



GEODATABASE DEVELOPMENT FOR THIMPHU THROMDE AND PERIPHERAL AREAS



**SURVEY AND GIS DIVISION
DEPARTMENT OF HUMAN SETTLEMENT
MINISTRY OF WORKS AND HUMAN SETTLEMENT
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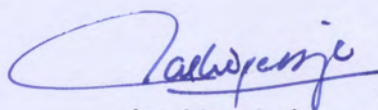
FOREWORD

This report presents the analyses and results of the data collected for the Development of a Geodatabase for Thimphu. The lack of a comprehensive Geodatabase for the capital city has resulted in difficulties in implementing the Thimphu Structure Plan 2002-2024 as well as the Bhutan Building Regulations 2018.

A comprehensive database is the key to efficient planning, effective service delivery, visioning, and innovation among others. The main objective of developing the Geodatabase is to have a repository of data under different themes for effective organization of the data, sharing and usage.

The Department would like to thank all the officials and enumerators from the Thimphu Thromde, Office of the De-suung, and the Department of Human Settlement for the support rendered during the data collection.

The Department is hopeful that the data will provide necessary guidance and information for the revision of the Thimphu Structure Plan and formulation of other plans and policies.



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1. INTRODUCTION

1.1 Project Context

Thimphu Thromde has seen immense growth in its population size and services requirement over the last few decades. Currently, Thimphu houses about 40% of the total urban population of the country. The migration trend, as reported in the Population and Housing Census of Bhutan 2017, indicates that Thimphu Thromde accounted for a net gain of 48,214 migrants. If this trend continues, there will be tremendous pressure on existing public facilities and amenities in Thimphu.

The Thimphu Structure Plan (TSP) 2002-2024 guides the implementation of activities within the Thromde area while the activities in unplanned areas beyond the Thromde boundary are implemented in line with the provisions of the Bhutan Building Regulations (BBR) 2018. However, deviations from the prescribed Development Control Regulations (DCR) in the TSP and the BBR

have been observed in many instances. The deviations could be attributed largely to the lack of a comprehensive data management system for Thimphu. The lack of a comprehensive data management system also impedes effective service delivery and makes it difficult to have access to vital information thereby hindering strategic decision-making.

Therefore, to address such issues from escalating further, the need for a comprehensive Geodatabase for Thimphu was felt necessary. The Geodatabase will be used for the review of the TSP (which is under review) and also for the development of a Housing Inventory System. Since the Geodatabase is a repository of crucial information related to demographic data, employment, education, housing, structures, income and many other important parameters, the data can be utilized by other relevant agencies as well.



Figure 1: Current growth trend in Thimphu

1.2 What is a Geodatabase?

A Geodatabase is a “collection of geographic datasets of various types held in a common file system folder, or a multiuser relational database management system (Environmental System Research Institute, ESRI). The data based on themes are stored in different layers which makes data editing, extracting, and sharing easier. Figure 2 below shows the pictorial representation of how data can be stored in the system as thematic layers.

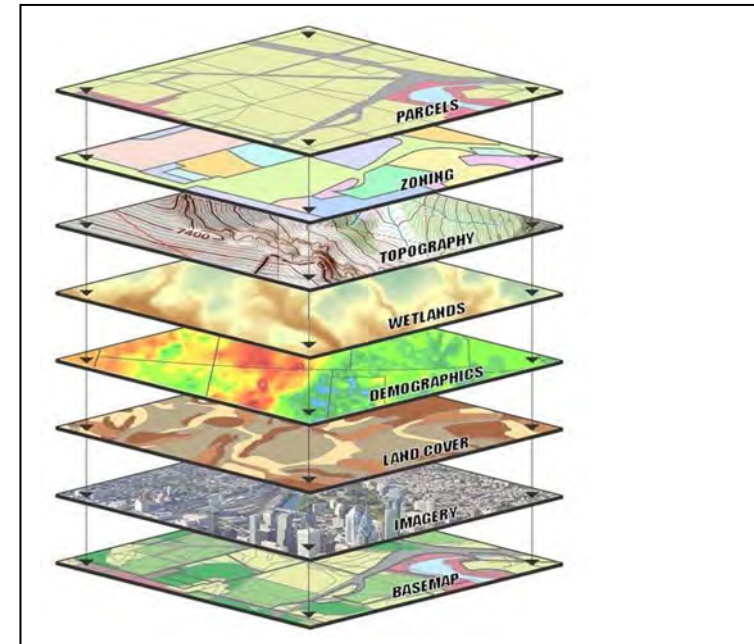


Figure 2: Data storage under thematic areas

1.3. Objectives of Geodatabase

The main objective of developing a Geodatabase System is to have a repository of data under different themes. The database is aimed to:

- i. Enhance strategic decision-making process;
- ii. Enhance storage, access, updating and sharing of spatial data;
- iii. Facilitate integration of spatial data with other relevant databases;

-
- iv. Enhance administration and management decision making through proper asset valuation, taxation, enhanced compliance monitoring of the approved Development Control Regulations, and provision of services; and
 - v. Provide real time data that can be used for planning and management purposes.

1.4 Methodology

The enumeration area was 35 Sq.km and covered Thimphu Thromde (26.9 Sq.km) and peripheral areas (8 Sq/Km) covering. Begana, Kabesa, Changtagang, Ngabephu, Depsi, Gangchey and Nyezergang. To ease the task of conducting the survey, the Zoning System prepared by the Zoning Taskforce was used to divide the survey area into 56 zones.

The data collection was conducted using an Application called “Zhi Char App” developed by the Department of Human Settlement. The first component of the Geodatabase development was the collection

of demographic data and details of all structures. The questionnaire comprised of concise details on buildings and household intended to capture all pertinent information needed for spatial planning purposes. A structure number was assigned to all structures or buildings to be enumerated in the map and a unit number for each unit was marked on the entrance in a clockwise manner for the enumeration. As the survey responses were recorded, the data was automatically stored in a GIS-compliant format for editing, cleaning and analyses. Pictures of each structure was captured during the survey and automatically transferred to the GIS server for storage.

Since the area of this assignment was huge, the Ministry carried out the data collection with the help of the Office of the De-suung and Thimphu Thromde. The Office of the Desuung deployed 113 Desuups for the data collection and Thimphu Thromde deployed 123 teachers as volunteers along with 12 Thromde officials to assist the officials of the Department of Human Settlement. The data collection was carried out from September 21 till October 5, 2020.

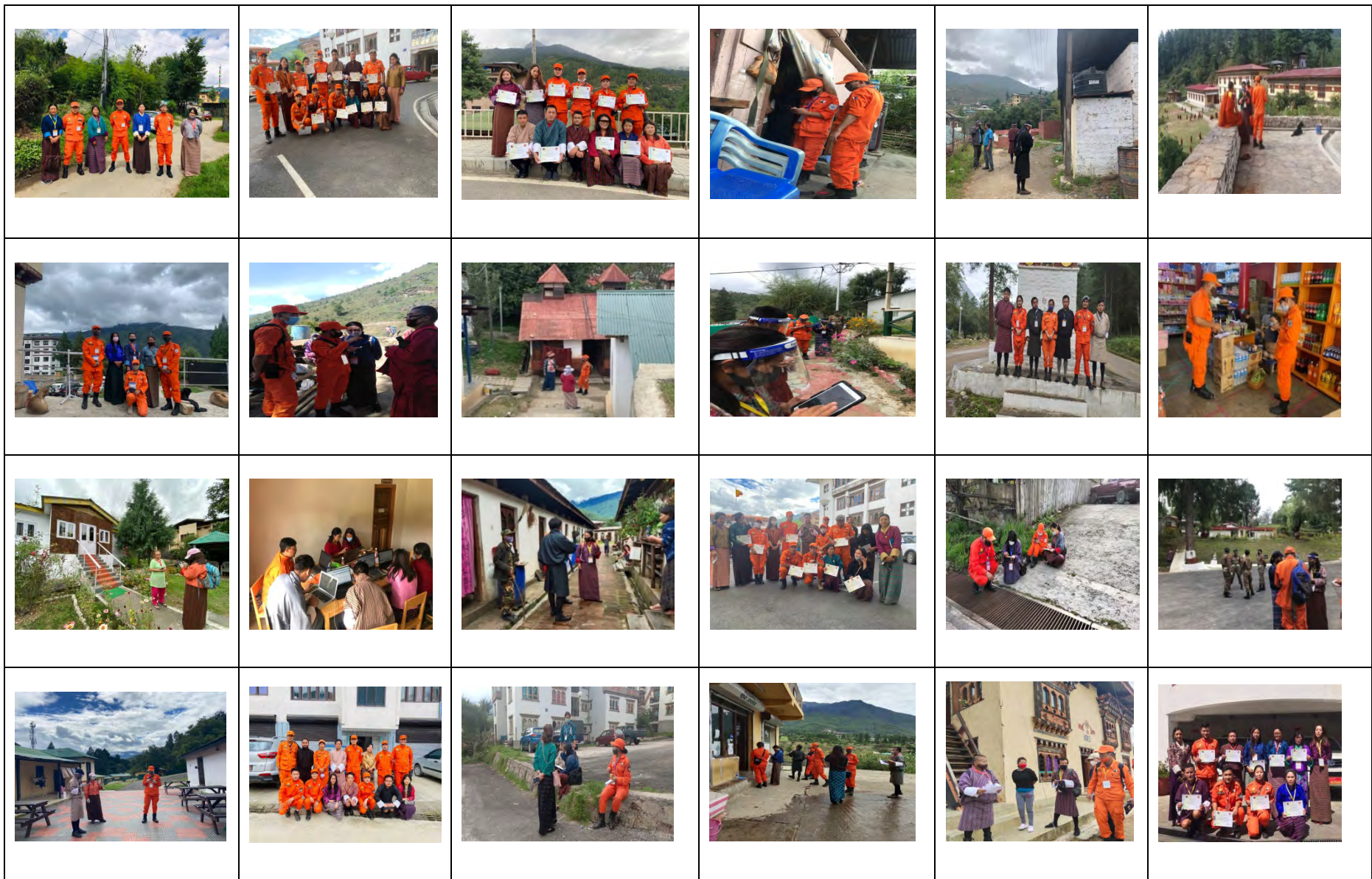


Figure 3: Supervisors and Enumerators in the field

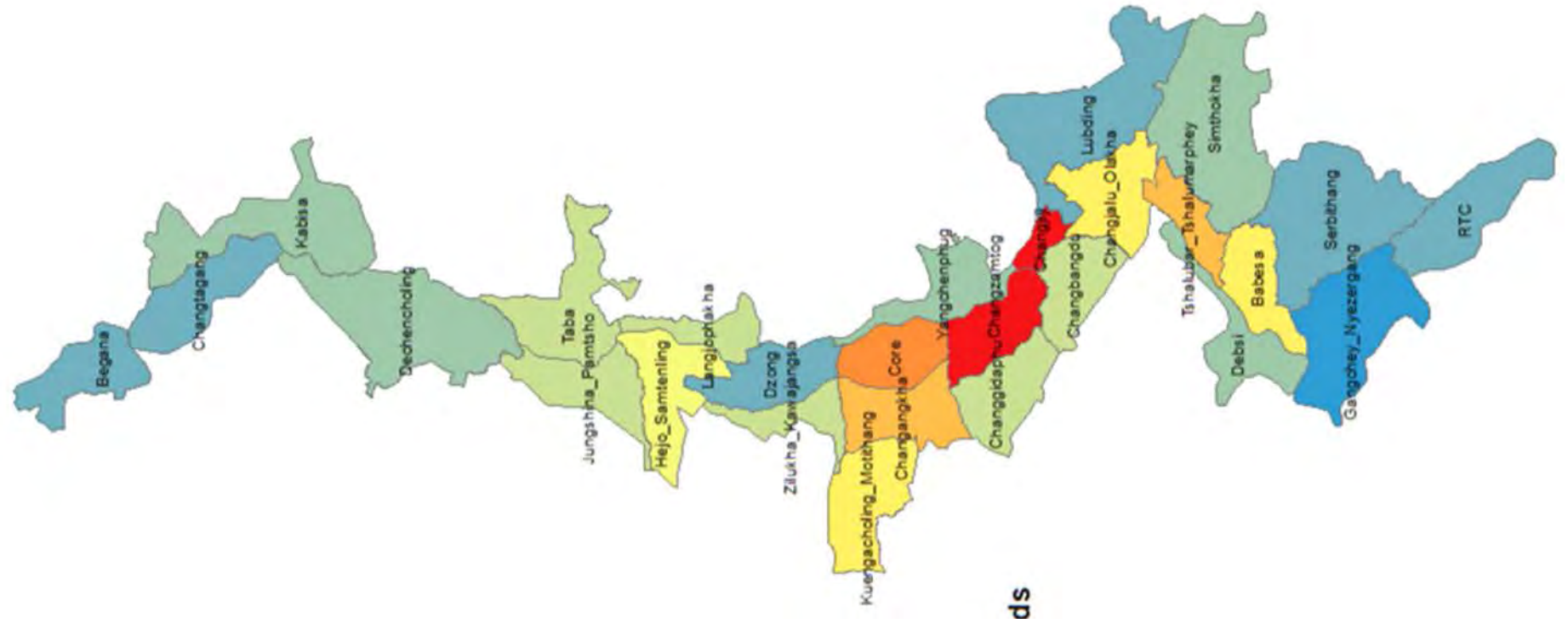


Figure 4: Enumeration Zones

2. ANALYSES

The report has been divided under different themes with graphical representations of the data and a brief description of the analyses carried out.

2.1. Detailed Analyses

2.1.1. Demography

The demographic details include population data, age, gender segregation, and religion.

2.1.1.1. Total Population

During the time of the data collection, Thimphu Thromde including the peripheral areas had a total population of 119,876 people of which 117,078 (98%) were Bhutanese and 2,789 (2%) were Non-Bhutanese. The population density calculated is 3,425 persons/ Sq. km or 35 persons/Ha. **The figure does not include those residents**

who were unwilling to respond to the survey questionnaire and who were unavailable during the enumeration.

The population point density calculates the density of point features around each output raster. Conceptually, neighborhood is defined around each raster cell center, and the number of points that fall within the neighborhood is totaled and divided by the area of the neighborhood. Effectively, this shows the population within each defined square on the ground. The analysis is effective in showing areas of high population density.

The population field can be used to weigh some points more heavily than others, depending on the number of observations they represent. While calculating population point density, for example, a spatial location (building point) with three people will be counted three times.

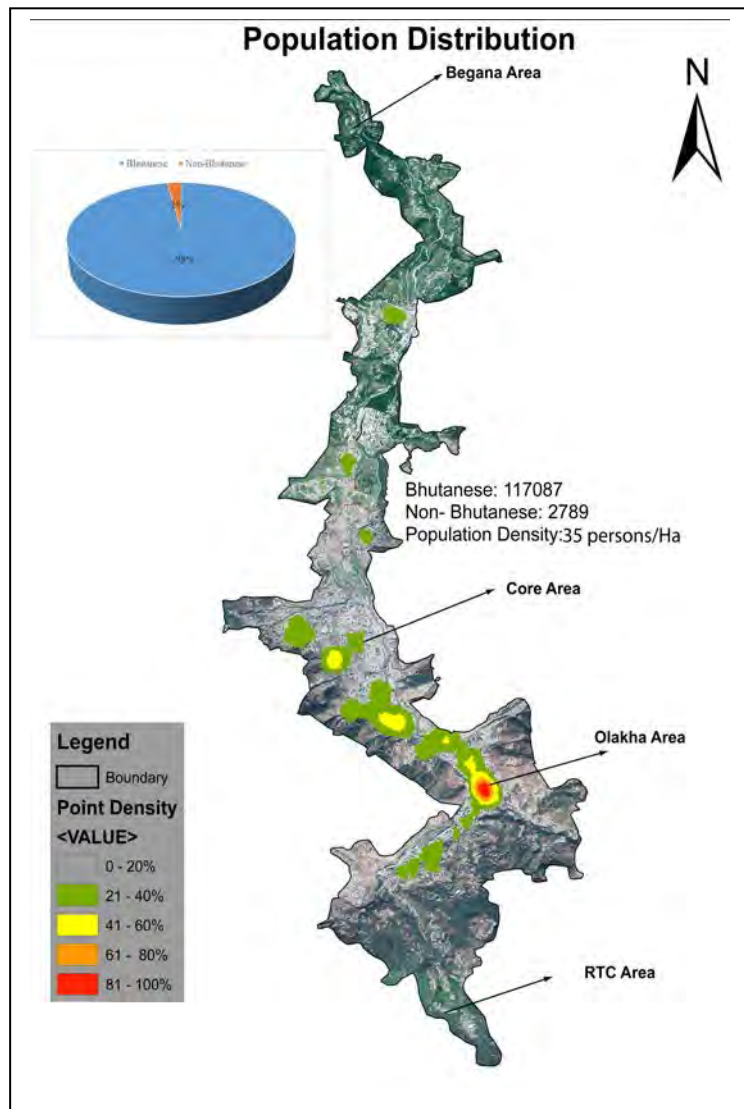


Figure 5: Population Distribution

2.1.1.2. Population by Age Group

Of the total 119,876 people enumerated, the age group of only 118,366 people was recorded. This includes the age group of Bhutanese nationals only. Therefore, of the total 119,876 people who were enumerated, 1,510 people (1.26%) of the total Bhutanese population did not respond. From the analysis, the population age group indicates that 11,174 were between 0-5 years, 23,229 were between 6-17 years, 16,879 were between 18-25 years, 60,234 were between 26-59 years and 6,841 were above 59 years of age.

It can be deduced that within the enumeration area, the number of elderly population above 59 years is comparatively lesser than the other age groups and the maximum number of people fall within the age group of 25-59 years.

It can also be concluded that there is more male population than the female population above 18 years of age while on the other hand, there are more females who are 17 and below.

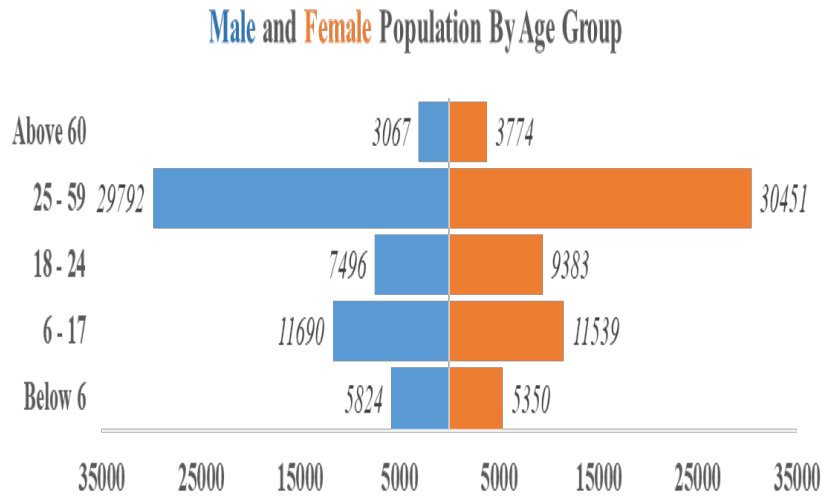


Figure 6: Male and Female Population by age group

Figure 7 shows the distribution of population below 6 years of age. From the analyses, it is evident that there is lesser number of children aged 6 and below in North and South Thimphu while the concentration of the age group is more in the central spine.

