



# ENVISION OF “INCLUSIVE & SUSTAINABLE URBANIZATION” DISCOVERING LAND USE/ LAND COVER CHANGE OF RISALI CITY: NEW NAGAR NIGAM, BHILAI (C.G.), INDIA

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**Abstract:** Urbanization in India leads to concentration and population growth through urban sprawl associated with improper use of land. The city of Risali in Bhilai is a rapidly growing urban center with a diverse range of land uses and cover types. This research aims to review the available literature on the mapping of land use and land cover and its analysis in Risali and to give proposals on the potential applications and implications of this research for inclusive and sustainable urban development. The literature study revealed several studies that have used GIS techniques to map and analyze the use of land and cover in Risali. According to this research, the city is distinguished by a wide variety of land uses and cover types, including commercial, residential, agricultural, and industrial areas. The literature also revealed several studies that have analyzed the mapping of the use of land and cover to comprehend the distribution and changes in the use of land and cover in the city. These studies have discovered that a number of variables, including population increase, economic development, and accessibility of infrastructure and services, influence changes in land use and cover.

**Index Terms:** GIS, Land use, Land cover, Urbanization.

## I. INTRODUCTION

Land use and land cover mapping are critical tools for understanding the distribution and dynamics of human and natural systems in urban areas. The city of Risali in Bhilai is an excellent case study for this type of analysis, as it is a rapidly growing urban center with a diverse range of land use and cover types. The objective of this study is to review the available literature on mapping the use of land and cover analysis in Risali and aid in proposals considering potential applications and implications of this research for inclusive and sustainable urban development. The phrase "land use" is intended to define the utilization of land through human activity. It stands for the social, economic, and cultural activities. That covers uses for agricultural, residential, industrial, mining, and recreational. This area functions at the specified locations. The residential areas, commercial, industrial, and retail business locations, as well as areas designated for institutional and recreational uses, contribute to the special distribution of the city's purposes. Land use on public and private properties frequently diverges greatly. Humans can use certain land parcels in a variety of ways.

## II. METHODOLOGY

The methodology for research on land use and land cover mapping, involving Risali, should involve gathering both primary and secondary data. Questionnaires, interviews, telephone surveys, and household surveys were used to collect the primary data. Through papers and reports on government policies, secondary data has been acquired, additionally from experts and research papers. Several classifications, approaches, and tools are involved with GIS-based analysis and interpretation of the results

### III. LITERATURE REVIEW

This section would summarize and critically evaluate the existing literature on land use and land cover change and analysis mapping in Risali and the surrounding region, containing a variety of approaches, models, and information sources that were employed. It would also include a review of remote sensing techniques and GIS-based methodologies that are commonly used in this field.

#### Land use classification:

On half of the planet's habitable land, agriculture is practiced. It is also significantly unequal how much land is used for cattle and crops for human consumption. Around the world, 77% of farmland is used for livestock. Included in this are areas utilized for animal grazing and those where crops are grown as animal feed. A land use classification is a division that provides information on the many types of human activities carried out in relation to both the land cover and its use. It might also make it simpler to assess how potential or alternative uses of real estate will affect the environment.

#### Land cover

The term "land cover" describes the physical material that covers the surface of the earth, including vegetation, bare soil, water, and urban infrastructure. Its identification, delineation, and mapping are crucial for planning, resource management, and global monitoring studies.

#### Class definition

The phrase "land use pattern" refers to the structure or organization of the uses of the land. The land could be used for pasture, farming, or forest. The qualities of the relief, the climate, the soil, the population density, technological difficulties, and socioeconomic considerations all have an impact on the way space is used.

#### 1. Water

Rivers, lakes, ponds, the oceans, and flood salt plains are a few places with water all year round. These places might not contain regions with irregular or transient bodies of water, sparse vegetation, rock outcrops, or man-made buildings like docks.

#### 2. Tress

A substantial collection of dense, closed-canopy plants that grow at least 15 feet tall Such as Mangroves, forested vegetation, or dense tall vegetation clusters are examples of dense or tall vegetation that has ephemeral water or a canopy that is too thick to detect water beneath it. Furthermore, in marshes, plantations, savannas, or other habitats that is similar to those.

#### 3. Flooded vegetation

A place containing any form of vegetation that is plainly interlaced with water for a large portion of the year, such as a seasonal floodplain that contains a combination of grass, bushes, trees, and bare soil. Mangroves that are submerged, emerging vegetation, rice fields, and other extensively sprayed and flooded crops are some examples.

#### 4. Crop

Humans have organized and planted crops, cereals, and grasses. These are not above tree height, such as organized maize, fallow land, wheat, and soy.

#### 5. Built area

Large uniform impervious surfaces, such as those seen in structures for parking, offices, and residential complexes, have significant road and rail networks; examples include residences, densely populated towns and cities, and paved or asphalt roadways.

#### 6. Bare ground

Explicit rock or soil, dry salt flats, pans, dried lake beds, and mines are a few examples of such conditions. It reflects on particularly those regions of rock or soil that see little to no year-round growth.

#### 7. Snow/ Ice

Glaciers, permanent snowpack, and areas with snow fields are examples of large, uniform areas of permanent snow or ice that are only found in mountainous regions or at the northernmost latitudes.

#### 8 Clouds

There is no information on the land cover because of the ongoing cover.

#### 9. Rangeland

Included in this are parks, golf courses, lawns, and pastures, also wide savanna with few to no trees. Wide open areas with uniform grass cover and hardly any higher vegetation, including grasses, unprocessed wild grains and despite a plan. Natural meadows and pastures having few or no trees as a backdrop are also present.

### IV. AIM:

To initiate inclusive and sustainable urban development that emphasizes improving the economy, protecting the environment, and protecting the identity and culture of the city.

## V. OBJECTIVE

- To prepare the most suitable and sustainable land use plan for Risali, keeping in view its physical, socio-economic, and environmental importance.
- To focus on inclusive development and growth in society.
- To initiate mixed land use as an economic source in the development of urban corridors.
- Interventions in land uses by focusing on recreational and increasing FAR and ground coverage according to density.

## VI. THE PLANNING AREA (RISALI CITY)

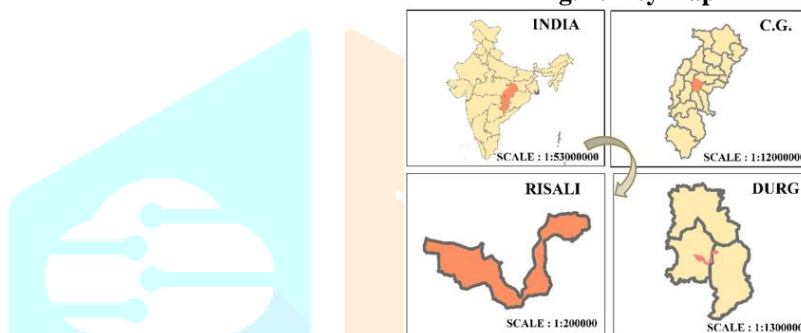
### • Introduction

Risali Municipal Corporation came into existence independently on Friday, December 27, 2019, when the notification for the formation of a separate Risali Municipal Corporation with the authority of the governor was finally published in the gazette. With this, the 21-year-old relationship of 13 wards of the Risali area with Bhilai Municipal Corporation has now broken down. The councillorship of the councilors here is also over now.

### • Risali

City Profile: Risali is part of Bhilai. This is known as an industrial town. Durg's twin city is Bhilai, which is referred to as "mini India" for its industrial growth, social harmony, and cultural diversity. The Bhilai Steel Plant has been awarded the prime minister's trophy eleven times for the country's best integrated steel plant. It also has the label "education hub."

