Urban Sprawl in GIS: Socio-Economic and Spatial Dynamics of Gondar City

Kurma Satyanarayana¹ and Kassahun Gashu²

¹. University of Gondar, Department of Geography and Environmental Studies
   kurmasatyam@gmail.com

². University of Gondar, Department of Geography and Environmental Studies.

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ABSTRACT

This study is to identify the socio economic and spatial problems of urban sprawl of the city of Gondar. The methodology used in the study was primary data sources collected using questionnaire and GPS to identify the actual spread of the urban sprawl and to demarcate the actual area of sprawl. GIS software is used to link the socio economic survey and the spatial dynamics of the urban sprawl. The secondary data was obtained from published and unpublished annual report, annual plan from the concerned offices, research documents and others. The analysis of data is done by using both quantitative and qualitative methods.

The data analysis shows that the dwellers of the areas monthly income was mostly below 1000Birr, which indicates they are unskilled labors, due to this reason life in urban sprawl is not much comfortable. It is observed that the distance between main road and the house rent pattern comfort on transport network, physical strain of residents and other amenities is not well established as spatial dynamics of the area.
1. BACKGROUND OF THE STUDY

Gondar is found in Northern Amhara region. It is an important administrative, commercial, religious and cultural center and was noted for the skill of its many craftsmen (Camerapix, 1995). It became the capital city of Ethiopia during the reign of emperor Fasiledes who was responsible for the building of the first of a number of castles like palaces. He established a tradition that was followed by most of his successors, where building greatly enhanced the grander of the city. In recent times the city of Gondar is working hard to create an environment that supports business development while enhancing the quality of life of the surrounding community. Striving to carry out the vision, the city has initiated various measures to attract large number of quality investment and to diversify the economic and employment base. Such measures include a new plant that endorse provision of land for investment at a reduced and negotiated land lease fee, preparation and development of industrial zone equipped with basic infrastructure streamline the permit process and reducing the approval time to expedite to develop projects.

As results this incentives, in the recent years, the city has been experiences steady growth and development in housing construction, hotel and transport services development, investments on agro processing manufacturing and increasing volume transactions of exportable agricultural products and other related goods.

The physical infrastructure development is about 160km of road of which 41.3km asphalt and 88.1km gravel; and the rest is classified as compacted earth road, recognizing roads represent an important asset in cities effort to promote economic development. The city government is committed to upgrade existing gravel road and by constructing about 2 to 3km of a new asphalt road and cobblestone each year. (Gondar. http://www.selamta.net/gondar.htm)

2. Statement of the problem

The occurrence and growth of urban informal settlements are context dependent. The issue of informal settlement in Gondar reaches at the stage one cannot undermine. Addressing the reality of urban informal settlement as a subject at the micro level is very important (Gossaye Bekele, 2007).
Gondar is one of the largest cities in Ethiopia, which provides centers of trade and tourism activities, so it becomes growth corridor city. This results many problems among these high housing problem, due to the migration of people from the neighboring zones and districts. This leads to increase in urban population with diversified socio economic activities which demand more urban space. Hence there could be urban sprawl.

These opposed ideas are sophisticated the problems of the city. Informal settlements become high in the case of weaker city administration and master plan and management of the city, this also aggravated sprawling; where farmers have left aside their land to agricultural activities. This forced them to be part of urban societies to familiarize with the urban activities socially, economically and culturally.

The city is rising under the shadow of different problems that can be listed as budget problem and lack of machinery which should facilitate different social services and economic activities. The other minor challenge to facilitate different services is topography. The city’s topography is more likely undulating or up and downs which requires high amount of capital, energy and human power to facilitate social services infrastructures and so on. Therefore, this study concentrates on challenges, consequences, socio-economic and spatial dynamics of urban sprawl.

3. Objectives of the Study

3.1. General Objective

The general objective of this study is to identify and analyze the socio economic challenges and spatial dynamics of urban sprawl in Gondar city.

3.2. Specific Objective:

The specific objectives of the study are to

- Identify the socio economic problems associated with urban sprawl.
- Analyze the spatial distribution and dynamics of urban sprawl.
- Identify whether there have been and will be significant urban land use changes;
- Predict and assess urban future land use changes;
Analyze the specific issues of the urban environment and put forward a recommendation or set of recommendations that may form the basis for a sound solution for sustainable land management.

4. Research Questions

Accordingly the study would design to answer the following questions.

- What is the spatial distribution and dynamics of Urban Sprawl in Gondar city?
- What are the problems of urban sprawl?
- How does the problem will be solved in the study area?

![Study Area of Gondar](image)

Fig. 1: Study Area of Gondar

5. Methodology of the study

Data used are from reliable secondary sources such as official reports, books, proceedings, research papers and unpublished workshop papers. The researchers adopt qualitative description to analyze the data so it is more of descriptive, but we have also used the primary socio-
economic survey and field survey with Global positioning system and presented the data in the form of descriptive analytical method to justify the objectives of the study.