Similarly, for age group 6-17, the distribution is more towards the central areas and southern part and lesser towards the Northern areas (Figure 8).

People aged 18-24 are also concentrated more towards the southern part of Thimphu with more than 80% in the south central areas. The

age group is almost negligible in North Thimphu and the extreme southern boundary (Figure 9).

Similar trend is also evident for the age group of 25-59. The distribution of the group is also more in the central west and southern part with more than 50% along the south central spine (Figure 10).

People above 60 years of age were found to be concentrated more in the central areas with 20-100 % of the age group being distributed in the core and central spine (Figure 10).

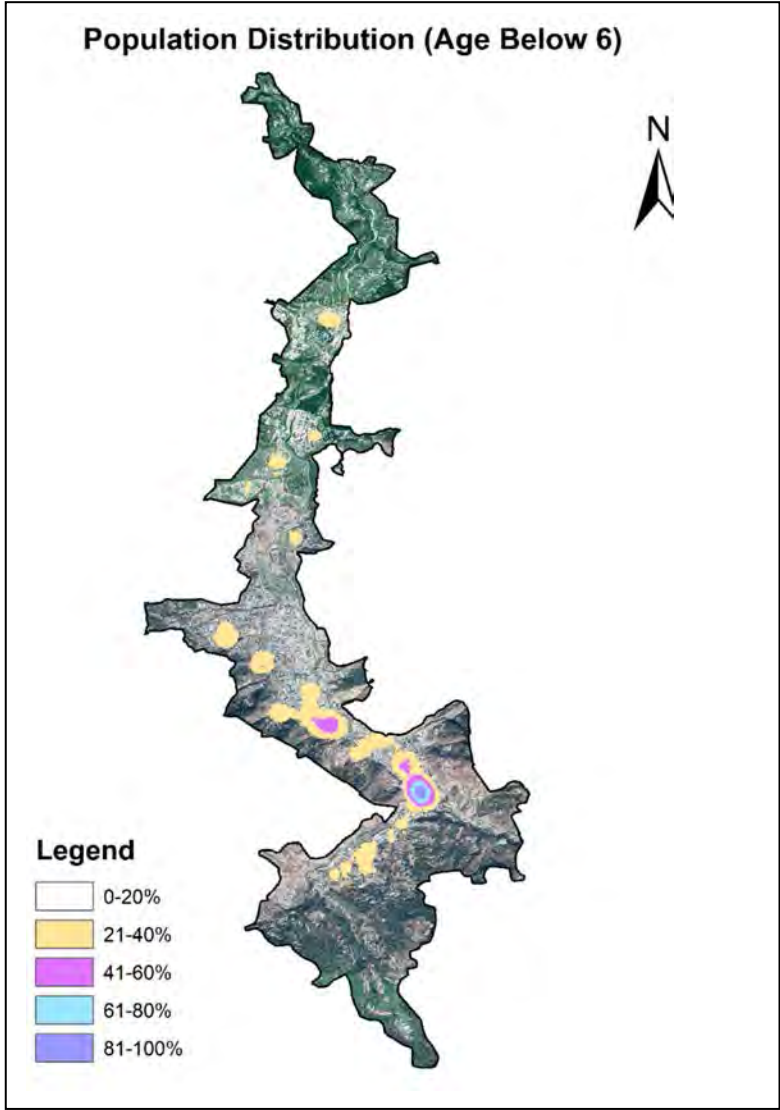


Figure 7: Population Density (Below 6 years)

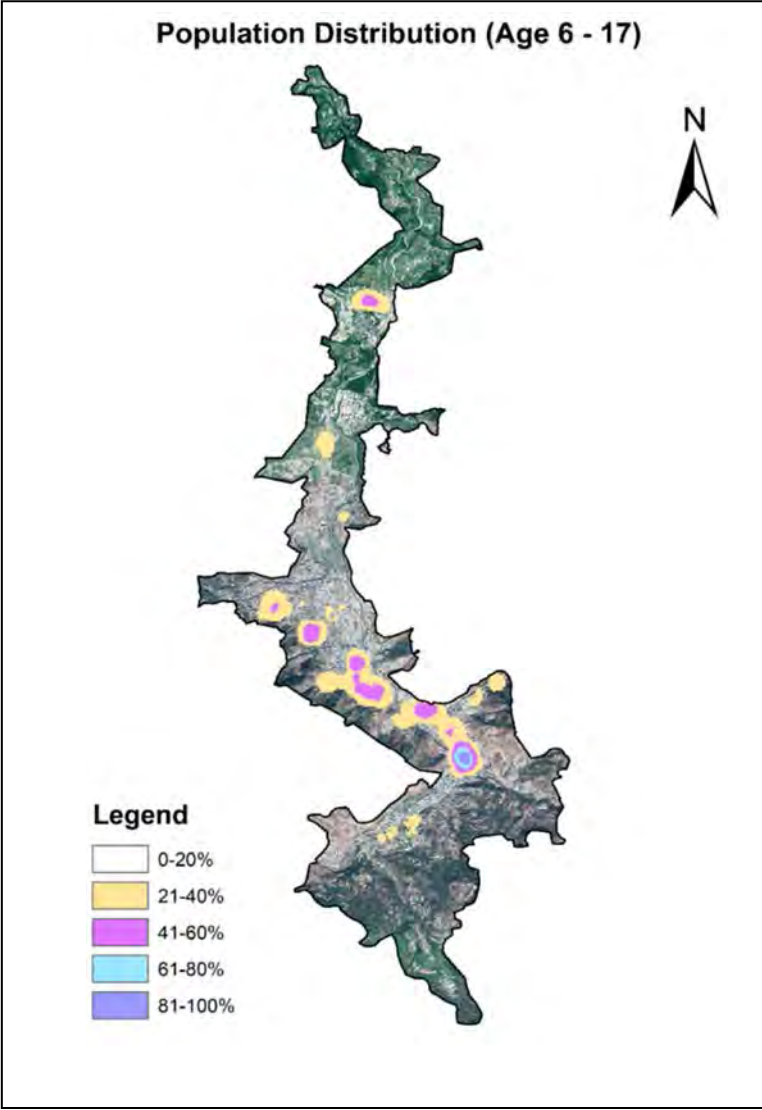


Figure 8: Population density (Between 6-17 years)

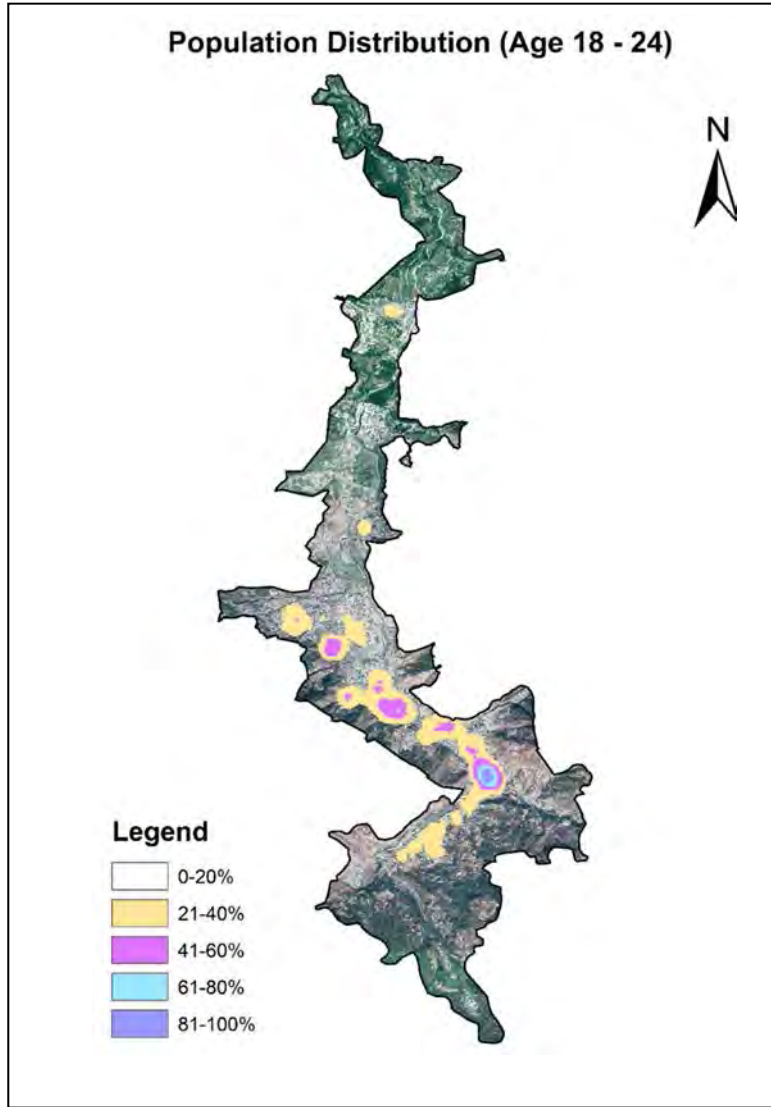


Figure 9: Population density (Between 18-24 years)

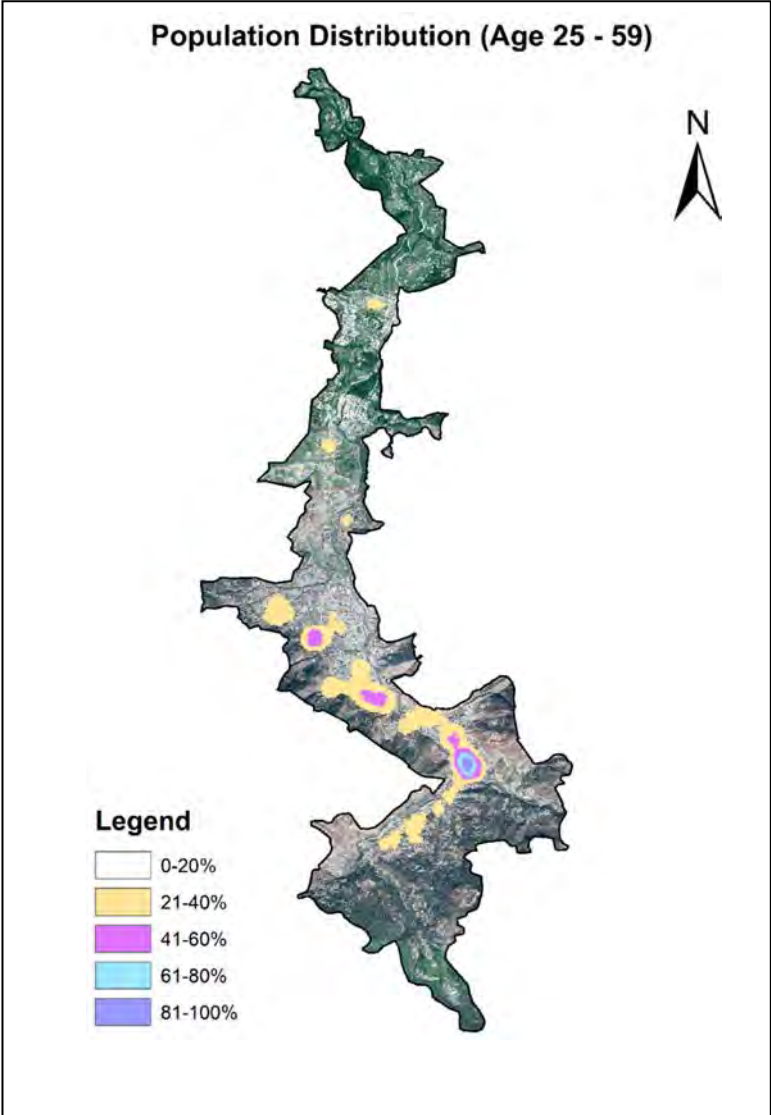


Figure 10: Population density (Between 25-59 years)

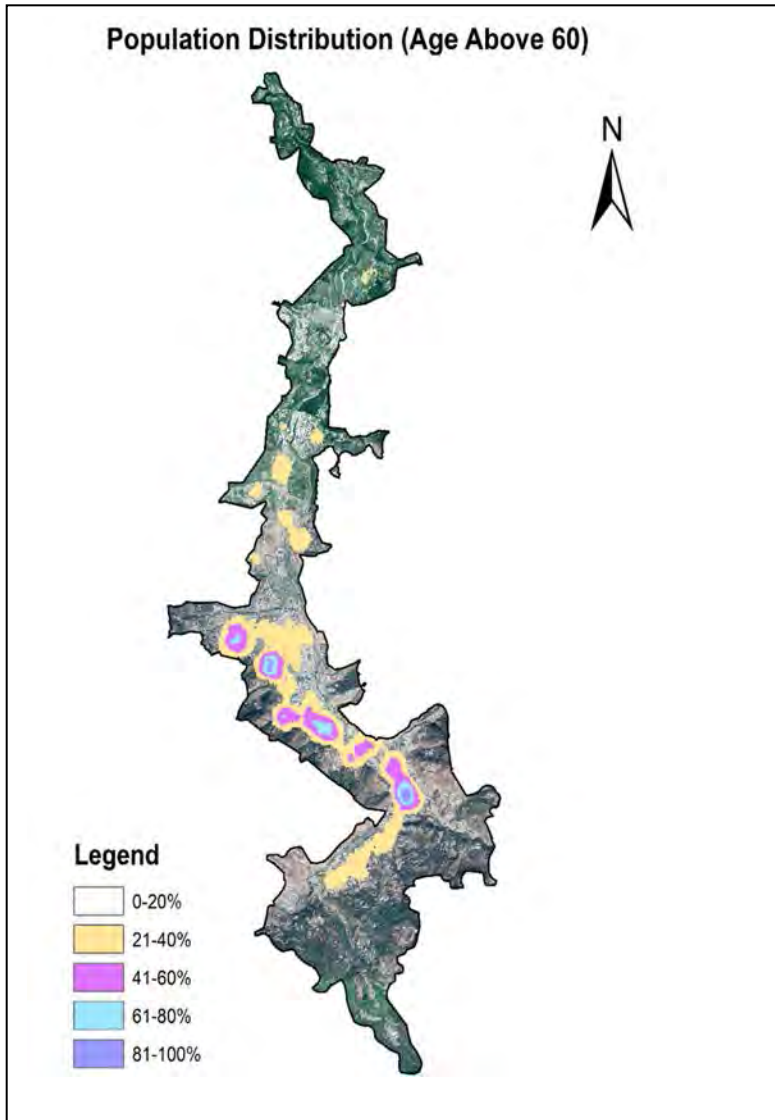


Figure 11: Population density (Above 60 years)

2.1.1.3. Population by Occupation

The occupation category was divided into 11 types viz. i) Students, ii) Civil Servants, iii) Corporate Employees, iv) Retires, v) Private employees, vi) Job seekers, vii) Home makers, viii) Farmers, ix) Armed forces, x) Monks and Nuns, and xi) Others.

The Ministers, Constitutional Post Holders, senior citizens, minors and professions not covered under any specific groups were all included under the ‘Others’ category. Of the total 119,876 people enumerated, the occupation of 108, 451 was recorded during the enumeration.

This includes mainly the occupation of Bhutanese nationals. The rest whose details are not recorded are construction labors from neighboring countries and minors. During the survey, some Individuals were unwilling to share their employment details. So their details are not reflected as well.

The data shows a skewed distribution of employment by gender especially in the category of armed force, and monks/nun where the number of male population is much more than the female population. Similarly, there is a huge disproportion in the number of homemakers with 97.34% of the total homemakers being females.



Male and Female Population By Occupation Group

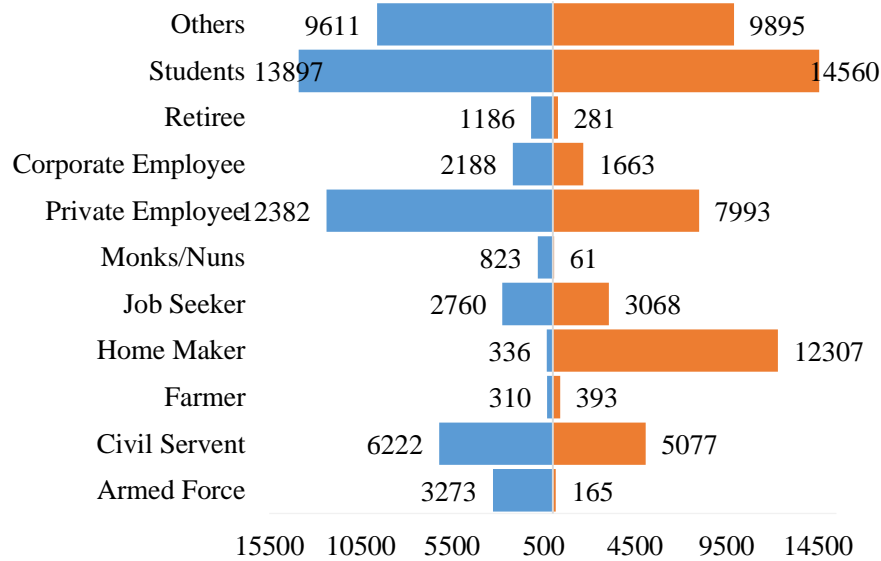


Figure 12: Population by Gender

The distribution of corporate employees is almost negligible in areas like Begana, Changtagang, Kabesa, Ngabiphu, Nyesergang, Serbithang and Lubding. The concentration of the group is more in the central spine. Similarly, the concentration of civil servants is more along the central spine from Taba till Olakha and less in other areas.

For occupations like students, homemakers, and monks/nuns, the concentration is more in areas between Taba and Babesa again with greater density in the Centre.

As for farming occupation, the density is more in areas like Changtagang, Kabesa, Hejo-Samteling, Zilukha, Changjalu-Olakha, Lubding, and Tshalubar. Following similar pattern, the density of population falling under the occupation group “Others” is more in Taba till Babesa.

