African, have a small percentage of green infrastructure as a result of urbanization ,low resource base of instituting on GI, lack of priority to green infrastructure, the influence of poverty ,corruption ,uncooperative attitudes of the local people and political instability. Unfortunately, efforts aimed at solving these problems have not yielded the intended result, thus, making it a major problem in towns and cities of the developing world (Mensah,2014).According to Foster (2011) observed that politicians, industrial houses, especially in developing country try to grab these green open spaces for creation of concrete jungle. Scientific understandings of how urban forests, river buffer vegetation, recreational parks and street trees benefits people is generally lacking in majority of developing countries especially in Africa .

In Debere birhan town which inhabits more than 97845 people DFEDO (2018) had been growing both vertically and horizontally starting from the time of establishment.

Since its foundation the number of buildings, road construction manufacturing industry and other infrastructure has been increasing. However, the provision and management of green infrastructures are insufficient with quantity and coverage. The existing Green infrastructure coverage is not proportional with the land use planning of the national urban development policy i.e. 30% for green infrastructure (MUDHCo, 2014). For instance, structural plan of the town designates 10 recreational public parks with a total area of 14.49 hectare, however currently none of them were developed for recreational service. Though at a recent year after construction of highway asphalt road in the town street trees are planted and protected in the median of the road, most of the other existing green infrastructures of the towns are not standardized, properly managed and protected and have been invaded by other development activities due to the low levels of awareness of communities, experts, officials and political leaders.

The lack of appropriate structural plan implementation of the town is becoming a cause for inadequacy of green infrastructure in town. Even though structural plan of the city shows the existence of green infrastructure, their development on the ground is absent.   Besides the lack of appropriate implementation of structural plan of the town, the institutional capacity perhaps contributes for the limited provision and management of green infrastructure. Low attention for the operation and maintenance of the green infrastructure by the city administration is also commonly visible in the town. This leads to deterioration of the existing green infrastructure facilities. The above-mentioned constraints leads to unavailability or limits the place for recreation ,meeting,

resting, or outdoor playing and learning etc for children's students, youths, old ages, and women of city administration inhabitants (Kebede *et al.*, 2005 as cited in Senbeta Adeba,2009). In the light of the above, this research study assesses the green infrastructure provision and management in DebreBerhan town.

RESEARCH METHODOLOGY

Description of the study area

DebreBerhan is the administrative capital of north Shewa Zone in Amhara regional state. The town is located at a Distance of 130 km from north east of Addis Ababa on the paved highway   which connects Addis Ababa with the north of the country. It is also found at a distance far 695 km south east from Bahirdar which is the capital city of the Amhara region. Today, the town has 97845 total population sizes and   09 *kebele* administrative and its total area coverage by structural plan is18018 hectare wide (DFEDO, 2018). Astronomically, the town Located in a latitude and longitude of 9º41' in north and 39º32' in the east coordinates. Debre Berhan is one of the coolest towns which are found at sub-tropical zone of Ethiopia. The average annual temperature of the city during day and night hour is 17.8 °C and 8.83 °C respectively with precipitation 66.17mm. Generally the town characterized by *Dega* (cool) climate condition which ranges on average annual temperature 4°c in the coldest month October and December even below 0 ^{o}c and 26 ^{o}c in the hottest month may. It has high rainfall on average between 814to1080mm (DSP, 2014)
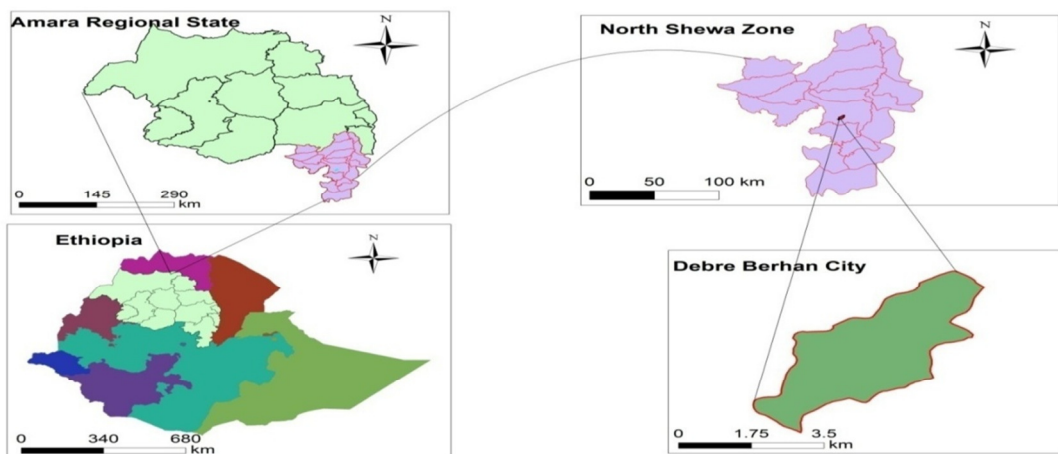
Figure 1. Location map of the Debrebirhan town
Source: *Own work by GIS, 2018*

Research design

Choice of appropriate research design for a study facilitates the smooth sailing of the various research operations such as data collection and data analysis, thereby making research as efficient as possible yielding maximum information with minimal expenditure effort, time and money (Kothari, 2004).To this end, this study was descriptive survey type of research employing non experimental research design that questions, interviews perusing both qualitative and quantitative research approach. Using this particular research design and approach, it helps to investigate the existing coverage, quantity, conditions or status of green infrastructure, as well as the perceptions of communities and the institutional frame works towards in the provision and management of green infrastructure in the town. This research approach was also enabling to investigate the major challenges and possible solution to alleviate green infrastructure provision and management in detail. The time dimension of the study is cross sectional design that was conducted at once.

Research Approach

This study employed both the qualitative and quantitative research approach. Quantitative methods are designed to study variables that can be measured in numbers as well as dealing with the quantitative information of the primary and secondary data and also qualitative approaches as inquiry process understanding the interest, attitude, and efforts, and opinion of the community and the public institution in provision and management of green infrastructure in Deberebirhan town. The reason for using these mixed research approach is that it would create a multifaceted view of the research questions and potentially facilitates the stronger inferences than do single research approach. Thus the two approaches were used inseparably during the research process.

Methods

The study utilized descriptive research method to achieve the purpose of the research; the justification for using this research method is applied for fact finding study with adequate and accurate interpretation of the findings. Therefore to assess the existing green infrastructure in the town in terms of quantity, area coverage, condition, the capacity of municipal, perceptions of community and challenges towards in managing, developing, and protecting urban green infrastructure in the town. The researcher used descriptive research method, since it helps to know professionals and public opinions towards green infrastructure provision and management as well

as to describe the qualitative and quantitative information's of the primary data which were collected through interview and questionnaires.

Research instrument/strategy

The study utilized survey research strategy to achieve the purpose of the research .Because the survey research is a tool that can identify social phenomena or reality by collecting information from sample or whole population using questionnaire (Crotty,1998). Hence, it produces information which is extensive and fairly generalizable. For the purposes of this study quantitative and qualitative survey is used.

Sampling design

Kothari (2004) states that a sample design is a definite plan for obtaining a sample from a given target population and it refer to the techniques or producers the researcher would adopt in selecting items for sample. There are 09 urban *kebeles* which the Debreberhan town has and of them three kebeles, namely 02, 05 and 07 were selected using probability sampling i.e. Stratified random sampling for the study of this research. The main reason for selecting the above three *kebels* is the shortest time, resources and finance as well as their spatial areas represents the other *kebele*s. Thus, 02 *kebele* is represents slime and compacted housing area, 05 represents medium housing quality areas & 07 represents decent (high quality) housing areas that recently built-in proper plan. In addition, 6 key informants were also purposively chosen in order to gather detailed data. The household from those *kebeles* were selected using probability sampling approach i.e. stratified random sample method.

Population Universe

The target population of this research was households of the town and key informants from the town municipality, *kebele* administration and youth sport office and Debrebirhan University. According to Debreberhan town administration, the town has   97845 total number of population   and 31522 the total number of households. The three selected   *kebele* adminstration households (02,05,07) is 9787 (DFEDO, 2018).Therefore,9787 HH of the three *kebeles* were considered as the target population from which the sample size of the study was selected. In addition, the researcher selected 6 key informants from four different sectors (the town greenery development core process, kebele administrations, D/brehan university community development directors

and youth and sport office) to get data on the provision and management of green infrastructure in the study town.

Sampling Frame

The sample frame consists of the list of the items from which the sample is to be draw. The sampling frame of this study was the 9787 households from three *kebele* administrations of the town as well as 6 key informants from four different sectors (municipal greenery development core process, *kebele* administration and youth and sport office Debreberhan university community development directors.

Sampling Unit

The sampling units were drawn from the sampling frame. Sampling units are a unit or sets of units considered for selection at a stage of sampling. Therefore, the sampling units were the household heads of all the three *kebele* (02, 05 and 07) and purposively selected 6 key informants 1(one) from municipal plan implementation, monitoring and evaluation core process, 3 managers from the three *kebele* and 1 (one) youth and sport office experts and 1(one) from Debreberhan university community development directors.

Sampling Technique

Sampling technique is the process of selecting a small number of elements from a large defined target group of elements. Both probability and non-probability technique applied to select the target group for the study purpose. From the probabilistic sampling techniques, first the researcher used stratified random sampling method for large target population and also non –probabilistic sampling techniques purposive sampling methods for small target population of the study.

To select the required kebele and sample size from the large population the researcher used stratified random sampling to categorized 9 *kebele* based on their residents housing condition slam area that have compacted housing and old aged , medium quality housing that compared to the slam and decent (higher quality) housing areas (kebeles) that built recently in proper plan. After this the researcher used unproportionally allocation under each stratum and the required three *kebeles* select by random sampling technique. Similarly, the researcher used random sampling technique to select the required sample size of the study from the list of three determined kebele households. On the other hand ,the researchers were used purposive sampling method to select 6 key informants from four sectors, 1 expert from municipal plan implementation ,monitoring and evaluation team office   and , 1 expert from youth and sport office, 1 expert from Debreberhan university community directorate and 3 managers from each three *kebele* administrations.

Sampling size

Sample size is the actual number of units which are to be selected for the analysis in the study. . The sample frame of this study was the 9787 households from three *kebele* administrations of the town. In addition 6 key informants from four different sectors. Different authors use different formula to determine the sample size of the study. In the city there were a total of 9787 households in three selected *kebeles* i.e *kebele* 02, 05 and 07. the sample size (n) was determined using the formula set by (Kothari, 2004) to calculate based on the population less than or greater than 10,000 population is as shown below wing formula.

