



---

## PLANNING FOR THE INDUSTRIAL HUB OF FARIDABAD, USING GEO-INFORMATICS APPROACH-A Case Study.

Parveen Sihag<sup>1</sup>, Dinesh Kumar<sup>2</sup>, Sandeep Kumar<sup>3</sup>

Department of Geo-informatics, Uttarakhand Open University, Haldwani  
(Uttarakhand)

### Abstract:

The present study “Urban Planning by Geo-Informatics” does heavily rely on technological and scientific discipline for sensing, modeling, representing, visualizing, monitoring, processing, and communicating geo-information in support of urban planning. Location & extent of Haryana state lies between 27° 39' to 30°35' N latitude and 74°28' to 77°36' east Longitude. The objectives of the study are: 1. To access the present status of urbanization with the help of Geo-spatial data and GIS based Information system, 2. To analyze the area of under-development & making planning for better facilities and development. The Urban Design Standards suggests that the Thematic Mapping Activity comprising preparing geospatial database of both Primary themes and Incorporated or attribute Layers at scale of 1:10000. Google Earth images i.e. high resolution satellite data with 50cm to 60cm resolution provided by geo-eye Inc was used. Thematic maps were prepared for study area. The built up area alone covers 22.25% area. Out of total study area of 481 sq.kms of Faridabad town AOI, agricultural alone constitute 49.55% area. The AOI has very low percentage of both wasteland and salt affected area around 0.67 of total area. The above conclusion, in general, provides all the important and updated information of the Faridabad Town AOI. Thus the report also fulfills the task of formulating planning and management of the town existing problems such as – afforestation, congestion, dumping area, wasteland and salt affected area.

**Key words:** Urban Planning, Geo-spatial and GIS.

### 1. Introduction:

#### **1.1 “Urban Planning and Geo-Informatics”:**

**Urban planning** integrates land use planning and urban renewal to improve the built and social environments of communities by adapting urban planning methods to existing cities suffering from decay and lack of investment. Sustainable development and sustainability influence today's urban planners. The present study “Urban Planning by Geo-Informatics” does heavily rely on technological and scientific discipline for sensing, modelling, representing, visualizing, monitoring, processing, and communicating geo-information in support of urban planning. The main focus of the study is to stress on present status and scope of future planning & management of the selected urban area (Faridabad District, Haryana State) with the help of freely available Satellite Data i.e. Google Earth Images.

#### **1.2 Applications of Geo-Informatics:**

There are various scientists have contributed a lot to the study of Urbanization for proper management, planning and sustainable growth & development of the existing urban resources. Many fields have benefited from Geo-Informatics; some of them are as follows;

- Urban Planning and Management.
- Environmental modeling & analysis.
- Transportation & telecommunication planning, engineering and management system.
- Development of in-car navigation system.
- Agriculture & Public Health.

Perceiving the importance of geospatial data and GIS based information System for urban decision support, In order to fulfill the task of present study “Urban Planning by Geo-Informatics” some assessments, such as-status of urbanization of town urban population, urban problems, urban facilities, urban functions, size of town etc.

### **1.2 Urbanization Scenario in India**

Urbanization is not a new phenomenon for India; it is traced since the early Indus Valley Civilization, e.g. Harappa & Mohenjo-Daro. Urbanization is an index of transformation from traditional rural economies to modern industrial one. The level of urbanization in India, in comparison to the world scenario, appears much lower urbanization phenomenon is no exception to India: in fact Indian cities are one of the fastest growing in terms of population and in geographical area among most of the cities outside India. The migration of people from villages to towns and cities continues unabated. The rapid urban growth has resulted in increasing the share of India’s urban population from 159 million (23%) in 1981 to 217 million (26%) in 1991, the 286 million (28%) in 2001 and 300 million (30%) in 2006. Thus, post-independence, while the population of Indian has grown three times, the urban population has grown five times. The urban population in the country is expected to rise India’s population is likely to reach around 1.50 billion (50%) by 2030.