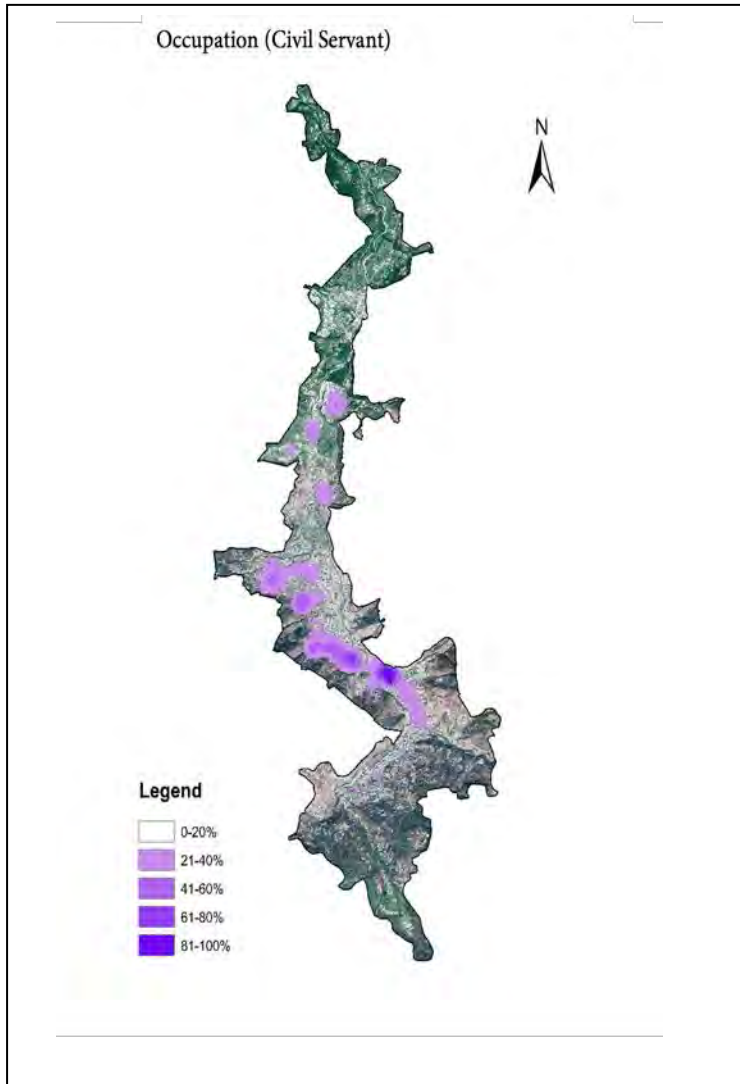


Figure 13: Population density of Civil Servants

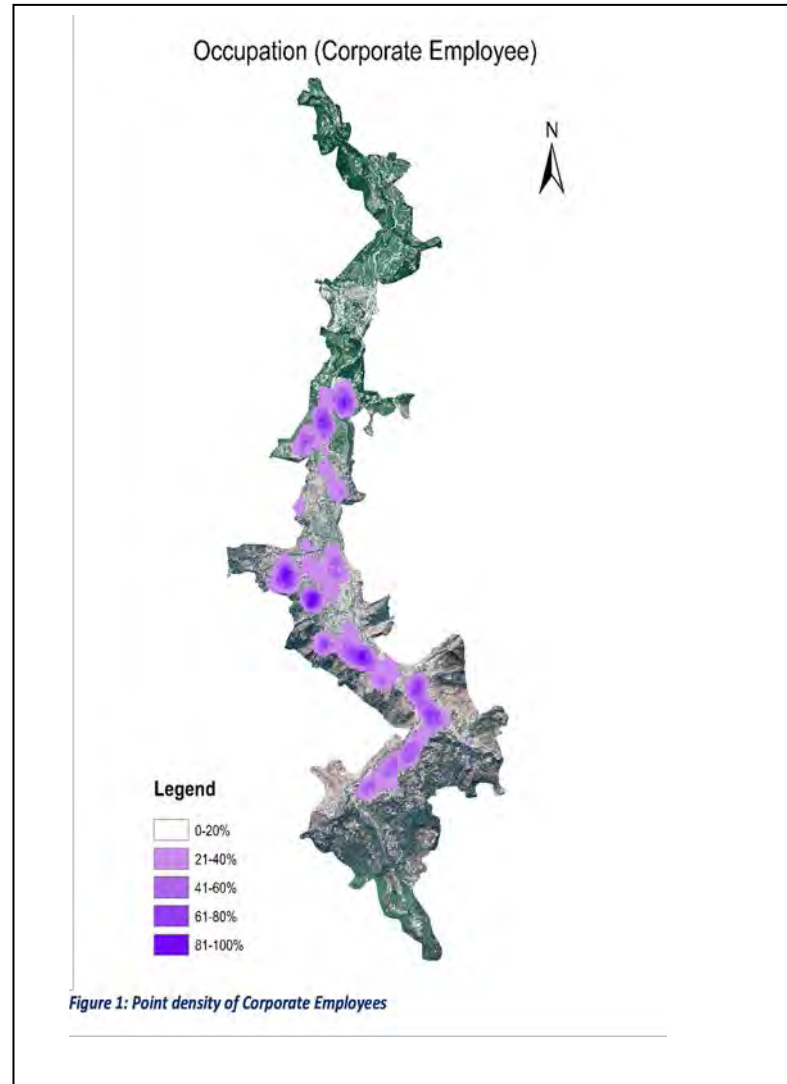


Figure 14: Population density of Corporate Employees

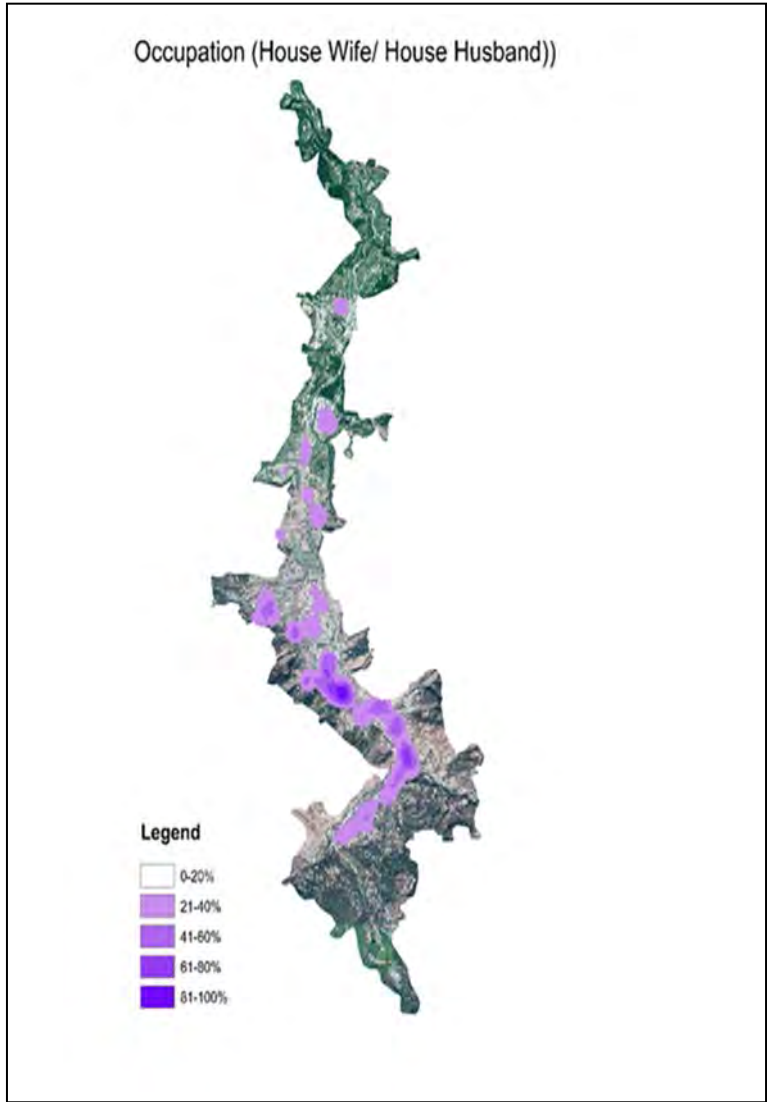


Figure 15: Population density of Homemakers

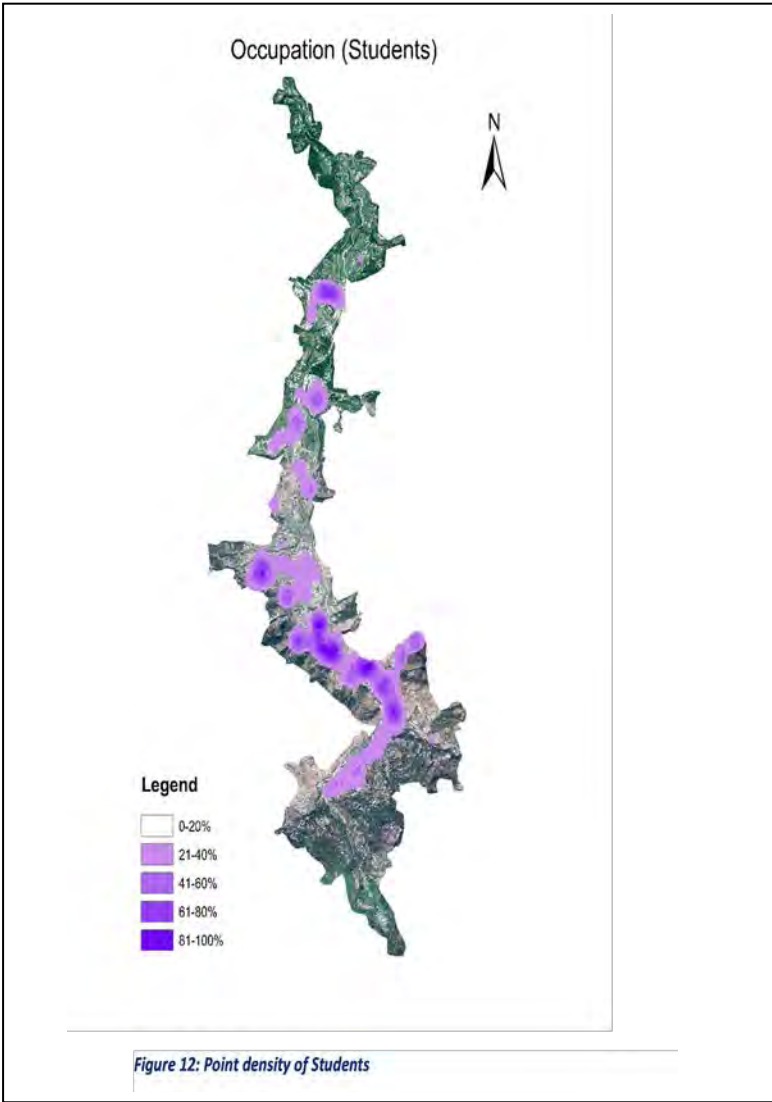


Figure 16: Population density of Students

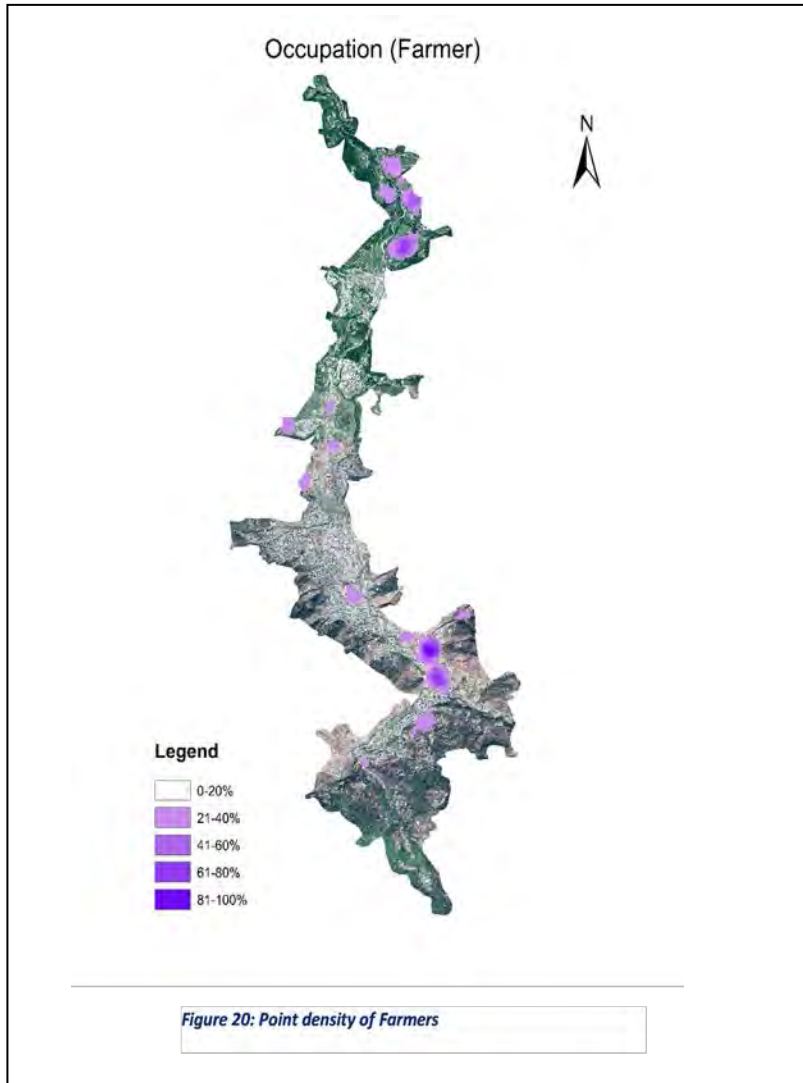


Figure 17: Population density of Farmers

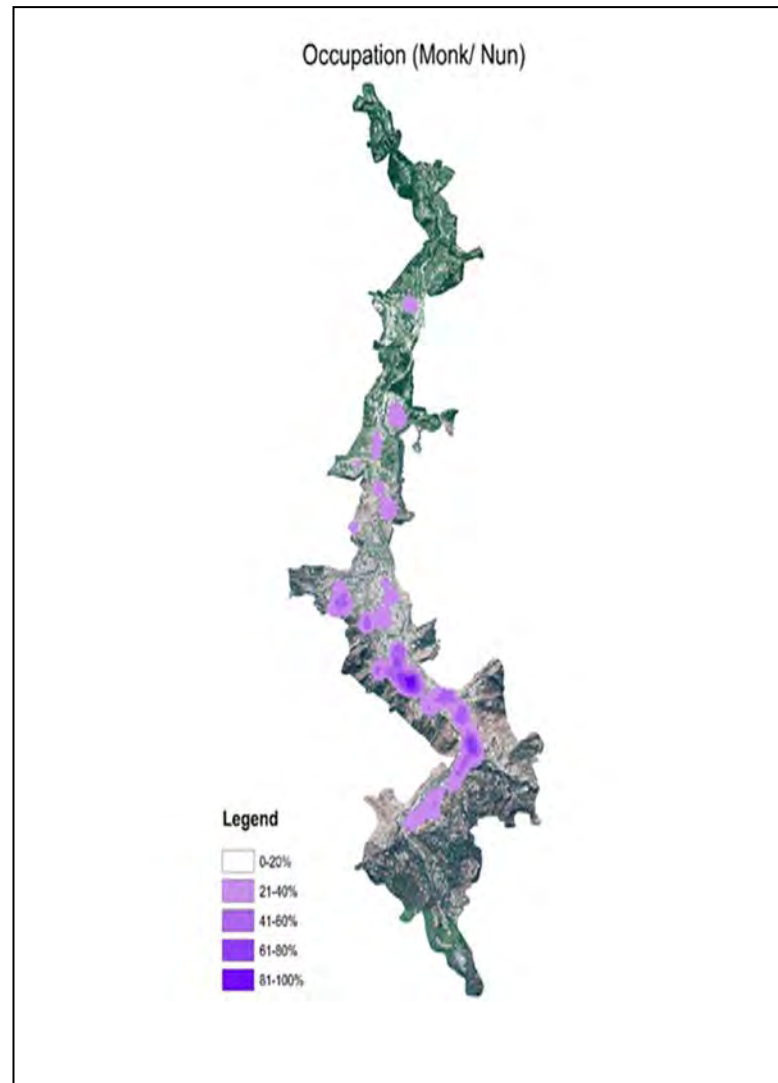


Figure 18: Population density of Monks and Nuns

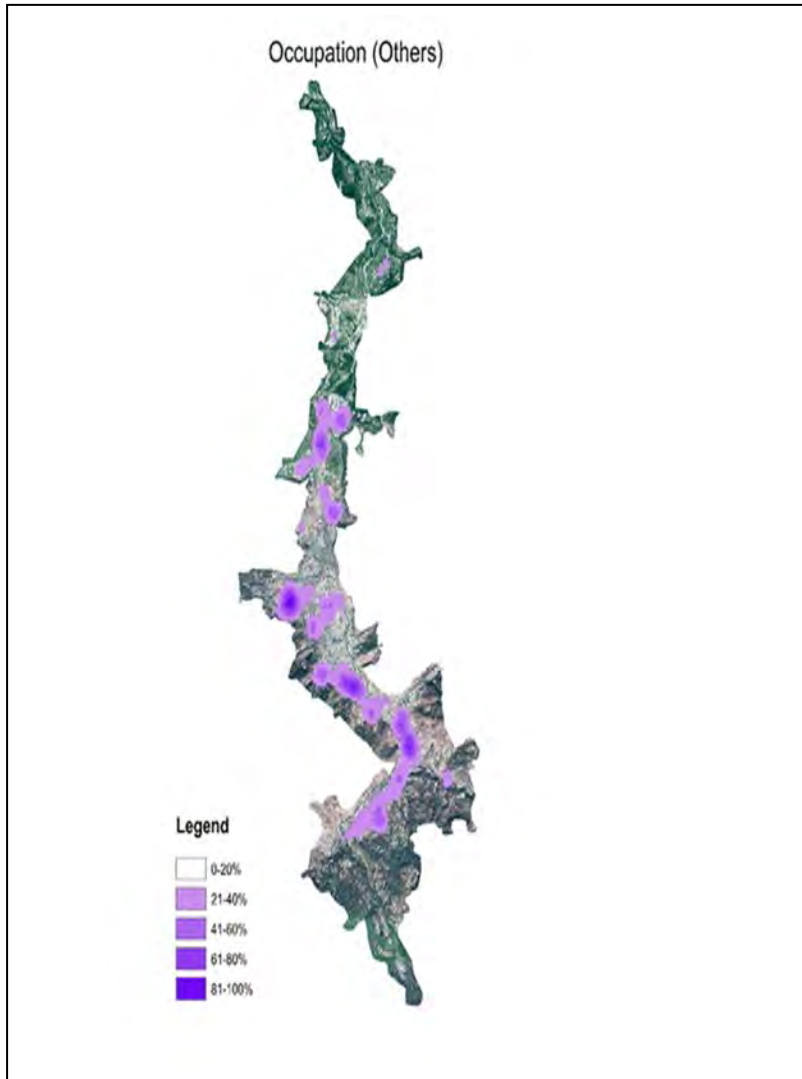


Figure 19: Population density of Other Occupations

2.1.1.4. Population by Religion

One percent of the total enumerated population did not respond to the religion type. Of the 114,702 people whose responses were recorded, 105,734 people were Buddhists, 10272 were Hindus, 2110 were Christians and 564 were categorized into other religions. The segregation of male and female population by religion is as shown in Figure 20.

The analyses show that the population density of people who follow Buddhism was more in the South Central areas and sparsely distributed towards the North. As for hinduism, the population density is more in areas like Changangkha, core area, Changbangdu-Chnagzamtog, Olakha, Tshalubar-Tshalumarphay, and Babesa.

As far as Christainity and other religion that have not been specified are concerned, the density is more in the Southern part with the highest concentration in Olakha.

