

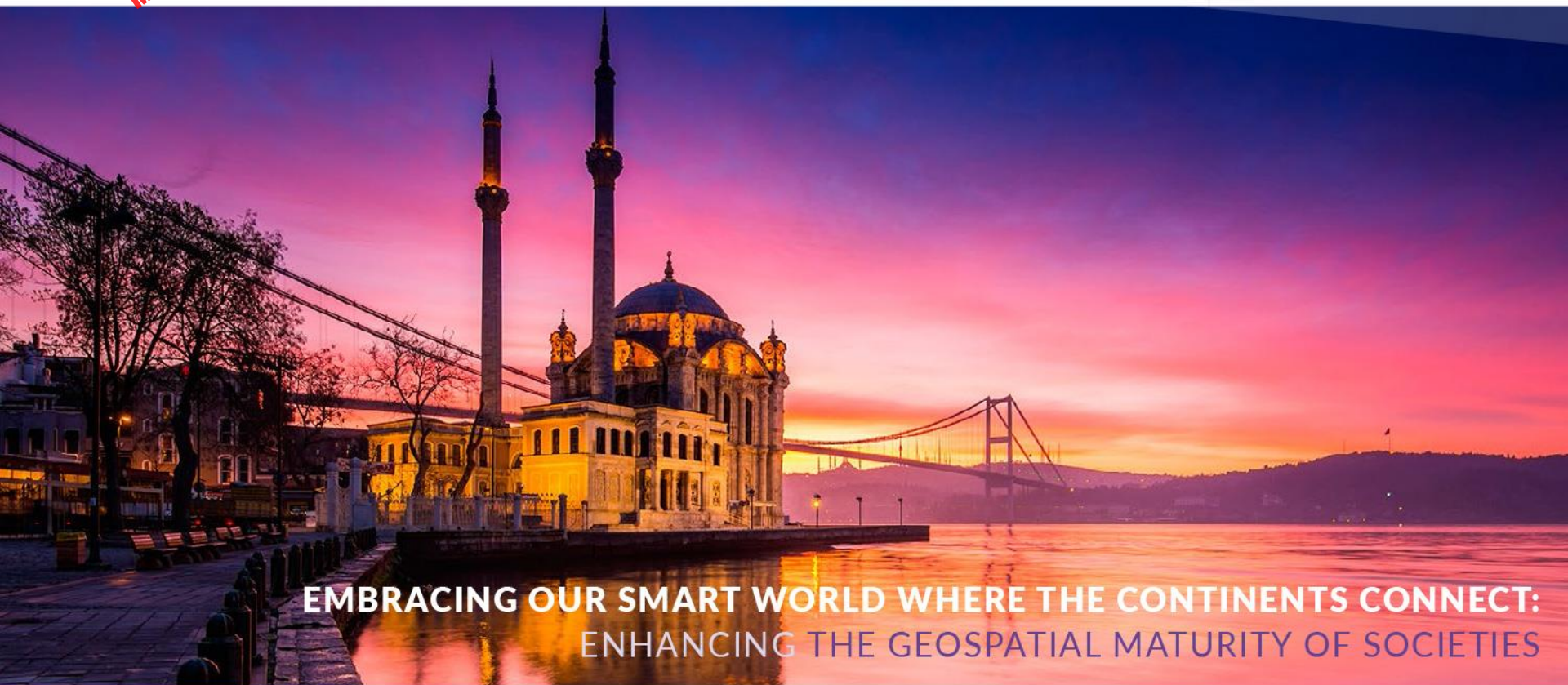


Presented at the FIG Congress 2018,
May 6-11, 2018 in Istanbul, Turkey

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Preparation of Geodatabase for Urban Planning in Nepal

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1. Introduction

- Land is one of the important and precious natural resources of the earth surface. The demands for arable land, grazing, forestry, wild-life, tourism and urban development are greater than land resources available. In the developing countries, these demands become more pressing every year and the population dependent on the land for food, fuel and employment will double within the next 25 to 50 years (FAO, 1993).
- The economic and social lifestyles of most of the Nepalese are intimately related to land. Hence, urban planning for making the best use of the limited land resources is inevitable. However, space science technology known as satellite remote sensing (RS) and the Geographic Information System (GIS) can be helpful in acquiring spatial/temporal data, and preparing digital data base.