1.   If N≥10,000

Total sample size $n = \frac{Z^2 PQ}{d^2}$

2. If N≤10,000

total sample size $fn = \frac{n}{1+\frac{n}{N}}$

N= total number of households (sample frame i.e. =9787)
Z=standard normal deviation at the required confidence level that corresponds to 95%   confidence interval equal to 1.96 appreciation
d=the level of statistical significance (allowable error) (0.05)
p=the proportion in the targeted population estimated to have characteristics being measured Q=1-p i.e. 1-0.5=05

Sample size $n = \frac{Z^2 PQ}{d^2}$ $= n = \frac{(1.96)^2(0.5)(0.5)}{0.05^2)} \Rrightarrow$ $n = \frac{(3.8416)(0.25)}{0.0025}$ $n = \frac{0.9604}{0.0025}$
n= 384

Using the desired sample size (n) =384 and total households N=9787, Then the actual sample size fn) is calculated as:

Total sample size $fn = \frac{384}{1+\frac{384}{9787}}$ $fn = \frac{384}{1.03923572}$ n =369

Therefore, n=369 were the sample size of the research. These sample households were drawn for data collection using stratified random sampling method depending on their determined percentage of each *kebele* holds from total target households.

Sample size of each *kebele* population

Kebels	Total HHs	Number of sample HH	Required sample size per kebele	Method of selection
2	4995	(4995×369)/9787=188	188	Stratified random sampling
5	3475	(3475×369)/9787=131	131	Stratified random sampling
7	1317	(1317×369)/9787=50	50	Stratified random sampling
Total			369	Stratified random sampling

Source: own compilation, 2017

From the 9787 total household units in three selected *kebele* administration, the study was undertaken on a total of 369 sample households were taken for questionnaire. Additionally, 6 interview respondents were included one expert from municipality plan implementation, monitoring and evaluation team department, three *kebele* managers, one from youth and sport office expert and one from Debreberhan university community service experts.

Data sources and type

For this study both primary and secondary data sources were collected from various sources.

The primary data were collected from households & key informants of D/dirham town i.e. Debreberhan municipality greenery development core process, youth &sport office and Kebele administrations by questionnaires, interview and direct observations by the researcher. In the study, Secondary data were obtained from strategic plan, annual reports, and compiled documents of the green infrastructure asset components of the town to examine the overall green infrastructure provision and management systems of the town there by ensuring data quality. In addition, relevant document collected from municipal office, *kebele* administration, youth and sport office. Other necessary documents like map of the town, standards, for green infrastructure planning and policy documents were collected from Debreberhan municipality mayor office, North Shoa Zone urban development and housing office, different books, journals, working papers, previous researches reports, unpublished materials and other related online searches documents as secondary data.

Method of Data collection

The research consists of questionaries, Observations and interview methods of data collection .The semi-structured questionnaires were used to gather information from the sample respondents of the community about their role in green infrastructure provision, management, and protection in the town. Both open ended and closed ended questionnaire prepared in English and translated to Amharic for the collection of information from local

community and other government stakeholders. To execute this study the researcher was conducted structured face to face interview. Accordingly, the prepared interview guiding questions were applied by the researcher to interview and gather primary data concerning the status of green infrastructure in the town, role, and the problems in planning, providing, and managing green infrastructure in the town .Observations were used to collect primary data .the researcher also used checklist to register relevant information about the condition of green infrastructure of the town. Photograph camera was used to capture the image of some green infrastructure element conditions.

Data Analysis and Presentations

In this study data analysis part involved both qualitative and quantitative methods .both manually and computer software programs for social science like software programs for social science (SPSS) were utilized for precise and reliable output. The data that were collected from primary and secondary sources through interview guide, questionnaire, and documentation search were organized, compiled, edited, processed, and tabulated to draw information prior to their analysis and analyzed through relevant statistical techniques of MS-EXCEL, SPSS . In so doing for the quantitative data analysis, descriptive statistics were applied to computer frequency, median and mean of responses and for the analysis of qualitative data narrative explanation were used. The Data were presented and analyzed against the main variables which were presented in the specific objectives and research questions. The finding of the study presented by using tables, photograph, pie charts, figures and maps with narrative descriptions. Tables, pie chart, graph and figures that represents quantitative and qualitative data.

RESULT AND DISCUSSION

This chapter deals with presentation, analysis and interpretation of the data obtained from the households,

municipal experts, youth and sport experts and *kebele* managers through questionnaires, interviews and field observations. The main objective of the study is to assess the green infrastructure provision and management in Debreberhan town. Based on the research objectives and questions, the collected data were quantitatively and qualitatively analyzed, interpreted and presented in tables, percentages pie charts and graphs .furthermore the demographic characteristics of respondents are discussed to give basic information about respondents.

Response Rate

In this study descriptive data analysis methods were employed based on the information collected by using questionnaire from sample households and interview with municipal experts, youth and sport experts , *kebele* managers, university community service and field observations. Hence, to collect data from households, 369 were distributed to 369 household respondents; 355 of them were filled and returned. This indicates that 96.2% response rate.

Demographic Data of Respondents

The socio-economic status of respondents shatters the understanding, view, need and respect towards the green infrastructure facilities, services and its management.

Sex of respondents

The sex of respondents affects the intention of using green infrastructure components like recreational parks and greenery areas for different purpose; because men and women have different experience in using GI. Hence, if the level of awareness of both sexes is increased in the use, values of green infrastructure, this will help to improve the development and management of green infrastructure. Figure 2 depicts out of 355 total respondents 166 (46.8%-of them are women and 189(53.2 %) of respondents are men.
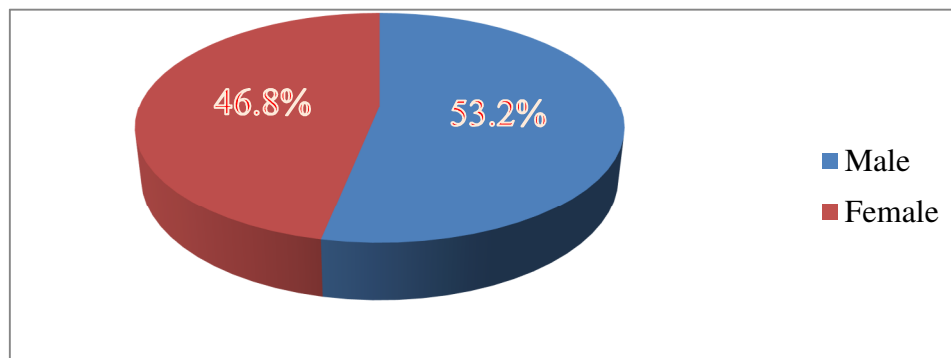
Figure 2. Sex Distribution of the Respondents
Source: Field survey, 2018

Age Structure of Respondents

Diverse age group has distinctive implication for green infrastructure development and management in the study area. Very much developed and managed green infrastructure components contribute more to social, mental cultural and economic development of all ages. For adults, green infrastructures areas create conducive atmosphere for socio-cultural development and social cohesion and for celebration of different ceremonies. For the young age, it provides a place for leisure, rest and information exchange among each other from different sources of media i.e. magazines, journals and newspaper. The table below indicated that the age category of the household was 33.8% youth age category i.e,18- 29 years old; 47.6% ages 30 -44 years;15.8% 45-60 years and 2.8% were above 60years old .

Table   1: Age of the Respondents

No	Age group	Frequency	Percent%
1	18 to 29 years	120	33.8
2	30 to 44 years	169	47.6
3	45 to 60 years	56	15.8
4	above 60 years old	10	2.8
Total		355	100

Source: Field survey, 2018

Occupational Status of Respondents
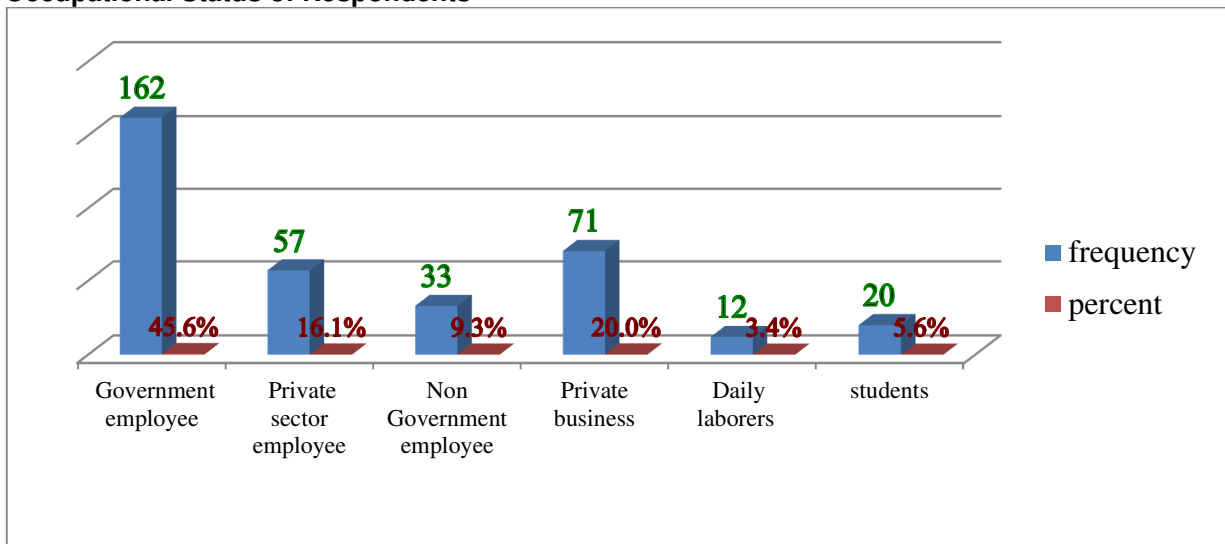
Figure 2. Occupational Status of the Respondents
Source: Field survey, 2018

Occupation of respondents also determines the value and use of green infrastructure. As Figure 4.2 above depicts that 162 (45.63%) of respondents were governmental employees whereas 71 (20%) of respondents were involved in their own business .in addition, 57(16.06%), 33(9. 3%), 20(5.63%) and 12(3.38%) of respondents were involved in the private sector , NGOS, students and daily laborers respectively. This implies that the samples are selected from different kinds of occupation groups of the city residents which make them representative and the data reliable.

