Course: BSc CSIT

Madan Bhandari Memorial College

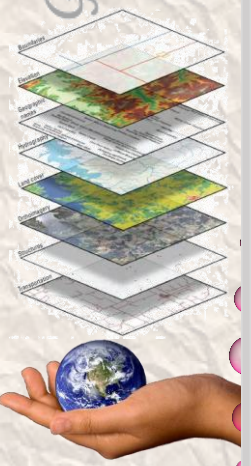
Geographic Information System

Digital Mapping Concepts

CSC482 Unit-2 Class 5

मधु सुदन अधिकारी

Geographic Information System
By: Madhu Sudan Adhikari



Agenda

- Database and Mapping Concepts
- 🔗 Linking Databases to Maps
- 🗺️ Thematic Maps and Map Layers
- 📏 Map Scale and Resolution
- 🧭 Vector vs. Raster Resolution
- ⚖️ Scale vs. Resolution
- 🌍 Representing Geographic Phenomena
- 🧠 Key Takeaways

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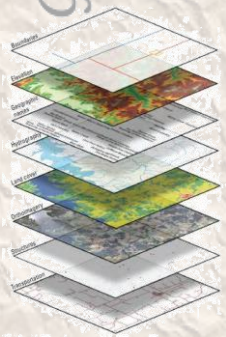
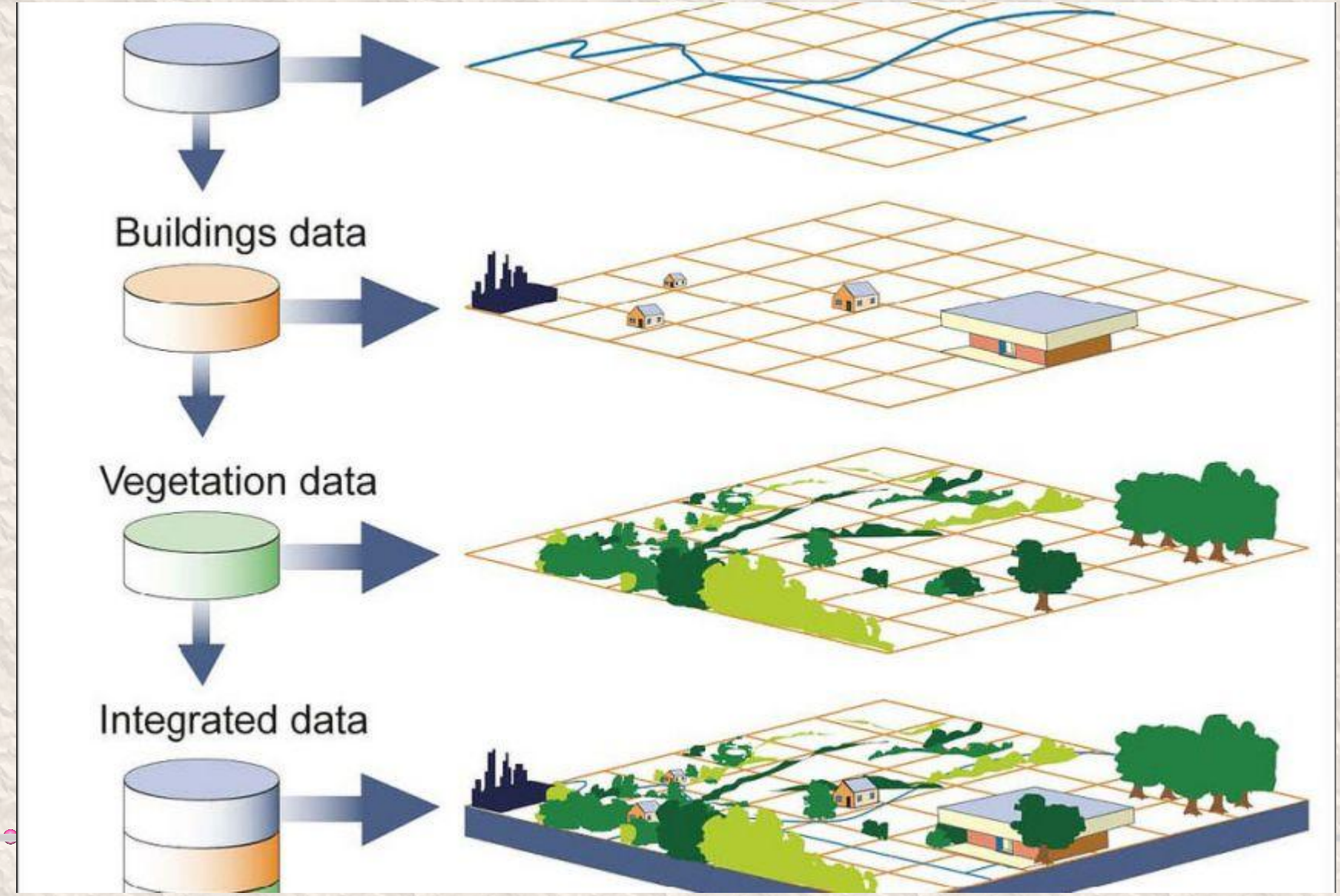