Fig 2: Urban Sprawl-GPS Survey

5.1. Sampling method

The GPS could be the most appropriate tool to delineate the boundaries of existing towns or vilalges (Mitasova et al., 2010). A field survey with GPS (Global Positioning System) was conducted to map the spatial distribution of urban sprawl on existing base map. With the GPS periphery areas of the settlements are marked and connected in line to indicate an area of urban Sprawl.

5.2. Sample size

Spatial random sampling technique was used in sample survey and the sampling points were generated by using ARCGIS 9.3 within two corridors of north and south of the city. This method of sampling is assumed to be useful where the topography of the study area is uneven with the elevation difference of 1928 meter to 2360 meters lowest and highest respectively.
5.3. Data analysis Methods

This research provides detailed quantitative, qualitative account of socio economic and spatial dynamics of urban sprawl. The quantitative analysis is combined with integration of various analytical categories which are identified by interviewing the respondents and reviewing the literature.

6. Physical condition of the study area

6.1. Location: Geographically Gondar town is located 12°40’ North and 34°45’ East. It is a capital city of north Gondar administration zone of Amhara region. Gondar town located at the distance 748km from Addis ababa, 60km East from Lake Tana, 410 km from Dessie city, 300km from Axum, 175 Km from Bahir Dar, 250 km Gadarif, the Sudanese border town and 150 km South at the foot hills of Semin mountain with elevation of 2300m above sea level.

The city was found by emperor Facilides in 1636 AD. It has also the current capital of North Gondar administrative zone. The city has been the capital city of Ethiopia for more than 200 years.
6.2. **Topography:** The topography of the city can be described as surrounded by hills and gentle slopes, excluding the highest elevation at Goha hotel. The main part of the city is located on the ridge between two rivers that is Angreb and Keha, which is less steep than the slope facing towards the Angreb. Our study area Kebele 18 which is generally called Maraki is an area which belongs to these areas where as kebele 19 areas is gentle as compared with northern part. The city belongs to the western highland, in particular North Central part of Ethiopia. It is also found the Western drainage system of Abay gorge.

6.3. **Climate:** Gondar though located at 12.4° North has mean monthly temperature that ranges from 14°C to mainly 20°C due to its elevation. The annual average temperature of the city 19.7°C and therefore it is most of the time comfortable; it could be categorized under Wina Dega climate zone. There is a seasonality of rain fall in Gondar with the maximum precipitation occurring from June to September. The rain occurs during summer and spring seasons. Summer is the main rain season which last from June to September. Little rain of spring usually occurs between February and April. The remaining months of the year are almost free of rain. The annual rain fall of Gondar amounts 1772 mm.
Fig 3.2 Climate Graph of Gondar; Source: www.climatetemp.info.

6.4. Soil: The dominant soil over extensive area in the towns is shallow cambi soil which refers to the shallowness of the soil in depth; unconsolidated medium size gravels and water tight clay texture underlie them. The soil is mostly brown in color with silt and clay texture; such soil endowed with relatively good agriculture potential especially around the firing area. The soil depth is between 20 and 70 cm.

6.5. Population: The projected population of Gondar town is about 228,977 by the year 2007 Census. And with the total household number of 44.03 out of the total population, 112,885 are females. The town has also 21 kebeles and of which the largest are Maraki and Azezo Demaza.

7. Economic activity of the town

7.1. Tourism: Gondar town is internationally known for with the original cultural facts of Ethiopia. Tourism has a long history it receives serious attention in recent years. Among the
tourist attraction sites in Gondar town, church of Kuskum, Debre Birhan Silasise, the Castle of Fasiledas and swimming pool are of which fascinate most of internal and foreign tourist.

7.2. Trade: Due to the presence of commercial activity from Gondar up to Metema the border town of Sudan, as well as the capital of zonal administration, Gondar becomes the city where the commercial activity is a prominent among all activities. 80% of the population engages in small scale trading, more than 5000 merchants get involved in 64 types of commercial activities, there are 14 types of whole selling and 32 retailing activities with the financial capital of 18,918,144 Birr which recruited more than 3,050 employees.

8. Amenities and services

i. Telecommunication and electricity: Microwave Telephone service is available in the city with 12,744 fixed telephone line and 16,972 mobile telephone subscribers. In addition to private or business internet line connections, cables are located throughout the city providing services to residents and tourists. Wireless telephone service is now being installed under the rural connectivity project. With two hydroelectric power sub stations, the city and its surrounding areas get sufficient electric power supply for both residential and industrial use.

ii. Educational institutions: With a recognized and prominent medical school a national university with research center, a nursing college, excellent teacher training college and the various private technical and vocational learning institutions, Gondar provides professionals who are exceptionally talented. Educational institutions in the city include University of Gondar, Gondar Teachers’ college, Tseda nursing college and Gondar vocational training college and various private colleges and training centres are spreading throughout the city. There are also seven high schools, 44 elementary and two preparatory schools in the city.

iii. Health services: A teaching hospital under the Gondar medical college, established in 1938, with over 300 hospital beds serve the city residents and surrounding towns. A private hospital, health centers and several clinics are also available and under construction.

iv. Water supply: The city benefits from the recent constructions of the Angerb dam/reservoir, relatively ample ground water sources, and a modern water treatment plant. Upon completion of the dam, it was projected on supplying the city’s water needs through 2021. Considering the
recent increase in population as well as growth in industrial and manufacturing plant development.