## **2. STUDY AREA**

### **2.1 General Description:**

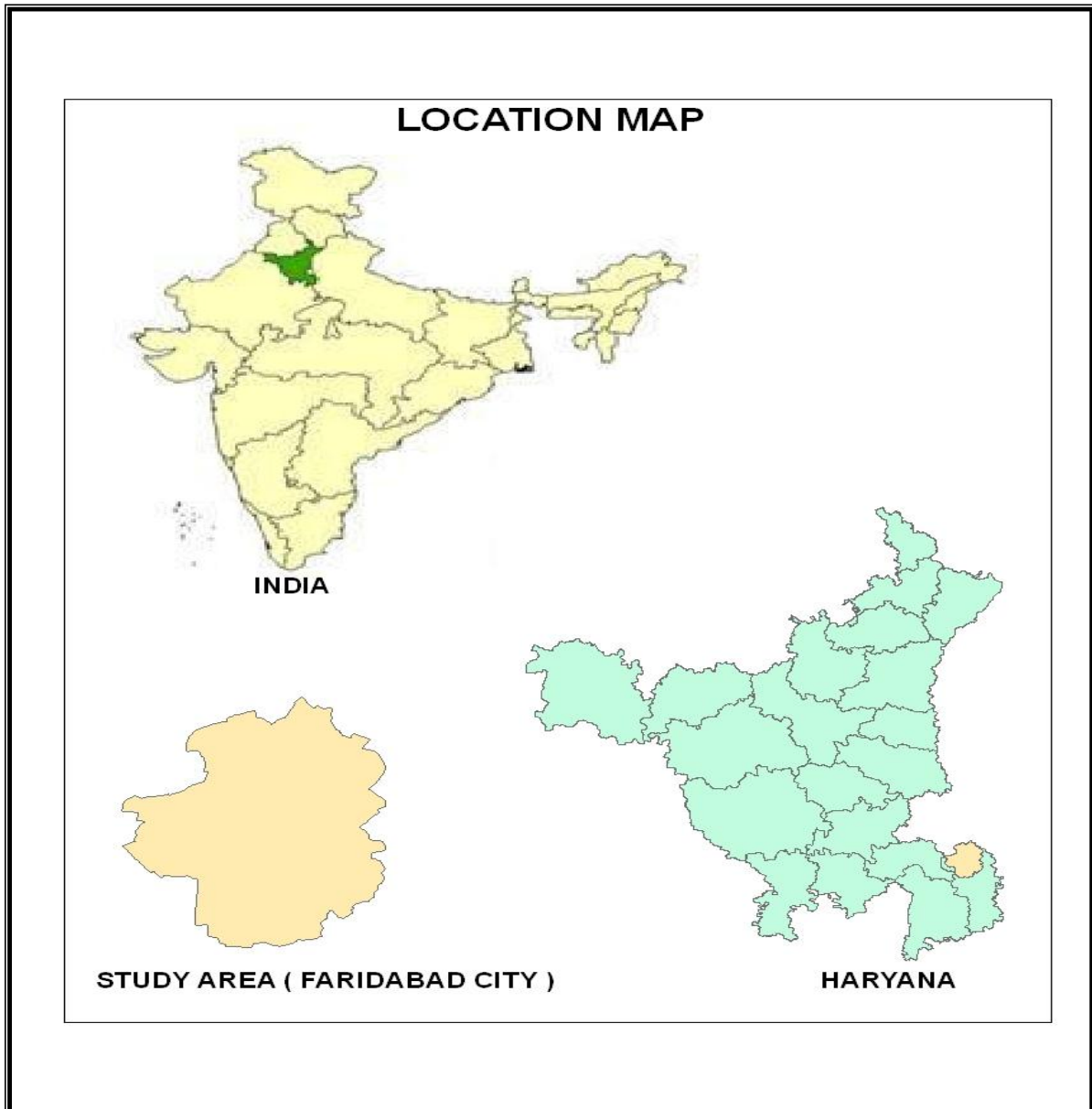
The study area selected for the project work “Urban Planning by Geo-Informatics” is Faridabad District of the Haryana State. In order to achieve the target of study it is must to have gone through the general description of the study area. Before discussing the study area hereby, firstly we will go through the short description of Haryana State i.e.-present urban status.

### **2.2 Haryana State**

Location & extent of Haryana state lies between 27° 39’ to 30°35’ N latitude and 74°28’ to 77°36’ east Longitude. The state of Haryana is located in the North-Western part of India. The river Yamuna flows on the eastern boundary of the state. The state of Himachal Pradesh forms its northern boundary. On the western side, it is flanked by the state of Punjab. At the southern side, the state is flanked by Arawali Hills & the desert of Rajasthan. On eastern side U.P. is the neighboring state. The total area of the state is 44212 Sq. Km.

## **3. Objectives of the Study:**

Here under this project have taken the Faridabad district of Haryana State for fulfilling the following conditions: 1.To access the present status of urbanization with the help of Geo-spatial data and GIS based Information system, 2.To analyze the area of under-development & making planning for better facilities and development.