Male and Female Population By Religion

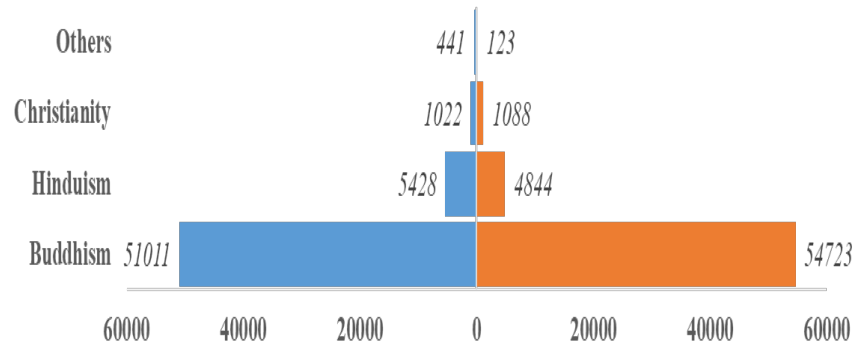


Figure 20: Male and Female population by Religion

Population Distribution By Religion (Buddhism)

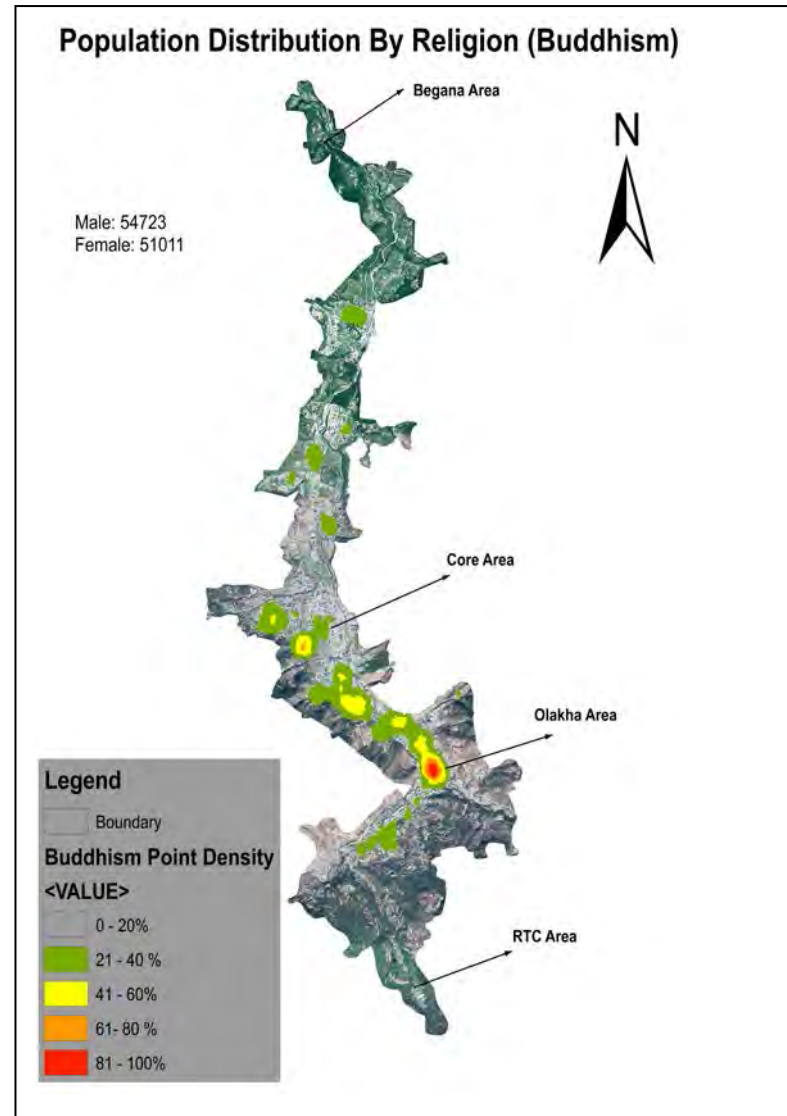


Figure 21: Population density of Buddhists

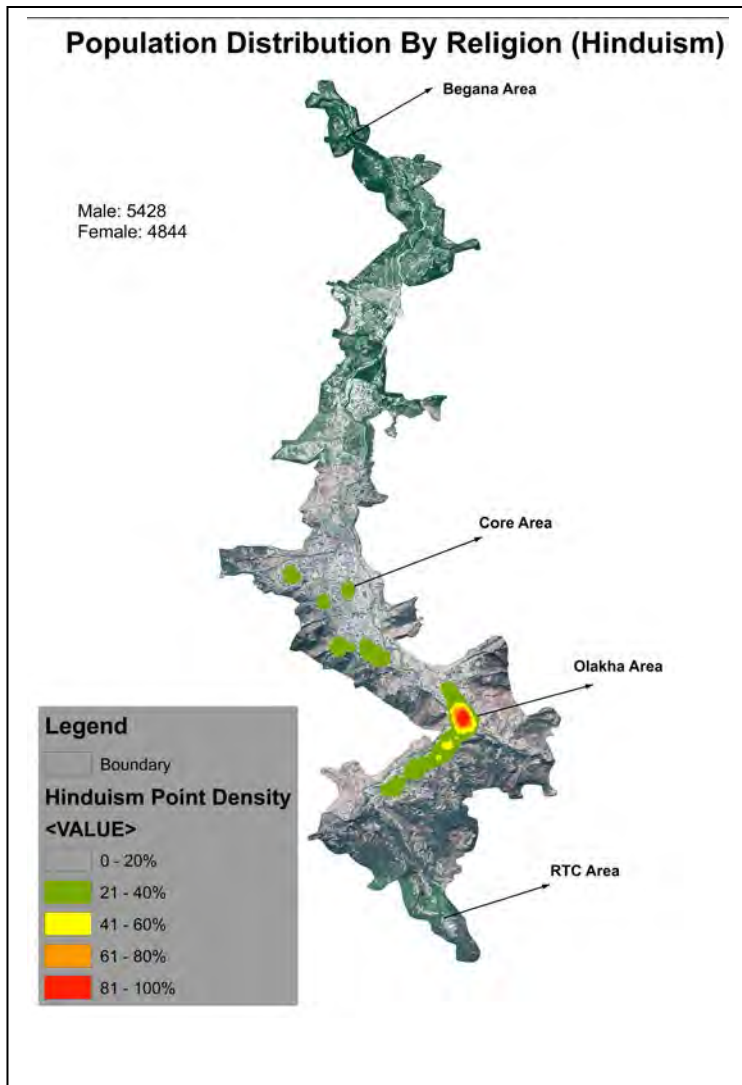


Figure 22: Population density of Hindus

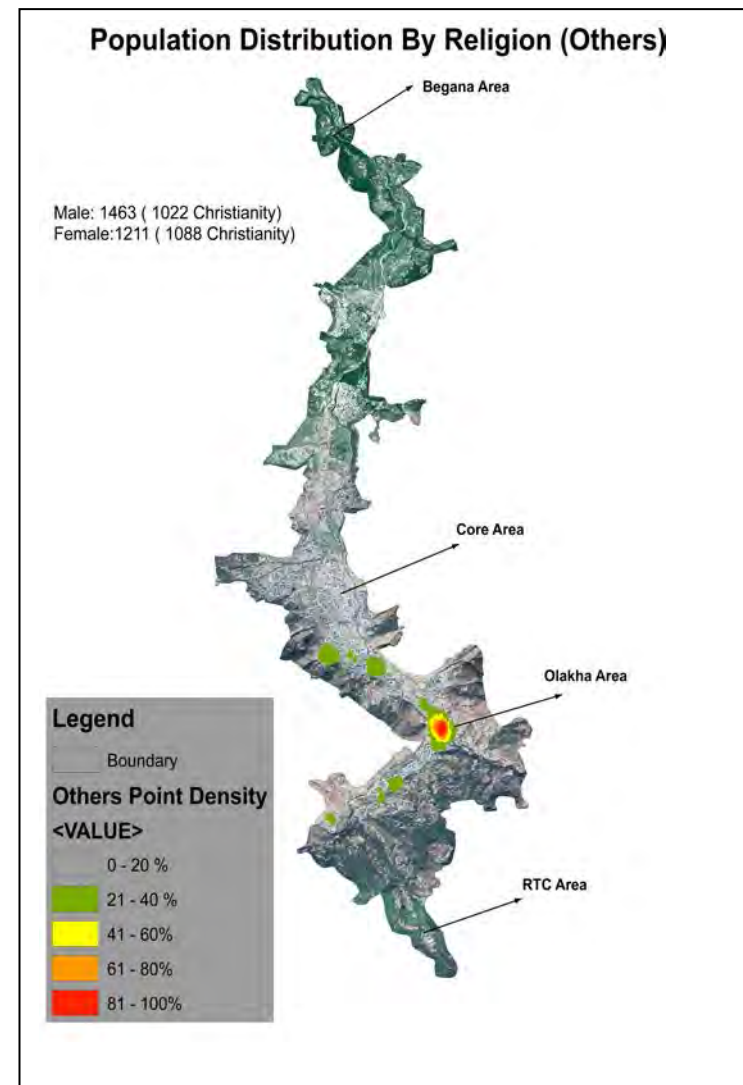


Figure 23: Population density of Other Religions

2.1.2. Household Income Details

A total of **26644** households were enumerated within and outside the Thromde. The household income detail was analyzed using a Whisker plot.

A Whisker plot represents the analysis for the household income. The plot displays the five-number summary of a set of data which indicate the minimum, first quartile, median, third quartile, and maximum dataset. As per the income details collected during the reference period, it can be deduced that, on an average, households have an income of Nu.33,094.55

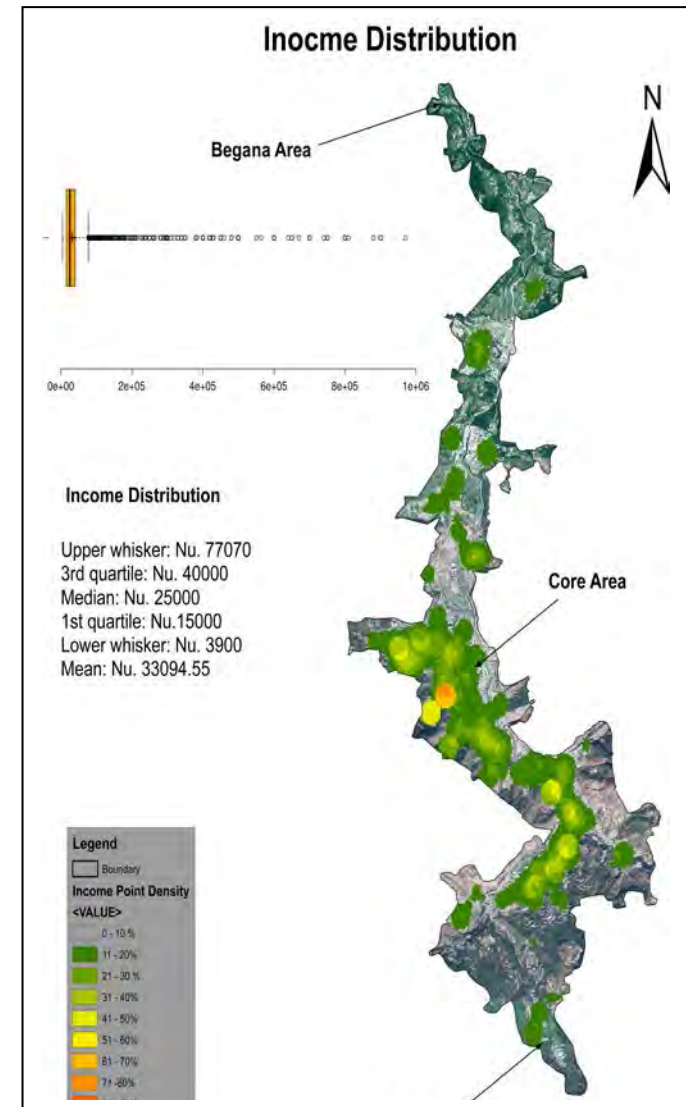


Figure 24: Population density based on Income

2.1.2.1 Home Ownership and expenses

Out of 41874 registered units, 72.5 % were residential or mixed use (residential and commercial). Among those, 18.9 % of the units were self-owned, **75.5%** of the units were rented out and 5.6 % of units were given without any rental income which comprised mostly residential unit of house owner's workers, labours and their families.

Based on the rental details collected, on an average, the rent for a household comes to Nu. 9051.45. Thus, a household in Thimphu spends **27.35%** of its income on rent.

2.1.3. Structure Data Statistics and Spatial Representation

Both main and ancillary structures were recorded for the 13095 structures enumerated in Thimphu Thromde and the peripheral areas. Building density was calculated which indicates the ratio between the total numbers of building per unit area. This only indicates the maximum or minimum number of building located in confined area but never specifies the exact location of the highest building density.

The Building Point Density Tool calculates the density of point features around each output raster cell. Conceptually, a neighborhood is defined around each raster cell center, and the number of points that fall within the neighborhood is totaled and divided by the area of the neighborhood. This gives the exact location of highest or lowest density of building.

The building point distribution indicates that the maximum concentration of buildings is from the core town area till Babesa.

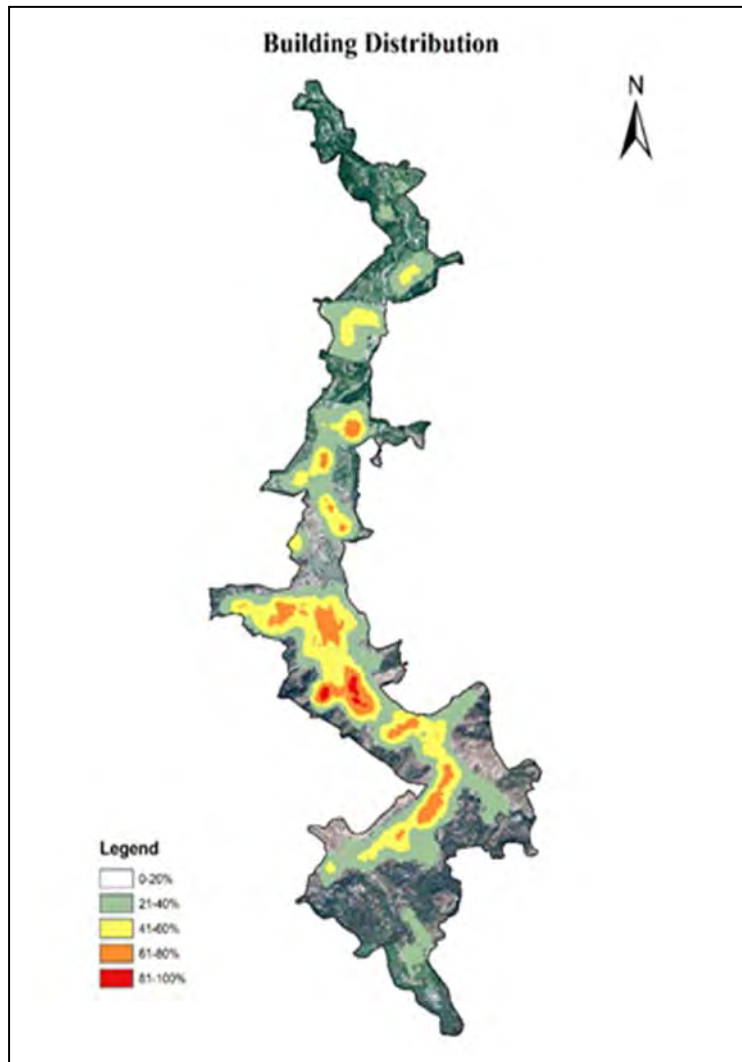


Figure 25: Building point distribution

2.1.3.1. Existence Status of the Structures

As per the existing status of the structures, 11,523 (88 %) are standing structures, 654 (5%) are under construction and remaining 916 (7%) are temporary structures like huts and sheds.

% OF STRUCTURES BY EXISTANCY STATUS

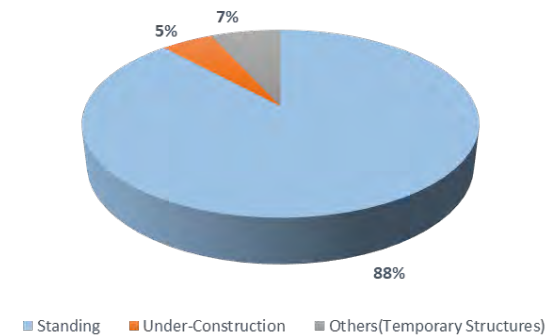


Figure 26: Building by existing status

2.1.3.2. Associative Position of the structures

Out of 13095 structures, 9393 (72%) are main structures and 3623(28%) are ancillary structures which includes labor camps, kitchens, toilet, garages etc. There were 79 structures under palaces and Royal properties that have not been covered during the survey.

% OF BUILDING WITH ASSOCIATIVE POSITION

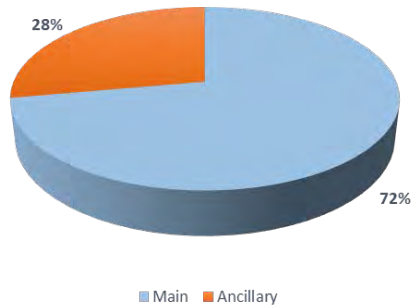


Figure 27: Building by associative position

2.1.3.3. Structures by ownership Type

Out of 13095 structures, 12,047 (92%) are singly owned including the government institutions and 1047 (8%) have joint ownership.

% OF BUILDING WITH OWNERSHIP TYPE

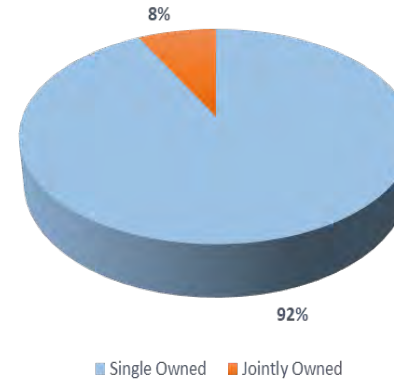


Figure 28: Building by ownership type

2.1.3.4. Structures by Number of Floors

Most of the building in Thimphu have only ground floor (3861 structures) followed by G+1(2462 structures), G+2(1010 structures), G+3 (801 structures), G+4 (749 structures), G+5 (113 structures), and G+ 6(6 structures).

Those buildings with complex floor counting and labor camps were classified under unknown category. The floor height distribution (Figure 30) analysis indicates that structures with one to floor are distributed evenly from North till the South. There are few structure comprising three floors in Changtagang and Kabesa while

the concentration of structures comprising three floors and above is more is more from Taba till the South.