Monthly income of respondents

The income of the town residences can affect the development and management of green infrastructure. As the income of the individuals increases using green infrastructures for other illegal activities decreases and the contribution for development and management of GI increases .Figure 4.3 indicates the income level of the respondents. 79(22.3%) respondents had earned less than 1000birr per month; 135(38.0%) respondents had earned 1000-2000birr per month; 88 (24.8%) respondents had earned 2001-3000birr per month; 33(9.3%)of respondents had earned 3001-4000 birr and 20(5.6%) of respondents had earned above 4001 birr per month. This implies that the majority of the respondents 72.1 % earned below 3000birr could not initiate to contribute some amount of money for green infrastructure development and management.
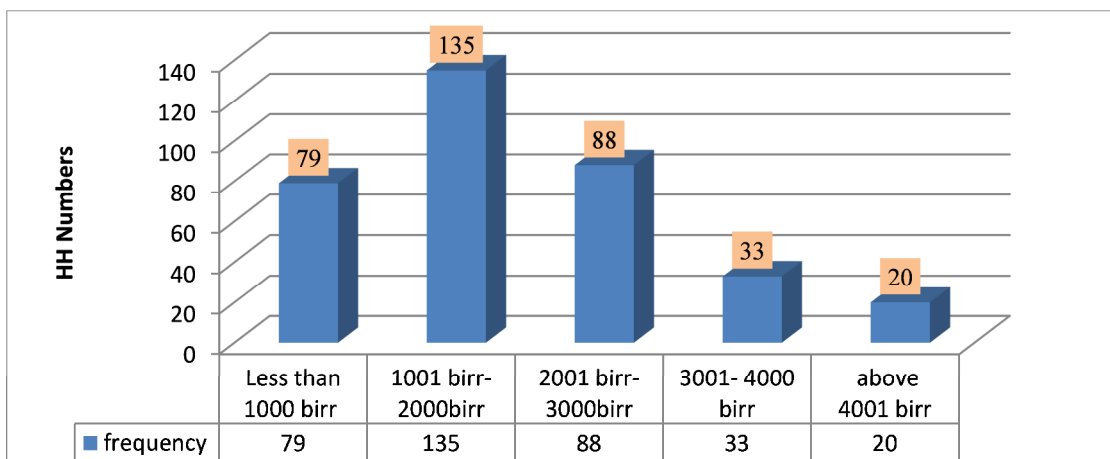
Figure 3. Monthly Income of the Respondents
Source: Field survey, 2018

Educational level of respondents

The education levels of respondents have a direct relation to their awareness about green infrastructure which encourages contribution towards green infrastructure provision and management. The table below presents the educational level of the respondents. 5 (1.4%) of respondents have no education level, they can only read and write; 31(8.7%) of respondents have completed primary school; 96(27%) of respondents have completed secondary school;76(21.4%)of respondents completed TVET;106(29.9%) of respondents hold diploma ;and 41(11.5%) of respondents hold first degree and above. This shows that most of the residents have relatively educated person that need little information to provide and manage green infrastructure in the town.

Table 2. Education level of the Respondents

| No	Educational level of respondents	Frequency	Percentage %
1	Read and write	5	1.4
2	1-8 grade	31	8.7
3	9-12 grade	96	27
4	TVET	76	21.4
5	Diploma	106	29.9
6	Degree and above	41	11.5
Total		355	100

Source: Field survey, 2018

Main concerns of the study (Findings)

In this section , the quantity and coverage of four major components of green infrastructure which were predetermined in the scope of the study part analyzed .the quantity and coverage of these five major components of green infrastructure(recreational parks ,road plantation ,road about and sport fields and cemeteries).were used as dependent variables.

Green infrastructure coverage in structural plan of the town

Green infrastructure constitutes either formal and informal green infrastructure elements like urban parks ,sport fields ,road side plantation ,road median plantation cemeteries ,roundabout greenery ,forests, urban agriculture, water bodies and buffer zone which make up the overall greenery area of the town. Debreberhan town has got new structural plan since 2014.
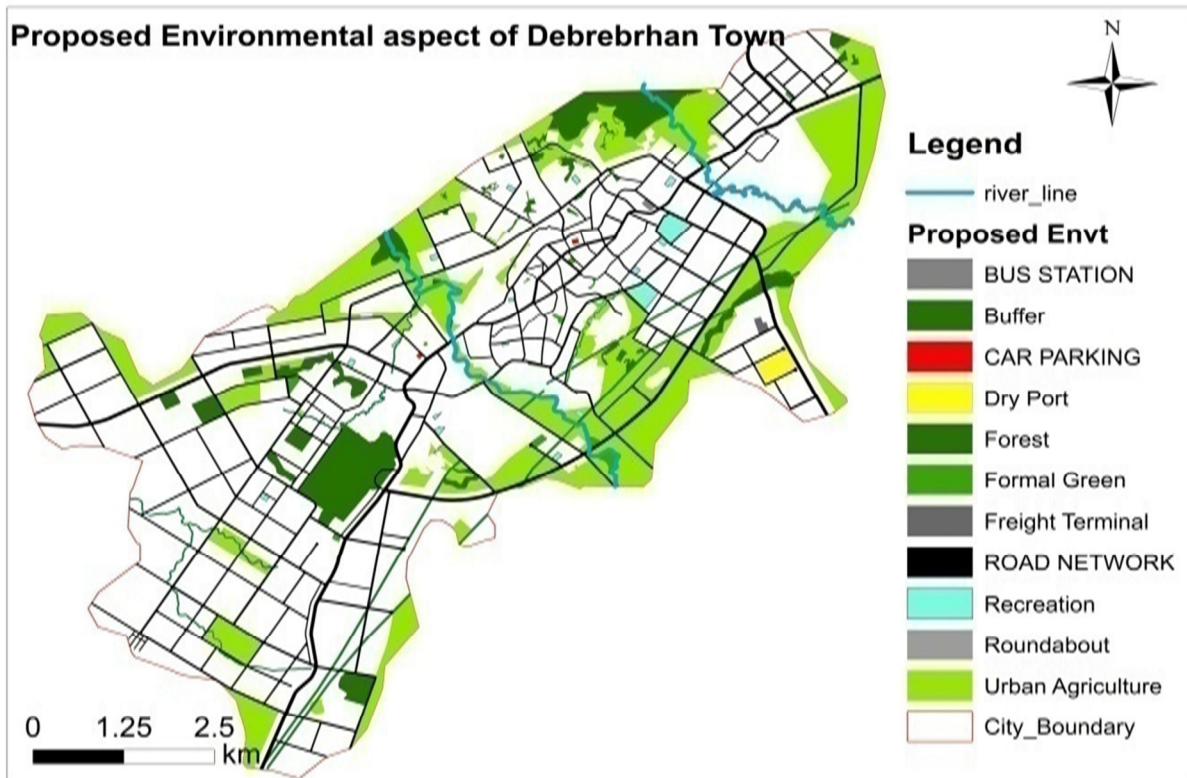
Figure 4. Proposed Urban Green Infrastructure of Debre Birhan town
Source: own compiled by GIS, 2018

According to the structural plan of the town the coverage of green infrastructure components presented as follows.

Table 3. Coverage and Quantity Of Green Infrastructure Of The Town In Structural Plan

No.	Green infrastructure components	area in hectare	Quantity	%of from the total urban land use
1	Public parks	14.49	10	0.25
2	Road side plantation		-	-
3	Road median plantation		-	-
4	Round about greenery	0.1843	6	-
5	Cemeteries	7.38	7	0.037
6	Sport fields/play ground	32.64	17	0.57
8	Forest area	347.6948	-	6.08
9	Urban Agricultural	1145.63	-	20.06
10	Buffer zone	95.89	-	1.67
	Total	1638.485		28.6%

Source: D/Berhan Town Municipality, 2018

According to the above (table 4.3), 1638.485 (28.6 %) of the total land use allotted for green areas .Out of all land use area of the town, urban agriculture has great proportion with 1145.63ha (20.06 %) and 70%from total greenery areas. This is a large proportion in terms of the total greenery land of the town reserved is used for agricultural farming and animal rearing such as horticulture, field cropping, livestock fattening and other activities. The structure plan of the town allotted 14.49(0.25%) of the total land use to public parks, 2.14(0.037%) to cemeteries; 32.64(0.57%) to sport fields; 347.67(6.08%) to forest area and 95.89(1.67%) of the total land use to buffer zone.

Existence of green infrastructure (quantity and coverage) in the town

Green spaces (public park, street tree, sport fields, roundabout and cemeteries) are one of the components of Green infrastructure and they have a number of benefits such as economic benefits, social benefits environmental benefits, urban beautification benefits and recreation and aesthetic benefits .Hence they can play a significant role in the sustainable development of a particular urban area especially by attracting inward investment. Despite their importance, most of the elements of GI in the Debreberhan town are confronted with different problems. According to the secondary data gathered from town municipality, the existence of   green infrastructures that were assessed in this study presented as follows.

Table 4. Existence of Urban Green Coverage and Quantity in The Town

No	Green infrastructure components	Area coverage in ha	Number
1	Public park	14.49	10
2	Road side plantation	-	-
3	Road median plantation	-	-
4	Round about	0.1843	6
5	Cemeteries	7.38	7
6	Sport fields	32.64	17
	Total	54.69	

Source: DebreBerhan Town municipal administration, 2018

But in reality, according to the interview and field observation, some urban green spaces in the town are not existed, and some others are little in numbered. In the table below from the total proposed urban green infrastructures that were considered in the study i.e. 54.69hactare, the actual (existed) urban green infrastructure coverage is only 12.48 hectare. This indicates the existing urban green infrastructures of the town is not implemented by town proposed structural plan of greenery area and achieved below the minimum standards which implies poor provision and management of green infrastructures.

Table 5. Proposed and Actual Green Infrastructure in the Town

No	Green infrastructure components	Proposed(ha)	Actual (ha)	Actual Quantity
1	Public park	14.49	-	-
2	Road side plantation	-	0.523	-
3	Road median plantation	-	0.328	-
4	Round about	0.1843	0.0639	3
5	Municipal Cemeteries	7.38	2.14	3
6	Sport fields	32.64	9.435	13
	Total	54.69	12.48	

Source: D/Berhan Town Municipal Administration, 2018

Public parks: though there are suitable reserved open lands for the development of public parks, still there was no public parks .In the table above there were 14.49hectare land reserved for public parks on structural plan. But the parks were absent in the ground and. the absence of public parks was not obstacle to life of the people and town also promote negative socio-economic implication on the whole town residences.

Road median and road side greenery: According to the interview result and field observation being made there are only 2.8km road side trees along pedestrians and 3.45km road median trees in the main asphalt road and collector roads developed from 40.1-hectare total area coverage of the arterial and sub arterial streets road of the town which is responsible by town municipality.

Round about: Based on the observation being made during the field work as well as information from municipal greenery development expert, the number and the coverage of roundabout is not existed as proposed plan. According to the above table 4.5, there were only three roundabouts which covered 0.0639hectare existed within three kebeles of the town.

Sport fields: according to the interview result from town youth and sport office and field observation being made, there 13 sport fields with a coverage of 9.45hectare. According to the researcher's observation during the field work except one sport field the rest are not developed.

Cemetery: according to the interview result from town the municipal green development expert, 7.38-hectare coverage municipal cemetery proposed on structural plan but only 2.14-hectare coverage existed on the ground.

All this implies that increasing the quantity of urban green infrastructure is not questionable to improve its coverage in the town .The following table shows the response of sample households concerning the trends of the quantity of urban green infrastructure within the last three years of the study three *kebeles.*

Table 6. Responses of HHs Concerning the Observed Trends of the Quantity of Green Infrastructure in the Town

Question	Response	Kebele 02		Kebele 05		Kebele 07	
		Frequency	Percentage	Frequency	percentage	Frequency	Percentage
How did the quantity and coverage of Urban Green Infrastructure in last three years?	Decreased	132	73.3	96	76.8	41	82
	Stayed the same	40	22.2	20	16	9	18
	increased	8	6.6	9	7.2	-	0
	Total	180	100	125	100	50	100

Source: Field survey, 2018

From the above table depicted that the majority of respondents (73.3 %) from *kebele* 02, (76.8%) from *kebele* 05 and (82 %) from *kebele* 07 answered the quantity of urban green infrastructure elements has decreased in both *kebeles* of the town within three years.

