

**United Nations/Austria Symposium on
Integrated Space Technology Applications for Climate Change**

**Austrian Academy of Sciences, Institute for Space Research
Schmiedlstrasse 6, Graz, Austria**

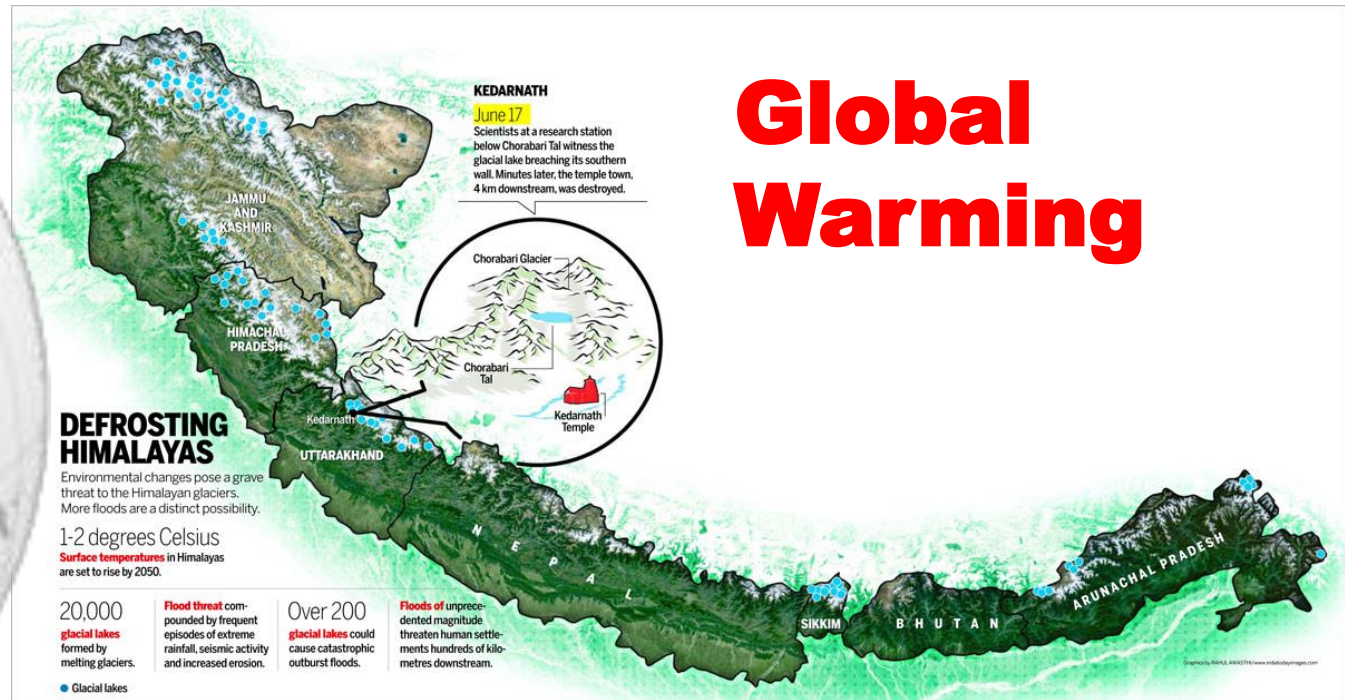
**Landuse Change and
Transformation Study of
Bangalore Metropolitan
Region and Plan for
Sustainable Development**

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Global Warming

Impacts of global warming on climate of India

Indian climate is dominated by the monsoon season type which, provides 80% annual rainfall.

The Himalayas participate in warming by preventing the cold winds from blowing in, and the Thar Desert attracts the summer monsoon winds and are responsible for the monsoon seasons in India.

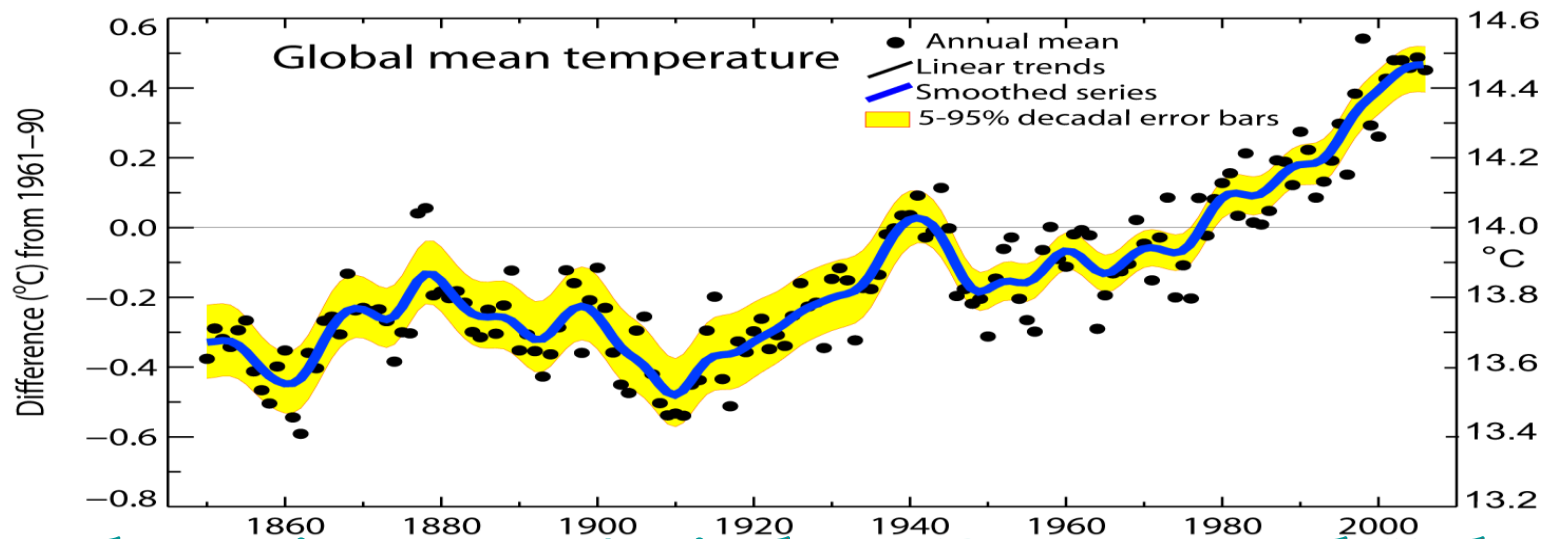
Global warming on the climate of India has led to climate disasters. India is a disaster prone area, with the statistics of 27 out of 35 states being disaster prone, with floods being the most frequent disasters.