**Figure:1 Location map of study area**

**4. Material and Methodology:**

The Urban Design Standards suggests that the Thematic Mapping Activity comprising preparing geospatial database of both Primary themes and Incorporated or attribute Layers at scale of 1:10000. Google Earth images i.e. high resolution satellite data with 50cm to 60cm resolution provided by geo-eye Inc was used.

**4.2 MATERIALS:**

**4.1 ArcGIS Software**

**4.2 MS Office**

**4.3 Satellite data**

**4.4 Ground Truth Data**

Ground truth data collected from the field/site from an important source of information for verification, augmentation and accuracy estimation/validation of thematic details mapped from satellite imagery. It is vital for quality assessment and evaluation of the spatial information derived from satellite data. The sources for acquiring ground truth data under thematic Mapping activity include – visual observations of sample doubtful points in field for verification / correlating image interpreted spectral signatures of thematic details; making field photographs and collecting GPS derived measurements in field. Ground truth should cover up to 40% of the study area. Care was taken to note observations of all the representative classes in the field and substantiate through field photos. The ground data also allows collecting the non-spatial or attribute information essential for integration with spatial data using GIS.

#### 4.5 Secondary Data

The information captured from the imagery would get enhanced in content and quality by use of secondary / ancillary data available both in spatial and non – spatial from published and unpublished sources. The secondary data under this heading broadly confirms to two types:

- **Spatial data:** Administrative and Town Boundary data is spatial in form. The administrative boundary would consist of different administrative limits such as district, Taluka, village cantonment, wards. Others would consist of forest, sanctuary, national parks and so on.
- **Non-spatial data:** This data would include as part of the city/town data useful to assist the development of urban indicators. This data would be made available by the SNA's/ULB's as an attribute or as a statistical data. The data broadly include

Urban infrastructure, housing, demography, socio-economic, utilities; environment and land use. The land use includes details of urban land use of residential public/semi-public and so on.

#### 4.6 METHODOLOGY:

Generation of Urban Planning Thematic layers database is accomplished through a series of procedural steps.

##### 4.6.1 Approaches to Thematic Mapping

- i) Data inputs and preparation
- ii) Administrative and Town Data
- iii) Thematic Mapping and Data preparation
- iv) Ground truth collection
- v) Quality Checks and Quality Control Procedures
- vi) Final interpretation & Spatial outputs
- vii) Thematic Layers Mapping using Geodatabase structure.
- viii) Final Map Preparation & Output Generation

In the present study the whole procedure of Thematic Mapping is done in Personal Geodatabase in Arc Gis-9.3 software. Following steps were involved in the digitization and preparation of Thematic Mapping:

##### a) **Geodatabase Creation and organization:**

Geospatial data base contributes immensely in the management of various thematic databases. It meets the project requirements in terms of value added information in content, format, multiple thematic layers integration and analysis. The Object Oriented GIS data structures use simplified data types and can accommodate vector & raster data, data tables and others GIS objects / features in a single, central repository. The thematic mapping geospatial data structure to facilities feature capturing and mapping was created using the Geodatabase technology. The georeferenced and rectified satellite imagery was displayed as a raster in ArcGIS, with the Administrative boundaries of Faridabad as a vector overlay, the