The decreased in the quantity of urban green infrastructure components of the town is due to different reasons. The following table illustrates the response of sample households regarding the major reason for decreasing in quantity of urban green infrastructure in the town.

Table 7. Response of sample HHs Concerning the Reason for the Decreasing the Quantity of GI in The Town.

No	Responses	Frequency	percentage
1	land use change	53	19.7
2	Misuse of the green spaces	43	16.0
3	lack of structural plan implementation	153	56.9
4	lack of stake holder integration	20	7.4
	Total	269	100.0

From the above table it can be inferred that the majority of the respondents (56.9%) responded that the leading reason for the decrease in quantity of urban green infrastructure in the town is land is lack of structural plan implementation followed by land use change 19.7%.regarding the lack of structural plan implementation that the municipality fail to realize the plan of the town might be due to the lack of budget, community participation and skilled professional. this was also conformed in the field observation being made and interview of municipal core process. On the other hand 16% of the respondents responded, misuse of green infrastructures spaces; their responses might be due to their observation consistent use of green infrastructure for solid waste dumping. 7.4% of respondents responded that the reason was lack of the integration among stakeholders.

To analyze the existing condition of GI of the city with respect to standards

Proper provision and management of green infrastructure implies not only the knowledge of the coverage of the infrastructure within the urban area but also their accessibility, condition and interconnectivity. The management of green infrastructure particularly green space elements should be sensitive to natural features and seasonal changes, physical attributes current and potential land use, the local community needs and the strategic position on sites in the local network green infrastructure. According to the researcher field observation and interview result from town municipality greenery development experts, *kebele* managers, youth& sport office concerning the current state (condition) of green infrastructure of the town presents as follows.

Table 8. Field Observation Concerning the Current Status of GI

No	GI elements	Current status		
		well fenced and protected	well planted &developed	adequate water &other facilities
1	Recreational parks	No	No	No
2	Road side plantation	No	No	No
3	Road median plantation	Yes	No	No
4	Round about greenery	No	No	No
5	Sport fields/play ground	No	No	No
6	Cemeteries	No	No	No

Source: Field survey,

Existing condition of public parks of the town

Debre Berhan town has 10 public parks in number with its coverage 14. 49 hectares on the structural plan. From 10 proposed sites no one of them were realized in the given time period. From the table above, one can easily infer that among the different elements of green infrastructure in the town, only road median are well fenced and protected. Regarding plantation and development, only road medians are well planted and developed. On the other hand, none of the existing green infrastructure elements are provided adequate water line. This was also confirmed by field observation 100% interview response. Hence, almost all of the green elements of the town are currently in degraded state and require immediate attention. On the other hand, the interview conducted with municipal greenery development expert revealed that any sites were not changed to other development activities. On contrary, in the field observation work the reserved green infrastructure site were changed to administrative use. The following plate show examples of public parks that changed to other purpose as well as unprotected and degraded urban green infrastructures areas in the town

Plate .1: Photograph Showing Public Park Land Use Changed to Other Purposes

Source: Picture Taken by Researcher, 2018

Plate 2: Photo graph showing and unprotected public park site used as solid waste dumping

Source: Picture taken by researcher, 2018

According to the standard set by AABA, 80% of the total area of public park should covered with vegetation and the left area for other physical facilities .Accordingly none of the public parks fulfill this standards. Moreover, it is stated in the Ethiopian national urban green infrastructure standard that every inhabitants shall live within 500m from a neighborhood park of size at least 0.3ha and area big enough for playing football and for other informal play .But this is not the case in the town due to this poor development and management of public parks. The following table shows the response of sample households regarding accessibility of green infrastructure within 500m from residents.

Table 9. Response of Sample HHs Concerning Accessibility of GI within 500meter from home

Question	Response	Frequency	Percentage
UGI elements can be accessed within a distance of 500m from your residence?	strongly agree	0	-
	Agree	0	-
	Neutral	0	-
	Dis agree	97	27.3
	Strongly dis agree	258	72.7
	Total	355	100

Source: Field Survey, 2018

From the table above, it can easily be indicated that (72.7%) of the respondents strongly Disagreed regarding accessibility of GI element 27.3% of them are responded Disagreed. this is also confirmed by the interview of key informants, we do not say about accessibility because of undeveloped and do not give a service for the residents due to the lack of proper implementation of public parks.

With regard to service of green infrastructure in the town, No public park existed that give a service with a payment in the town. The table below indicated Sample HHs responded about public parks service provision.

Table.10. Response of Sample HHs Concerning Green Infrastructure Service In The Town

Question	Response	Frequency	Percentage
Is there any green infrastructure that gives a service with a service charge?	Yes	11	3.1
	No	344	96.9
	Total	355	100

Source: Field survey, 2018

From the table above, it can be seen that the majority (96.9%) of the respondents answered NO any a green infrastructure that give a service with a payment for residence .Only few respondents were yes for the issue ,this may be due to the lack of information.

Existing condition of sport fields in the town

As one element of green infrastructure, sport fields are those areas identified as place of different sporting activities, which are considered as one of recreational green infrastructures .it could be football fields, athletics fields, game fields, gymnasium and others. Currently what the city has as sporting fields under the ownership of administration are presented as follows.

Table 11. Sport Fields of the City Under City Administration

Kebele /location	Type of sport fields	quantity	Area coverage in ha	Plant coverage in %	condition	Remark
01	Football field	1	0.843	Not planted	Poor	
02	Football field	1	0.79	Not planted	Poor	
03	Football field	1	0.358	Not planted	Poor	
04	Football field	1	0.82	Not planted	Poor	
05	Football field	1	0.79	Not planted	Poor	
	Hand ball	1	0.384	Not planted	Poor	Concrete
06	Football field	1	0.72	Not planted	Poor	
07	Football field	2	1.34	Not planted	Poor	
08	Football field	1	1.3	Not planted	Poor	
09	Football field	3	2.09	Not planted	Poor	
	Total	13	9.435ha	Not planted	Poor	

Source: Field survey, 2018

With regard to the provision D/berhan town has 17 sport fields with 32.64 hectare. Coverage proposed in structural plan. But according to the field observation carried out by the researcher and the interview conducted with the officials marked currently only 13 sport fields with coverage of 9.435hectare.Under town administration operating and managed by youth and sport office of the city as presented in the above table (11). The town has no any standardized volley ball, hand ball, ground table and other sporting games .All existing sport fields are football fields. Though football fields large in coverage, in quality it is not well fenced &protected, well planted & developed and provides adequate sport facilities (equipments).Currently the football fields in kebele 02 administration that considered as one of the sport fields by town youth& sport office is serving as a festival square providing many ceremonial and festival activities for the orthodox church as well as administered by the church. It is possible to say that there are no functional sport fields in that *kebele*. *Kebele* 07 administrations have two (2) football fields under the city administration without any development. In *kebele* 05 administration there are two sport fields one concrete (pavement) hand ball fields that served the whole year summer and winter. But not fenced & protected. The other one is a football field that is not well fenced, protected, planted and developed to provide a service. The following photos show examples of unprotected, not well fenced, planted and developed sport fields

Plate 3. Photograph Showing Kebele 05 Unprotected Hand Ball Fields

Source: Picture taken by researcher, 2018

Plate 4: Photograph Showing Kebele 07 Undevelopment Foot Ball Fields

Source: Picture taken by researcher, 2018

Plate 5: Photograph Showing Kebele 02 Old Foot Ball Fields Used As Festival Ceremony

Source: Picture Taken by Researcher, 2018

According to Ethiopian National Urban Green Infrastructure Standards, the playgrounds should have at least 5 types of play equipment, shall have adequate space around the equipments Pavements on playgrounds should have protective surfacing and it includes seating area for parents around the play equipments. (NUGIS, 2015). Accordingly, none of the sport fields in the town fulfill these standards except for their sufficient spaces they occupied.

Existing condition of road median and road side plantation

According to the interview result being made with the town municipality development greenery development expert, from 40.1ha total road area coverage of the town, there are only 2.8 km road side trees along pedestrians and 3.45km road median trees in the main asphalt road and other collector roads developed by municipality. All are existed within kebele 03, 05, and 06. Also the interview result discussion confirmed that both road side and road median trees are less occurrence and small proportion of coverage as compared to the total road coverage existed in the town. Though small coverage of road median tree plantation, it is well developed, protected and managed. It is also a good proportion of plantation. Similarly, information from municipality, the town administration allocating 2.9 million birr in 2018 to construction new road median tree protecting fence on the main asphalt road of Debreberhan town. Currently, the activities are under operation.

On the other hand, road side trees along pedestrian are not well developed, protected and managed. Based on the observation being made during the field work, the majority of pedestrian walk ways are existed without tree plantation as well as in some places used as a construction material dumping site. The following plate shows undeveloped and managed right ways of tree plantation, well developed and managed road median tree as well as road median protection under construction in the town.

Plate 6: Undeveloped Road side trees along pedestrian

Source: Field survey, 2018

Plate.7 Well- Developed Road Median Trees in the Town

Plate.8. Road Median That Is Fenced In the New Project Plan but Not Developed

Source: Field survey, 2018

Existing Condition of Round About in the town

Round about green space is one component of green infrastructure in the town, which have social, environmental and economical, benefits. According to the municipal greenery development expert information, the structural plan of the town proposes for round about greenery which is 0.1843 hectare in six (6) different locations. But on the ground only three roundabout greenery with the coverage of 0.063 hectare implemented. By the field observation being made on the ground confirmed the existing roundabouts have not well fenced &protected, planted & developed as well as do not provided with adequate water line. The following photograph show example of unprotected and undeveloped aste Zere Yaqob Roundabout of Debre Birhan which is found in front of Debre Birhan Selassie Church.

Plate .9: Undeveloped Roundabout in the Town

Source: field survey, 2018

Analyze the Community Perception towards the GI Provision and Management.

Perception of community awareness about the benefits GI

Studies have indicated that the general perceptions and attitudes of citizens towards nature, use as well as the complexity are reflected in urbanities relationship with urban green infrastructure. The complexity can be characterized by positive and negative response of urban residents towards green infrastructure. a sample respondent from the study area differs in knowledge about green infrastructures. The following table shows the response of sample households concerning their knowledge about green infrastructure components.

Table 12 .Response of Sample HHs Concerning Knowledge About GI

Question	Response	Frequency	Percentage
Do you know about green infrastructure?	No	255	71.8
	Yes	100	28.2
	Total	355	100

Source: Field Survey, 2018

Table 12 shows 255(71.8%) of respondents said nothing about GI and 100(28.2%) of respondents said to know about GI. The result indicates that the majority of respondents don't know anything about GI in the study area. Even those respondents that answered to have knowledge (yes) do not interpret properly some said related to other infrastructure like water & electricity infrastructure.

On the other hand, the education levels of respondents have a direct relation to their awareness about green infrastructure. The following cross tabulation table indicates the relation between level of education and knowledge of green infrastructure: among the respondents who said "No", 5 were read &write; 31 were 1-8grade; 83 were 9-12 grades; 52 were TVET professionals; 74 were diploma professionals and 10 were degree and above professionals whereas among the respondents who said "Yes" , read &write and 1-8gradedonot no anything about GI; 13were 9-12 grades; 24 were TVET professionals; 32 were diploma professionals and 31 were degree and above professionals.