Climate change: High Vulnerability to Weather



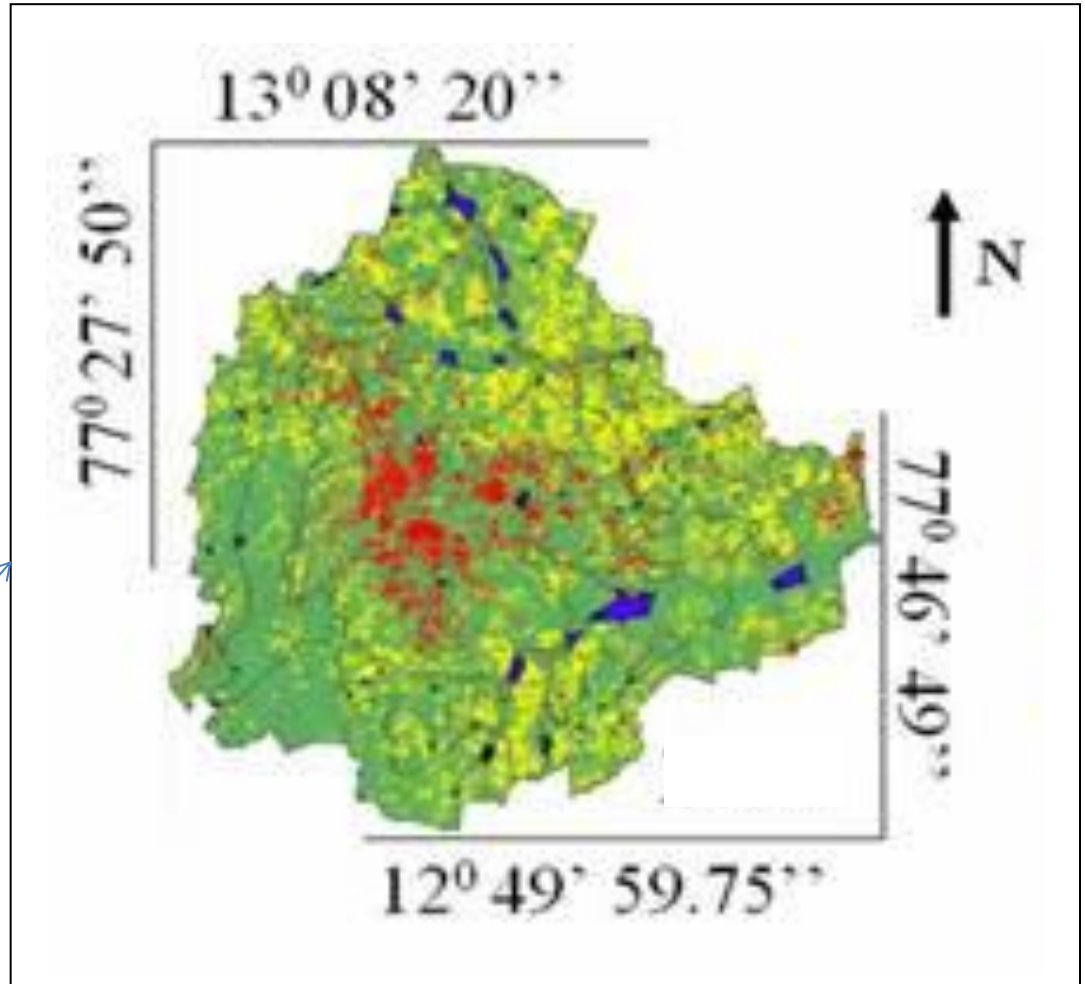
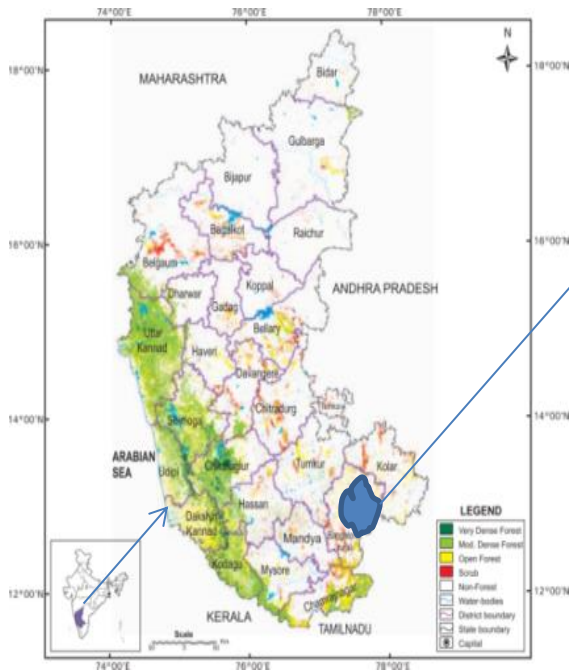
**Large Droughts :
Adverse Impacts**