1. Introduction Contd...

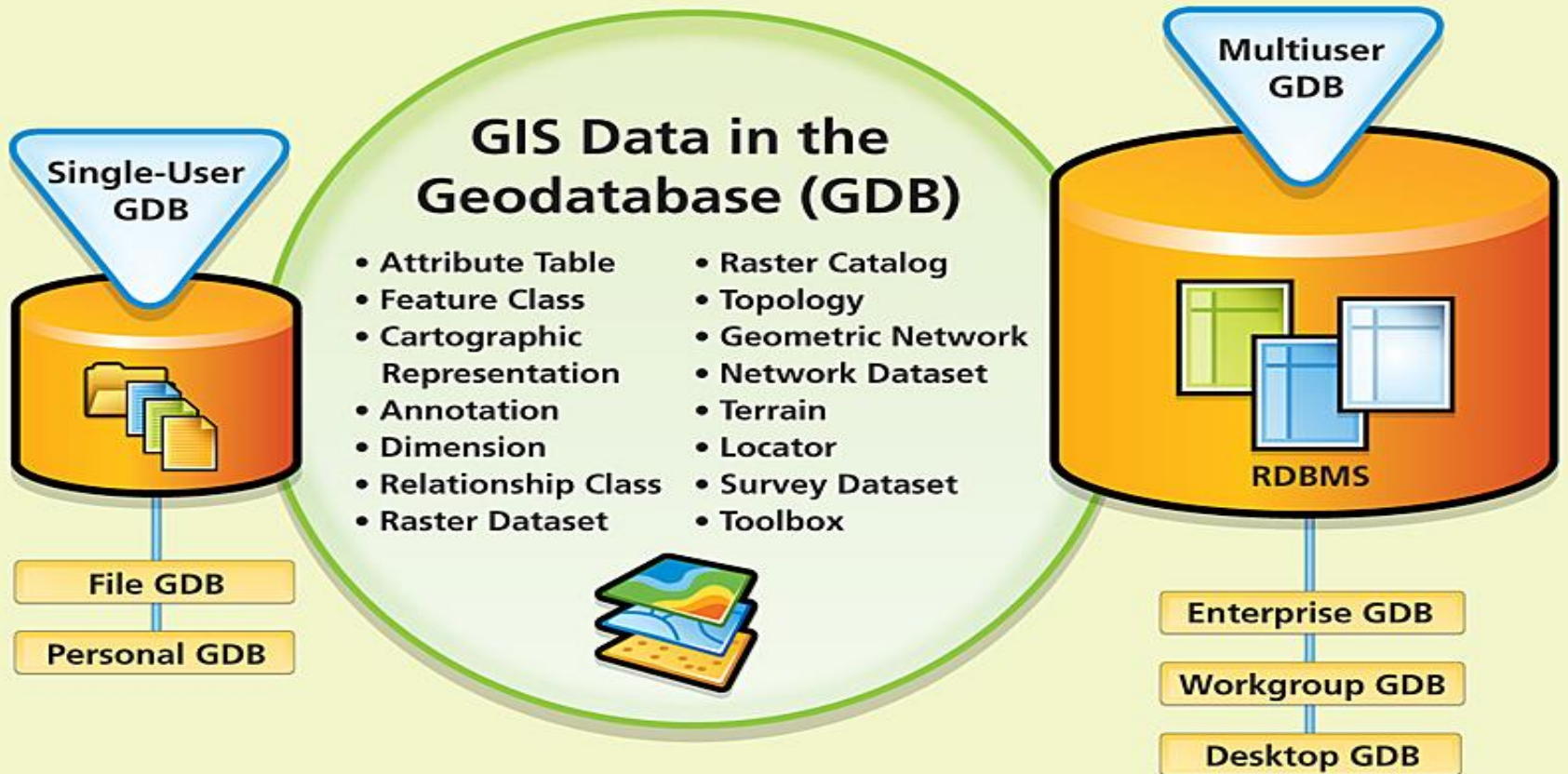
- These spatial databases together with data on different land characteristics that could be collected from field survey certainly will be helpful in decision making support system for an efficient management of resources in municipality level.
- On the April 16, 2012, the Government of Nepal has approved the National Land Use Policy, 2012 with an intention to manage land use according to land use zoning policy of the Government of Nepal and outlined six zones such as Agricultural area, Residential area, Commercial area, Industrial area, Forest area and Public use area. The policy has defined the respective zones as per the land characteristics, capability and requirement of the lands.