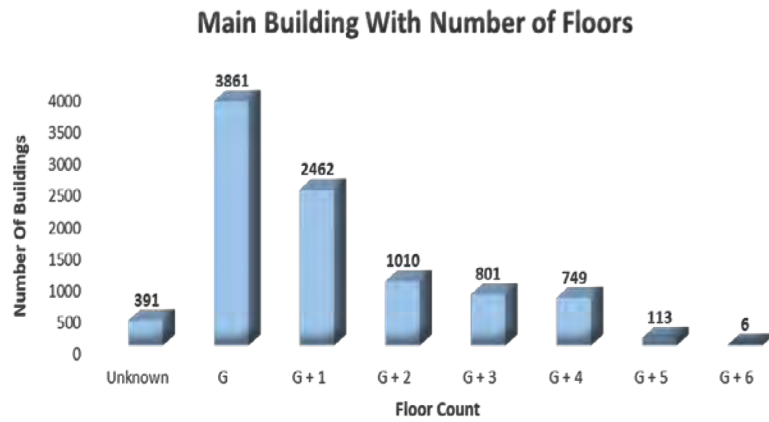


Figure 29: Buildings by Number of Floors

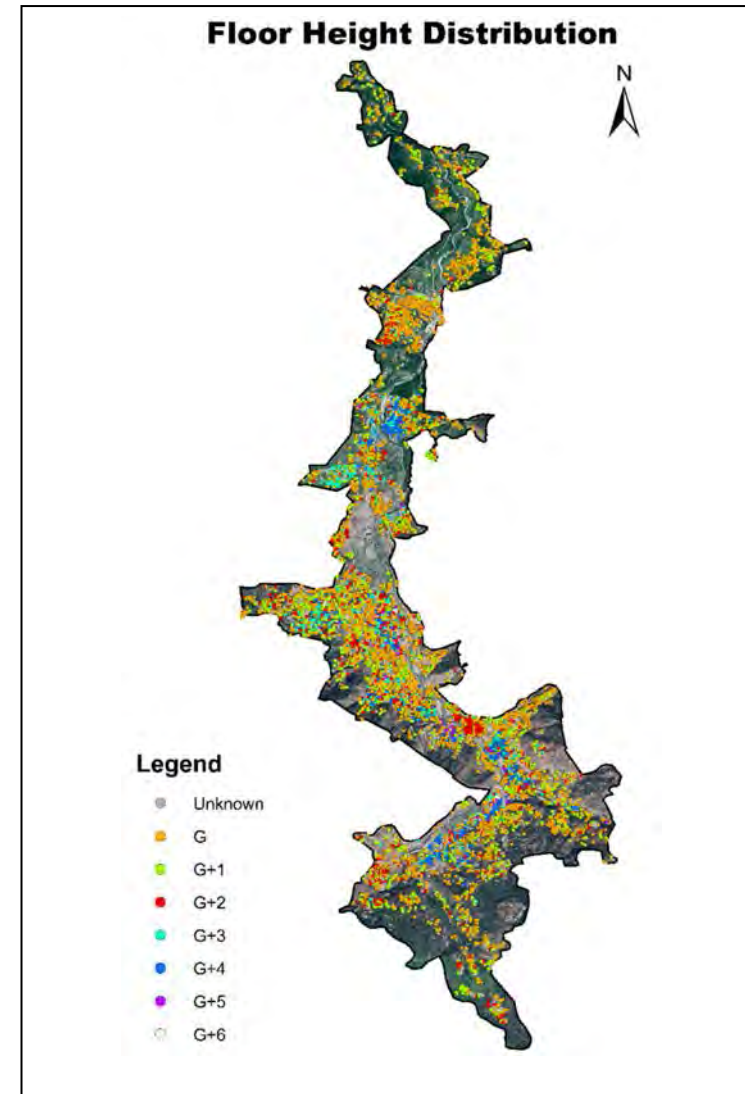


Figure 30: Building density by floor height

2.1.3.5. Structures by Use

Different types of building uses were also recorded during the enumeration. The statistics show that 7,107 structures are being used for residential purposes followed by mixed use with 1385 structures and commercial uses with 449 structures. Other uses include Institutions with 336 structures, schools with 240 structures, and religious uses with 218 structures.

The “Others category” include structures like gates, canopies, and garages while unknown uses include labor camps and structures whose uses were not recorded during the enumeration.

The point density of different building uses indicates that structures with residential uses are distributed throughout the survey area.

However, the concentration is the highest towards the West and the South (Changidaphu, Changzamtog, Changjiji, and Tshalumarphey).

As for commercial uses, the concentration is more from the core towards South with the highest concentration in the Core Area.

Similarly, mixed uses can be found mostly in the Core Area and Changjalu - Olakha Zone.

The point density of Institutional uses shows that Kawajangsa and the Core Area have the highest concentration of structures with institutional uses.

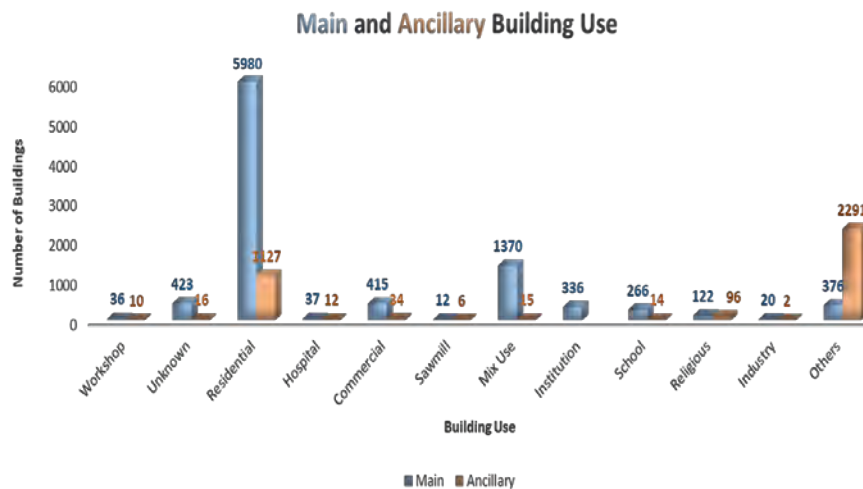


Figure 31: Buildings by Main and Ancillary Uses

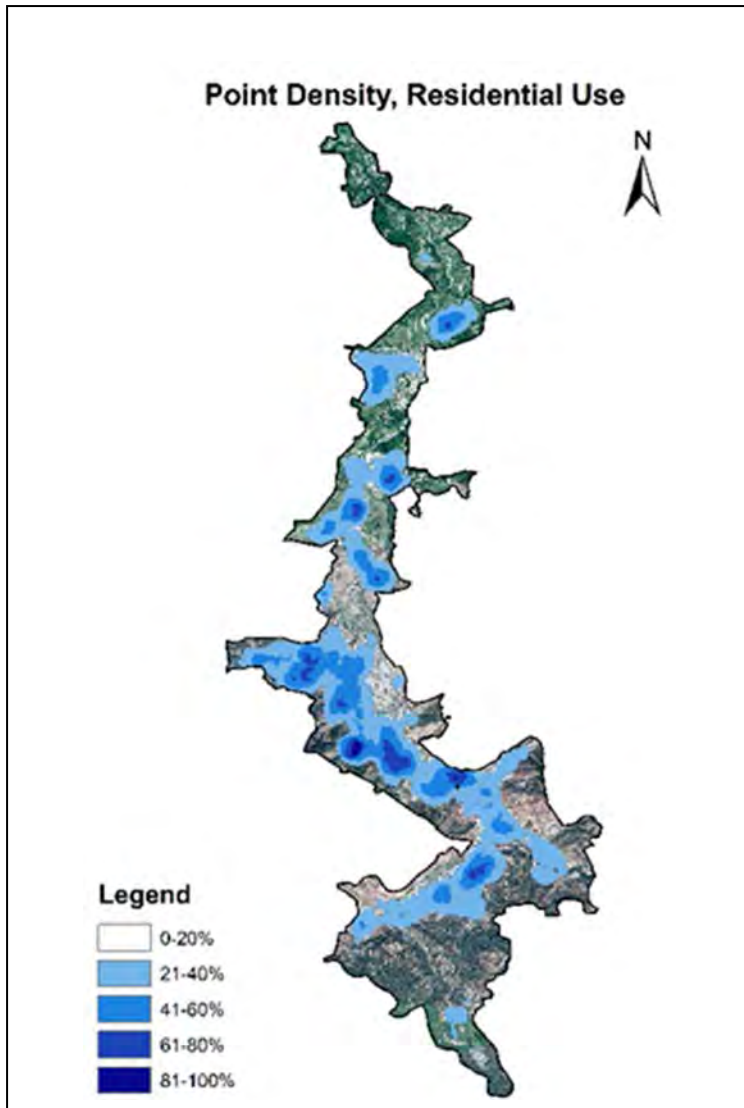


Figure 32: Building density by residential use

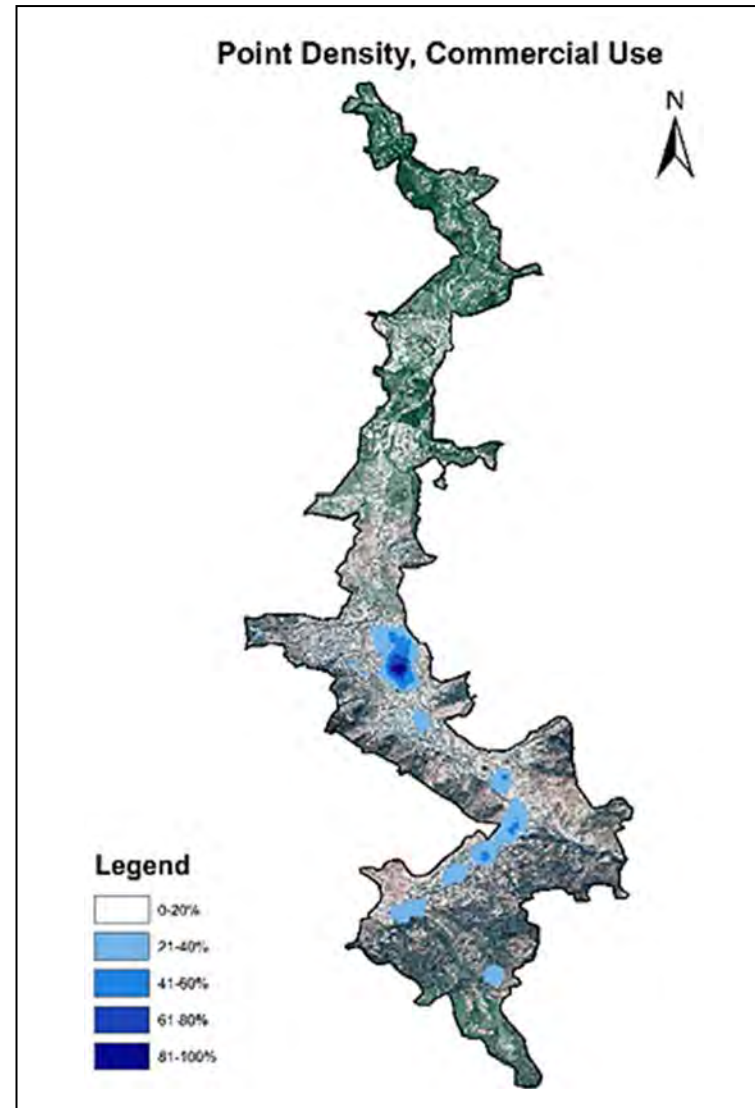


Figure 33: Building density by commercial use

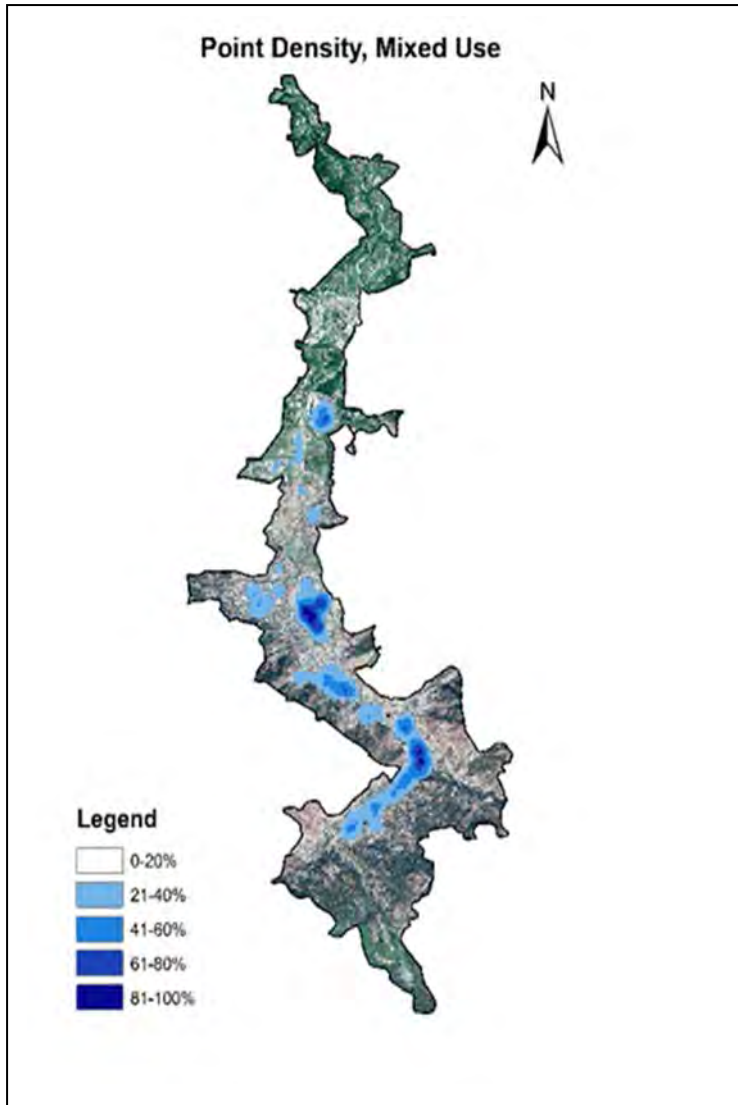


Figure 34: Building density by Mixed uses

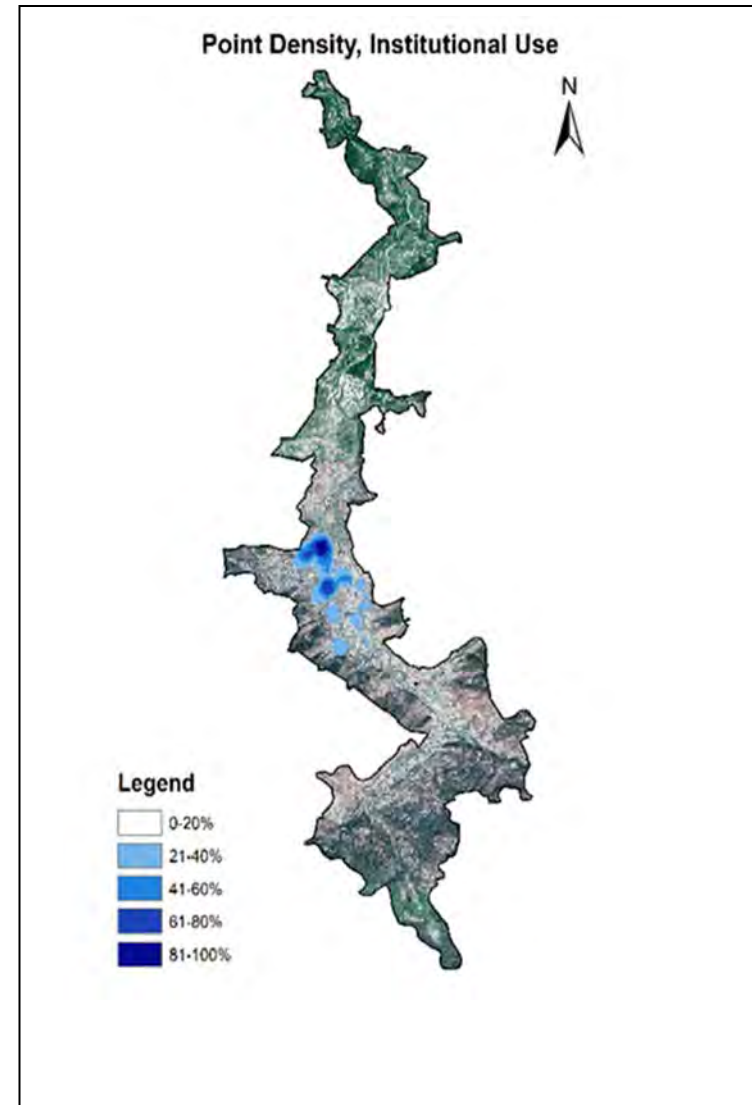


Figure 35: Building density by Institutional use

2.2.3.6. Jamthog and its usage as habitable space

Out of 354 registered units with Jamthog, 257 units (72.8 %) are being used as residential units while the rest are either empty or used as office space, for storage of water tanks, stores, guestrooms, and for religious purposes.

The highest concentration of Jamthog with residential uses can be found in Langjophaka, Changzamtog, Changjiji, Changjalu, Olakha, and Babesa. Other uses are few in number in scattered locations.

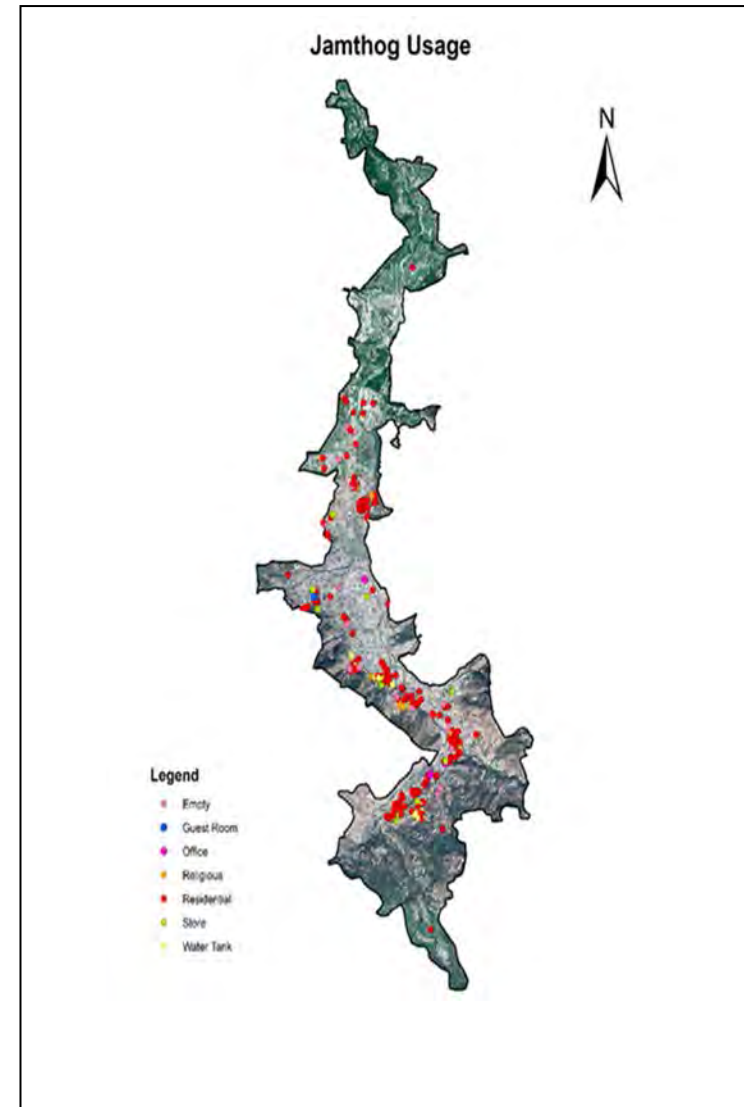


Figure 36: Density by uses of Jamthog

2.1.3.7. Structure by Construction Technique

Building classification was also carried out based on the construction technique. The three major construction styles include Composite style, Traditional style, and Contemporary Style.

Traditional style of construction includes those structures that have either been built long ago or those that have been constructed using local materials with all traditional architectural elements. Traditional buildings can still be seen scattered throughout the survey area with greater concentrations in Changtagang, Kabesa, Jungshina, Kawajangsa, and Semtokha.

Contemporary construction style includes new techniques and design that have evolved over the past few decades. This is the most common method used in Thimphu and the structures with contemporary designs can be found throughout the enumeration area with highest concentration from Kabesa till Babesa.

Composite building is one with both traditional and contemporary looks and can be seen mostly between Kabesa till Depsi.