Increasing trend in surface temperature



Climate change impact on Agriculture, Ecosystem and Hydrology

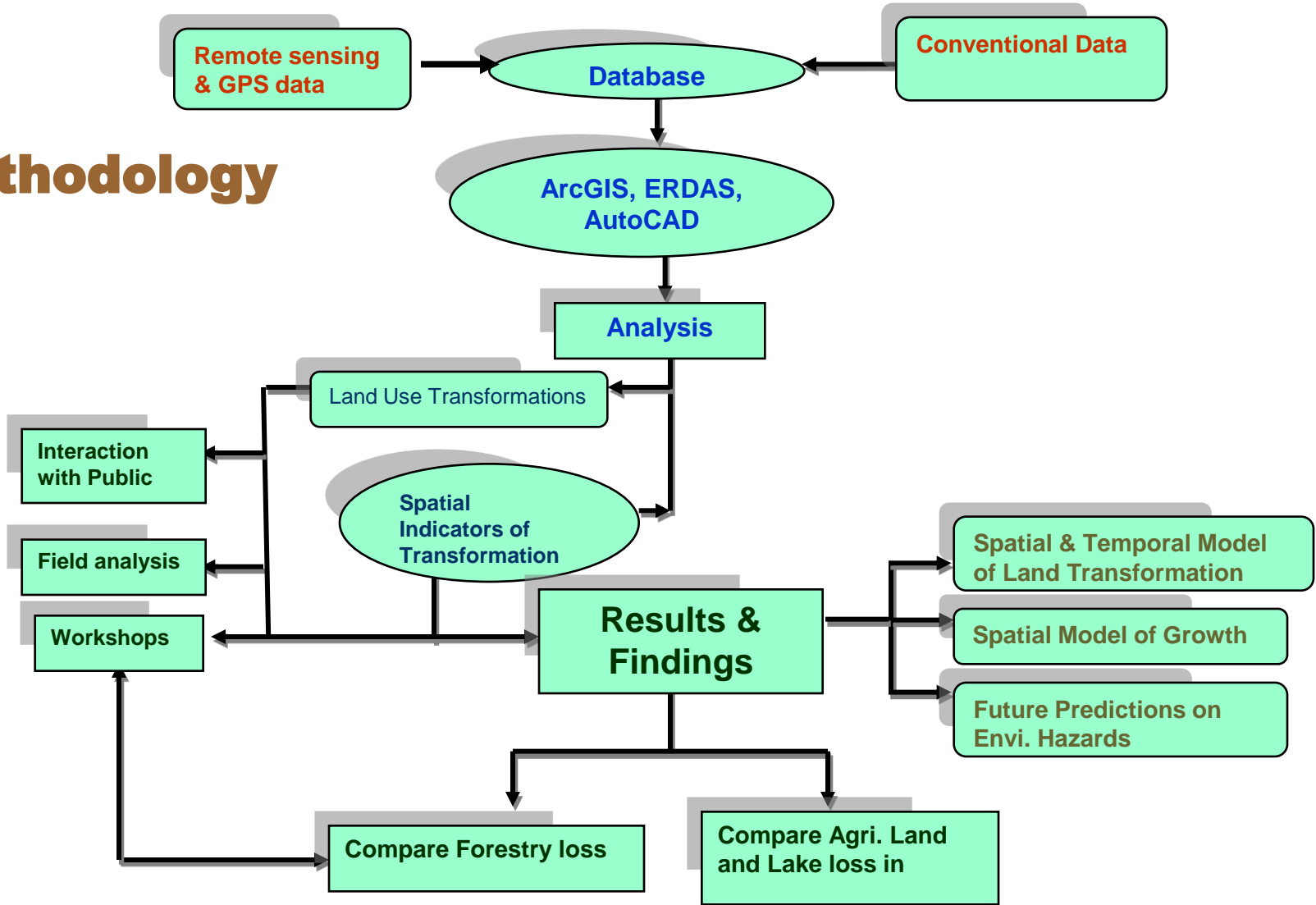
Location Map of Bangalore Metropolitan City



Introduction

- Land Use is one of the efficient indicators for planning and development.
- Space is limited inside the city, but multifaceted demands keeps it shooting up.
- Land use is pertaining to an important environmental issue. Sound land use planning is essential for better economic development, for avoiding conflicts between land uses and for maintaining a high quality of life.
- Scientific land use based-on ecosystem approach require adequate green cover, open spaces, lakes, drainages, etc
- When a city efficiently manages its land and resources we call it is a good planning. From an each science perspective, the basic philosophy of good land-use planning is to avoid hazards, conserve natural resources and generally protect environment through the use of sound ecological principles.

Methodology



ERDAS IMAGINE 8.7

Session Main Tools Utilities Help

Viewer Import DataPrep Composer Interpreter Catalog

Viewer #1 : 57h9.tif (:Band_3)(:Band_2)(:Band_1)