Table.13. Response of Sample HHs About the Knowledge GI With Their Education Level

		Do you know about green infrastructure?		
		No	**Yes**	**Total**
Education level of respondents	**read and write**	5	0	5
	1-8 grade	31	0	31
	9-12 grade	83	13	96
	TVET	52	24	76
	Diploma	74	32	106
	Degree and above	10	31	41
Total		255	100	355

Source: Field survey, 2018

From the above table (13) shows respondents that have not completed grade 12 ,their level of awareness about green infrastructure were poor whereas respondents that have degree and above professionals were better understanding about green infrastructure. Moreover, the level of knowledge gap reflects on the general benefits of green infrastructure as indicated in the figure below. It is known that the general use of the different components of green infrastructure includes economic, social, environmental and recreational and aesthetic benefits.
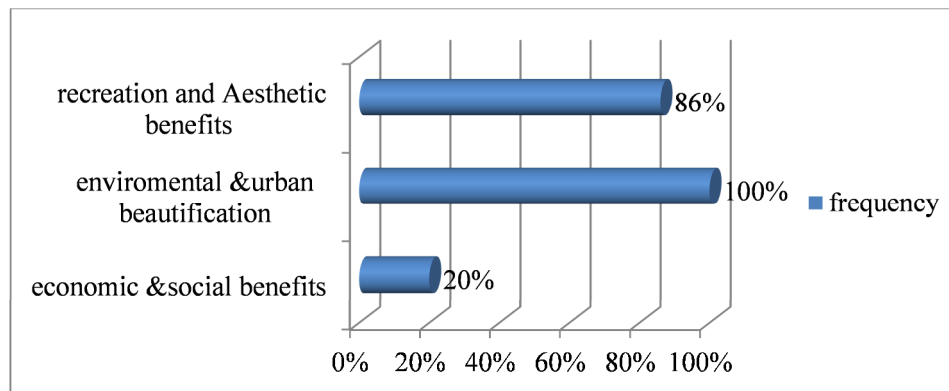

Figure 5. Responses of HHs Regarding the General Benefits of Urban Green Infrastructure
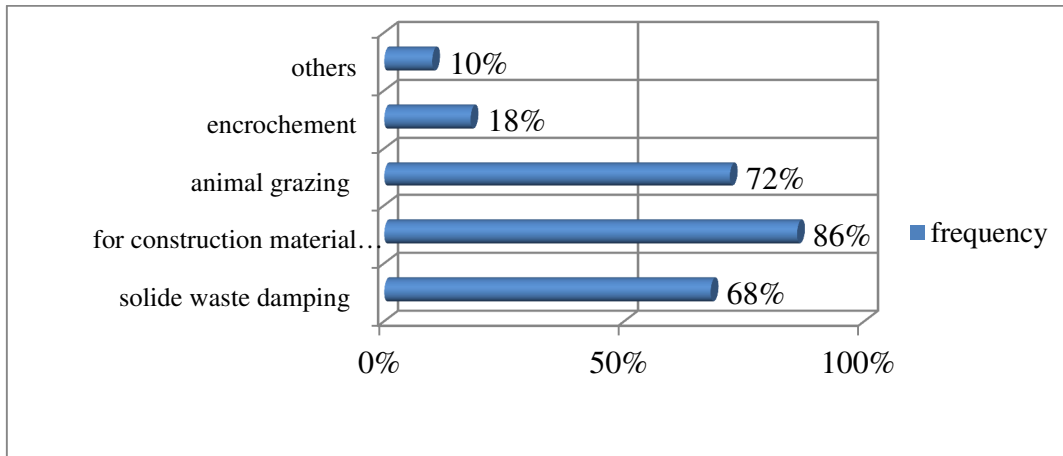Source: Field survey, 2018

From the above figure, one can easily see that 100% of the sample households responded that the general benefits of urban green infrastructure are only environmental, and urban beautification: 86% of households responded that the general benefits of urban green infrastructure include   recreation and aesthetic benefits and only 20% of them responded that the general benefits of urban green infrastructure include economic and social benefits. this indicates that the majority of the town residents are not well aware of the general benefits of urban green infrastructure since urban green infrastructure in general have multifaceted functions from which the society benefits.
As the table 11: Depicted that, the majority of sample households used green infrastructure for holiday ceremony and meetings 93%% .In addition small numbers, 38.3% for relaxation and walking;10% for educational activities and 20% for playing sports & exercise purposed used in their life.
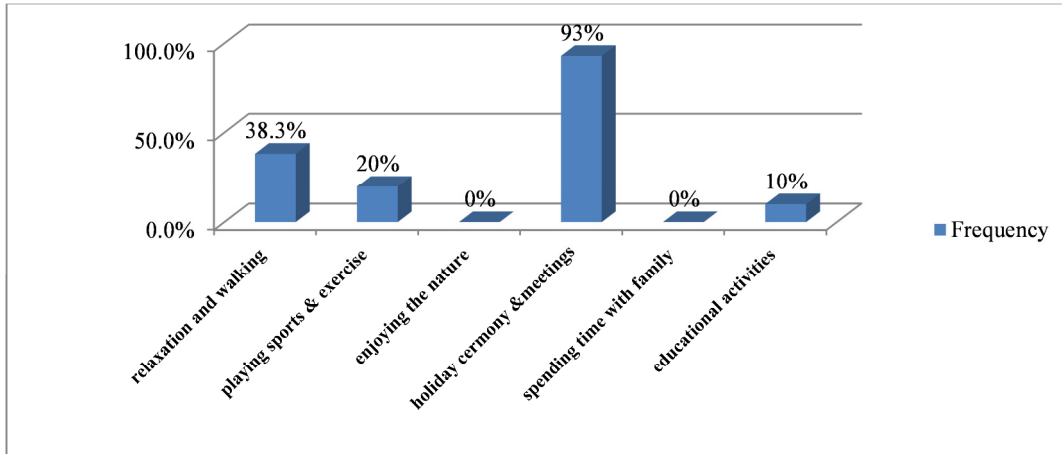
Figure 6. Respondents Perception towards the Purpose of Green Infrastructure
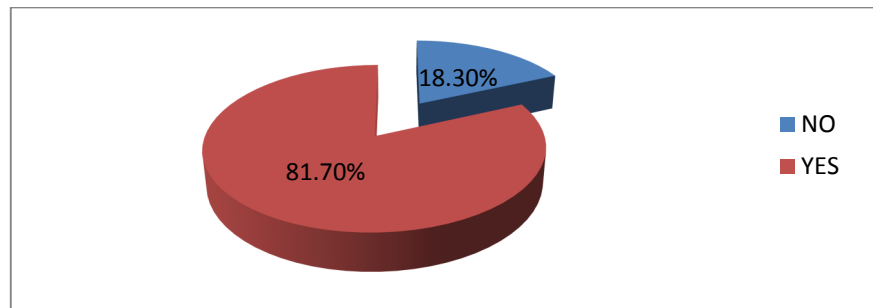Source: *Field Survey, 2018*

In spite of the above uses, purpose and other related value, the community, civil servants, the officials, and even professionals and leaders are not well aware of these values or simply ignore them. Because of this low level of awareness, the community has the habit of practicing illegal purpose like dumping solid waste, dumping construction materials and letting domestic animals as grazing purpose. The following figure shows the response of sample households and their illegal practiced.

Figure 7. Responses of HHs Regarding Improper Activities Practiced on Urban GI
Source: Field Survey, 2018

   The figure above indicates 68% of house hold respondents use and practiced Green spaces for solid waste dumping;86% of respondents for construction material damping;72% of respondents for animal grazing; 18% respondents encroaching Green space and 10% other illegal activities like informal road side trading practiced in the town.

   On the other hand, green infrastructure needs for quality of life as illustrated in the figure below perceived by the community.

Figure 8. Responses of HHs Regarding the Importance of Urban GI For Quality of Life.
Source: Field survey, 2018

In the figure above the majority of households 290(81.7%) responded that green infrastructure is important for quality of life whereas only 65(18.3) responded not as much important for quality of life.

**The condition and responsibility for development and management of GI perceived by the community**

Table.14. Current Condition of GI Perceived By Households

Response	frequency	percentage
very good	1	0.3
Good	7	2
Satisfactory	14	3.9
Poor	298	83.9
very poor	35	9.9
Total	355	100

Source: Field Survey, 2018

Table 14 above illustrated that the general condition of urban green infrastructures was less. The rate of GI in the city was 83.9. % of respondents agreed that poor ; 9.9% of the house hold responded very poor on the issue; 3.9% of respondents satisfied on the condition of green infrastructures and only, 2.3%of the households' responses very good condition of the urban green infrastructure. Similarly, the field observation indicated that there was poor condition urban green infrastructure in the town.

Figure 9 below shows that 226(63.7%) of household respondents pass their spare time at home; 78(22%) of them at hotel; 21(6%) of them walking on the road and 30(8.4%) of them were pass their time at sport fields.
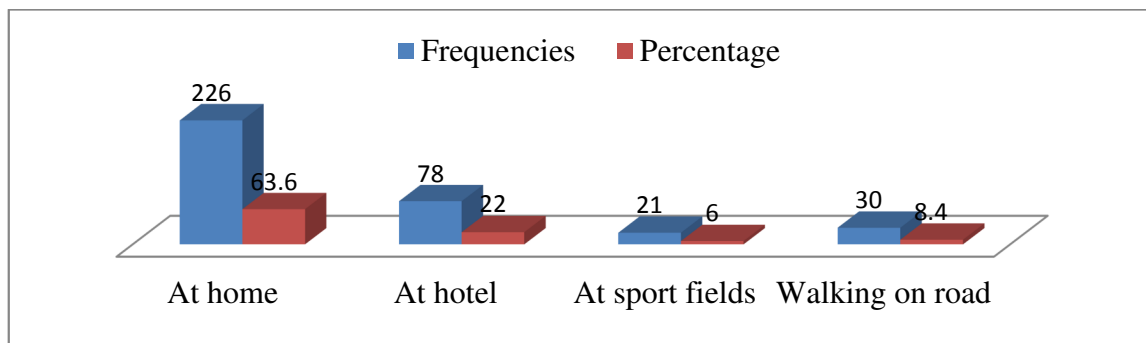
Figure 9. Responses of HHs Where Do You and Your Family Pass Your Spare Time
Source: Field survey, 2018.

Concerning responsible bodies for the development and management of green infrastructure, the Table below shows that the responsible bodies for development and management of green infrastructure perceived by communities.

Table 15. Responsible Bodies to Develop and Manage Existing Green Infrastructure

Response	Frequency	Percent
Community	30	8.5
Municipality	176	49.6
Individuals	28	7.9
NGOs	43	12.1
Public private partnership	20	5.6
All	58	16.3
Total	355	100

Source: Field survey, 2018

The above table result indicated that the majority of the household responses were the municipality since 49.6% of households stated municipality; 7.9 % of household's responses agreed as private person(individuals) whereas community 8.5%% ; Non-governmental organization 12.1% ; public private partnership(PPP) were 5.6% and 16.3% respondents said all the above listed categories were responsible for the development and management of green infrastructure. On the other hand, the interview made with *kebele* managers and municipal greenery development experts, previously the only responsible body for green infrastructure were municipality. Currently, it is also give a chance for individuals, private investments and micro and small-scale enterprises to participate in the provision and management of green infrastructure in the town due to the municipal is lack of budget but still the responsible body is the municipal.