**Fig. 1: Key map**



Source: Author

### • Planning Area

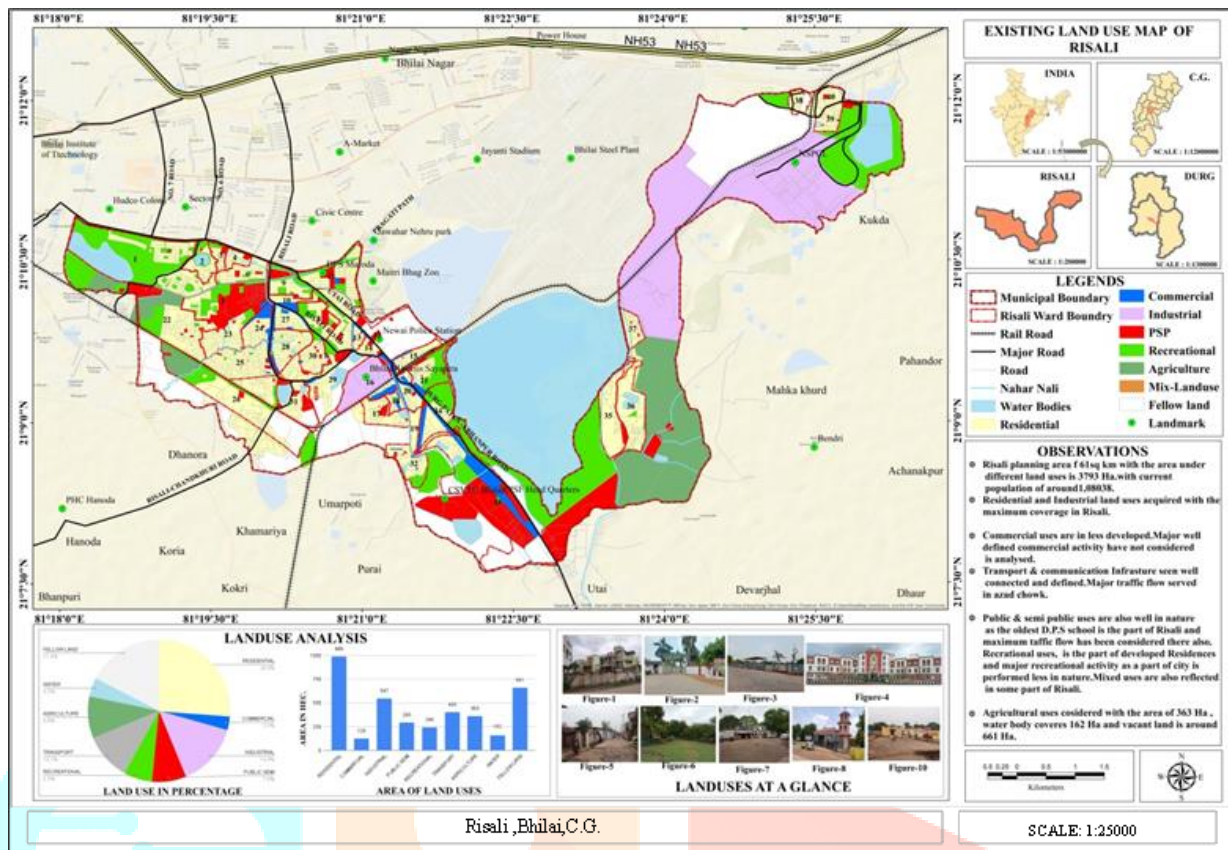
Risali Municipal Corporation's planning area consists of 61 sq. km, which includes 40 wards. Based on the 2011 census, Risali town has a population of 108838, of which males are 47288 and females are 46814. The decadal growth rate of the population of Risali is 9.57%. According to the URDPFI guidelines, Risali falls under the medium town category, which caters to the 1 lakh to 5 lakh population.

### • The Existing land use

The planning area, under different land uses, covered 3793 ha. The table reveals that the implementation is quite satisfactory under the land use categories: public and semi-public, and industrial, while the other categories show a poor status of implementation.

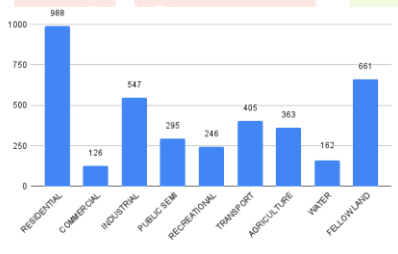
- Residential: The existing land use scenario represents 26.0% of residential uses.
- Commercial: Existing land use scenarios share 3.3% of commercial uses.
- Industrial: A proportion of 14.4% is present industrial development in areas where the situation is favorable.
- Public and semi - public: Public and semi-public space consideration for Risali existed at a percentage of 7.8%.
- Recreation: There is a need for the development of recreational uses, which have a share of 6.5% in existing land use.
- Transport and communication: Improvement and the development of new means of communication are the important factors taken into account by the analysis. It reflects 10.7% of transport infrastructure.
- Agricultural: A stable amount of agriculture exists with at a percentage of 9.6%.
- Water body: It reflects the 4.3 % share of natural features in the Existing land use analysis.

Fig. 2: Existing Land Use Map of Risali



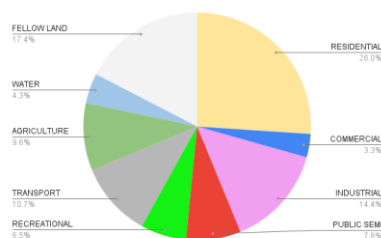
Source: Author

Fig. 3: Area of Land uses



Source: Author

Fig. 4: Percentage of Land uses



Source: Author

Table. 1: Land Use Categories

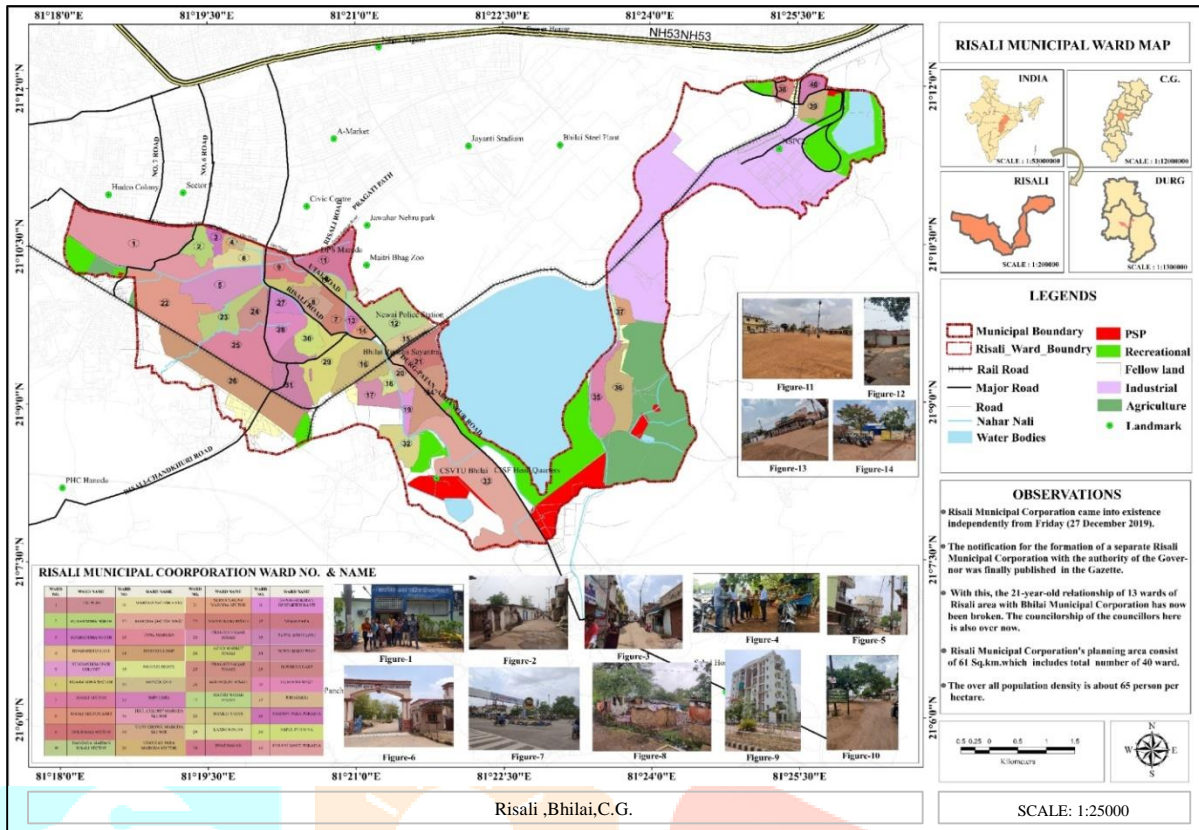
S. No	Land use Category	Existing land use of Risali	
		Area In Ha	Percentage %
1	Residential	988	26
2	Commercial	126	3.3
3	Industrial	547	14.4
4	Pub. & semi-public	295	7.8
5	Recreation	246	6.5
6	Transport & communication	405	10.7
7	Agriculture	363	9.6
8	Water body	162	4.3
9	Fellow land	661	17.4
Total Development Area		3793	100

Source: Author

• Demography

The ward with the lowest population density is ward number-1,5,12,16,22,25,26,29,34,33 which has a density of 12- 47 persons per hectare. Ward with the highest population density 3, 13, and 14,18,38,40 which has a density of 193-322 persons per hectare. The overall population density is about 65 people per hectare.