Database and Mapping Concepts



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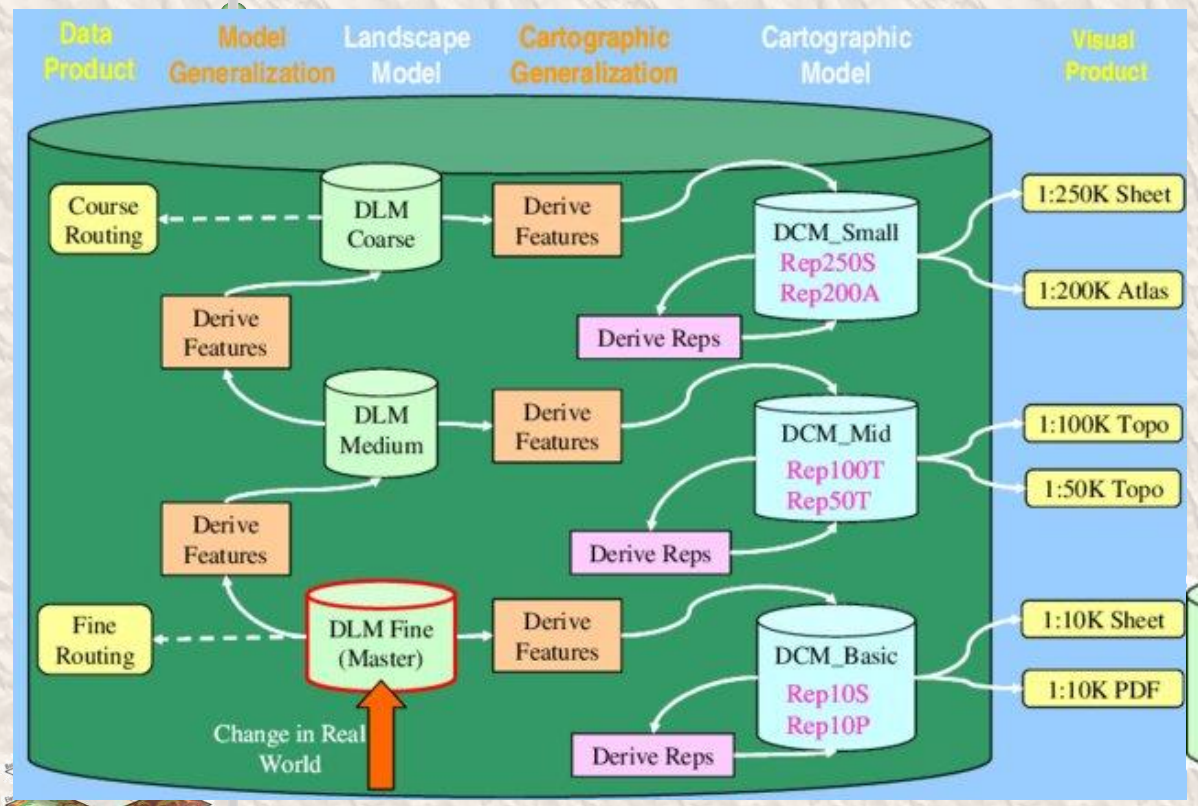
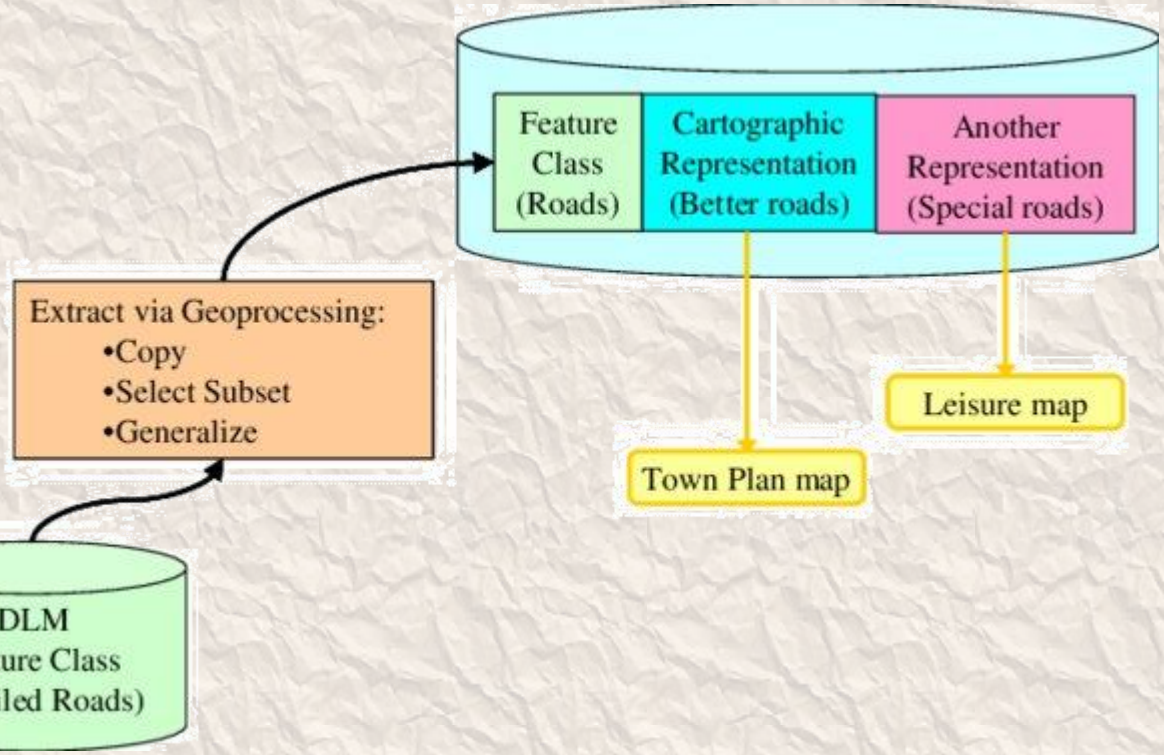
Database and Mapping Concepts