The unknown category includes the labor camps and other temporary structures.

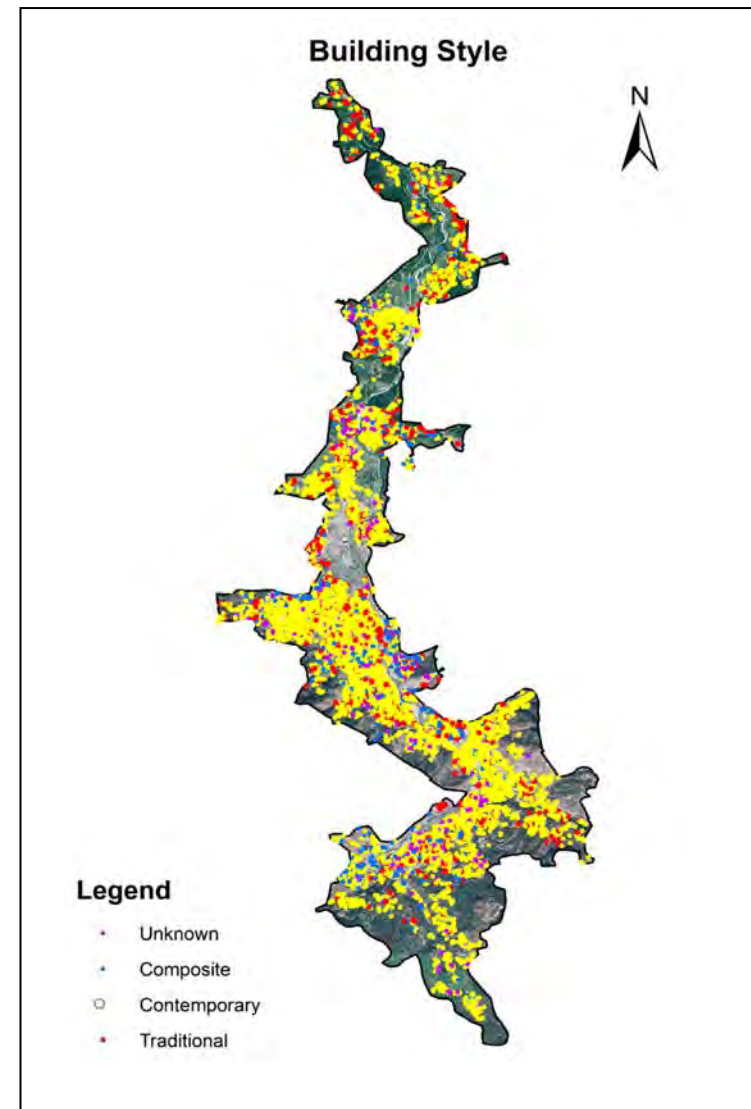


Figure 37: Building density by Construction Technique

2.1.3.8. Structure by Frame Type

Among the enumerated structures, 5499 structures (42 %) are framed structure, 2880 (22%) are load bearing and 2619 (20 %) fall under the “Others” category like the labor camps, temporary structures, and those where it was not possible to analyze the frame, either in absence of drawings or because the owners could not be contacted.

Similarly, there are few structures which is a combination of both framed and load bearing which have been categorized as Composite type.

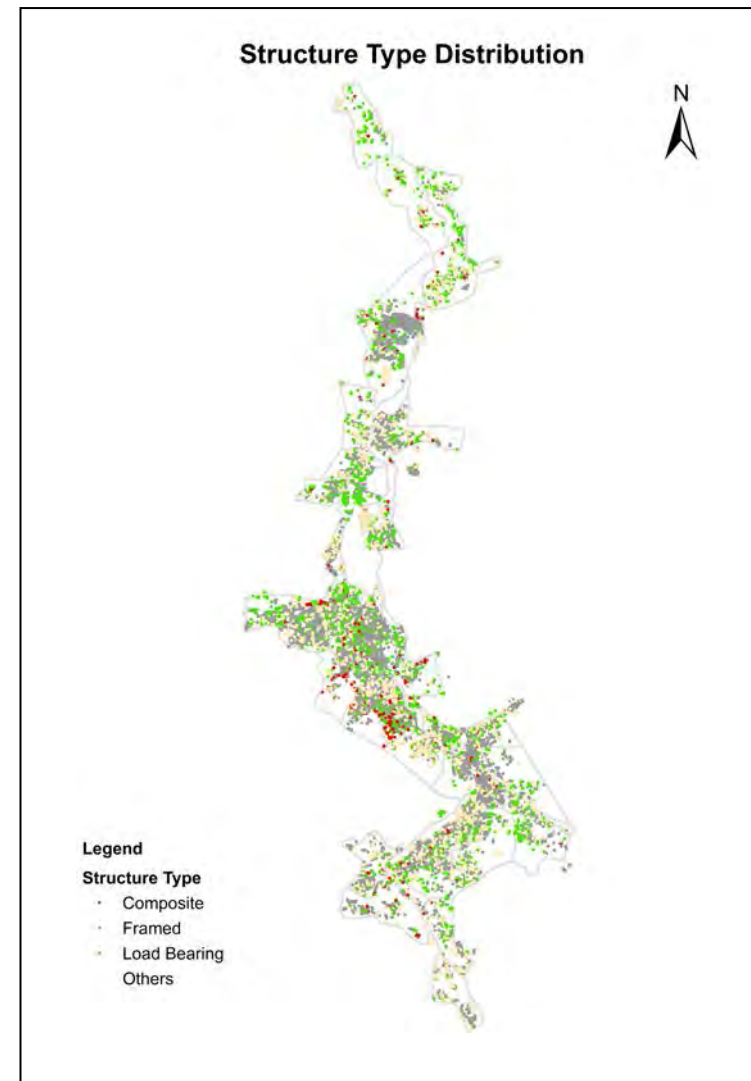


Figure 38: Building density by Frame Type

2.1.3.9. Structure by Roof Type

Depending on the architecture, the slope of a roof has both practical and aesthetic functions. Understanding the potential performance and design impact of different roof shapes and slopes can help in deciding which shingles and roofing materials are best for our homes. The roof type analysis indicates that both gable and hipped roofs are common in Thimphu and can be seen in all the areas. In Changtagang and Kabesa, gable roofs seem to be more common whereas towards the south, both gable and hipped roofs have been used uniformly.

In Bhutan, a traditional **hip roof** consists of four equal-length slopes that meet to form a simple ridge. There are variations, though, such as a half-hip that features two shorter sides with eaves. On the other hand, a **gable roof** is a roof consisting of two sections whose upper horizontal edges meet to form its ridge.

A **composite roof** type is a combination of both gable and hipped roof type. The **Others** category includes those buildings that were either under construction during the reference period, and temporary structures.



Figure 39: Building density by Roof Type

2.1.3.10. Structure by Roof Material Type

Out of 13095 surveyed structures, 12702 structures (97%) of the structures were roofed by CGI sheet which is predominantly used throughout the survey area. Remaining 392 structures (3%) includes wooden shingles, Slate, composite roofing and Others categories.

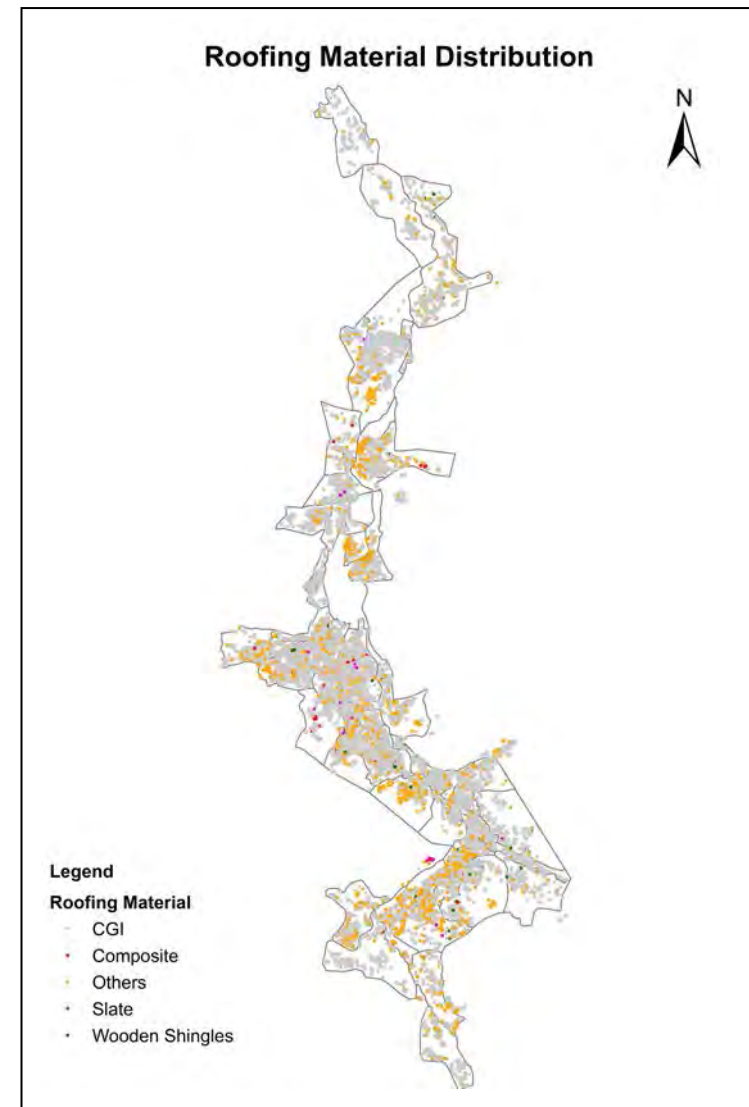


Figure 40: Building density by Roofing Material

2.1.4. Public Facilities and Amenities Data Statistics

2.1.4.1. Parking Type

The parking analysis indicates that only 19,440 households responded to the parking requirements. Among them, 4471 (23%) households park their vehicles in undesignated areas, 6220 (32%) households have designated parking areas, and the remaining 8748 (45%) households have private parking.

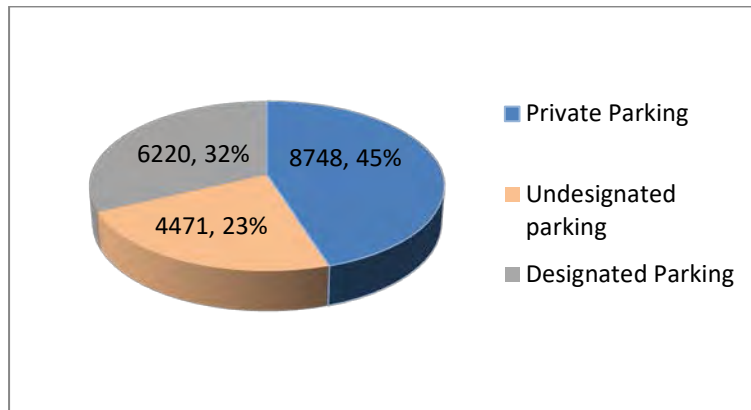


Figure 41: Parking type



Figure 42: Designated parking areas in Town



Figure 43: Undesignated parking areas

2.1.4.2. Public Transport

The most commonly used mode of public transport in Thimphu is the City bus. According to the survey, 33% of the respondents use the city bus for transportation. The Heat Map indicates that towards the North, there is almost negligible usage of public transport.

The highest usage is represented by red colour, followed by yellow with intermediate usage and blue with the lowest usage.

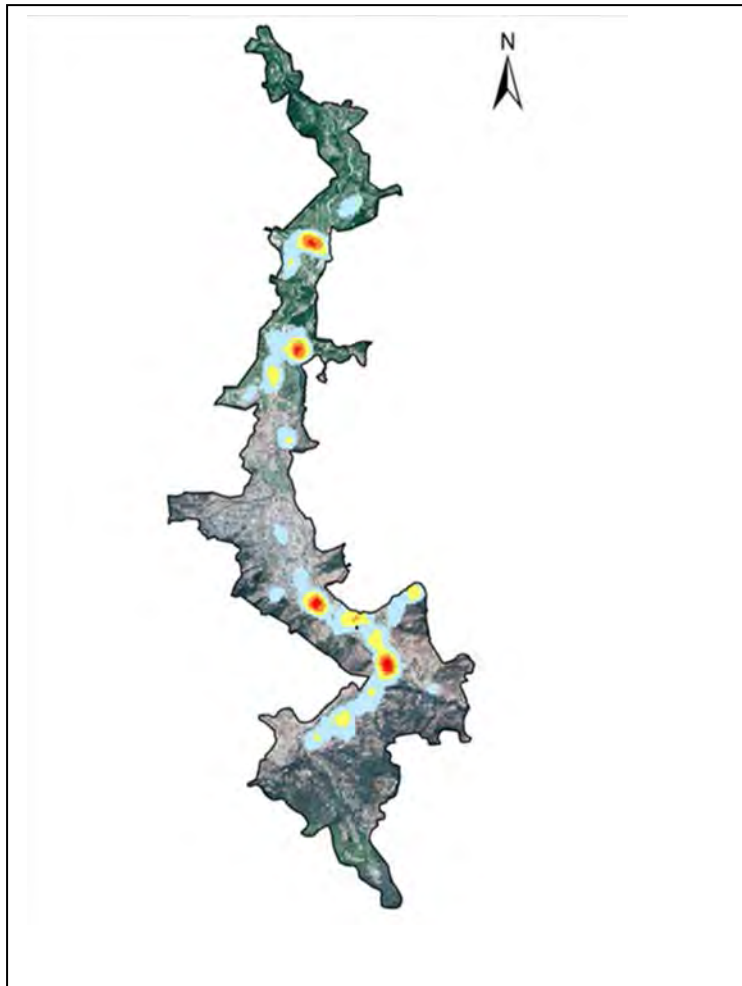


Figure 44: Heat Map for Public Transport

2.1.4.3. Other Modes of Transport

Vehicle statistics collected during the survey records 60 electric cars, 1210 are hybrid cars, 1611 taxis and 17398 other vehicles.

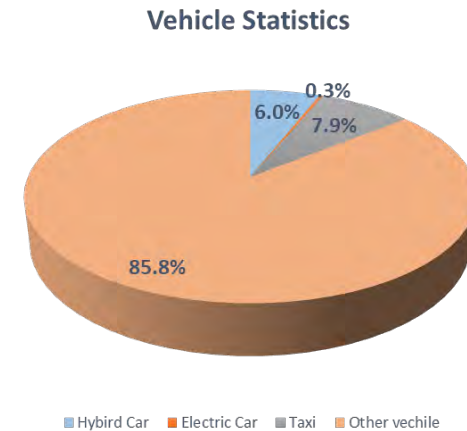


Figure 45: Vehicle Statistics

2.1.4.4. Water Supply services

The water supply statistics indicates that of the 13095 structures, all structures within the Thromde boundary is serviced by the Thromde. In addition, there are several households even within the Thromde boundary that have private individual water supply connections.

The remaining areas outside the Thromde boundary are serviced by the Rural Water Supply Scheme (RWSS) and private connections. The Others category includes those structures which are either

serviced by community supply or whose source could not be determined during the enumeration.

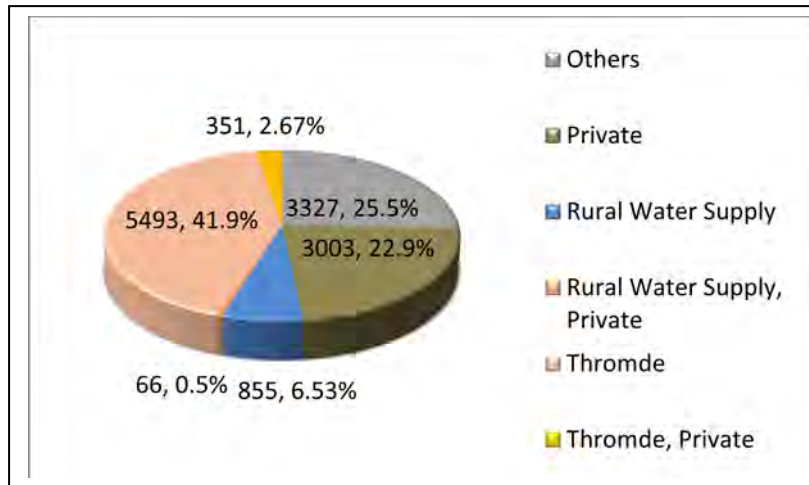


Figure 46: Types of Water Supply Schemes

2.1.4.5. Waste Collection Services

The waste collection services in Thimphu Thromde is mainly provided by the Thromde (62%) while in the Dzongkhag the service is provided by the Dzongkhag (4%) along with some Private companies (5%) on contract by the Dzongkhag. There are also some households availing waste collection services from private companies while some manage the wastes on their own accounting for 2% of the total..

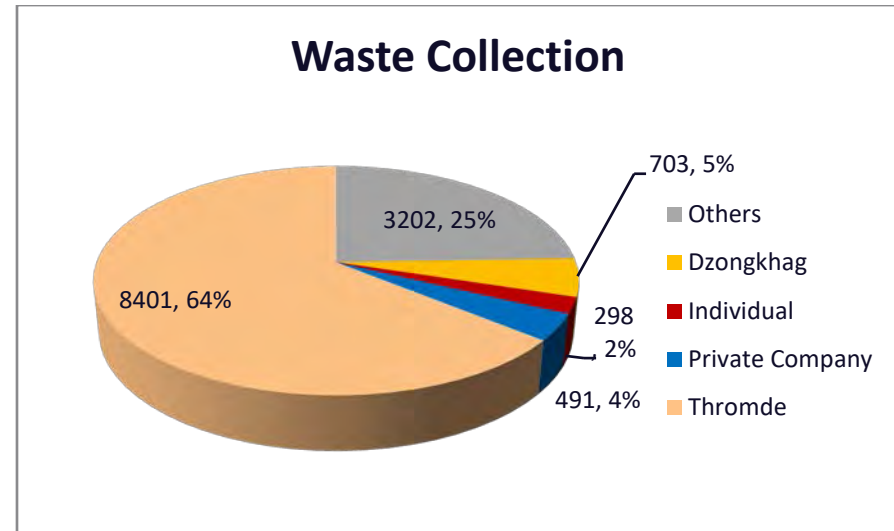


Figure 47: Types of waste collection services

2.1.4.6. Sewerage System

The statistics on the current sewerage network indicate that of the total enumerated structures, 4463 (34%) of the structures have individual septic tank followed by 3898 (30%) that are connected with the Thromde Sewerage Network, 1124 (8%), with combined septic tank, and 367 (3%) that use pit latrine. The data also indicates that 3243 (25%) fall under the Others category which includes those that could not be picked up and the ones under construction.