Institutional frame work towards the provision and management of green infrastructure

Currently, municipality of the town has eight (8) team departments by the newly applied structure of public service reform since September, 2017. Plan implementation, monitoring and evaluation team department is one of the team department of municipality that responsible for development and management of green infrastructure. The structure of the team department is delineated from wordal to kebele level. However, According to the interview made municipal greenery development experts, the existing structure is not appropriate to implement the green development and management activities yet previously green development and management activities were being implement under the sanitation and beautification core process independently, now a day's greenery development and management activities is implementing by greenery development experts existed within the plan implementation, monitoring and evaluation team

A. Human capacity of plan implementation, monitoring and evaluation team

Data collected from the town civil service and human resource office presented in the table below, plan implementation, monitoring and evaluation team had 21 positions .Among the 21 positions 11 are occupied while 10 are vacant, 1 for planner and 9 for greenery development expert in kebele level.

Table 16. Human Resource Capacity for Plan Implementation, Monitoring and Evaluation Team of the City

No	Proposed position	Needed		Existing	Remark
		Qualification	Qu.	Qu.	
1	plan implementation, monitoring and evaluation team leader	MA degree	1	1	
2	Secretary I	MA degree	1	1	
3	Urban planner I	MA degree	1	1	
4	Urban planner II	MA degree	1	-	
5	Urban planner III	MA degree	1	1	
6	Surveyor II	MA degree	1	1	
7	Surveyor III	MA degree	1	1	
8	Greenery development expert I	MA degree	10	1	9for kebele
9	Greenery development expert II	MA degree	1	1	
10	Greenery development expert III	MA degree	1	1	
11	Awareness creation and training expert	MA degree	1	1	
12	Awareness creation and training expert	MA degree	1	1	
	Total		21	11	

Source: Civil Service and Human Resource Office, 2018

B. Budget allocation for green infrastructure provision and management

According to the secondary data taken from the town municipal finance and economic development office budget allocation of the town for green infrastructure in the last five years presented in the following table:

Table 17. Budget Allocated For Green Infrastructure of the Year (2014-2018)

Planned year	Total capital budget of the municipality	Budget allocated for UGI Provision &management	Percent%
2014	17,896,320	175,000	0.97
2015	22,346,879	-	-
2016	29.550.774	-	-
2017	55,618,658	1000000	1.8
2018	55,550,000	1900000	3.4
Total	151411857	3,075,000	2.03

Source: Own Survey from Secondary Data, 2018

From the table above shows in 2015 and 2016 in two years no budget allocated by the city administration; whereas 2014-year 175,000 birr, 2017 1million birr and 2018year 1.9 million birr allocated for green infrastructure provision and management. This also confirmed by the interview from municipal green development expert.

C. Manuals and guidelines

Green infrastructure provision and management guided by national and regional manuals and standards. According to the interview made with the municipality greenery development expert, the municipality applied national and regional manuals and standards in the process of provision, protection and managements of green infrastructure. Some of the manuals and standards are: nursery establishment manual, development of open green space in communal housing area, urban outdoor sport field and facilities development and management manual, cemetery management and Ethiopian national urban green infrastructure standards.

Challenges for Provision and management of Green infrastructure in D/berehan town

The development and management of green infrastructure in Debreberhan town administration are hindered by different challenges. According to the response from the interviewee and sample household there are challenges that hinder the provision and management of green infrastructure like lack of public awareness ,low level of community participation, poor implementation of structural plan lack of budget, lack of skilled man power , shortage of land in urban area , lack of regular follow up, problem of pollution in different sources, less attention is given for green infrastructure provision and management and lack of cooperation among different stakeholders. Thus in this section try to explain some major challenges that hinder the provision and management of green infrastructure.

A. Lack of awareness

Urban green infrastructures have different values, both direct and indirect uses. Among the values of: For recreation and leisure for economic benefits through job opportunities, for environmental benefits: reducing run off, for ecological value: conservation of biodiversity and for socio-cultural cohesion. Beside of the use green infrastructure provision and management requires more integrated approaches and active involvement of public, private and non-government actors at individual, community, city and national level .Active involvement of the public in urban green infrastructure provision and management can be achieved through awareness creation and community mobilization. However in Debreberhan town, lack of awareness about the importance is a problem of the people. The following Figure shows respondents perception toward the awareness of green infrastructure importance.
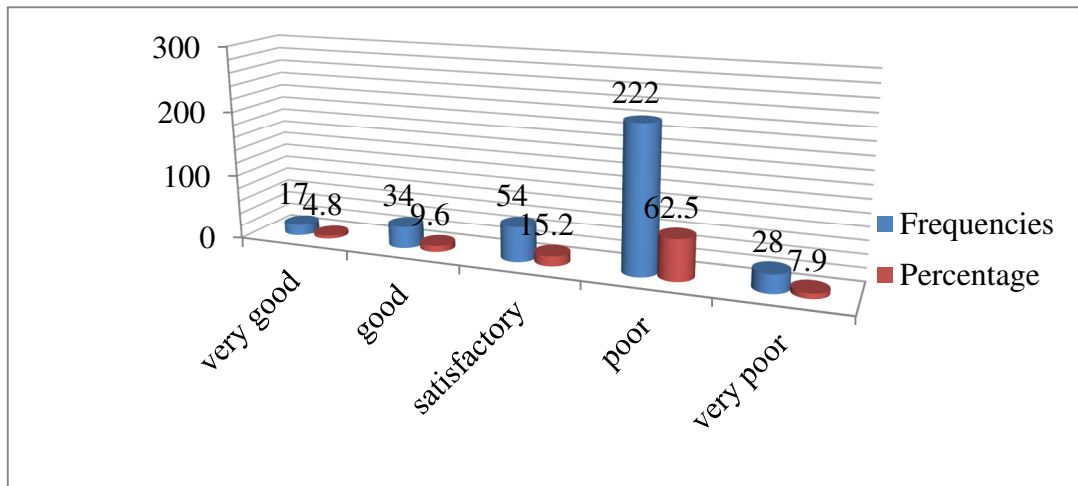
Figure 10. Level of Awareness about the Importance Green Infrastructure
Source: Field Survey, 20018

   According to respondent's perception towards the level of awareness about the importance of green infrastructure (figure 10) above 62.5% of respondents have poor awareness on urban green infrastructures; 7.9% percent of the

respondents had very poor awareness on the issue; 15.2% of respondent's satisfactory awareness of on the green infrastructures and only 14.4% of the households have both good and very good awareness on the urban green infrastructure. It implies that there is a large number of households who did not have deep awareness on urban green infrastructures development, management and its importance.

B. Lack of public participation

The awareness disparity of most of the residents about responsibility of urban green infrastructure provision and management is so limited that their participation discharges their responsibilities becomes very minimal in the study area. The following table shows the response of sample households regarding the participating in the green infrastructure development and management campaign that organized by the municipality.

Table 18. Responses of HHs Concerning Participating In the Green Infrastructure Development and Management Campaign

Question	response	Frequency	percentage
Had you ever participating in the green infrastructure provision and management that organized by the municipality?	Yes	81	22.8
	No	274	77.2
	Total	355	100

Source: Field survey, 2018

From the above table, it can be seen that only 22.8% of the respondents participated in the program. This indicates that the public participation in urban green infrastructure provision and management activities is very low in the study town. Even those participated in the activities were not participated frequently. The following figure indicates the degree of participation of those households who participated in the provision and management activities of green infrastructure.
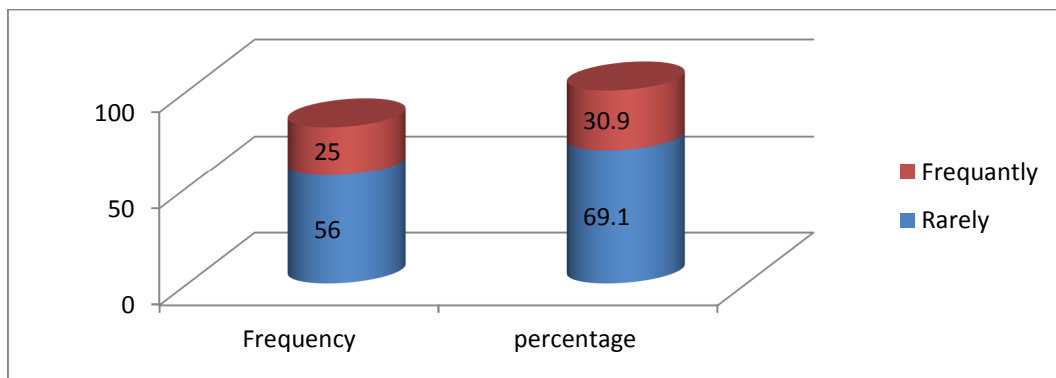
Figure 11. Responses of HH Concerning Their Level of Participation in the Provision and Management of GI
Source: Field survey, 2018

Moreover, the following table shows the response of sample households regarding the method of participation in urban green infrastructure provision and management of the town, the highest rate for method of participate in the development and management of green infrastructure was "don't want to engage" 62.3% followed by participating in volunteer works of cleaning and management 22.8 %, and the response participate for paying money in cash. Also, table 19 Indicates, joining or assisting non-profit civic organization like youth association, women association etc, and the low response frequency of 2.8%for paying more tax and none for contributing knowledge.

Table 19. Response of HHs Concerning Methods For Participates In The Provision And Management of Green Infrastructure?

Question	Participate in	Frequency	percentage
What are the methods you participate in the provision and management of green infrastructure?	By Joining or assisting non-profit civic organizations	15	4.2
	By Participating in volunteer works of cleaning and management	81	22.8
	By contributing money in cash	28	7.9
	By sharing knowledge	0	0
	Agreement with paying more tax	10	2.8
	Do not want to engage	221	62.3
	Total	355	100

Source: Field survey, 2018

Similarly, the interview made from the municipality greenery development experts and kebele managers that the town has two days a development program within a week for sanitation and beautification of the town. But, there is low community participation in development and management of green infrastructure of the city, the officials as well as the community focuses on the activities of sanitation than greenery development.

C. Lack of Cooperation and Integration among Different Stakeholders

The integrated effort of government, non-governmental institutions and community-based organizations can help ensure achievements of a goal set to address a particular problem. The same is true for green infrastructures development, management and maintenance in the study town. As stated in the interview discussion made with Debreberhan municipality greenery development expert, the major stakeholder that participates and will participate in the future is presented in the table below**.**

Table 20. Major Stakeholders of The Town

No.	Stakeholders	Major role played
1	Town administration	Allocate adequate budget
2	Municipality	Manage budget properly
3	Other team department	Prepare proper design,
4	Communities	Participate in different contribution mechanism
5	NGOs	Support money , create awareness by training
6	Universities	Support money , create awareness by training
7	Different civic associations	Support to Mobilize communities

Source: Interview with Municipal Greenery Development Expert, 2018

Even though the town have a number of stake holder, their cooperation and integration to involve in the development and management of urban green infrastructure were very low. This also confirmed by the *kebele* managers as well as town's youth and sport office at the time of interview discussion. Similarly , Debre birhan university community service director office one expert stated in the interview discussion , the university involves only in beatification of its compounds rather

no activity were done towards green space development and management with the integration of municipality town.