1. Introduction Contd...

- The VDCs and municipality of Nepal lack proper base map. They are mostly dependent on 1:25,000 or 1:50,000 scale topographic maps, Land resources maps or other available analogue maps which is not sufficient or too coarse to use for municipality level planning. The available maps are also not much useful for proper decision making process of the municipal development activities. The lacking of digital geographic information in Nepal, particularly large scale, has resulted ineffective and inefficient planning activities in urban development.

2. Geodatabase

- A database is a lot of information stored in a computer device, taking into account the existing technologies used to organize and structure the database, so we can easily manipulate the content. A database is collection of data organized in a structured way, so that; information can be retrieved quickly and reliably (Closa et al., 2010).
- The invention of information technology has led the database to be used in a management system, which is called database management system. A database management system is a set of programs that enables the management and access to a database. It generally hosts multiple database, which are designed with various software by themes.



2.1 Types of Geodatabase

There are three types of ESRI Geodatabase. The short description of geodatabase as below;

- **The File Geodatabase:** Dataset can weigh up to 1T. This database can be encrypted and secured.
- **The Personal Geodatabase:** The data is stored in an access database. The maximum size of this database is 250 to 500 MB.
- **The ArcSDE Geodatabase:** The data is stored in external databases and much more cumbersome to manage but also more efficient as Oracle, DB2, SQL Server.

2.2 Conceptual Modeling of Database

Model as a simplification of reality and defined the reason for modeling as to better understand the system (Booch et al., 1999). Also they outlined four aims to be achieved through modeling systems;

- Visualization of a system as it is or as we intend it to be.
- Specification of the structure or behavior of a system.
- Models provide a temple for guidance while constructing a system.
- Documentation of decisions made during the design process.

2.2 Conceptual Modeling of Database Contd...

According to the (Yeung and Hall, 2007) different modeling techniques used for database management systems can be classified in the following categories.

- Hierarchical Systems
- Network Systems
- Relational Systems
- Object-oriented Systems



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2.3 Database and Geodatabase Structures

Attributes

ID	Name	Type
1	Water Bodies	River
2	Water Bodies	Stream
3	Water Bodies	Pond, Lake

Objects

Figure 2: Database Structures: Classes, Objects, and Attributes

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2.3 Database and Geodatabase Structures Contd...

Attributes

Shape	ID	Name	Type
Polygon	1	Public Use	Hospital
Polygon	2	Public Use	School
Polygon	3	Public Use	Institutions

Features

Figure 3: Polygon Feature Class



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Database for Present Land Use Land Cover

Field	Data Type	Description	Remarks
FID	Feature Id	Feature	FID
SHAPE	Geometry	Geometric Object type	SHAPE
ID	Long	Unique Object ID	ID
LEVEL1	String	Land Use Class	LEVEL1
AREA	Double	Area in Square KM	AREA

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3. Study Area

- Rampur Municipality is located in northern part of Palpa district. It covers the area of 123.34 sq. km. \
- The municipality is surrounded by Wakamalang VDC in east, Heklang VDC in the west, Chapakot Municipality, Sekam, and Sakhar VDCs of Salyan district and Gajarkot VDC of Tanahu district in the north, and Birkot, Ringneraha, Siluwa, Galdha, Jhirubas and Sahalkot VDCs in the south.
- It is situated at the altitude 250m to 1850m and 270 48' 9.84" to 270 55' 38.32" N latitude and 830 39' 23.73" to 840 0' 8.57" E longitude.

4. Materials and Methods

- The Topographical Maps of the Study area are covered under 2880 04D, 08A, 08B, 08C, 01C, 05A, 05C in the scale of 1:25,000 scale bearing supplementary contour of interval 10m.
- These maps are published in 1996 and are compiled from 1:50,000 scale aerial photography of December, 1990 and field verification done in December, 1991.
- The Topographical Maps were used for planning process of GCPs collection with DGPS survey and also used for feature extraction of dataset such as Municipality boundary, location name, and additional data for GIS based analysis.