Fig. 5: Risali Municipal Ward Map



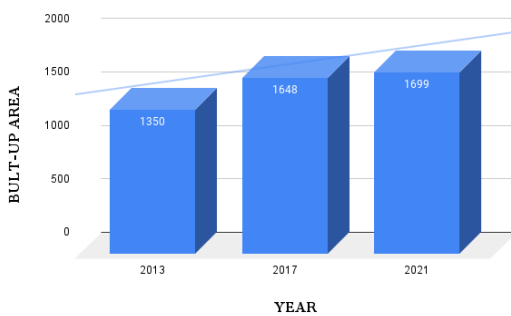
Source: Author

Urban Growth Patterns

Urban growth waves are frequently used to explain a city's history of spatial expansion (physical growth). Following are the findings from the analysis of urban sprawl:

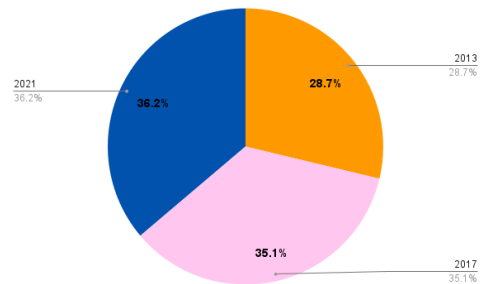
- In the research areas are subjected towards south-west and south-east Directions. The Utai road observed an increase in Urbanization.
- The proposed ways of communication would address railway crossings as part of the future expansion that will also take place in the direction south of the study area.

Fig.6: Area in percentage



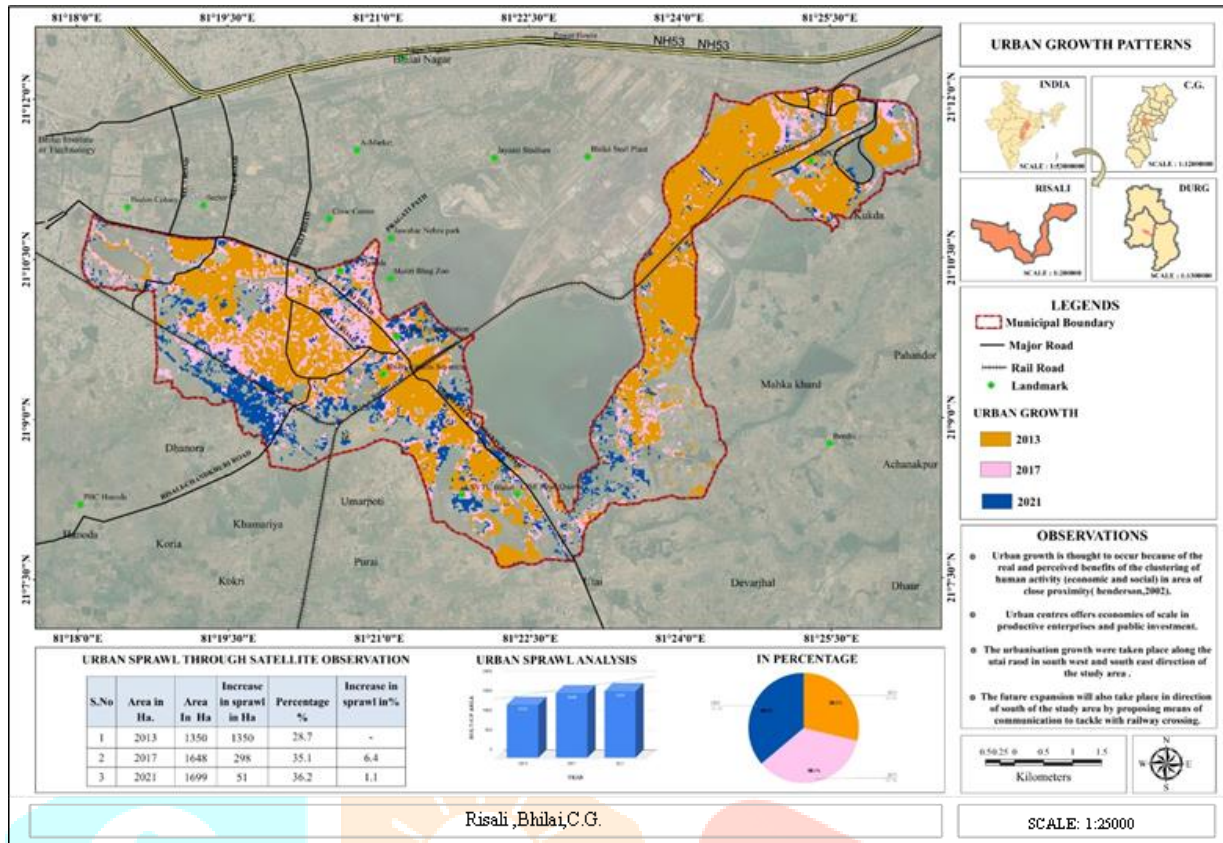
Source: Author

Fig. 7: Analysis in percentage



Source: Author

Fig. 8: Urban Sprawl Analysis



Source: Author

• **Land cover Analysis**

LULC is the process of categorizing or classifying human activities and natural landscape elements using appropriate source data and time –tested scientific and statistical analysis techniques.

The modification of land use and cover as a result of the project's topographic changes, including the filling of low-lying areas and the removal of steep hills and hillocks. It is important to discuss how drainage patterns and reclamation are impacted.

Observations are as follows:

- The overall land cover scenario depicts that the growth of built-up area is increasing over a different time frame, which reduces the percentage of the area covered by agricultural land.
- Water bodies and vegetation were initially increasing and decreasing simultaneously at the same time.

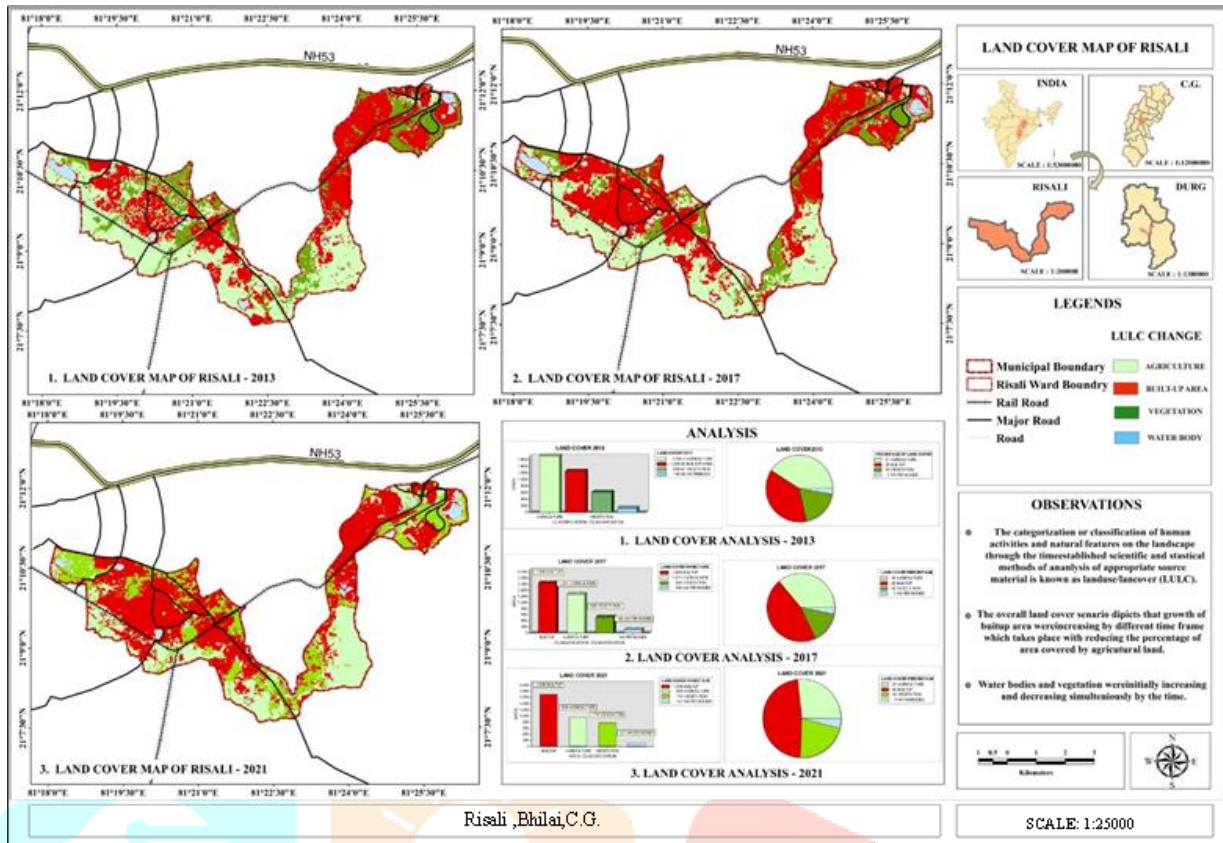
**Natural structure**

Digital elevation mode (DEM): It is representation of the topographic surface of the earth that excludes any surface features like tress, Building or other vegetation.