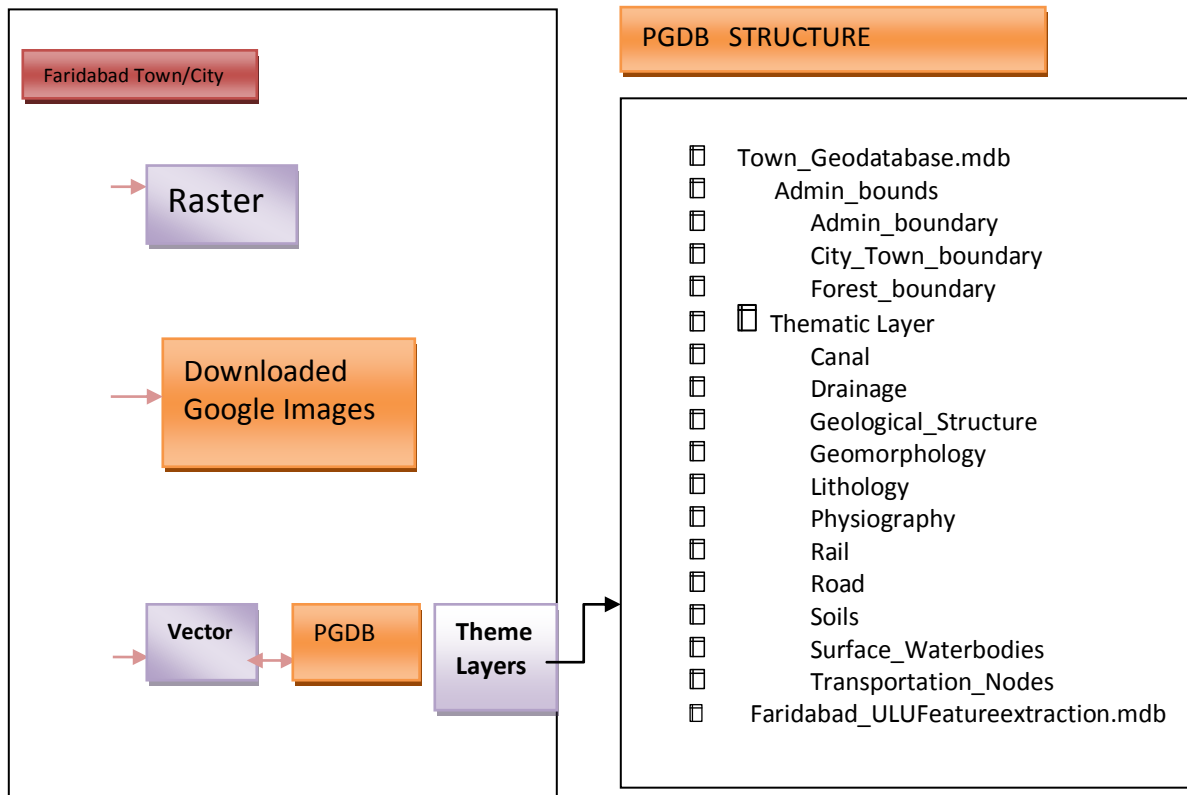
2D based visual or onscreen Interpretation kept limited to the area outside the Urban Core and within the urban sable are boundary depending upon the theme to be mapped. We adopted different enhancement techniques on the terminal, which facilitated better delineation of thematic feature boundaries.

The overview of the database structure given the Figure 2. The structure contains data for each city comprising of raster and vector layers.

#### 4.6.2 Personal Geodalatabase

Personal Geodatabase uses Microsoft Access as a backend database to store spatial and non spatial data. Personal Geodatabase can store database up to maximum of 2GB in single user mode. Personal Geodatabase structure met all the requirement of creation and organization of town wise thematic layers GIS data.

**Figure 2: Personal Geodatabase Creation for Thematic Mapping:**



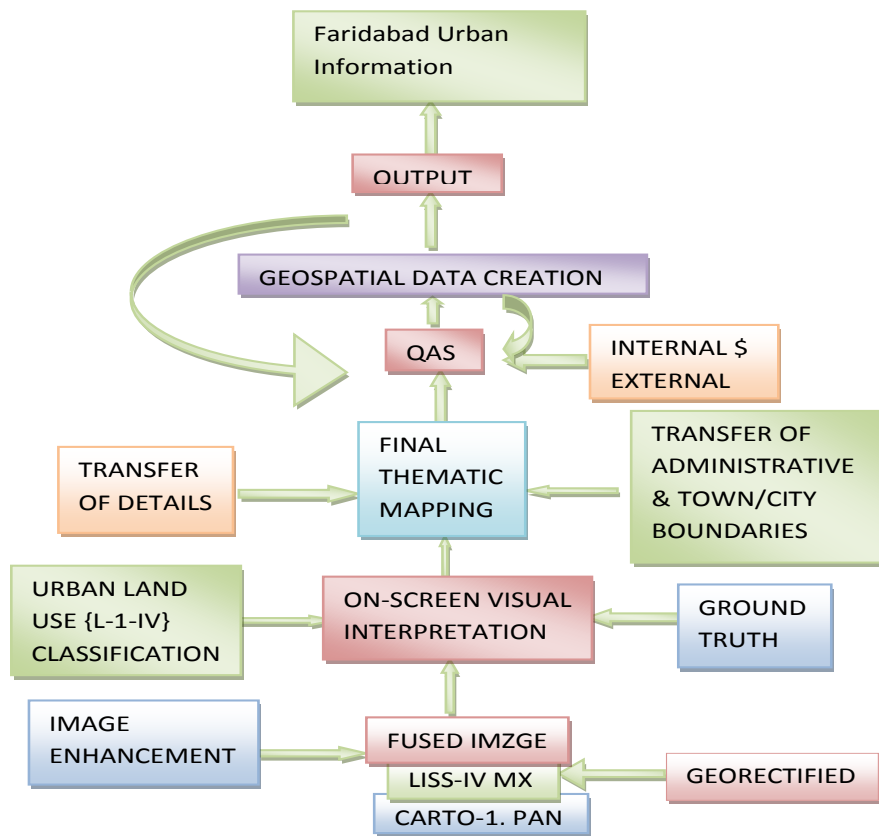
#### b) Organization of Thematic Layers in Geodatabase

The organization of thematic layers and its attributes in Geodatabase model would be done at two levels.