File Utility View AOI Raster Help

Attributes

lakes 1

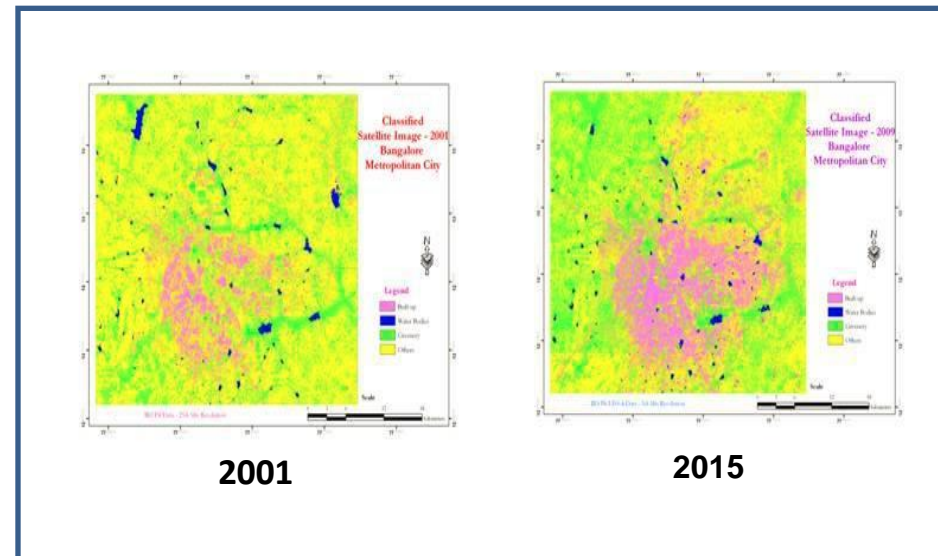
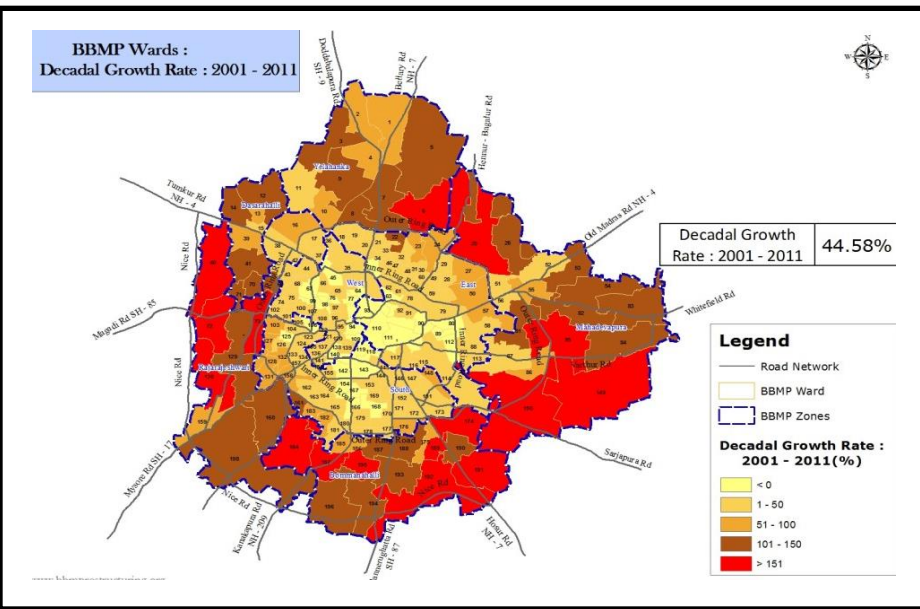
Property	Value
OBJECTID	1
SHAPE_Length	8206.179
SHAPE_Area	4544454.401
Lake_name	<Null>
Present_Absent	Absent
If absent what...	Vegetation

1 features

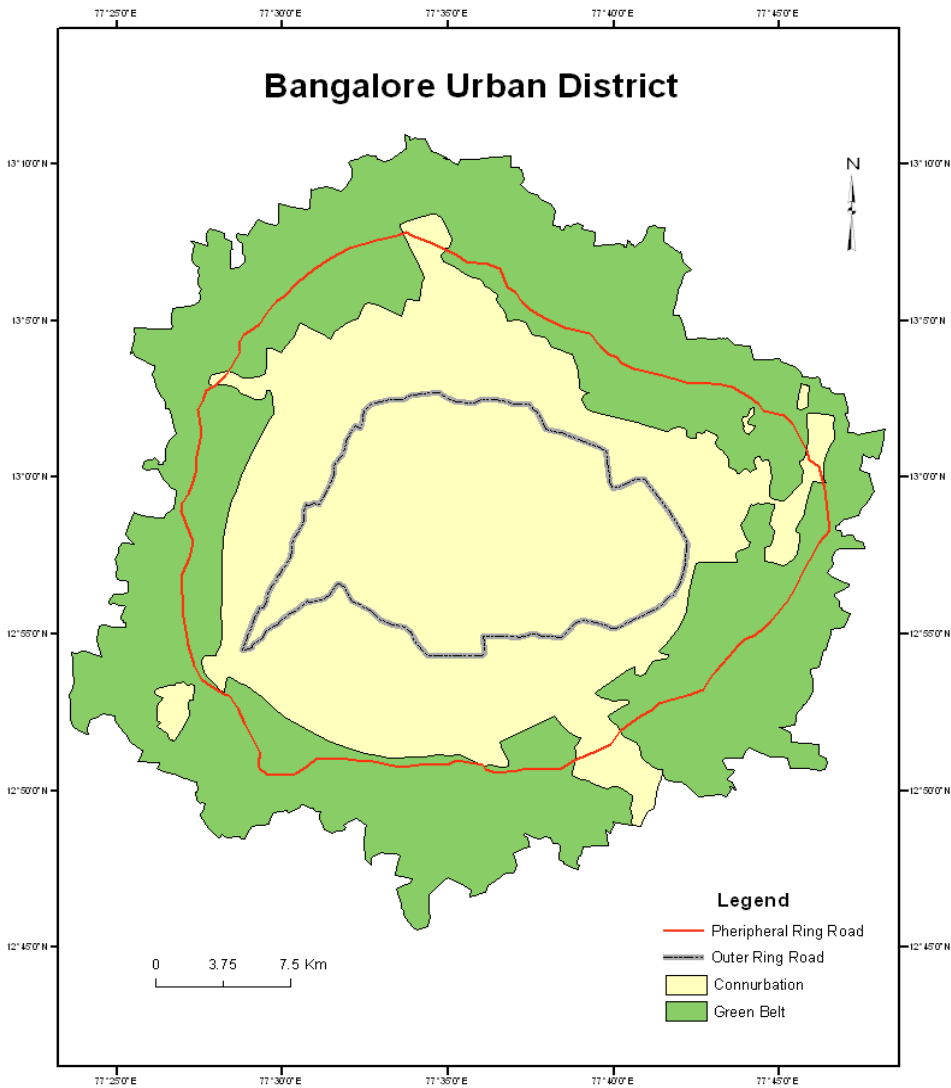
Landuse & Land cover change: 1995 – 2015

(The Total Geographical Area of under study is 1500 sq km)