9. Data analysis and interpretation

Urban sprawl in Gondar city especially north and south corridors of the city are more prevalent but there are no facilities as per the needs of the residents. However the municipality provides different social and infrastructure facilities, this part of study is to identify the problems of community in respect to socio economics and spatial dynamism of the area.

This part of the paper tried to assess the factors which hinder to the urban sprawl. A total of 300 households were selected through spatial random sampling method, among there respondents 200 were males and 100 were females.

Figure 4: Pattern of House rents

The above map show that the rents high along the main road and as we move apart there is a decrease in rent, this can be one of the spatial dimension of the urban sprawl. Most of the
respondents 86.96% rental pattern in the locality is less than 1000ETB, and 13.04% of respondents who lives in the rental pattern between 1000-1500ETB. These indicates that in the urban sprawl place the people who live low level of income due to these reason most the people who lives less than 1000ETB.

Figure 5: urban Sprawl and Road network

The extended area from the existing boundary of Gondar is not having proper road network hence the residents of the area who are far from the main road are not satisfied by the services. About 31.7% of the respondents answer related to insufficient public transport network due to
urban expansion, which means that this problem is happen frequently due to uncontrolled expanding of sub-urban, but 21.6% of the respondents said that sufficient public transport network is very low which indicates that this respondents have the owner of the automobile does not use the public transport services.

The segregation of residential area in sprawling areas is significant(41.67%). This indicates that the community is not living together as the open spaces are more, hence we can observe this phenomena in urban sprawl area. Therefore, social interaction is low due to the scattered pattern of settlements. Most of the respondents say that they feel physical strain due to topography of the area as they move far away from main road. This shows that a challenge of physical strain to reach home is high due to inaccessibility of transport, and inadequate road. This implies the impact of urban sprawl where the provision of different amenities becomes expensive. Additional cost of the extension of urban infrastructure construction is very high (43.34%).

As the above map represent the areas which are apart from the main road are located on steep slopes hence they are not comfortable to going and coming back to work from the main road as it is challenging their physical stamina.
10. CONCLUSIONS AND RECOMMENDATIONS

10.1. CONCLUSION

The urban management authority of Gondar must look onto the problem of squatter settlements along the north and south main corridors which are the result of Urban Sprawl. The low income of the residents of the study area is forcing them to use low quality construction material and temporary housing pattern. The spatial dimension of the rental pattern is well established with the accessibility to main road as the rent is high along the main road and low as we move apart. The low income and lack of awareness of sustainable environment the residents are predominantly using wood as fuel (firewood). The residents are not satisfied by the community services such as education, health and transportation etc facilities which could be an outcome of Urban Sprawl. The road network also established a spatial dimension that those who are nearby the main road are well satisfied than far apart. The public transport is identified as a major problem in the study area. The impact of Urban sprawl can be clearly seen as less social interaction with a segregated community. It is understood that the cost of provision of physical infrastructure is very high due to urban Sprawl. The undulating terrain resulted with a physical strain on human accessibility, those who are away from the main road felt higher physical strain. Finally in spite of all the problems majority of the residents supported the urban sprawl due to high rental pattern in the core of the city.

10.2. RECOMMENDATIONS:

The municipality of the city should bring a strict legislation to discourage the squatter settlements. Tentatively it could collect some user charges to improve the facilities in the ares of the urban sprawl. The income level of the study area is low due to lack of skills /education. The municipal authorities may propose some urban development project with the objectives of improving the technical skills /education in the areas of sprawl. The municipal authority may establish a rent control agency in order to avoid difference in rent by spatial segregation of community. Different governmental and nongovernmental organizations together with the urban authorities may propagate the importance of environmental control and give training /material to optimal utilization of non conventional energy sources, such as solar cooker and solar water
heaters etc, on subsidized rates. The governmental and nongovernmental organizations could involve in provision of education, health and transportation facilities in the community with community partnership for the success of the project. The road network is very bad in the study area hence the government may undertake construction of internal roads on the basis of cost sharing. The undulating surface and open lawn culture of the study area resulted in less interaction within the community this could be corrected by development of some sort of community centers to share the problems of community. The urban planning department of the municipality may develop suitable housing designs to overcome terrain related problems in providing physical infrastructure in Urban sprawl region. The urban sprawl is unavoidable condition in any urban scenario, hence it is recommended that it should be treated as a natural phenomenon of urban growth and must be planned to minimize the problems of urban sprawl.

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