- i) Feature Dataset.
- ii) Feature Class

#### 4.6.3 Topology

The topology manages the rules that control how features can be spatially related. Spatial relationships between entities (point, line, and polygon) are known as Topology. A separate Topology feature class was created within the feature database to define topological rules for the feature class within the themes and also across the themes such as a road / canal / drainage should not cross the building, agriculture and forest should not overlap and so on. Hence, topology describes how 2 lines connect, defines areas and identifies the areas that are adjacent to each others.



**Figure: 3 Methodology Flow Chart**

#### 4.6.4 Final interpretation & Spatial Outputs

The thematic mapping activity comprises of preparing GIS (geospatial) database of all the Primary themes and Attribute. The interpreted themes along with the Administrative (town/city) boundary data of Faridabad district and other spatial attributes collected during the ground truth were updated, created and stored in geodatabase.

The personal Geodatabase structure and the Arc Map, (mxd) document was prepared based on the Geodatabase (spatial) data structure which include theme wise & layer wise data organization within the ArcMap environment with layer wise standard symbology, template. Figure-5 shows the sample mxd document in Arc Map.

#### 4.6.5 Final Map Preparation and Output Generation

An Arc Map document contained the geodatabase structure. Using the standard ArcGIS interfaces the output was generated. The area covered by each layer/theme of the total area under study, in percentage, was derived.

### 5. Results

The present study “**Urban Planning by Geo-Informatics**” clearly demonstrates the importance and role of GIS based Information System and potentialities of Satellite Remote Sensing technique for preparation of more updated and reliable information.

#### Classification Schema:

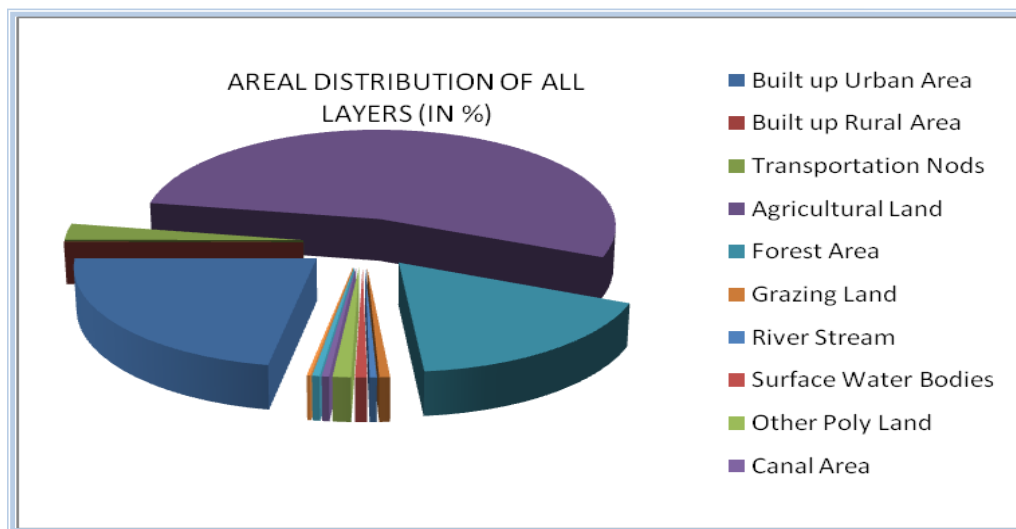
The urban land use classification can be delineated from used Satellite images of google Inc. The classes as mentioned in the classification may or may not reflect in Faridabad town/city and vice-versa. Similarly all land use classes observed in a Faridabad town/city might not

have been incorporated in the classification schema. This classification schema is indicative and flexible.