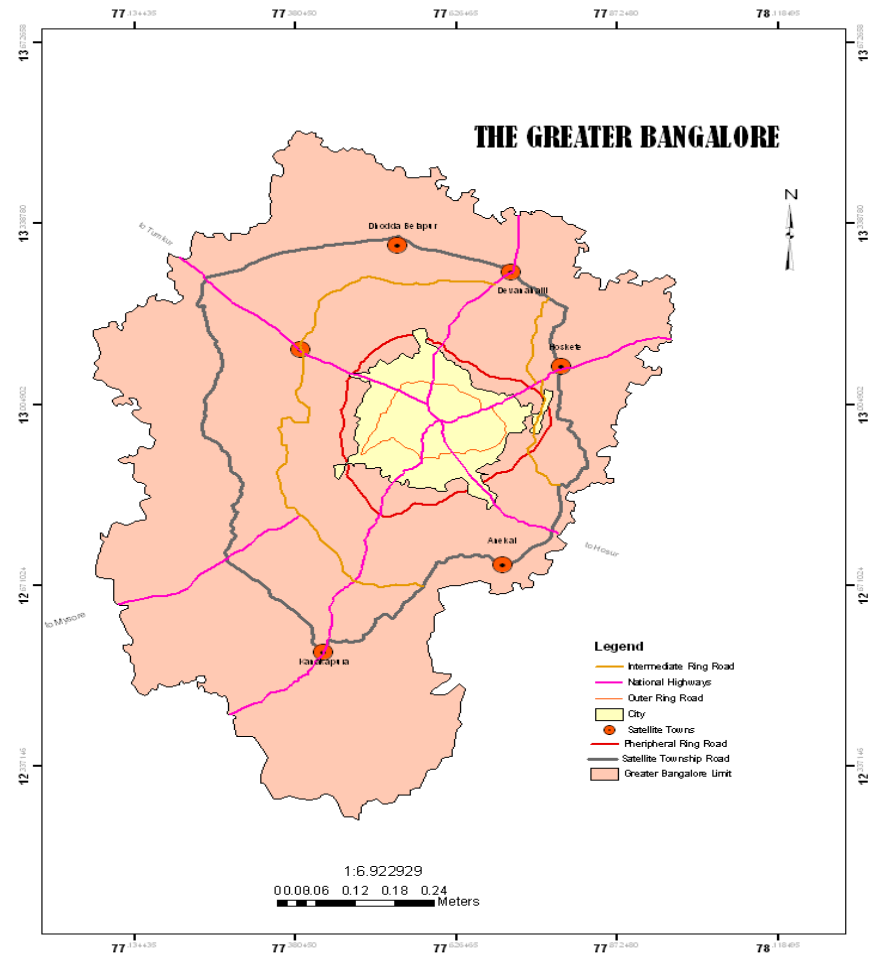
Land Use Type	1995		2001		2005		2009		2015	
	Area in Sq Km	%	Area in Sq Km	%	Area in Sq Km	%	Area in Sq Km	%	Area in Sq Km	%
Built-up Areas	163	10.86	225	15.00	320	21.33	410	27.33	450	30.20
Waterbody Areas	41	2.73	35	2.33	28	1.86	18	1.20	16	1.10
Greenery Areas	633	42.20	595	39.66	540	36.00	515	34.33	500	33.30
Other Areas	663	44.21	645	43.01	612	40.81	557	37.14	536	35.40
Total	1500	100	1500	100	1500	100	1500	100	1500	100



Bangalore Urban District

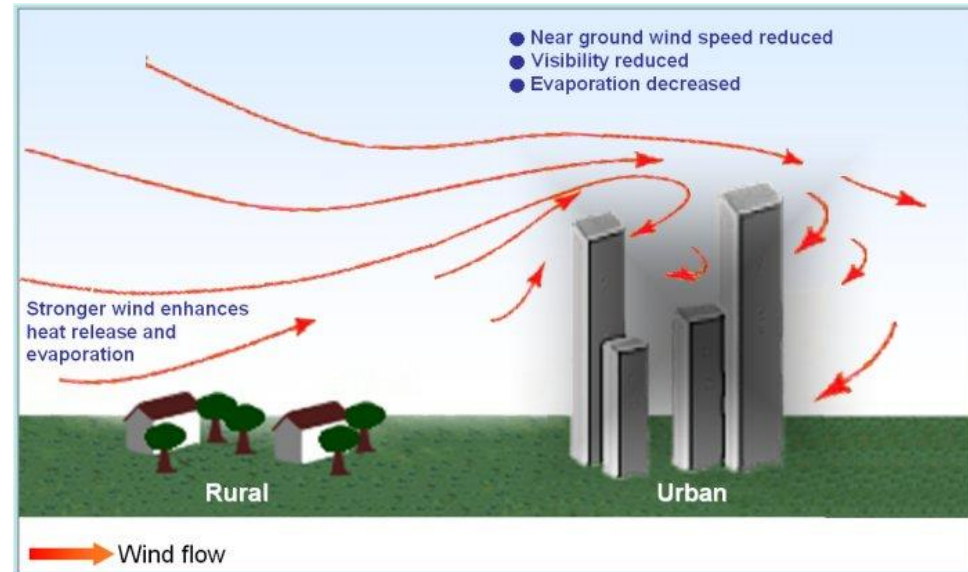


THE GREATER BANGALORE



Major changes in Bangalore City due to Landuse & Land Transformation

- **Change in the city temperature**
- **Decrease in the city's underground water**
- **Loss of green (Forest) and blue (lakes) spots**
- **Increase in the land value**
- **Loss of agricultural land**



Major contributors for rapid Landuse Change

- Rapid urbanization led to change in local climate.
- High growth in sectors like IT industries, insurance, tourism, cultural, political, commercial establishments.
- Increase in population, people are rushing from other states to Bangalore city causing urban sprawl.
- **Heat islands formation, blocking of ambient winds and impact on rainfall.**
- **Increased energy consumption by the urbanites.**

Impact of Bangalore City's Landuse & Land Transformation

- In order to meet the space requirements, the fringe areas are targeted by the city, which the cultivated and vegetated land.
- When changes are not planned in the city it accounts for a haphazard growth, which in turn yields problems for the proper functioning of the city.
- It includes inadequate housing, economic decline, poverty, slums, overcrowding, ill-health, social- polarization, traffic congestion and environmental pollution, etc.
- Once the city was known as garden city of India and now, it is a large metropolitan city.
- Monsoon winds also got affected adversely by urban sprawl. IMD has predicted above normal rainfall (110%) in India this year but so far, it deficient by 40% and the case is same with Bangalore also.
- In India, major metropolitan cities like Bangalore, Kolkata, Delhi, Mumbai. Chennai have led to loss of fertile agriculture, forest ecosystem, biodiversity and increased aridity.