Observations are as follows:

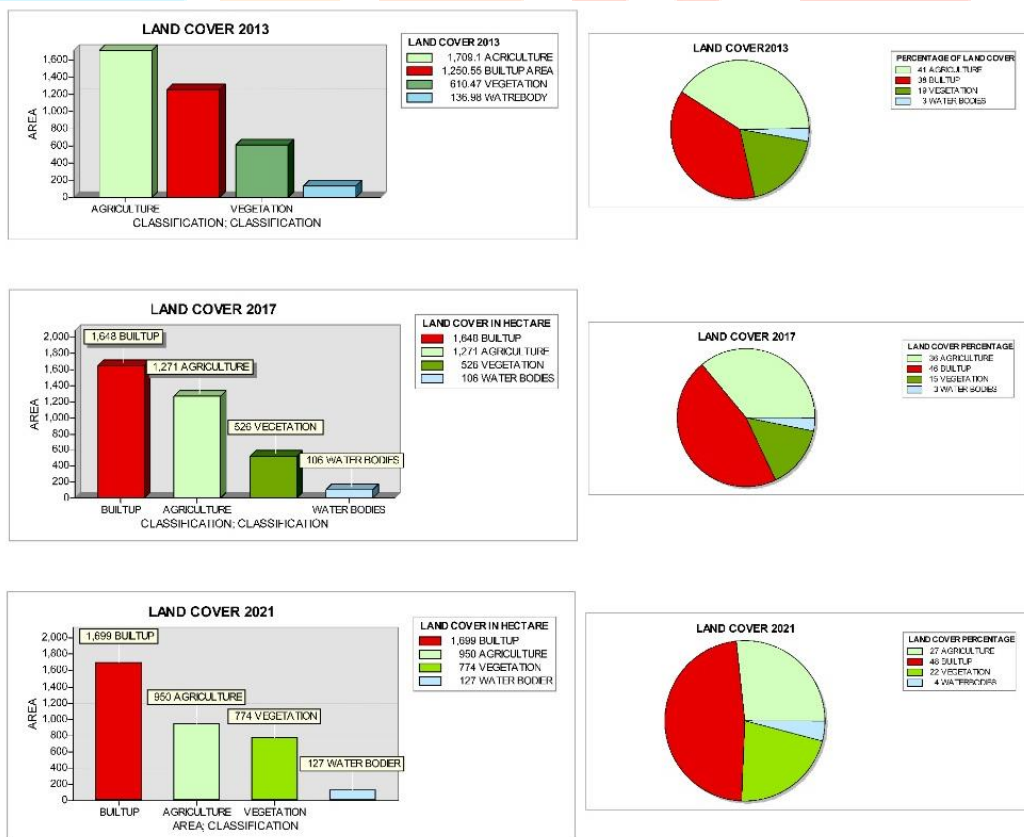
- The slope map has been employed, and it is discovered that the majority of the regions fall into the very gentle to a gentle slope group.
- The study area's slope information is essential for establishing whether the property is suited for various land uses. Drainage systems can also benefit from that understanding.

Fig. 9: Land Cover Map of Risali



Source: Author

Fig. 10: Land Cover Analysis



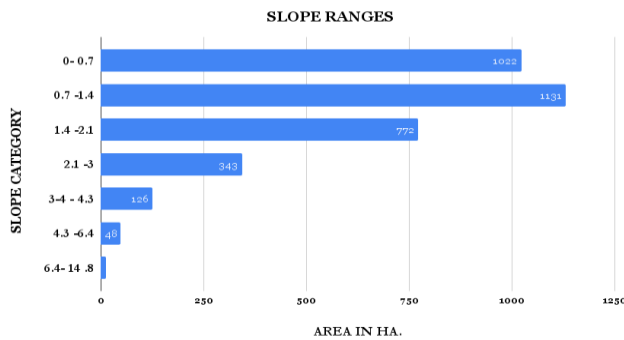
Source: Author

• Slope Analysis

Observations are as follows:

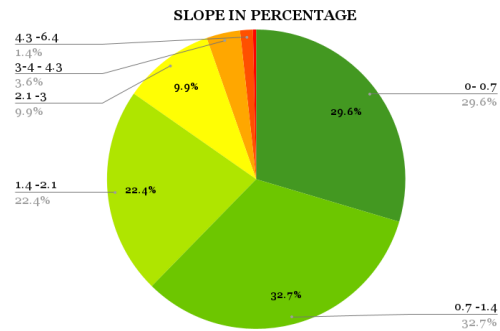
- The slope map has been employed, and it is discovered that the majority of the regions fall into the very gentle to a gentle slope group.
- The study area’s slope information is essential for establishing whether the property is suited for various land uses. Drainage systems can also benefit from that understanding.

**Fig. 11: Slope Ranges**



Source: Author

**Fig. 12: slopes**



Source: Author

**Table 2: Areas under different slope classes**

S.No	Slope Category	Area In Ha	Percentage %
1	0- 0.7	1022	26.6
2	0.7 -1.4	1131	32.7
3	1.4 -2.1	772	22.4
4	2.1 - 3	343	9.9
5	3-4 - 4.3	126	3.6
6	4.3 -6.4	48	1.4
7	6.4- 14.8	12	0.3
TOTAL		3454	100

Source: Author

**Contour Analysis**

In a contour map, the contour lines and the distances between them are used to depict the shape of the ground surface. It reveals the specific surface’s relative slope. This is a set of lines that define the boundaries of each property on the map. The equivalent worth of that characteristic, which is provided as data points, is employed to draw the lines.

Applications of contour mapping:

Contoured surfaces offer significant information that able to assist comprehends the peculiarities of the landscape. This aids in site selection, establishing the catchment area of drainage basin, figuring out the consistency between two or more stations, etc.

Nature of Grounds:

This stimulates interest in terms of studying the nature of the ground.

To Locate Route:

A contour map offers useful guidance in order to locate a route and helps to identify the path. As it is difficult to determine the intersection visibility between two sites by visual inspection, this is where the contour map comes in.

To determine the catchment area or drainage area:

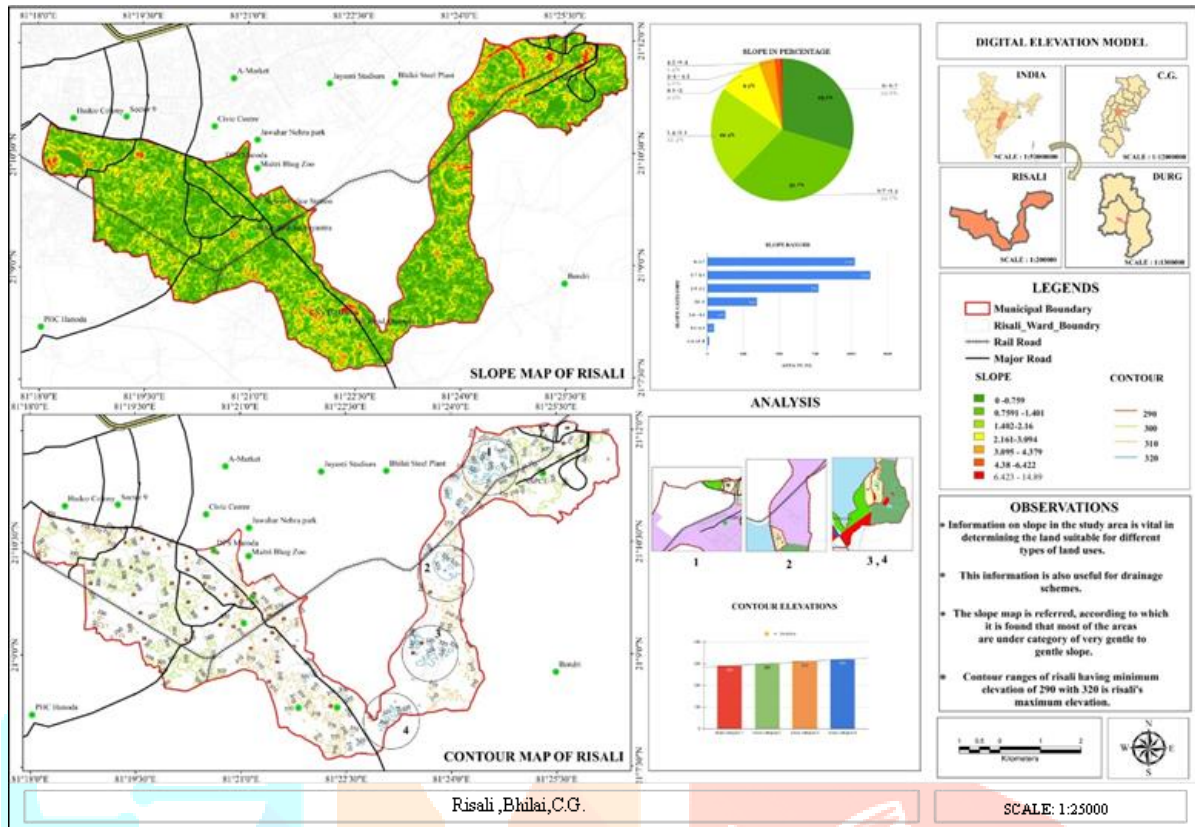
The contour map is an excellent resource for locating a river's catchment area. The river’s drainage basin is clearly indicated by the watershed line. Which travels across the ridges and then saddles the sand that curves around the river .it always aligns itself parallel to the contour lines. Using a plannimeter, the catchment area that is between this watershed line and the river outlet is determined.