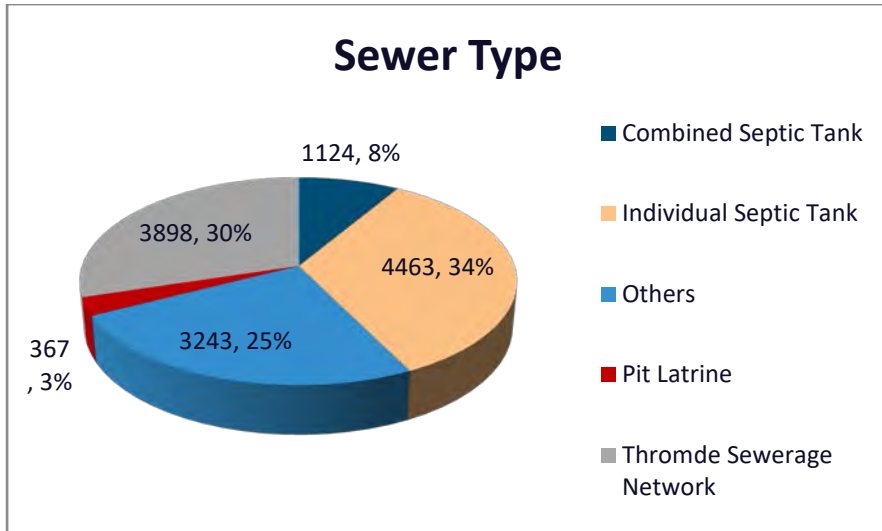


Figure 48: Types of Sewerage Connections

2.1.5. Squatter Settlements

Squatter settlement can be seen in many areas in Thimphu and are more widespread towards the central and southern areas as show in the map. The data indicates that there were **641** squatter settlements during the reference period.

This is an indication that there are many who live in deprivation of basic needs including inadequate sanitation and hygiene.



Figure 49: Squatter settlements in Thimphu



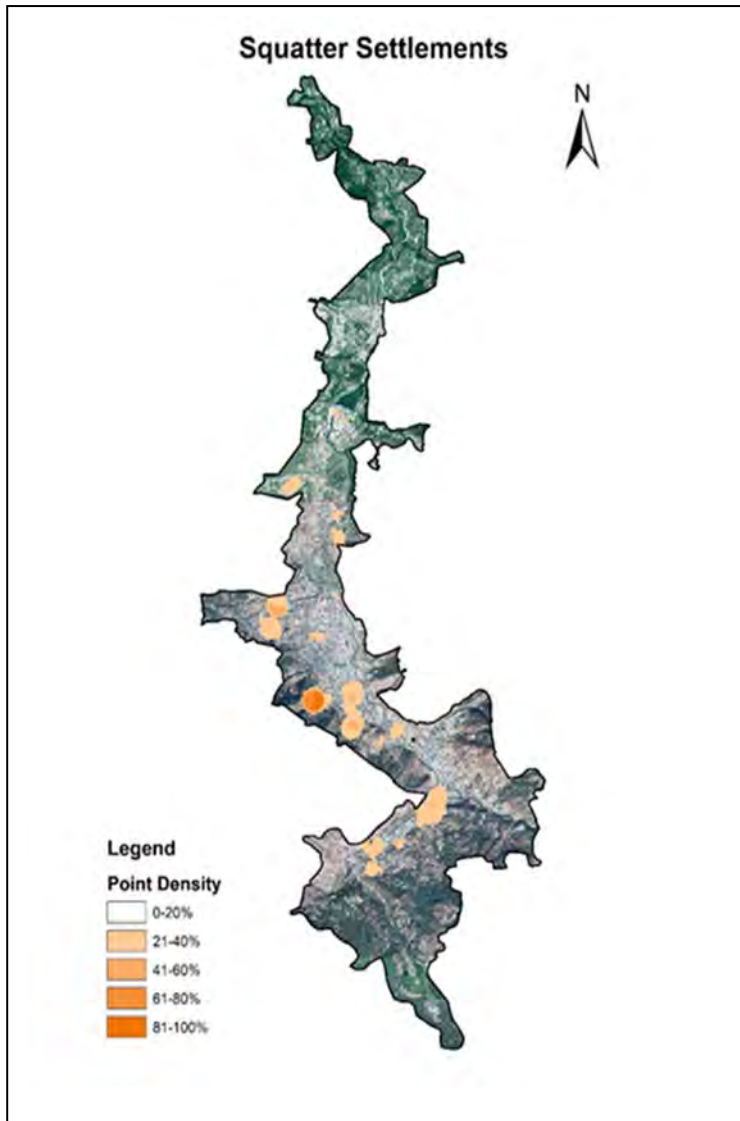


Figure 50: Density of Squatter Settlements

2.2. Advanced Data Analysis and Visualizations

The Geodatabase can be used for advanced data analysis and visualization as well. Such advanced analysis is crucial for many important activities like planning of services, traffic management, and so on. The following section contains few examples of how such analyses could be used.

2.2.1. Network Analysis

Network Analyst extension allows you to solve common network problems, such as finding best routes across a city, finding the closest emergency vehicle or facility, identifying a service area around a location, servicing a set of orders with a fleet of vehicles, or choosing the best facilities to open or close.

2.2.1.1 Shortest Route Analysis

Whether finding a simple route between two locations or one that connects several locations, people usually try to take the best route. But "best route" can mean different things in different situations. The best route can be the quickest, shortest, or most scenic route, depending on the impedance chosen. For example, if a person staying

somewhere at Babesa, has first drop at JDWNRH, then Motithang HSS, and finally Hejo Satellite Clinic, then the network analysis can be used to find the quickest and most reliable route for the person. It is an effective tool for traffic management.

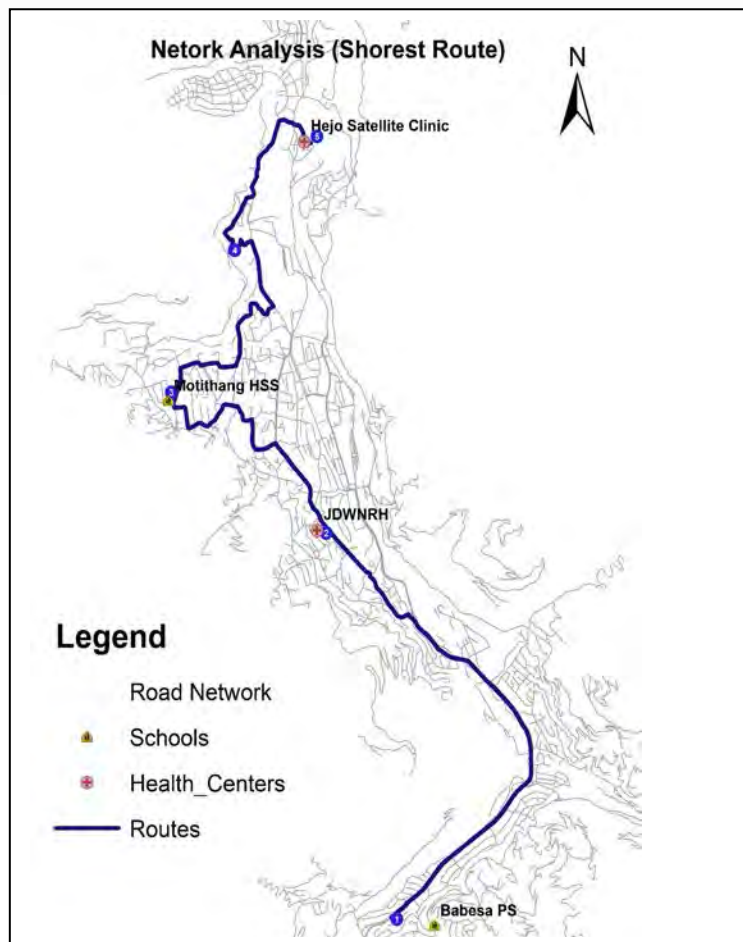


Figure 51: Network Analysis for Shortest Route

2.2.1.2 Service Area Mapping

Service areas created by network analysis help evaluate accessibility. Concentric service areas show how accessibility varies with impedance. Once service areas are created, they can be used to identify or calculate the occupied area, and the population it can cater to. Depending on the population size and the area that can be serviced, different types of services can be planned.

For example, Figure 52 shows two services and areas within 1000 m range and 569 m range they can cater to. Based on the calculation, the population coverage can be calculated and depending on that accessibility, future expansion plans, and need for similar services, could be worked out.

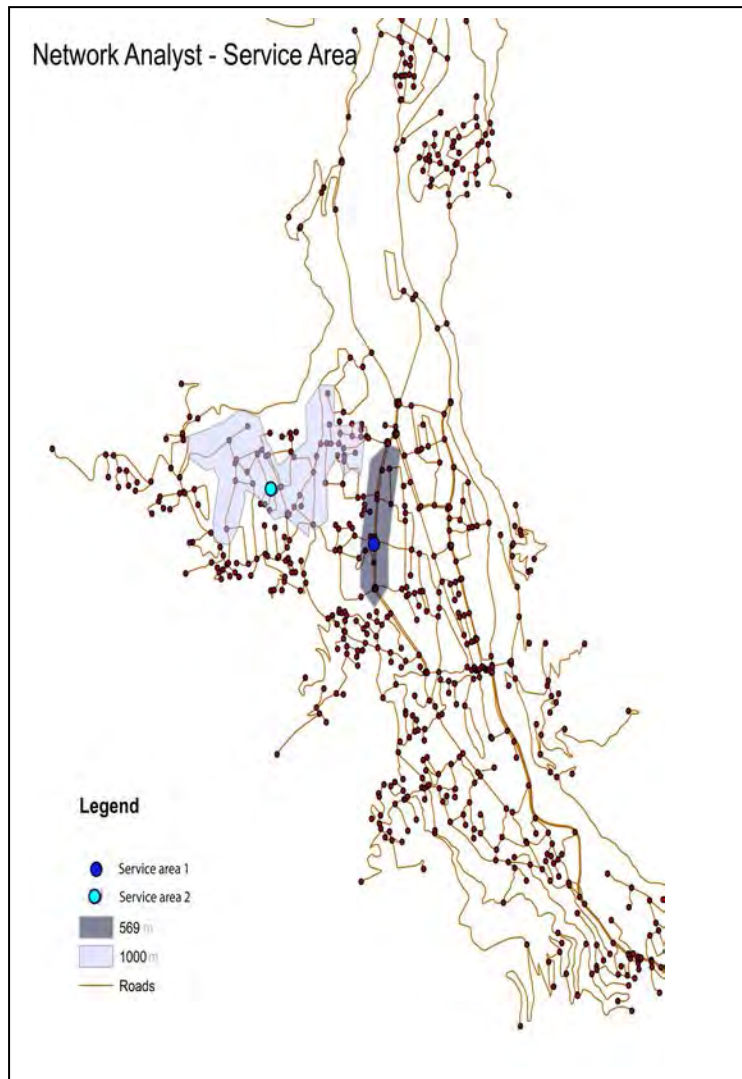


Figure 52: Network Analysis for Service Area

2.2.2. Web-based Data Visualizations

2.2.2.1. Zhi-Char App - Real Time Data Collection

The use of Global Positioning System (GPS) and Global Navigation Satellite System (GNSS) apps and solutions have made data collection smarter, better and more efficient in recent times. But in Bhutan, due to the mountainous terrain and inadequate skills and knowledge of the systems, the functionality of mobile GPS and GNSS apps is not so popular. Therefore, the need of a new application to collect geo-spatial attributes information on already existing spatial geographic features was deemed necessary. Thus the “Zhi Char App”, a web based application was developed by the Department of Human Settlement to meet the requirements.

The Zhi Char App is a data collection application developed to collect the attributes information of the geo-spatial features. The application uses GPS to direct the data collectors to the geographic features, allows updating the information on existing points, and also allows adding photos to the existing online database hosted in the server system. The Application includes a high level of customization specific to any organization's data collection needs. Data from the

surveys are sent instantly and integrated into the database for real-time monitoring by the decision makers.

The difficulty with spatial data is that it can be stored in formats that cannot be easily used by all applications or users. While one may have the hardware to use it, the right software or the knowledge to use the software may not be available. For example, the geospatial data collected for this project has been analyzed in ArcGIS format. So, if there is no one acquainted with the software, such robust data usually gets outdated and not used. That is why 'Zhi char' can be used as a dashboard (**Web-based data Visualization**) too to view the collected data for better visualization and easy understanding. The app is available at <https://zhichar.bt>

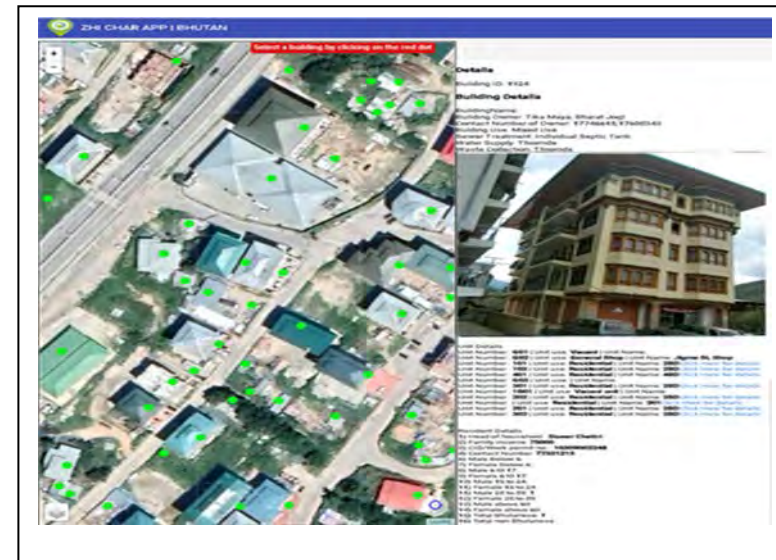


Figure 53: Zhi char Dashboard

2.2.3. Origin and Destination Mapping

Origin and destination mapping is the representation of movement of people in geographic space, from an origin to a destination. The data sets contain the details of trips between two or more geographic points or zones (which are often represented by the zone centroid). The datasets typically contain multiple non-geographic attribute information. These usually include the number of trips that take place from the origin to the destination over a given time period, sometimes the breakdown by the mode of transport used for trips,

and also sometimes the additional disaggregation of overall counts which may include trip counts at different time periods.

For example, the sample data from the geo-database survey mapping the movements of the employees from their respective origin

(building) to the destination (institution) been mapped in the web based platform. For details, [Click to View](#) or [log into](#)

<https://origindestination.herokuapp.com/>

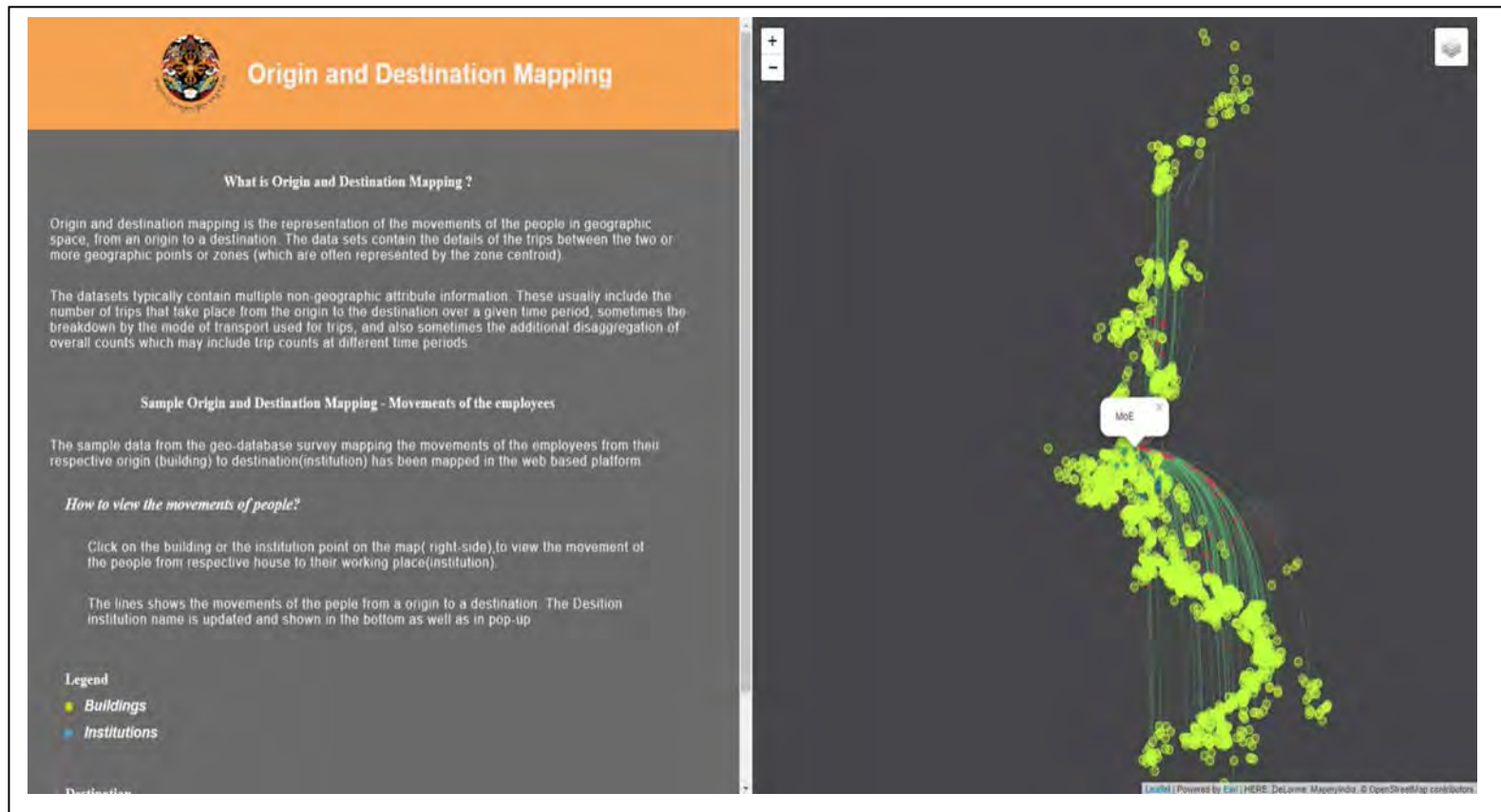


Figure 54: Origin and destination mapping

Annex 1: Enumeration Areas

Legend

 Above old Highway	 Lower Dechencholing
 Babesa Lam Tag	 Lower Motithang (Kawang Damisa)
 Babesa Lam Wog	 Lower Samtenling
 Begana	 Lower Taba
 Chang Jalu	 Lubding
 Chang Olakha	 Lungtenphu RBA
 Chang Zeri	 Norzin Tag
 Changbangdu	 Norzin Wog
 Changgangkha	 Olarongchu Workshop Area
 Changgidaphu	 Pamtsho
 Changjiji	 Pelkhil Area
 Changkhorlo	 RBA
 Changtagang	 RBP HQ
 Dantak	 RIM (Tsa Tsho)
 Debsi	 RTC Area
 Dechencholing RBG	 Samazingkha RBA
 Gangchey and Nyezergang	 Serbithang
 Hejo Village	 Simtokha Dzong Area
 IMTRAT Area	 Simtokha E4
 INDIA HOUSE	 Tshalu Bar
 JDWNRH	 Tshalumarphey
 Jungzhina	 Upper Changzamtok
 Kabisa	 Upper Dechencholing
 Kawajangsa	 Upper Motithang
 Kawang Chenjo/Dzong Precinct	 Upper Samtenling
 Langjophakha	 Upper Taba
 Lhengye Densa	 Yangchenphu Area
 Lower Changzamtok	 Zilukha