Impact of Bangalore City's Landuse & Land Transformation

- The land use land cover change has led to loss of tropical nature of climate and increased draught conditions.
- Bangalore city's growth is seen curbing smaller villages on the periphery and engulfing fertile agricultural lands. Uncontrolled and unauthorized constructions are continuously coming up at the edge of the city.
- Most of the development is at the cost of natural drainages, canals and lakes.
- Bangalore has lost 70 lakes out of 110 major lakes through which ground water recharge was happening also were source of drinking water alongside supporting large biodiversity.
- The driving force of Land-use/cover change has complex interactions with the ecosystem, hydrological cycle and atmospheric circulation which leads to modification of micro-climate and adverse impact on the quality of life.

Years	Two Wheeler	Three Wheeler	Cars	Jeeps	Taxi	Bus	Truck	Tractor	Tralee	Maxi Cab	Others	Total
2000	1067430	61424	201052	6827	6299	20656	41887	6158	5544	4238	16542	1438057
2001	1162111	64001	221508	6934	7062	22841	47683	6743	6100	4723	16436	1566142
2002	1292228	67778	245893	7091	7974	24989	53424	7681	6873	5270	19728	1738929
2003	1419396	72107	269648	7434	9444	28262	59150	8723	7359	7219	23599	1912341
2004	1586397	74357	314931	7991	13132	34271	68186	10481	9456	10458	27820	2157480
2005	1811361	80432	359580	11012	16484	36888	84571	11994	11023	12659	31266	2467270
2006	2074306	90934	426394	7587	20025	39162	91699	18564	10699	16100	45682	2841152
2007	2232271	95029	490982	7609	28223	48159	109761	19646	11670	18017	45197	3106564
2008	2263552	95859	515109	7272	30940	48605	119051	20151	11779	18653	53668	3184639
2009	2607536	105630	606427	8188	31879	42164	129312	20353	12133	20903	68843	3653368
2010	2546728	93058	681500	7003	35126	73357	138304	7273	5608	20034	78266	3686257