Observations are as follows:

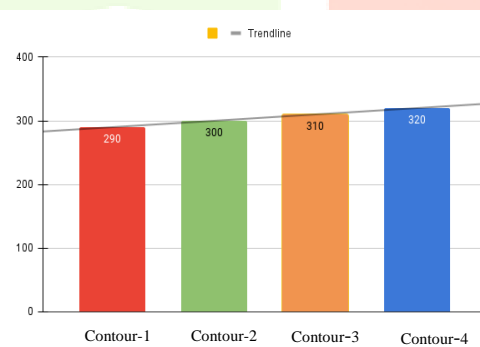
Risali's contour ranges have a minimum elevation of 290 and a maximum elevation of 320.

Fig. 13: Digital Elevation Model



Source: Author

Fig. 14: Contour Elevations



Source: Author

• **Proposed Land Use Map of Durg - Bhiali**

- Residential

Residential land uses comprise the majority of the area, which raises research concerns.

- Industrial

Industrial land uses have been a major part of future development as the city has a core relationship with the industry (Bhilai steel plant).

- Recreational

The amount of agricultural land used for recreation was kept to a minimum.

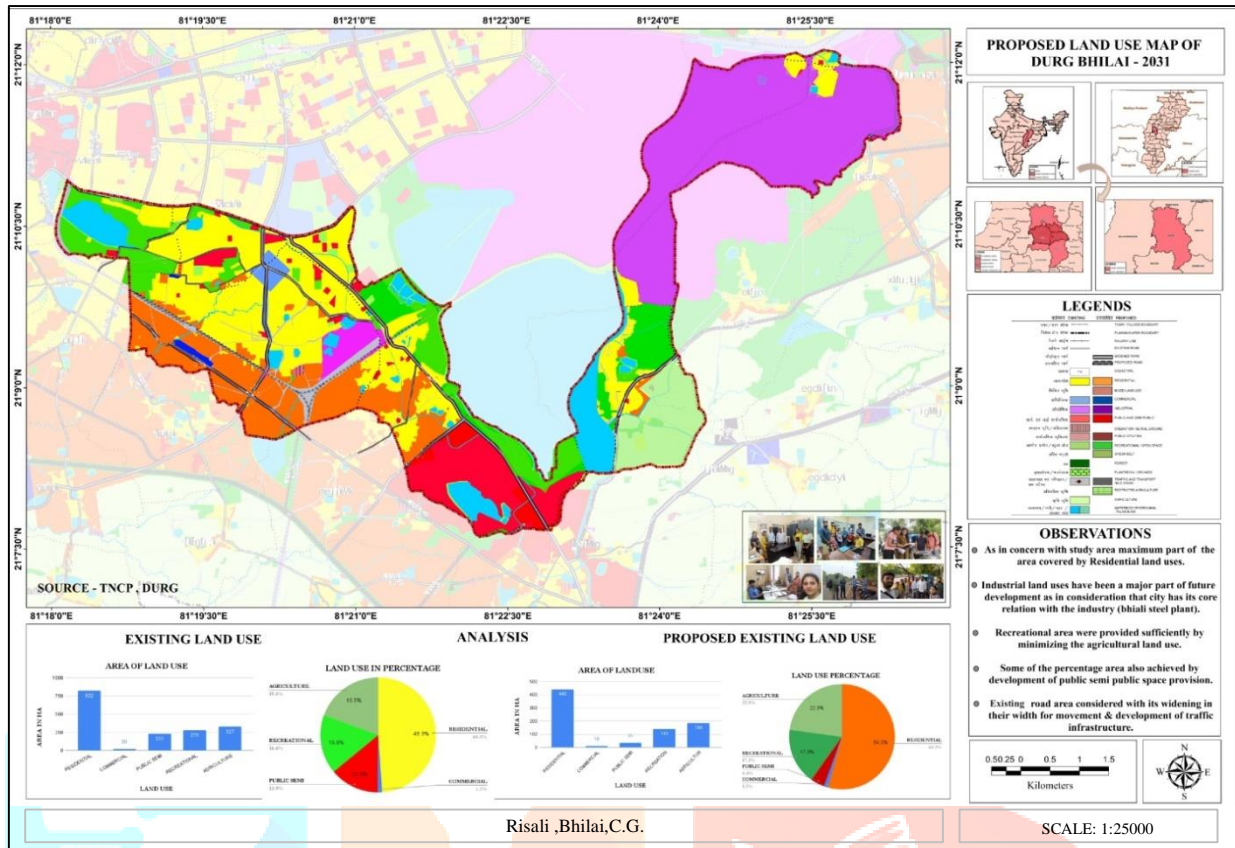
- Public & semi-public space

The upward trajectory of public and semi-public space also contributes to some of the percentage of area.

- Transportation

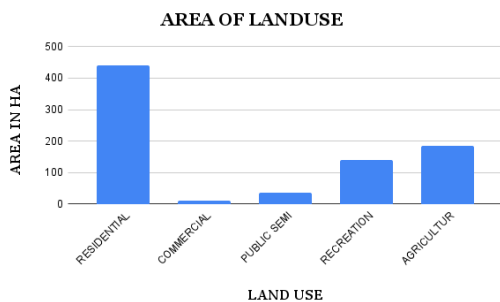
Existing road areas are considered with their widening in width for movement and the development of traffic infrastructure.