Annex 2: No of Households

Sl.no	Location	Household
1	JDWNRH	102
2	Pamtsho	355
3	INDIA HOUSE	0
4	Kawang Chenjo/Dzong Precinct	0
5	Olarongchu Workshop Area	307
6	RBP HQ	502
7	Samazingkha RBA	153
8	Dantak A	17
9	Dantak B	72
10	Pelkhil Area	45
11	Gangchey and Nyezergang	45
12	Simtokha Dzong Area	256
13	Changtagang	118
14	Lower Dechenchholing	70
15	Chang Zeri	47
16	Lhengye Densa	29
17	Tshalumarphey	86
18	Changjiji	1229
19	RIM (Tsa Tsho)	192
20	Lubding	286
21	Lower Taba	160
22	Begana	80
23	Simtokha E4	193
24	Kabisa	742
25	Serbithang	159
26	Lower Changzamtog	1432
27	RTC Area	167
28	Hejo Village	362
29	Upper Changzamtog	1364
30	Above old Highway	272
31	Norzin Wog	699
32	Upper Dechenchholing	579
33	Langjophakha	282
34	Lower Samtenling	277
35	Norzin Tag	912
36	Zilukha	374
37	Tshalu Bar	719
38	Kawajangsa	342

39	Yangchenphug Area	310
40	Upper Samtenling	600
41	Changangkha	613
42	Upper Motithang	371
43	Dechenchholing RBG	928
44	Changbangdu	800
45	Debsi	365
46	Babesa Lam Tag	700
47	Upper Taba	711
48	Changgidaphu	875
49	Lower Motithang (Kawang Damisa)	1347
50	Babesa Lam Wog	1159
51	Changkhorlo	1509
52	Chang Jalu	1343
53	Chang Olakha	2730
54	IMTRAT Area	50
55	Jungshina	869
56	Lungtenphu RBA	350
57	RBA	106
	Total Households	26644

Annex3: List of Supervisors & Enumerators

Sl.no	Name	Responsibility	Zone
Department of Human Settlement			
1	Bhawana Chhetri	Overall Coordinator	Entire survey area
2	Tashi Dema	Coordinator	South Zone
3	Tshering Dorji	Coordinator	North Zone
4	Tandin Dorji	Supervisor	RBA Lungtenphu
5	Jigme Jamtsho	Supervisor	Begana and Changtagang
6	Jigme Namgyal	Supervisor	Kabesa and Taba
7	Dorji Yangki Dorji	Supervisor	Lower Motithang and Chang Khorlo
8	Tshering Penjor	Supervisor	Jungzhina and Pamtsho
9	Tshering Denka	Supervisor	Chang Jalu and Olakha
10	Yeshey Jamtsho	Supervisor	Lubding and RIM
11	Samdrup Norbu	Supervisor	Tshalu bar and Tshalu Maphey
12	Sonam Dorjee	Supervisor	Semtokha Dzong Area
13	Kinzang Dorji	Supervisor	Changzamtog
14	Yangchen Lhamu	Supervisor	Changgidaphu
15	Deki Wangmo	Supervisor	RBP and JDWNRH
16	Ngawang Tshomo	Supervisor	Norzin Tag and Wog
17	Hem Bdr. Bhattarai	Supervisor	Depsi
18	Sangay Rinzin	Supervisor	Changjiji and Samazingkhar
19	Trilochan Sharma	Supervisor	Taba
20	Amrita Gurung	Supervisor	Norzin Tag and Wog
21	Damber Singh Mongar	Supervisor	Semtokha
22	Nima Yoezer Tenzin	Supervisor	Upper Dechencheling and Dechencheling RBG Area
23	Sonam Eden	Data Editing and Server Duty	Entire Survey Area
24	Kinley Wangyel	Data Editing and Server Duty	Entire Survey Area
25	Sangay Wangdi	Data Editing and Server Duty	Entire Survey Area
26	Tshering Phuntsho	Data Editing and Server Duty	Entire Survey Area
27	Tshering Pelden	Data Editing and Server Duty	Entire Survey Area
Thimphu Thromde			
1	Ugyen Dorji	Supervisor	Zilukha and Hejo
2	Sonam Zangmo	Supervisor	Kawa Jangsa and Dzong Area
3	Sonam Wangchuk	Supervisor	Gangchey and Neyzeygang
4	Sangay Jamtsho	Supervisor	Upper Motithang
5	Robin Rimal	Supervisor	Robin Rimal
6	Prem Kumari Chhetri	Supervisor	Samtenling
7	Passang Gyem	Supervisor	Changangkha
8	Kezang Dorji	Supervisor	Langjophaka
9	Sonam Choden	Supervisor	Lhengye Densa

10	Roshan Rai	Supervisor	Babesa Lam Tag and Wog
11	Sonam Jamtsho	Supervisor	Serbithang and RTC
12	Jigme Loday	Supervisor	Yangchenphug and Changzeri
Thimphu Thromde School Teaching and Non-Teaching Staff			
1	Nidup Lhamo		Yangchenphug HSS
2	Phuntsho Dorji	Enumerator	Yangchenphug HSS
3	Sonam Deki	Enumerator	Yangchenphug HSS
4	Kinley Wangmo	Enumerator	Yangchenphug HSS
5	Leki Dema	Enumerator	Motithang HSS
6	Sherub Wangchuk	Enumerator	Motithang HSS
7	Chimi Zangmo	Enumerator	Motithang HSS
8	Kinzang Choden	Enumerator	Motithang HSS
9	Tshering Wangchuk	Enumerator	Dechencholing HSS
10	Phuntsho Namgyel	Enumerator	Dechencholing HSS
11	Chundu Tshering	Enumerator	Dechencholing HSS
12	Sonam Chopel	Enumerator	Dechencholing HSS
13	Chungten Meto	Enumerator	Dechencholing HSS
14	Rinzin Lhamo	Enumerator	Dechencholing HSS
15	Tshering Lham	Enumerator	Dechencholing HSS
16	Pema Yuden	Enumerator	Dechencholing HSS
17	Sangay Tshering	Enumerator	Babesa HSS
18	Ugyen Dorji	Enumerator	Babesa HSS
19	Yeshey Dhendup	Enumerator	Babesa HSS
20	Choda	Enumerator	Babesa HSS
21	Pema Yoezer	Enumerator	Babesa HSS
22	Wangchuk	Enumerator	Babesa HSS
23	Sonam Thinley	Enumerator	Babesa HSS
24	Choeten Thinley	Enumerator	Babesa HSS
25	Kelzang Wangdi	Enumerator	Babesa HSS
26	Tshedupla	Enumerator	Lungtenzampa MSS
27	Karma Tshomo	Enumerator	Lungtenzampa MSS
28	Tashi Tashi	Enumerator	Lungtenzampa MSS
29	Tenzin Dorji	Enumerator	Loselling MSS
30	Nidup Gyeltshen	Enumerator	Loselling MSS
31	Ugyen Choten	Enumerator	Loselling MSS
32	Nagendra Khati	Enumerator	Loselling MSS
33	Sonam Wangdi	Enumerator	Zilukha MSS
34	Kinley Pelden	Enumerator	Zilukha MSS
35	Ngawang Yangchen	Enumerator	Zilukha MSS
36	Deki Yangzom	Enumerator	Changangkha MSS
37	Tshewang Pelmo	Enumerator	Changangkha MSS
38	Tashi Tshering	Enumerator	Changzamtog MSS
39	Yangchen Lhamu	Enumerator	Changzamtog MSS
40	Tshering Dorji	Enumerator	Changzamtog MSS
41	Thinley Jamtsho	Enumerator	Taba LSS

42	Kinley	Enumerator	Taba LSS
43	Tashi Wangmo	Enumerator	Jigme Namgyal LSS
44	Kunzang Dolma	Enumerator	Jigme Namgyal LSS
45	Sonam Yangden	Enumerator	Jigme Namgyal LSS
46	Tshering Wangmo	Enumerator	Motithang ECCD
47	Tshering Wangmo	Enumerator	Rinchenkuenphen PS
48	Jangchub Choden	Enumerator	RBP ECCD
49	Dorji Zam	Enumerator	RBP ECCD
50	Jangchub Lhamo	Enumerator	RBP ECCD
51	Tashi Pelzom	Enumerator	RBP ECCD
52	Gyem Lham	Enumerator	RBP ECCD
53	Dechen Zangmo	Enumerator	RBP ECCD
54	Seki Choden	Enumerator	RBP ECCD
55	Chokey Zangmo	Enumerator	RBP ECCD
56	Tulasi Subba	Enumerator	Dr.Tobgyal MSS
57	Karuna Gajmer	Enumerator	Dr.Tobgyal MSS
58	Tandin Dorji	Enumerator	Dr.Tobgyal MSS
59	Choten Dorji	Enumerator	Deki PS
60	Sangay Tenzin	Enumerator	Deki PS
61	Rinzin Dema	Enumerator	Kelki HSS
62	Asha Biswa	Enumerator	Kelki HSS
63	Tshering Yuden	Enumerator	Kelki HSS
64	Dorji	Enumerator	Kelki HSS
65	Dechen Wangdi	Enumerator	Thromde Education
66	Khenrab Jamtsho	Enumerator	Rinchen HSS
67	Menuka Gurung	Enumerator	Thimphu PS
68	Sonam Tenzin	Enumerator	Kuenselphodrang PS
69	Leythro Dorji	Enumerator	Kuenselphodrang PS
70	Tandin Bidha	Enumerator	Babesa PS
71	Yeshey Choden	Enumerator	Etho Meto PS
72	Anu Golay	Enumerator	Babesa HSS
73	Chimmi Wangmo	Enumerator	Not given
74	Tandin Wangmo	Enumerator	Not given
75	Dechen Dema	Enumerator	Not given
76	Ugyen Tshering	Enumerator	Not given
77	Choda	Enumerator	Not given
78	Yangka Wangmo	Enumerator	Not given
79	Yuden	Enumerator	Not given
80	Tshering Lham	Enumerator	Not given
81	Tashi Dhendup	Enumerator	Not given
82	Tshering Dema	Enumerator	Not given
83	Sonam Choden	Enumerator	Not given
84	Dechen Lhamo	Enumerator	Not given
85	Tenzin Norbu	Enumerator	Not given
86	Sonam Choki	Enumerator	Not given
87	Zam	Enumerator	Not given

88	Pema Lhaden	Enumerator	Not given
89	Chimi Wangchuk	Enumerator	Not given
90	Pema Choki	Enumerator	Not given
91	Samten Choki	Enumerator	Not given
92	Pema Yangzom	Enumerator	Not given
93	Sonam Yangchen	Enumerator	Not given
94	Karma Dema	Enumerator	Not given
95	Kunzang Wangdi	Enumerator	Not given
96	Nima Wangchuk	Enumerator	Not given
97	Kencho Wangdi	Enumerator	Not given
98	Tshering Lhamo	Enumerator	Not given
99	Tashi Wangchuk	Enumerator	Not given
100	Dawa Dolma	Enumerator	Not given
101	Ngawang Phuntsho	Enumerator	Not given
102	Sangay Duba	Enumerator	Not given
103	Phurpa Wangdi	Enumerator	Not given
104	Kencho Bidha	Enumerator	Not given
105	Sapuna Tamang	Enumerator	Not given
106	Sarita Gurung	Enumerator	Not given
107	Tashi Doma	Enumerator	Not given
108	Pema Yangzom	Enumerator	Not given
109	Tenzin Wangmo	Enumerator	Not given
110	Tika Gurung	Enumerator	Not given
111	Sonam Tsheltrium	Enumerator	Not given
112	Phub Rinchen	Enumerator	Not given
113	Rinzin Dorji	Enumerator	Not given
114	Tenzin Dema	Enumerator	Not given
115	Kinley Sithup	Enumerator	Not given
116	Sangay Thinley	Enumerator	Not given
117	Dawa Dema	Enumerator	Not given
118	Sonam Tobgay	Enumerator	Not given
119	Choki Wangmo	Enumerator	Not given
120	Tshering Lham	Enumerator	Not given
121	Dechen Dema	Enumerator	Not given
122	Kinley Dema	Enumerator	Not given
123	Dawa Lhamo	Enumerator	Not given

Office of the De-suung

	Names	Responsibility	Desuup ID No
1	Kinley Wangchuk	Enumerator	DS(02)11-167
2	Yeshi Nidup	Enumerator	DS(40)20-10347
3	Sangay Choda	Enumerator	DS(41)20-14704
4	Tshering Deki	Enumerator	DS(40)20-12649
5	Kinga Tshering	Enumerator	DS(40)20-12282
6	Thinley Choden	Enumerator	Ds(40)20-10034

7	Bijay Ghalley	Enumerator	DS(41)-20-14549
8	Pem Pem Jamtshok	Enumerator	DS(40)20-11930
9	Pema Yuden	Enumerator	DS(40)20-12708
10	Sangay Zangmo	Enumerator	DS(40)20-11926
11	Selden	Enumerator	Ds(39)-20-8238
12	Karma Tshomo	Enumerator	Ds(41)20-14671
13	Sangay Tenzin	Enumerator	40-20(11914)
14	Yangchen Lhamo	Enumerator	DS(40)20-11969
15	Sonam Yangchen	Enumerator	DS(39)20-7801
16	Khandu Wangmo	Enumerator	DS(40)20-12807
17	Namgay Wangchuk	Enumerator	(40)20-12628
18	Sithup Gyeltshen	Enumerator	DS-40(20)-11948
19	Lhatu	Enumerator	Ds(34)19-3993
20	Deki	Enumerator	13165
21	Sonam Jamtsho	Enumerator	DS(39)20-9153
22	Choda Jamtsho	Enumerator	DS(02)11-224
23	Kencho Drukpa	Enumerator	DS(39)20-8656
24	Tenzin Wangchuk	Enumerator	DS(40)20-10581
25	Joshna Monger	Enumerator	Ds (41)20-12882
26	Pema Choden	Enumerator	
27	Sova Chhetri	Enumerator	DS (38)20-5909
28	Tandin Phub	Enumerator	DS (39)20 7877
29	Sherab Gyeltshen	Enumerator	DS(17)15-1942
30	Tenzin Norbu	Enumerator	DS(30)20-8676
31	Dujum Dema	Enumerator	DS(40)20-10494
32	Tandin Penjor	Enumerator	DS(40)20-11452
33	Dechen Wangmo	Enumerator	DS(41)20-14786
34	Cheten Zangmo	Enumerator	Ds (41)20-13413
35	Yeshi Dendup	Enumerator	DS(40)20-11771
36	Sonam Dorji	Enumerator	DS(39)20-9335
37	Sangay Choden	Enumerator	DS(40)20-11933
38	Yeshi Norbu	Enumerator	Ds(41)20-14014
39	Sonam Phuntsho	Enumerator	DS(40)20-10565
40	Karma Jigme	Enumerator	DS(39)20-8218
41	Yeshi Dema	Enumerator	Ds(39)20-7794
42	Dechen Selden	Enumerator	DS(39)20-8932
43	Sonam Tenzin	Enumerator	10113
44	Tashi Penjor	Enumerator	Ds(40)20-12193
45	Jigme K Tshering	Enumerator	2571
46	Tshewang Norbu	Enumerator	DS(41) 20.14274
47	Sonam Choden	Enumerator	Ds(40)20-11633 U
48	Chimi Dorji	Enumerator	20-41-14439
49	Ngawang Dorji	Enumerator	DS(40)20-11852
50	Tshering Chogyel	Enumerator	Ds(41)20-13533
51	Ngawang Jampa	Enumerator	DS(39)20-8007
52	Tshewang Penjor	Enumerator	Ds(39)20-8544

53	Namgay Thinley	Enumerator	DS-37-20-4356
54	Sonam Jamtsho	Enumerator	DS(41)20-13902
55	Pema Yangzom	Enumerator	Ds(40)20-12561
56	Karma Yangchen Tshomo	Enumerator	Ds(41)20-14671
57	Tshering Yangzom	Enumerator	1052
58	Tshering Yangki	Enumerator	5806
59	Ugyen Tshomo	Enumerator	(40)30-11876
60	Yezer Choki	Enumerator	Ds(40)20-11886
61	Sonam Dorji	Enumerator	Ds(39)20-7879 U
62	Ganga M. Tamang	Enumerator	DS(38)20-5863
63	Ngawang Younten	Enumerator	Ds-39-9054
64	Sonam	Enumerator	DS(27)17-3208
65	Karma Wangchuk	Enumerator	DS(40)20-11457
66	Kezang Dema	Enumerator	Ds(40)20-11489
67	Nim Pem	Enumerator	(49)20-12715
68	Chokey Wangmo	Enumerator	DS(40)20-10888
69	Deki Dema	Enumerator	41-20-13043
70	Sangay Lhaden	Enumerator	DS(40)20-12084
71	Kelzang Tshomo	Enumerator	DS(40)20- 12088
72	Sonam Tobgay	Enumerator	Ds(39)20-9138
73	Karma Wangdi	Enumerator	DS(41)20-13274
74	Tandin Gyeltshen	Enumerator	DS(40)20-12015
75	Pema Wangchuk	Enumerator	DS(40)20-12769
76	Pema Yangchen	Enumerator	DS(40)20-11357
77	Sonam Gaki	Enumerator	11882
78	Ugyen Dorji	Enumerator	9037
79	Tshering Nima	Enumerator	DS(39)-7914
80	Sonam Wangchen	Enumerator	DS(04)12-434
81	Tashi Dhendup	Enumerator	DS(40)20-11755 U
82	Sangay Thinley	Enumerator	DS(40)20-11391
83	Wang Tshering	Enumerator	DS(39)20-8889
84	Dema	Enumerator	Ds(40)20-12246
85	Kinley Tenzin	Enumerator	DS(39)20-9074
86	Mendrel Tshomo	Enumerator	DS(40)20-12058
87	Sonam Dhendup	Enumerator	DS(11)14-1185
88	Nidup Jamtsho	Enumerator	DS(36)19-4262
89	Karma Pem	Enumerator	Ds(40)20-11917
90	Dawa Zangmo	Enumerator	DS(40)20-11566
91	Sonam Lhaden	Enumerator	DS (40)20-12050
92	Jigme Tenzin	Enumerator	DS(40) 2020- 12823
93	Tashi Namgay	Enumerator	Ds(41)20-12971
94	Namgay Rinchen	Enumerator	Ds(40)20-10274
95	Sangay Sumden	Enumerator	Ds(39)20-8931
96	Kabita Mongar	Enumerator	Ds (40)20-10375
97	Sonam Tobgyal	Enumerator	DS(39)-20-7909

98	Wangdi Tshering	Enumerator	Ds(40)20-12289
99	Tenzin Norbu	Enumerator	DS(19)16-2259
100	Thuji Yonten	Enumerator	Ds(39) 20-8430
101	Dejong Yeshey Choden	Enumerator	DS(39)20-9104
102	Tashi Gyeltshen	Enumerator	Ds(38)20-5425
103	Yeshey Dorji	Enumerator	N/A
104	Chencho Norbu	Enumerator	N/A
105	Chimi Dema	Enumerator	Ds(41)20-14800
106	Phub Dorji	Enumerator	N/A
107	Leki Phuntsho	Enumerator	DS(39)20-8215
108	Sonam Euden	Enumerator	Ds(40)20-10309
109	Tara Mongar	Enumerator	DS(39)20-9508
110	Rinzin Tempa	Enumerator	DS(39)20-9515
111	Tshering Denkar	Enumerator	DS(04)12-469
112	Dorji Khandu	Enumerator	Ds(39)20-8948
113	Chhejay Dorji	Enumerator	N/A