D. Lack of budget

According to the interview made with the municipal official's challenges on the provision and management of

green infrastructures are insufficient budget. The possible causes for budget constraints could be less attention and lack of awareness about the values of urban green infrastructure. As stated previously in the (table 17) shows the total budget of the municipality 151,411,857 birr out of this 3,075,000-budget allocated for green infrastructure provision and management. This is a share less than 2.03 % from the total five years. The expert stated in the interview discussion two years 2015 and 2016 were no budget allocated for greenery development and management. Where as in the year 2017 and 2018 the town administration allocated budget only to construct new fence of road median in the main asphalt road of Debreberhan town.

E. Poor institutional structure and Lack of human resource

According to the information obtained from municipal greenery development expert, one of the challenges in the provision and management of green infrastructure were human resource capacity. Currently in D/birhan town there are nine (9) kebels which are following up and administered by the town administration and the lower-level government structure contacts the community at kebele level. However, as stated by experts of municipal greenery development and *kebele* managers, there one greenery development positions in each kebele not occupied by professionals rather the *kebele* managers rendering the green infrastructure provision and management activities. In addition to the above challenges, there are also regular follow up, and chilling injuries, absence of nursery site that produce plants are the challenges facing the provision and management of urban green infrastructure in the town.

DISCUSSION

Extent of green infrastructure (quantity and coverage) of the town

Yngve (2016) suggested that the different elements of urban green infrastructure elements should be available for all people. Similarly, the total area occupied by green spaces in the city should be large enough to accommodate the city population needs (Haq, 2011). 28.6 percent total proposed greenery land use coverage in the structural plan of the town is good enough as near as to the required land use standard of the urban greenery development town i.e., 30 percent (Urban plan preparation & implementation strategy, 2014). However, the findings of the study town showed that the existing urban green infrastructures are scarce in coverage and quantity even some of green infrastructure components

are absent in the town.

The 2014 revised strategic structural plan of the town proposed 54.69 hectare for the green infrastructure particularly for green spaces. But, currently the existing urban green space in town is only 12.49 hectare which is below the minimum standard .This indicates that small coverage and quantity of green spaces existed in the town.

In structural plan 10 park sites, which is e of 14.49-hectare coverage for development of public parks on the structural plan. But none of them were developed in the town. Similarly, the findings of the study indicate that only 9.43ha implemented on the ground from 32.64 ha total proposed area in the structure plan. According to the interview result and field observation being made there are only 2.8km road side trees along pedestrians and 3.45km road median trees in the main asphalt road and other collector roads from 40.1 ha total road coverage of the town. And also there were only three roundabouts which covered the area of 0.0639ha within three *kebeles* of the town without any development. Moreover, the town 7.38-hectare municipal cemetery proposed on structural plan but only 2.14 hectare implemented .Those above all findings indicated that the coverage and quantity of green infrastructure elements of the town is insufficient.

Beatly (2000) suggested that development of green infrastructure has to be connected with the need to create or increase integrated green infrastructure successfully within high density urban landscape. However, the findings of this study showed that the coverage and quantity of green infrastructure has decreased in the study town within the last three years. The leading reason for the decrease in quantity of urban green infrastructure in the town is lack of structural plan implementation that the municipality fail to realize the plan of the town followed by land use change (see table 7).

Existing condition of green infrastructure in the town with respect to standards

As indicated by cvejie et al. (2015) well-designed, well managed and well-connected spaces are indispensable to the urban green infrastructure approach**.** However, the findings of the study indicate that among the different elements of green infrastructure the town, only road median is well planted & developed, fenced, and protected but all the other elements: proposed public park site, sport fields, roundabout, road side plantation and cemeteries are not well developed, planted, fenced and protected. On the other hand, none of the existing green infrastructure elements are provided adequate water line. Hence, almost all the green elements of the town are currently in degraded state and require immediate attention. This was also confirmed100 percent by field observation and interview response.

Moughtin and sharley (2005) described that vegetation; accessibility and proximity are very important factors to consider during developing and planning of an urban green infrastructure. According to the standard set by AABA, 80% of the total area of Public Park should cover with vegetation and the left area for other physical facilities. Accordingly, none of the public parks fulfill this standard. Moreover, it is stated in the Ethiopian national urban green infrastructure standard that every inhabitant shall live within 500m from public green open space of size at least 0.3ha and area big enough for playing football and for other informal play. But this is not the case in the town due to this un developed and managed public parks. From 10 proposed public park sites with 14.49-hectare coverage no one of them were realized in the given time period in the town. This implies that the recreational parks in the town are not accessible for residents. With regard to the provision and management of sport fields, D/berhan town has 17 sport fields with 32.64-hectare Coverage proposed in structural plan. But according to the field observation carried out by the researcher and the interview conducted with the officials marked currently implement only 13 sport fields with coverage of 9.435hectare under town administration operating and managed by youth and sport office .The city has no any standardized volley ball, ground table and other sporting games . Almost all existing sport fields are football fields. Though football fields large in coverage and in quantity it is not well fenced &protected, well planted & developed and provides adequate sport facilities (equipments). Exceptionally in *kebele* 05 a concrete (pavement) hand ball fields serve the whole year summer and winter. But it is not fenced & protected. Currently the football fields in kebele 02 administration that considered as one of the sport fields by town youth& sport office was serving as a festival square providing many ceremonial and festival activities for the Orthodox Church as well as governments. However , it is owned by the church. Hence it is possible to say that there are no functional sport fields within kebel 02. Also Kebele 07 administrations have two (2) football fields under the city administration without any development.

According to Ethiopian national urban green infrastructure standards ,the Playgrounds should have at least 5 types of play equipment, shall have adequate space around the equipments Pavements on playgrounds should have protective surfacing and it includes seating area for parents around the play equipments (NUGIS, 2015). Accordingly none of the sport fields fulfill these standards except for their sufficient spaces they occupied.

The interview result discussion regarding the development and management of street plantation confirmed that both road side and road median trees are less occurrence and small proportion of coverage with the total coverage of road existed in the town. Though

small coverage it is well developed protected and managed. It is also a good proportion of plantation. Round about is one of the components of green infrastructure which have social, environmental and economic benefits. According to the field observations being made the existed roundabouts are poorly managed. It has not well fenced &protected, planted & developed as well as do not provided with adequate water line. Moreover, the town has 2.14-hectare municipal cemetery without well managed and other facilities which is most part of the cemetery plots covered by natural vegetation and weeds. As indicated by Samson (2014), officials and industries particularly in developing nations focus mainly on economic aspect of development by attempting to get green open space for the formation of grey wilderness. In line with this the results of this study indicated that officials of the study town focus mainly on economic and social aspects of development by showing very minimal sensitive to the environmental aspects particularly urban green space elements. This implies that besides increasing the coverage of urban green space elements the town officials should also focus on accessible to all residents of the town within the standard distance.

Analyze the Community Perception towards the GI Provision and Management

Mell (2010) indicated that the general perceptions and attitude of citizen towards nature as well as the complexity are reflected in urbanities relationships with urban green infrastructure. People typically appreciate green infrastructure and cherish positive attitudes towards its various benefits. With the rise in public awareness and its assessment of the growing instability of local, regional and global environments, people are looking more than ever at ways to manage their surrounding in a sustainable way. Unlikely in Debreberhan town majority of the household (71.8 percent) have poor knowledge about green infrastructure and 62.5percent of respondents the level of awareness about the importance of green infrastructure has poor 7.9 percent of the respondents had very poor awareness on the issue. On the other hand, the education levels of respondents have a direct relation to their awareness about green infrastructure. But the research indicated that respondents that have not completed grade 12, their level of awareness about green infrastructure were poor whereas respondents that have degree and above professionals were better understanding about green infrastructure (Table 13 cross tabulation).

The above implies that there is a large number of households who did not have deep awareness on urban green infrastructures. As a result, low involvement of investment on green infrastructure provision,

management and protection in the town. In addition, due to the low level of awareness of the people about the benefits of urban green infrastructure, most of the residents choose to use the green infrastructure for un intended (illegal) purpose such as dumping of solid waste, animal grazing and construction material dumping place, encroaching Green space and other illegal activities like informal road side trading practiced in the town as stated previously (figure 7).

The non-use of green infrastructures for good purposes leads to weak cultural cohesion and loss of the eco-system and aggravate environmental degradations. This loss of socio-cultural cohesion brings about total loss of the culture of the society due to lack of transitivity from generation to generation and also encourages to create unwanted (bad) habits in the society like chewing chat and addiction to alcoholic drinks. The findings of the research indicated that (63.7%) of household respondents pass their spare time at home and (22%) of them at hotel (Figure 7).

Similarly, 94 percent sample household response indicated that there was very poor and poor condition of urban green infrastructure in the town. As a result there is environment deterioration rate in the town. Hence, it needs emphasis to promote the provision and management of green infrastructures.

On the other hand, the interview conducted with municipal greenery development expert revealed that any sites were not changed to other development. On contrary, in the field work confirmed the reserved green infrastructure sites for public park purpose were changed to administrative use in kebele 06 and kebel 02 of the town. This and the other reasons for nonexistence well developed GI were obliged the sample respondents to pass their spare time in their home and hotel.

Concerning the responsible body for the provision and management of green infrastructure , the majority of the household responses were the municipality since 49.6% of households stated municipality followed by 16.3 percent of all private person (individuals),community ,Nongovernmental organizations , and public private partnership(PPP) were responsible for the development and management of green infrastructure.

Institutional frame work

In order to meet social, economic and psychological needs of citizens satisfactorily and to bring sustainable environmental development; maintaining and regenerating the degraded environment and sustain the existing environment is important. The main essential things for the provision of green infrastructure are having legal instruments, Institutional mandates and roles, Institutional capacity (human resource...), Vertical & horizontal relationships and institution that introduced in

the cities (Mc Shane, Steven, 2004).

In line with this, like any other city administration in the region Debre Birhan city administration has to work towards fulfilling the objectives bestowed upon it by proclamation No. 91/2003 (DSP, 2014). Plan implementation, monitoring and evaluation team department is one of the team department of municipality that responsible for the provision and management of green infrastructure .The structure of the team department is delineated from woreda to kebele level and guided by national and regional urban greenery development manual through the process of operation and maintenance. However, According to the interview made municipal greenery development experts, the existing structure is not appropriate to implement the green infrastructure provision and management yet previously green development and management activities were being implement under the sanitation and beautification core process independently, now a day's greenery development and management activities is implementing by greenery development experts existed within the plan implementation, monitoring and evaluation team in small number of positions with regard to support large number population in the town.