Fig. 15: Proposed Land Use Map of Durg, Bhilai - 2031



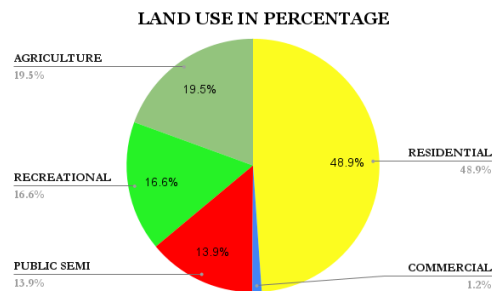
Source: Author

Fig. 16: Area Of Land Use



Source: Author

Fig. 17: Land uses in percentage

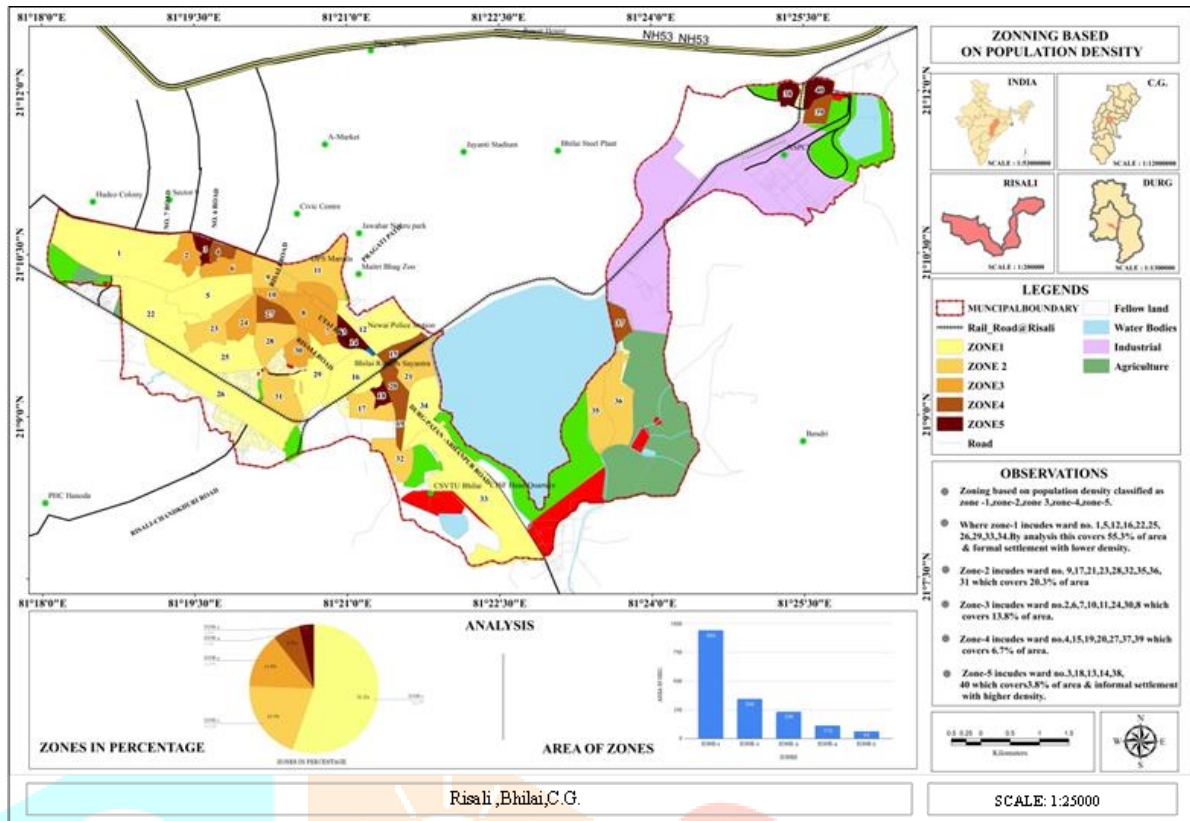


Source: Author

• Zoning Based On Population

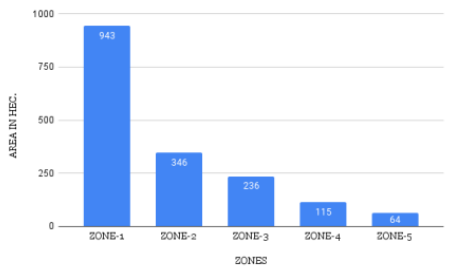
- According to the population density, zoning is divided into zones 1, zone 2, zone 3, zone 4 and zone 5. Where zone-1 includes ward numbers 1,5,12,16,22,25, 26,29,33,34. By analysis, this covers 55.3% of the area & formal settlement with a lower density.
- Zone-2 includes wards no. 9, 17,21,23,28,32,35,36, and 31 which cover 20.3% of the area.
- Zone-3 includes wards no.2, 6, and 7,10,11,24,30,8 which covers 13.8% of the area.
- Zone-4 includes ward no.4, 15, 19, and 20,27,37,39 which cover 6.7% of the area.
- Zone-5 includes ward no.3, 18,13,14,38, 40, this covers 3.8% of the area and informal settlements with a higher density.

Fig. 18: Zoning Based On Population Density



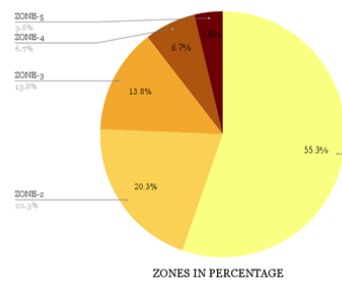
Source: Author

Fig. 19: Area of Zones



Source: Author

Fig. 20: Zones in percentage

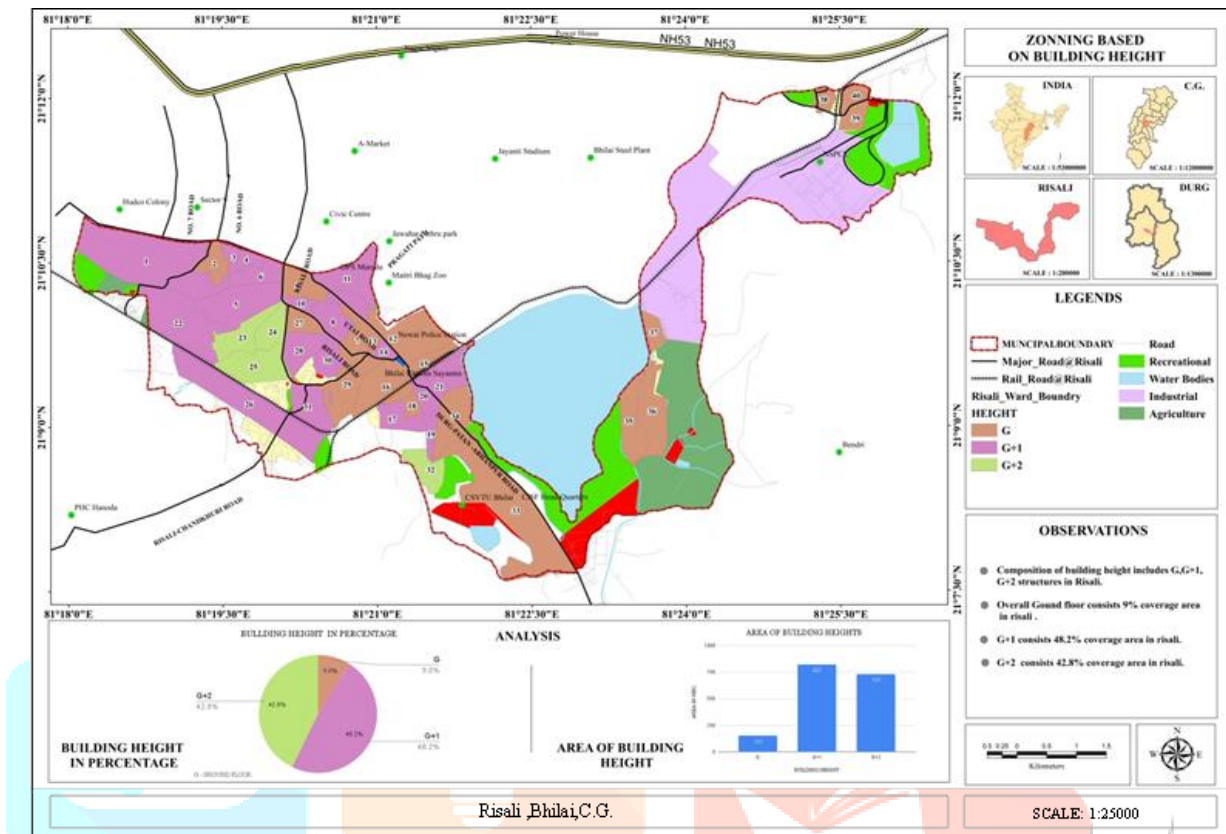


Source: Author

• Zoning Based On Building Height

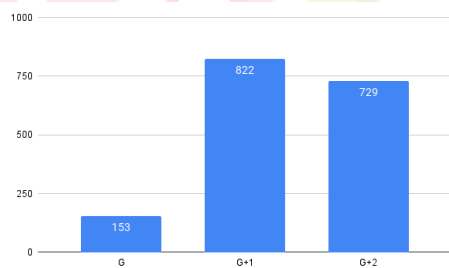
- The composition of building height includes G,G+1, G+2 structures in Risali

Fig. 21: Area of Zones



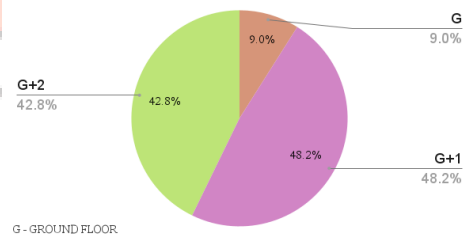
Source: Author

Fig. 22: Area of building height



Source: Author

Fig. 23: Building height in percentage



Source: Author

VII. GAP ANALYSIS

Existing Land Use and URDPFI Guidelines:

According to guideline of urban and regional plan formulation and implementation (URDPFI), the town of Risali, which has a current population of 1 lakh, is classified as a medium city.

Problems Identification:

- In low-density regions, F.A.R. and ground coverage are lower, and informal settlements are a reflection of high –density places where the population struggles to receive basic services.
- Slum settlement encroachment and negligent land repurposing.
- Land use violations and decrease in the implementation of town planning initiatives have been noted.

Table 3: Comparison of existing land use and URDPFI

S. No	Land Use Category	Existing land use of Risali	As per URDPFI recommendation	Gap
		Percentage (%)	Percentage (%)	Percentage (%)
1	Residential	26	43-48	17-22
2	Commercial	3.3	4-6	0.7-2.7
3	Industrial	14.4	7-9	7.4
4	Pub.& Semi Public	7.8	6-8	0.2
5	Recreation	6.5	12-14	5.5-7.5
6	Transport & Communication	10.7	10-12	1.3
7	Agriculture	9.6	18-3	4.4 -NA
8	Water body	4.3		-
9	Fellow land	17.4	-	-
Total Development Area		100	100	100

Source: Author

## VIII. RESEARCH ANALYSIS:

- The research determined numerous studies that mapped land use and land cover in Risali. Broad spectrum of land use and land cover types, comprising commercial, residential, agricultural and industrial areas is distinguished according to research.
- Several studies have also used field survey methods to map land use and land cover in certain parts of the city. These studies have discovered that, particularly in areas that area quickly urbanizing, the city characterized by a major change in land use and land cover.
- The literature also revealed several studies that have analyzed the results to comprehend the pattern and movement of land cover and land use of the city. These studies have discovered that a number of factors, including as population increase, economic development, and the accessibility of infrastructure and services, affect alterations in land utilization and coverage.