As on 31-03-2014 - 5050057

As on 25-08-2016 – 6381000

Vehicles Growth in Bangalore City 2000 - 2016

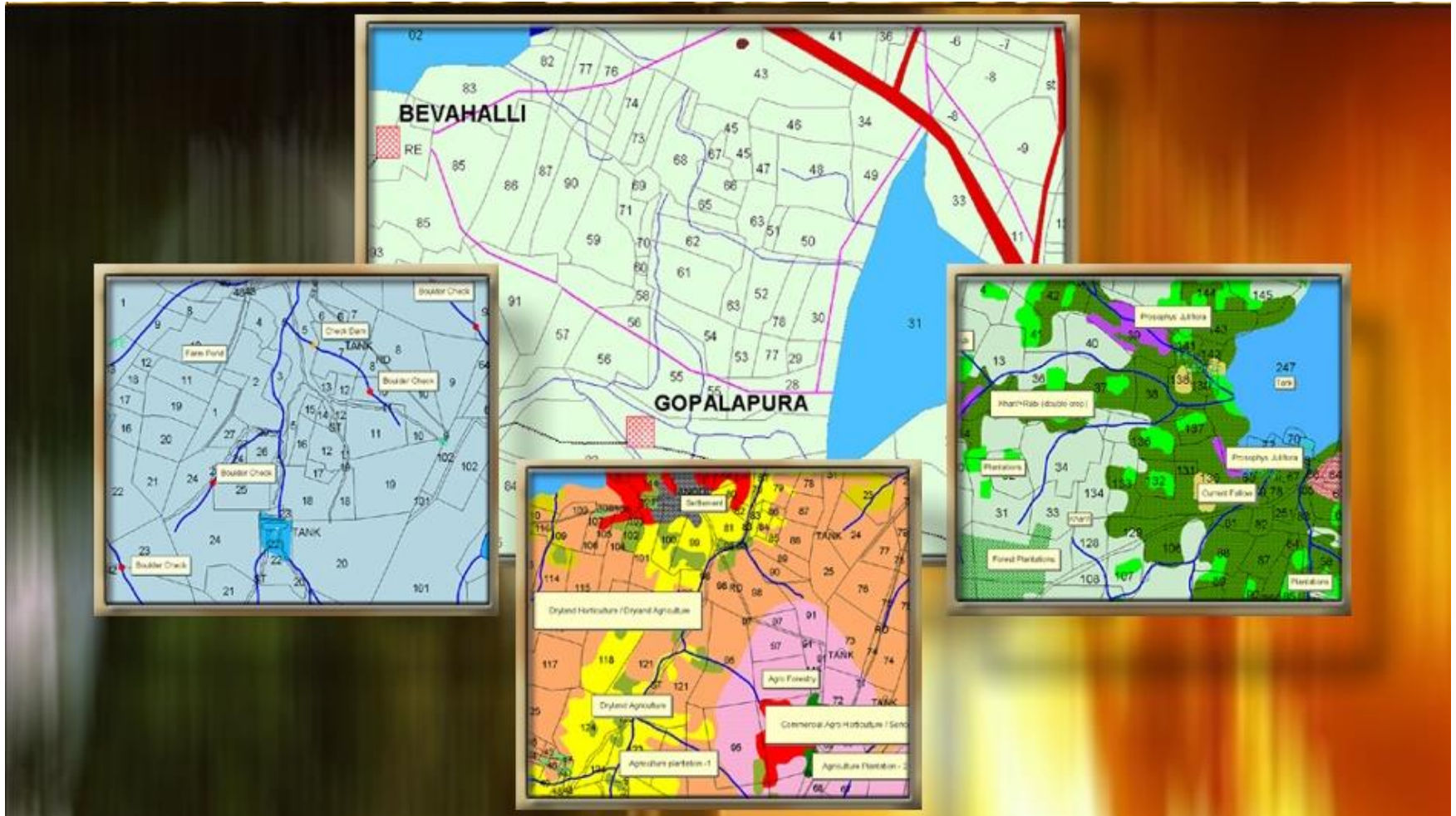


Sustainable Development of Bangalore City

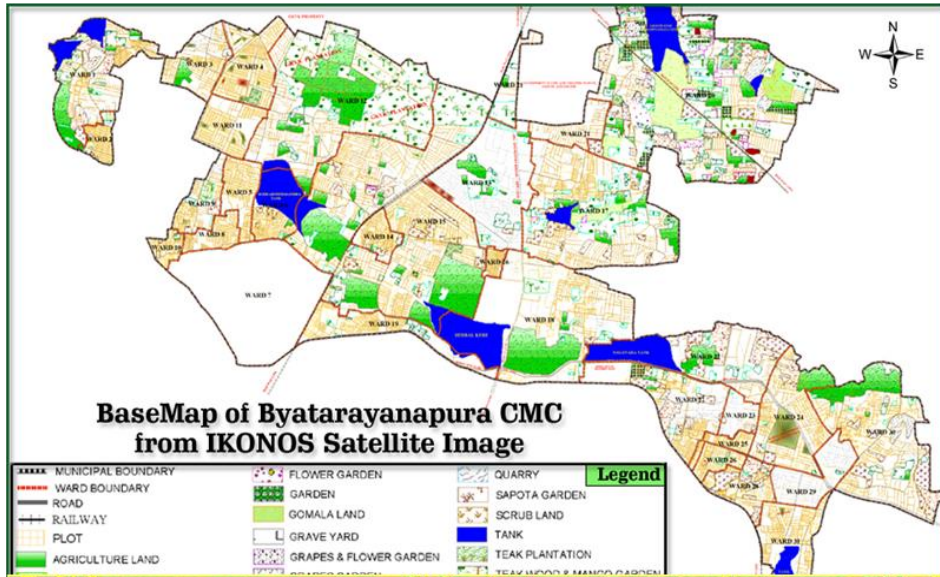
- Pollution has to be controlled through strict legislation, creating awareness and through ecosystem developments.
- The approach should be to conserve water by adequately storing, recharging, recycling through a scientific water management planning.
- Need to have balanced urban growth with increased green cover and reduced pollution.
- Data from earth sensing satellites have to be used frequently in mapping the earth's features, infrastructure managing, managing natural resources and studying environmental change.
- Synoptic analysis of city functions & patterns has to be studied over the time.
- Such data provides vital link between intense localized ecological effects & regional, national and international conservation and management of biological diversity
- Since Bangalore is focal point, that controls surrounding hinterland and decides the economical development of the region, the city has to be carefully planned for the sustainable development.

Cadastral Reference Database (CRD)

Sustainable development needs Cadastral level information of natural resources and infrastructure. Planning has to be made to sustain water, vegetation, soil structure and ecosystem. This leads to the city becoming sustainable and self-sufficient.



Bangalore City Land-use Mapping



- Preparation of land-use map for ward-wise with 1:4000 Scale.
- Generating property information to collecting property tax for city development.



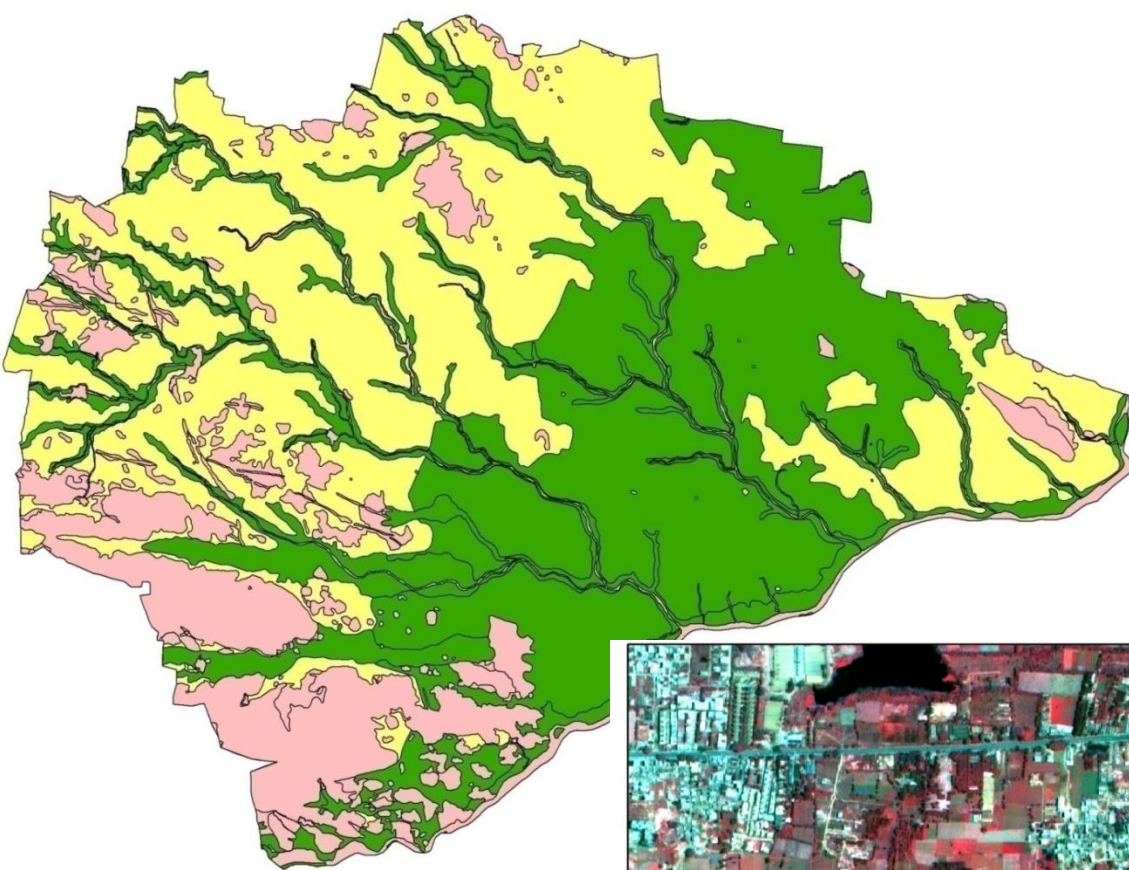
Location: (781675.623937 1429312.893353)