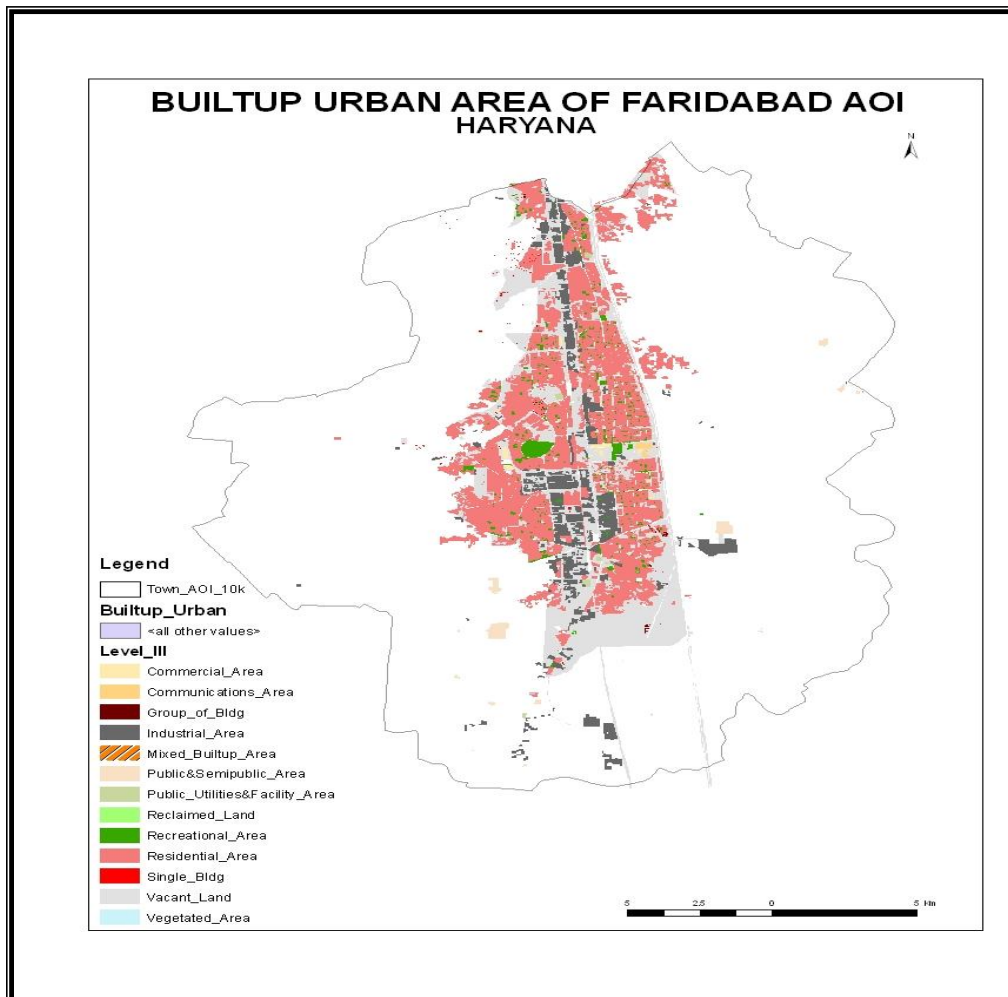
**Table-1: Distribution of Thematic layers in Faridabad Study area.**

Sr. No.	Thematic Layers (polygon feature)	Area in (% age)
1	Built up Urban Area	22.25
2	Built up Rural Area	0.05
3	Transportation Nods	2.65
4	Agricultural Land	53.65
5	Forest Area	17.23
6	Grazing Land	0.67
7	River Stream	0.45
8	Surface Water Bodies	0.74
9	Other Poly Land	1.14
10	Canal Area	0.46
11	Mettle Road	0.48
12	Drain	0.23
<b>Total</b>		<b>100</b>

Any new or additional classes delineated during the process of interpretation can be suffixed against the appropriate classes which would also enable to strengthen the classification schema in Geodatabase Structure in ArcGIS 9.2 Software. The results & discussion can be computed on the basis adopted materials and methodology.