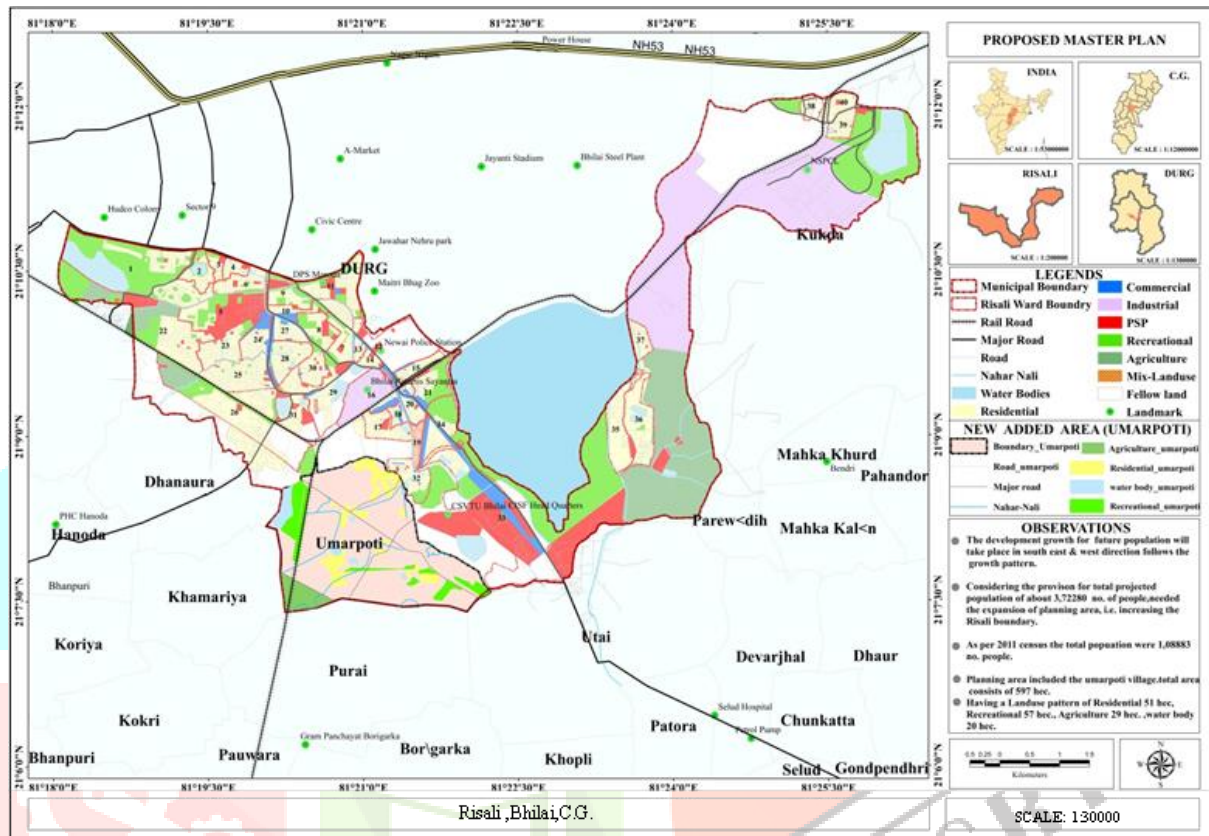
## IX. PROPOSAL

### Area Delineation (the addition of Umarpoti):

- The development growth for future populations will take place in the south, east, and west directions, following the growth pattern.
- Due the provision for an estimated 3, 72280 total population, the planning area must be expanded, i.e., the Risali boundary must be widened, in order to meet the needs of the planning process.
- As per 2011 the census, the total population was 1, 08883 people.
- The Planning area, including Umarpoti village, consists of a total area of 597 hectares.
- Having a land use pattern of residential 51 ha, recreational 57 ha, agriculture 29 ha water body 20ha.
- The total municipal boundary of Risali consists of 3543 hectares.
- The population density of Risali is 61 people per hectare, and according to the projected population, it reaches 312 people per hectare. This falls under the settlement of a metropolitan town.
- As per consideration, to cater the population density according to the projected population, the Umarpoti is relatively accessible area for fulfillment of future needs.
- Under the new boundary of Risali, all consisting of Umarpoti village, the population density was proposed as per classification of medium town.

- In settlements, there will be about 150 people per hectare of population per hectare of population density, and the projected land use percentage also follows the medium town land use structure with medium town tier-II.
- The percentage of developed area requirements are such as: residential up to 43-48%, commercial 4-6%, industrial 8-10% public-semi public 6-8%, recreation 12-14%, transport and telecommunication 10-12%, and the balance will consist of agriculture, water bodies, and, special areas, resulting in a 100% developed area of land use category.

Fig. 24: proposed master plan



Source: Author

Table 4: Proposed Zone

S. No.	A-N	USE CATEGORY	A-N	USE ZONE
1.	R	Residential	R-1 R-2	Primary residential zone Unplanned/formal residential zone
2.	C	Commercial	C-1 C-2	Retail shopping zone general business and commercial district/ Center's Regulated/ Informal/ Weekly Markets (TCPO)
3.	I	Industry	I-2	Extensive and Heavy Industry
4.	PS	Public and semi- public	PS-1	Medical and Health
5.	M	Mixed-Use	M-2	Mixed Residential Zone
6.	R	Recreational	P-1 P-2	Playgrounds/stadium/sports complex/parks & gardens –public open spaces
7.	T	Transportation	T-1	Roads/ BRTS
8.	A	Primary Activity	PA-1	Agriculture

Source: Author

- The Proposal : 1

Zoning: One of the most popular ways of land use regulations adopted by municipal governments is zoning.

- Ensuring the general welfare, security, and health of the public.
- Supporting positive development patterns.
- Distinguishing conflicting land uses.
- Supporting encouraging growth patterns preserving the beauty and character of the community.
- Preserving local resources like agriculture, forest, groundwater, surface water and historic and cultural assets.
- Providing public infrastructure and services in cost –effective way.
- Safeguarding both public and private investment.

#### Proposed zones: proposed areas

**Table.5: Proposed Area**

S No.	Categories of land use	Proposed
		Area in Ha.
1	Residential	386
2	Mixed Land use	306
3	Commercial	30
4	Public & Semi- Public	72
5	Recreation	235
6	Transport & Communication	100
Total		1129