Like any other city administration in the region Debre Birhan city administration has to work towards fulfilling the objectives bestowed upon it by proclamation No. 91/2003. And it is required to perform various activities for attaining these objectives for which fulfillment of human and material resources are inevitable (DSP, 2014). Data collected from the town civil service and human resource office, Among the 21 positions of plan implementation, monitoring and evaluation team had 52.3 percent position were occupied where as 47.7 percent non occupied positions. This implies that 47.5 percent were non- occupied greenery development positions. As a result the institutions were facing a problem to follow up and properly implement urban green infrastructure provision and management activities.

Moreover, from the total budget allocated of the municipality for the last five years (2014-2018) birr 151,411,857 only 3,075,000 birr allocated for green infrastructure development and management activities in the last five years. This is a share less than 2.03 %. This also confirmed by the interview from municipal green development expert. According to the interview discussion made with officials two years 2015 and 2016 were no budget allocated for green infrastructure provision and managements. Where as in the year 2017 and 2018 the town administration allocated budget only for the construct of road median new fence in the main asphalt road of the town. The implication of the above all is lack of budget due to the lack of attention of the town administration.

Challenges of the provision and management of green infrastructure in the town

Provision and management of urban green infrastructure requires more coordinated approaches and dynamic inclusion of public, private and non-governmental actors at individual, community, city and national level (Baycan-Levent and Nijkaml, 2004:2-3 cited in Gebrye Kefelew,2012). However the findings of the study indicated that lack of stakeholders cooperation and integration were not the only challenges that hinder urban green infrastructure provision and management of the town yet some of the challenges are lack of public awareness ,low level of community participation, poor implementation of structural plan, lack of budget, lack of skilled man power , lack of regular follow up, less attention is given for green infrastructure provision and management ,lack of nursery site and chilling injuries . This implies that there is a need of high political commitment from the part of higher officials of the town as well as zone administrations so as to address the challenges systematically.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The proper provision and management of urban green infrastructure implies knowledge of the coverage, quantity and access ability of the infrastructure within the urban area; their conditions and interconnectivity. It is known that availability of green infrastructure components in a particular town or city is one of the factors affecting the attraction of inward investment .The different green infrastructure have a number of benefits such as economic , social, environmental urban beautification ,recreation and aesthetic benefits . To have these benefits, development and management of green infrastructure is necessary.

However, the findings of the study indicated that in Debreberhan town, the existing coverage and quantity of green infrastructure is below standard and inaccessibility across the different parts of the town. The town has 10 park sites which is 14.49 hectare; from this area nothing has been developed. Concurrently, the quantity and coverage of urban green infrastructure elements particularly public parks, sport fields, street trees has decreased in the town due to different reasons. Some of the reasons include land use change, lack of integration among stakeholders, misuse of green spaces and failure of the municipal to properly realize the plan of the town among others.

The findings of the study also indicated that among the different elements of green infrastructure in Debreberhan town, only road median plantations were well fenced and developed other green infrastructure elements were not well fenced and developed. On the other hand, none of the existing green infrastructure elements are provided with adequate waterline. Because of this, the sites are used for unintended purpose like solid waste dumping site, storing construction material and animal grazing activities and some sites totally changed to other development. This implies that the existing condition of the town were poor. Hence, almost all of the green infrastructure elements of the town are currently in a degraded state and required immediate attention.

Active involvement of the public in urban green infrastructure provision and management can be achieved through awareness creation and community mobilization .However the study indicated that in the town lack of awareness is not only a problem of the community but also that officials and political leaders as well . Majority of the household (71.8 percent) have poor knowledge about green infrastructure in the town. As a result the contribution of the community and the budget allocation by officials for green infrastructure is very low. Even there was also land use change by officials for other development purpose.

Institutional frame works and its capacity is the core of provision and management of green infrastructure of any town. But the current structure of the plan implementation, monitoring and evaluation team that responsible for green infrastructure provision and management lacking human resource and budget. At worda level there are small numbers of greenery development positions with regard to support large number of populations in the town. In addition, among non-occupied position in plan implementation, monitoring and evaluation team, the majority were greenery development experts at *kebele* level. On contrary, the lower level human resource structure direct contacts the community at kebele level. More over the budget allocated for greenery development of the town were not sufficient. This implies that no attention is given for urban greenery development and management by the town administration, but environmental degradation was occurring in the town. Green infrastructure provision and management need multi-disciplinary and integrated approach among stake holders. In Debreberhan town the provision and management system has limitations to involve different stakeholders who can take part for provision and management. Generally, the study identified lack of public awareness, low level of community participation, poor implementation of structural plan, lack of budget, lack of skilled man power, lack of regular follow up,   lack of cooperation among different stakeholders, regular follow up, chilling injuries, absence of nursery site that produce plants are the major challenges that hinder the development and management of urban green infrastructure in the town.

Based on the findings and conclusions of the study, to improve the existing situations of green infrastructure provision and management in Debre berhan town the following recommendation was proposed.

➢ To improve the coverage and quantity of urban green infrastructure of Debreberhan town and make maximum use of it, the town's officials should focus on increasing the quantity as well as coverage of urban green infrastructure with the attention to properly planning & design as a base of structural plan of the town in continues budget year. Similarly cascading the plan up to kebele level and implement accordingly. In this regard, the political leaders as well as experts must a committed to implement as proposed on structural plan of the town.

➢ The town municipality work a collaboration with the major actors such as, NGOs, practitioners, urban planner, business communities and local residents should jointly develop the spatial coverage of green infrastructure and expand at different *kebeles* of the town based on the proposed structural land use plan and to match with the local, social and environmental need of the town. They should also determine and compare the existing green infrastructure with proposed green area coverage to fill the gap by ensuring the sustainability of the town and implementing the expansion of green infrastructure like public parks, play grounds, street trees, and round about according to the proposed structural plan of the town.

➢ The municipality of the town has to conduct awareness creation program among the community and other stakeholder even for political leaders in order to make them aware of the benefits of green infrastructure and be motivated and inspired to participate and engage in the development and management of green infrastructure.

➢ Success full urban green infrastructure provision and management program requires the active participation of stakeholders and the public in its planning and implementation. As the level of stakeholder's participation increases, the level of contribution for development and sense of ownership increases. Therefore, the municipality should create conducive situation to the integration among residents and other stakeholders in the town; the community based organization like Edir , Iqub, youth association, environmental club, and business men and other potential stakeholders to participate in developing, managing consulting, monitoring and evaluation of green infrastructure and the city administration should coordinate the development activities done by different sectors such as road ,electric lines with green infrastructure development.

➢ The municipality of Debrebirhan town should create a partnership with community, private sector, and NGOs to make practical and meaningful contribution in

money, resource and knowledge for the development and management of urban green infrastructure. Besides of this the town administration could be create a special taxes, and fees for green infrastructure improvement that target specific groups such as developers and business men for supporting urban green infrastructure in the town and collect replacement fee from bazaar programs. In addition the community must pay for replacement cost for their recreation, using for ceremonial wedding and business men for using advertising their trade marks. Similarly town administration should give equal attention to green infrastructure with other urban development activities in allocating the financial and material resource to improve the provision and management of green infrastructure of the town.

➢ Currently, green infrastructure provision and management rendered under the plan implementation, monitoring and evaluation team department. However, it should be better to create independent core process as greenery development up to kebele level so as to ensure sufficient required leader ship and staff for the planning and maintenance of UGI to be adequately executed.

➢ Similarly, the town administration should hire qualified professionals who have good experience in green infrastructure development and management for the vacant positions and prepare long term and short term training for the present staff to increase their skills and to develop and manage the existing green infrastructure. In the town administration, the political appointed authorities should capacitate by allocating multi-disciplinary professionals without negligence for environmental issues like other economic, social and political issues since, it is the component of social issues and good governance.

➢ Chilling injuries is one of the problems in the town. Yet the municipal were provided plants by purchasing seedling from tropical and sub tropical areas**.** Therefore the municipal should develop nursery site for plant seedling that is adaptable for cool environment.

In order to make the aforementioned by recommendation feasible, coordination and integration among stakeholders is a fundamental importance to come up with more sound solutions that consider the interest of all stake holders.

REFERENCES

Baycan-Levent, T. (2002). Development and management of green spaces in European cities: a comparative analysis. Research Memorandum, 2002: 25.

Benedict, M.A., & McMahon. (2002). *Green Infrastructure Smart Conservation for the 21st century. Renewable Resources Journal. Autumn Edition .page .12-17*

Beatly, T. (2000).*Green urbanism: Learning from*

European Cities. Washington D.C.: Island Press

Crotty, M. (1998). The foundations of social research: Meaning and perspective in the research process. London: Sage

Cvejić, R., Eler, K., Pintar, M., Zeleznikar, S., Haase, D., Kabisch ,N., and Strohbach ,M. (2015). A typology of urban green spaces, ecosystem provisioning service. Green surge Project Report D31.Copenhagen: university of Copenhagen.

Debrebrehan town administration. (2014). Urban Study Report of Debre Birhan Structure Plan. Debrerehan .

Debrebirhan town finance and economic development office. (2018).development socio economic survey. Debrebirhan: unpublished.

Debrebrehan town administration. (2017).Trade &market development office annual report. Debrerehan: unpublished

Gebreye kefelew . (2012) .*Urban Green Areas In Addis Ababa: The Case Of Cooperative Housing And Street Trees* In Nifas Silk lafto Sub city .Addis Ababa.

Haq, C.Y.(2011). *Green Space Allocation and Preservation for Sustainable Green of Compact*

Kong,L., Yuen, B.,Sodhi, N.S., Briffett, C.(1999).the construction and experience of nature: perspectives of urban youths. Journal of economic and social Geography)90(1):3-16

Kothari, C. (2004). "Research Methodology: Methods and techniques". New Delhi New Age International (P) Limited Publishers.

Mell, I. C.(2010). Green infrastructure: concept, perceptions and its use in spatial planning. PhD. Thesis and dissertation .Newcastle University.

Mc Shane, Steven, L. (2004). Organizational Behavior Toronto: Mac Graw. Hill

MUDHo.(2014). Urban Planning Preparation and Implementation Strategy .Addis Ababa.

MUDH. (2015). Ethiopia National Urban Green Infrastructure Standard .Addis Ababa.

MDUHo.(2016). Development of Amenity Green Space Infrastructure in Residential Area: Vol.15.

MUDHo. (2016). Manuals of cemetery management manual in Ethiopia NO. 22, 2016.

Moughtin,C., and Shirley,P.(2005). City Maker: Design Grammars for Urban Design, Published by Elsevier. Available online at http://books.google.com.et/books?isbn=14935502X

Samson Ayenachew . (2014). *An Assessment of Green Infrastructure In Addis Ababa*: The Case Of Bole Sub city, Masters. Addis Ababa University

Senbeta Adeba .(2009). *Evaluation Of urban Green Infrastructure: The* Case of Nekemte city, Masters. ECSU.

World Bank. (2001a). *Municipal Decentralization in Ethiopia* .A Rapid assessment AFTUI

Yngve, L.(2016). *Distribution of green infrastructure along walkable roads.* Active Living Research, Clearwater Beach.