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Data Types and Sources

Data Type	Year	Scale / Resolution	Source
Topographical Maps	1996	1:25000	Department of Survey
Geology Map	1978/79	1:125000	Department of Survey
Digital Globe 4 Band Satellite Image, PAN & MSS	March 07, 2015	1m PAN and 2m MSS	National Land Use Project
Aster DEM	2011	PS. 30*30	Download from USGS Website
DGPS Survey for GCPs and field verification	2015	Boundary Land Use	& ERMC team including me

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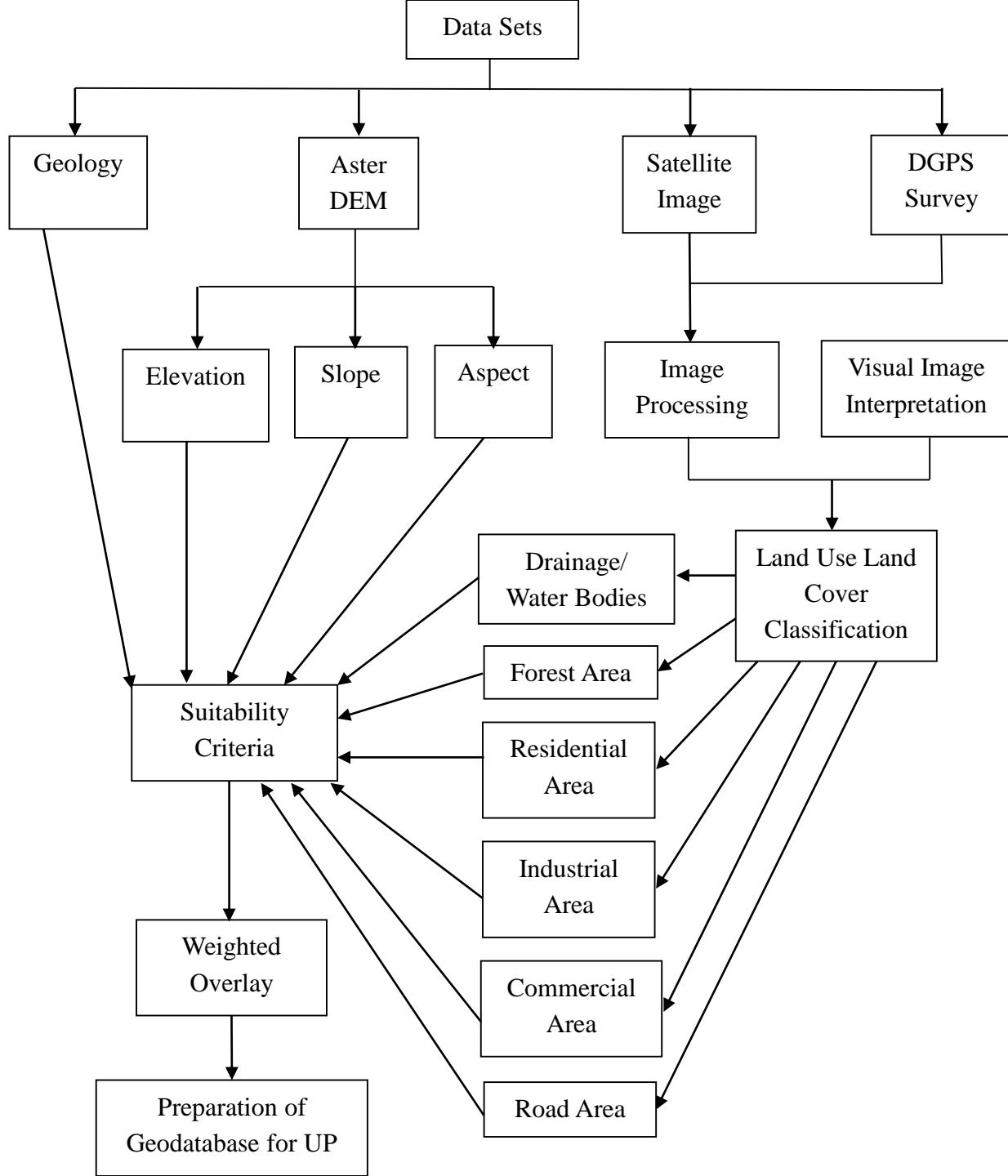
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Methodology





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Weight for Geodatabase Preparation of Urban Planning