**Figure: 4 Diagrammatic Representation of Areal Distribution**



**Fig: 5 Distribution of Built up Urban Area Map of Faridabad Area (%age)**



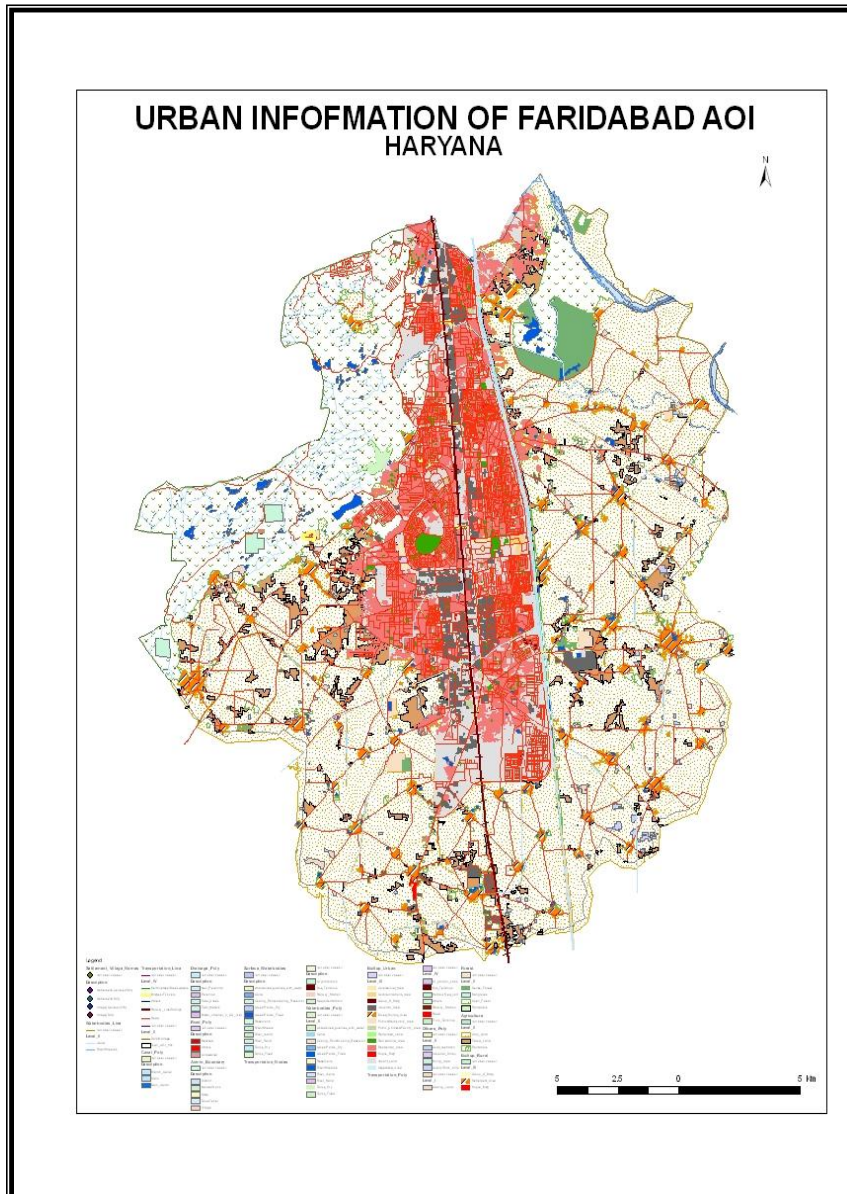


Fig: 6 Thematic Map of Faridabad Study Area

## 6. Conclusions

The study demonstrates the importance and potentiality Satellite Remote Sensing technique for preparation of more consistent, accurate and up-to-date baseline information on urban land use for future planning, management and development of any area, The present study is derived on the basis of interpretation of Faridabad city with the help of downloaded satellite data i.e. Google Earth- The study together with satellite data incorporated with ground truth data and secondary data revealed different layers in altogether created in 3 Datasets of Geo database, namely, a) Urban Land use, b) Soils, c) Base Layers

On the basis of the results and discussion, that has been derived on the basis of interpretation of satellite data at scale of 1:10000, incorporation of ground data & secondary data. according we can conclude in following manner:

### 1) Built up Urban

It comprises of residential area, industries, public-semi-public utilities, communication, etc. The built up area alone covers 22.25% area. In overall the built up area is well planned. The

area is well connected with metalled roads. Though the area is facing some congestion and greenery problem.

## **2) Built up Rural**

The interesting thing in Faridabad AOI town is that even villages have modern facilities like- 90% roads are metalled, school facilities, health and sanitation facilities. There are few un-metalled roads.

## **3) Industries, Research and Commercial Areas**

There are both large and small units. The industries are secondary - base, such as –Escort industry, JCB Machine, Thermal plant, FCI and rice mills. There are national importance research Centers & Wheat Research Directorate, 3 Water purify Plant in this study area.

## **4) Agricultural Area**

Out of total study area of 481 sq.kms of Faridabad town AOI, agricultural alone constitute 49.55% area. Most of agriculture area is cropped, some of it under plantation and fallow land. Hence the town has mixed economy.