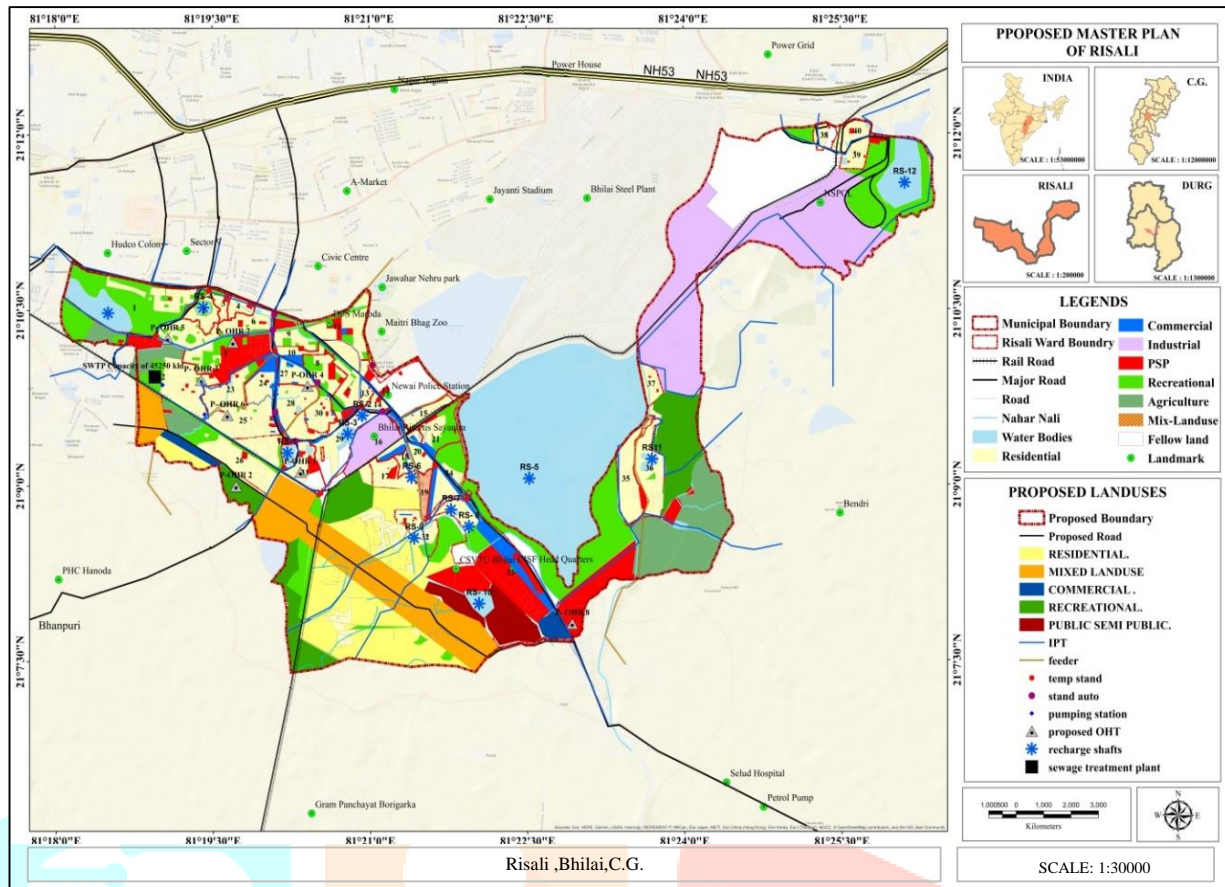
Source: Author

**Table 6: Proposed Area**

S. No.	Categories of land use	Proposed (Intervention)
		Area in Ha
1	Agriculture	263
As Existing		
2	Industrial	547
3	Water body	162

Source: Author

Fig. 25: Proposed Master Plan of Risali



Source: Author

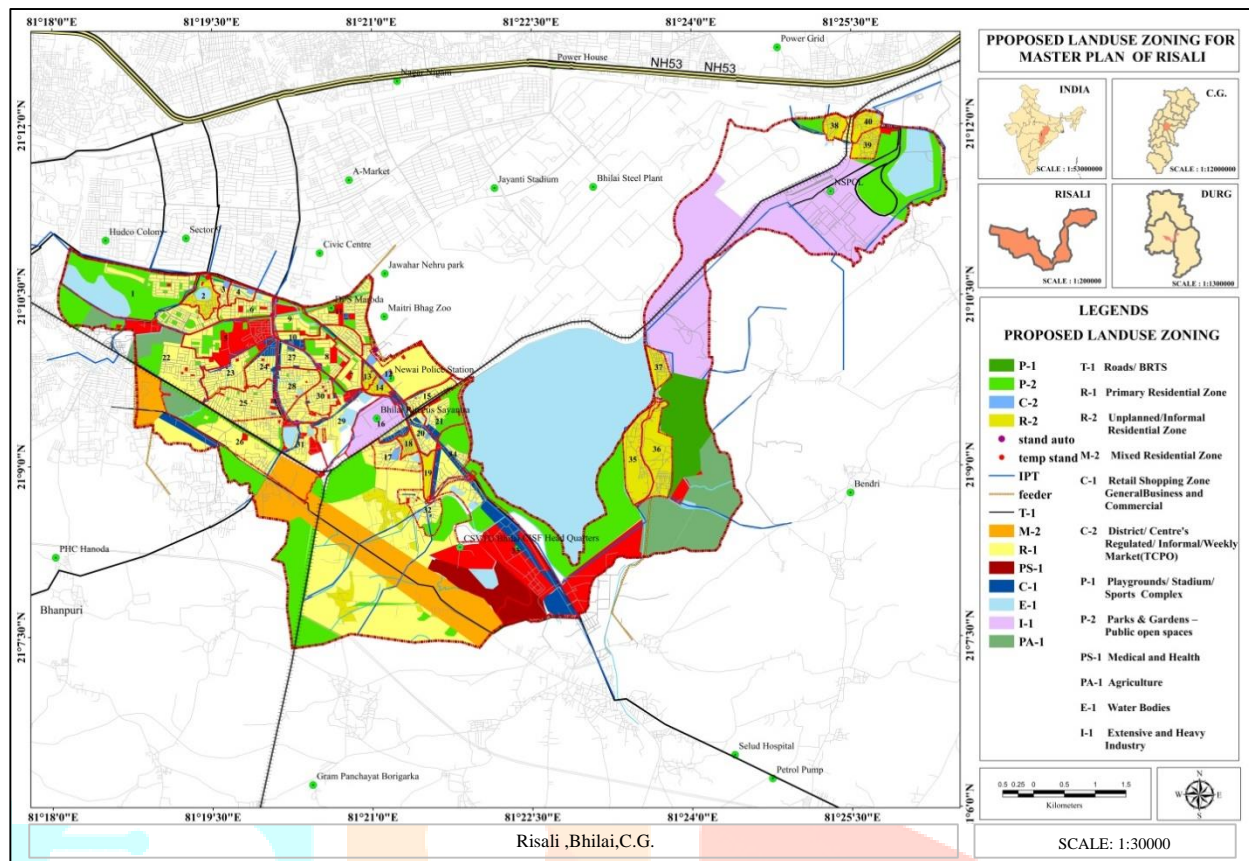
Table 7: Proposed Zones

S. No.	A-N	Use Category	Code	Base Far	Premium FAR	TDR		Total Permissible FAR	
						Genera-ting (G)	Receiv-ing (R)		
1.	R	Residential	R-1 R-2	1.7	0.75	-		3.7	
2	C	Commercial	C-1 C-2	2.5	1.5	1.00		5.00	
3.	I	Industry	I-2	2.0	0	-		2.0	
4.	PS	Public and semi-public	PS-1	1.00	0.5	-		1.5	Note: This FAR is Free for Govt. Projects
5.	M	Mixed land use	M-1 M-2	1.00	1.00			1.00	4.0

Source: Author



Fig. 26: Proposed Master Plan of Risali



Source: Author

## Proposed Zones

Based on Land use:

Proposal: 2

Provision of the green belt zone

The openness and durability of the green belts are two of their main goal of preventing urban sprawl. Support urban regeneration through encouraging the productive use of vacant and other urban land.

Importance of green the belt:

1) Air pollution

Air quality is improved by trees because they produce oxygen into the atmosphere, which helps to remove CO<sub>2</sub> and other pollutants from the atmosphere.

2) Noise reduction

A green belt serves as a sound barrier and reduces sound intensity. To reduce the intensity of sound, trees, can reflect, deflect or absorbed.

3) Aids in preventing soil erosion

Substantially enhancing soil quality and trying soil particles together.

4) Aids in preventing water runoff

It controls urban sprawl and encourages the vital urban revitalization.

5) Green belt plantation

As trees absorb both gases and particle pollutants, a green belt is a planting of tress with the purpose of lowering pollution. It raises the aesthetic value of the surrounding area.

The Proposal: 3

Commercial zone improvements and development Near Azad Chowk and Krishna Talkies, the major commercial area has been identified in the study area as needing to develop more by proposing an increase in FAR. Risali will develop an identity as a commercial hub with the development of better infrastructure. Commercial zones will be considered as C1, and C2.

The Proposal: 4

Recreational zone

Long-term water recharge will be supported by raising the percentage of water percolation, which is taken into account in the promotion of strategically planned recreational development.

The Proposal: 5

Residential zone

Vacant land near railway lines will be part of residential development, which has increased by FAR 1.7 with 60% coverage. For an existing land use, it will also be considered the same. In consideration of the analyzed gap, a total of 30 to 35% will be covered by the development of residential zones, and 8-12 % will be achieved by increasing the FAR.

The Proposal: 6

Recreational zone

Water body Proposal for deepening in the water bodies of Risali planning area Consideration of bore well development in a water body for water percolation will be the strategic approach.

The Proposal: 7

Transportation

Proposed route T-1 by widening it. The development of transportation will be significantly impacted by soft paving's support of green infrastructure. Soft landscaping will be covered by ROW, which will aid in enhancing water percolation.

Proposal: 8

Mixed land use

In the Promotion of mixed land use, its major development will take place in Umarpoti along with the proposed road T-1 in connection with Risali.

## X. CONCLUSION

According to the study, mapping and analysis of land use and land cover are crucial techniques for comprehending the distribution and dynamics of human and natural systems in Risali. Studies reviewed have used a variety of methods, including GIS tool, and field survey, to map land use and land cover in the city. These studies findings have shed important light on Risali's patterns and trends in changing land use and land cover though this. Also research highlighted the potential implications of this change for inclusive and sustainable urban development. Overall, this study demonstrates that mapping and analyzing land use and land cover might give important insights into the intricate human and ecological systems in Risali. Future study should concentrate on tracking modifications in land cover and use through time and comprehending the underlying causes of these changes. And can support inclusive and sustainable urban development.

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