S. N.	Category	Criteria	Value	Suitability Level
1.	Geology	Unconsolidated Sediments	4	Highly Suitable
		Sallyan Series	3	Moderately Suitable
		Midland Metasediments Group	2	Least Suitable
		Thrust Buffer 100m	1	Not suitable
2.	Elevation	< 500m	4	Highly Suitable
		500 – 750m	3	Moderately Suitable
		750 – 1000m	2	Least Suitable
		> 1000m	1	Not Suitable
3.	Slope	0 – 10 Degree	4	Highly Suitable
		10 – 20 Degree	3	Moderately Suitable
		20 – 30 Degree	2	Least Suitable
		> 30 Degrees	1	Not Suitable
4.	Aspect	157.5 – 202.5	4	Highly Suitable
		112.5 – 157.5 and 202.5 – 247.5	3	Moderately Suitable
		90 – 112.5 and 247.5 - 270	2	Least Suitable
		0 – 90 and 270 - 360	1	Not Suitable
5.	LULC	Agriculture	4	Highly Suitable
		Buffer of Forest 100m, River 40m, Stream 20m, Commercial 20m, Residential 20m, Public Use 20m, Industrial 20m and Road 20m	1	Not Suitable

5. Process

5.1 Geology

S. N.	Category Geology	Value	Suitability Level
1.	Unconsolidated Sediments	4	Highly Suitable
2.	Sallyan Series	3	Moderately Suitable
3.	Midland Metasediments Group	2	Least Suitable
4.	Thrust Buffer 100m	1	Not Suitable

5.2 Elevation

S. N.	Category Elevation	Value	Suitability Level
1.	< 500m	4	Highly Suitable
2.	500 – 750m	3	Moderately Suitable
3.	750 – 1000m	2	Least Suitable
4.	> 1000m	1	Not Suitable



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5.3 Slope

S. N.	Category Slope	Value	Suitability Level
1.	0 – 10 Degree	4	Highly Suitable
2.	10 – 20 Degree	3	Moderately Suitable
3.	20 – 30 Degree	2	Least Suitable
4.	> 30 Degrees	1	Not Suitable

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5.4 Aspect

S. N.	Category Aspect Direction	Value	Suitability Level
1.	157.5-202.5	4	Highly Suitable
2.	112.5-157.5 & 202.5-247.5	3	Moderately Suitable
3.	90-112.5 & 247.5-270	2	Least Suitable
4.	0-90 & 270-360	1	Not Suitable



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5.5 Land Use Land Cover

S. N.	Category LULC	Value	Suitability Level
1.	Agriculture	4	Highly Suitable
2.	Buffer of Forest 100m, River 40m, Stream 20m, Commercial 20m, Industrial 20m and Road 20m	1	Not Suitable

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6. Results: (Preparation Geodatabase for Urban Planning)

Feature Dataset	Feature Class	Feature Type	Class	Description
Administrative Boundary	<u>Municipality_Boundary</u>	Polygon		Municipality Boundary
LULC	<u>Land Use Land Cover</u>	Polygon		Land use land cover
Raster Datasets	DEM	Raster		Digital elevation model
	Geology	Raster		Geology Raster
	Elevation	Raster		Elevation Raster
	Slope	Raster		Slope model
	Aspect	Raster		Aspect Model
	LULC	Raster		LULC Raster
	<u>Weighted Final</u>	Raster		Final Map
	<u>Satellite Image PAN</u>	Raster		Panchromatic Satellite Image

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-  Geodatabase
 -  Rampur_Municipality_Geodatabase.mdb
 -  Administrative_Boundary
 -  Municipality_Boundary
 -  LULC
 -  Land_Use_Land_Cover
 - +  Aspect
 - +  DEM
 - +  Elevation
 - +  Geology
 - +  LULC
 - +  Satellite_Image_PAN
 - +  Slope
 - +  Weighted_Final

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7. Conclusion

- Urban growth and land use study is very useful in local government as well as in urban planners for the appropriate plans of land use planning in sustainable urban development. Urban development provides the knowledge for the planners and decision makers, the required information about the current state of development and the nature of changes that have occurred, physical conditions, public service accessibility, economic opportunities, local market, population growth, and government plans and policies are the driving forces of planning process. GIS and Remote Sensing provides spatial analysis tools which can be applied at the municipality, city and district level urban development planning. The present land use pattern of the municipality under study is classified by using remotely sensed image with the help of ground based information.

7. Conclusion Contd...

- Lack of clear guidelines on the classification system has posed a level of difficulty in assigning the classes of different hierarchy in land use categories. Hierarchical classification system helped in incorporation of complex land use pattern of this municipality. NLUP specification and research knowledge classification system used in the study attribute to standardization in the land use land cover result among this municipality. Digitization and visual image interpretation incorporated with extensive field visit and use of ancillary data such as geology map, and topographical map. The land use classes yield better accuracy because the classes are designated manually based on ground knowledge and visual interpretation rather than automatic classification.



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Thank You

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