Field	Value
Geo_ID	64_20583
Property ID	64-128-52
Old No	1453
New No	52
Floor No	6
Flat No	
Total No Floors	2
Owner Name	Channabasappa R C
Building Name	
Block Phase	9th Block East
Locality Name	Jayanagar
Pin Code	560093
Telephone No	
Water Meter No	
Electricity Meter No	
Sital Length	9.3
Sital Width	12.2
Sital Area	113.46
Built-up Area Residential Tenanted	0
Built-up Area Residential Self Occupied	90
Built-up Area Non-Residential Tenanted	0
Built-up Area Non-Residential Self Occupied	0
Total Built-up Area Floorwise	90
Total Built-up Area Allfloors	180
Roof Type	RC
Non-Residential Level - I	
Non-Residential Level - II	
Property Usage	1
Ownership Status	S
Year of Construction	
Cost of Construction	
Assessment Status	A
Change in Status	
Photo	64-128-52.jpg
Ward_ID	64
Parcel ID	0641706736
Landuse	Residential
Remarks	
Modified By	
Time Stamp	

64-128-52 - ACDSee 32 v2.42




File Edit View Zoom Tools Help

Lake Encroachment






Legend

Ground Water

-  H Very Good - Good
-  M Moderate
-  N Poor to Nil

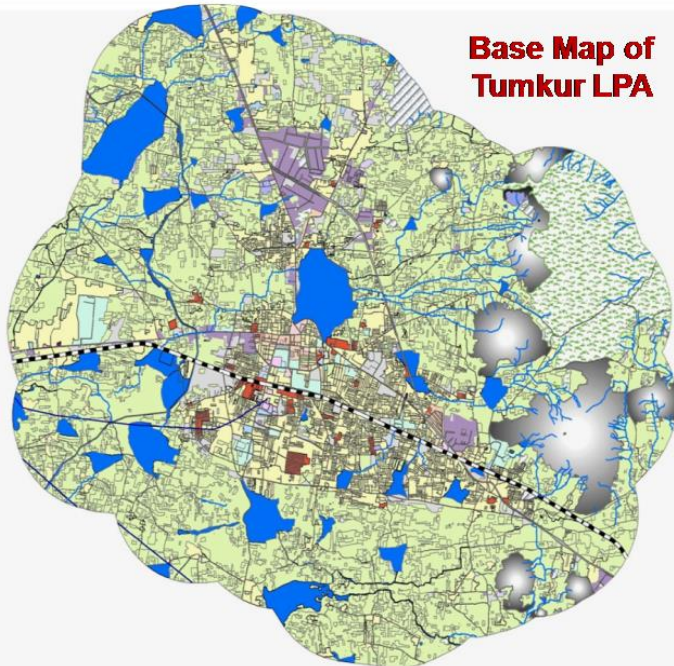
Soil Suitability

-  H HHHH
-  M XXXX
-  N NNXX

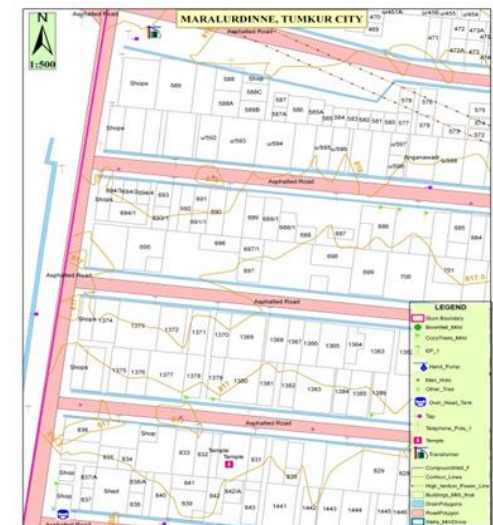
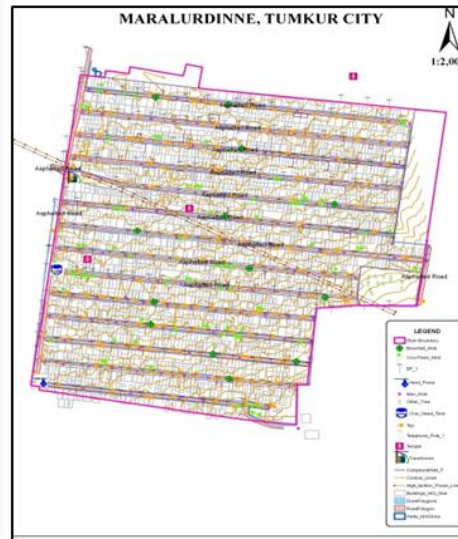


Land-use Planning for Sustainability

Base Map of Tumkur LPA



- Preparation of city base map using large-scale satellite imageries.
- Identification and delineation of ward boundaries.
- Total Station Survey of infrastructure in the city.
- Integration of spatial & non-spatial data.





Bangalore University



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Hosted by : Department of Geography & Geoinformatics, Bangalore University, Bengaluru, India

Thank U