## **5) Wasteland and Salt Affected Land**

The AOI has very low percentage of both wasteland and salt affected area around 0.67 of total area. But it has been concluded through earlier decade's records that their share has been increasing mainly salt affected area. The main cause behind this is the use of fertilizers, pesticides and faulty methods of practice. This is important point of study for Agricultural Scientists for the future management of agricultural land.

## **6) Water bodies**

The study area has many water bodies, including- Tow major canal and nine branch canal in Faridabad AOI area, hence has good water facilities. In rural built up area the water bodies consists of ponds and lakes.

## **7) Forest land**

There is devoid of forest cover in study of AOI. The forest comprises of only 17.22% of total area. That's why the area is facing several environmental problems. This report will definitely be of great useful for Department of Forest in formulating future planning and management.

## **10) Soils**

The soil type, depth and texture has been derived by satellite data interpretation, Pre-Field interpretation, ground truth data and post-field interpretation, as described below:

- a) soil type - Alluvial soils, aioli soil
- b) soil texture – Core loamy, sandy, fine clayey to fine loamy
- c) soil depth – very deep (>160 cm)

The important place of the study area has been taken in other point, with names, in feature class, such as- Bus stand, Civil hospital, Railway station, Neelam chowk, B K chowk, Ankhir chowk, etc.with their photographs. The above conclusion, in general, provides all the important and updated information of the Faridabad Town AOI. Thus the report also fulfills the task of formulating planning and management of the town existing problems such as – afforestation, congestion, dumping area, wasteland and salt affected area.

## **7. References**

- i) Geo-Informatics for Urban & Regional Planning: Environment, Planning & Design, Holmberg S.C (1994), Volume-21(1), pp 5-19.
- ii) Urban Growth Analysis using Spatial & Temporal Data: H.S Sudhira, T.V Ramchandra, Karthik S. Raj & K.S. Jagdish, pp 90-105.(Urban growth identification, quantification, knowledge of rate & trends of growth would help in Regional Planning for better infrastructure provision in environmentally sound way).

- iii) Urban Growth & Land use Change in the National Capital Region of Delhi using Remote Sensing & GIS Techniques- B.Ramesh, Paliwal Rakesh, Jayanthi C. Satish, Bhavani S.V.L, Raghaswamy & S. Surendra, pp 1119-1124, ISPRS by NRSC.
- iv) National Urban Information System (NUIS) – Design and Standards (July 2006), Town & Country Planning Organization, Govt. of India, Ministry of Urban Development, New Delhi, pp 1-121.
- v) National Urban Information System (NUIS) Scheme – Guidelines for Implementation (March 2006). Town & Country Planning Organization, Govt. of India, Ministry of Urban Development, New Delhi, pp 1-52.
- vi) UN (2001): World Urbanization Prospects.
- vii) Emergency Management & Land use Planning in Hazardous Areas (November 2007): Journals of Contingencies & Crisis Management-Volume 15, Issue-4, and pp 194-207.
- viii) Urban Growth & Environmental Consequences: A Brazilian Case Study using Geotechnologies- Sandra Maria Fonseca Da Costa, pp 1069-1074, ISPRS by NRSC.
- ix) Urban Land use Planning: J. Kaiser, David R. Godschalk & F. Stuart Chapin, Journals of Urban Land use Planning, pp-4.
- x) Hydrology for Urban Land use & Planning: A Guidebook on the Hydrologic Effects of Urban Land use-LB Leopold, 1968, pp-4.
- xi) Urban Form, Energy & the Environment: A Review of Issue by Evidences & Policy- William P. Anderson, Department of Geography University of Hamilton, Ontario, Volume-33, pp 7-35.
- xii) Diurnal Air Temperature in Built up Areas in Relation to Urban Planning- Landscape & Urban Planning Volume 61, Issue-1, Sept. 2002, pp 37-54.
- xiii) The Article “The Rural-Urban Fringe”: Ramachandran and Shrivastava (1974).
- xiv) The Essay “Urban Sprawl”: Whyte (1958).
- xv) UN (2001): World Urbanization Prospects.
- xvi) Urban Growth Analysis using Spatial & Temporal Data: H.S Sudhira, T.V Ramchandra, Karthik S. Raj & K.S. Jagdish, pp 90-105.(Urban growth identification, quantification, Knowledge of Rate & trends of Growth would help in Regional Planning for better infrastructure provision in environmentally sound way.