Linking Databases to Maps

- GIS integrates geographic features (points, lines, polygons) with attribute data (e.g., name, category).
- Enables maps to show not just where things are, but what they are.
- Uses unique identifiers (IDs) to connect spatial features to database entries.
- Two primary data models:
  - Vector: Discrete features with geometry (points, lines, polygons).
  - Raster: Grid cells representing continuous phenomena (e.g., elevation, land cover).

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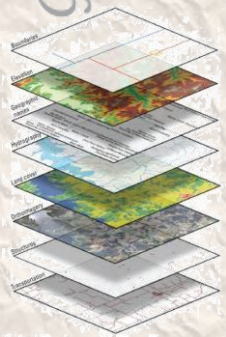

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Nepal_Spot_Height
Nepal_Streams
Database
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Road Network of Nepal
This map
is prepared to
demonstrate to the students of BSc CSIT
at
Madan Bhandari Memorial College,
New Baneshwor, Kathmandu
Legend
Nepal_Roads
TYPE
Foot Path
Main Trail
Gravelled
Metalled
Highway
Railway
30 15 0 30 60 90 120
Miles

Thematic Maps and Map Layers

- Reference maps: Show general features (e.g., topographic maps).
- Thematic maps: Focus on one topic (e.g., population density, rainfall).
- Thematic mapping uses visual variables (color, pattern, size).
- Common types: choropleth, dot density, proportional symbols, flow maps.
- GIS layers:
  - Each represents a single data theme (e.g., roads, rivers, land use).
  - Can be stacked, symbolized, and analyzed together.
- Example: Narayanghadh City mapping with multiple layers (built-up, roads, land use)

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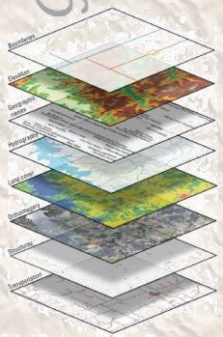

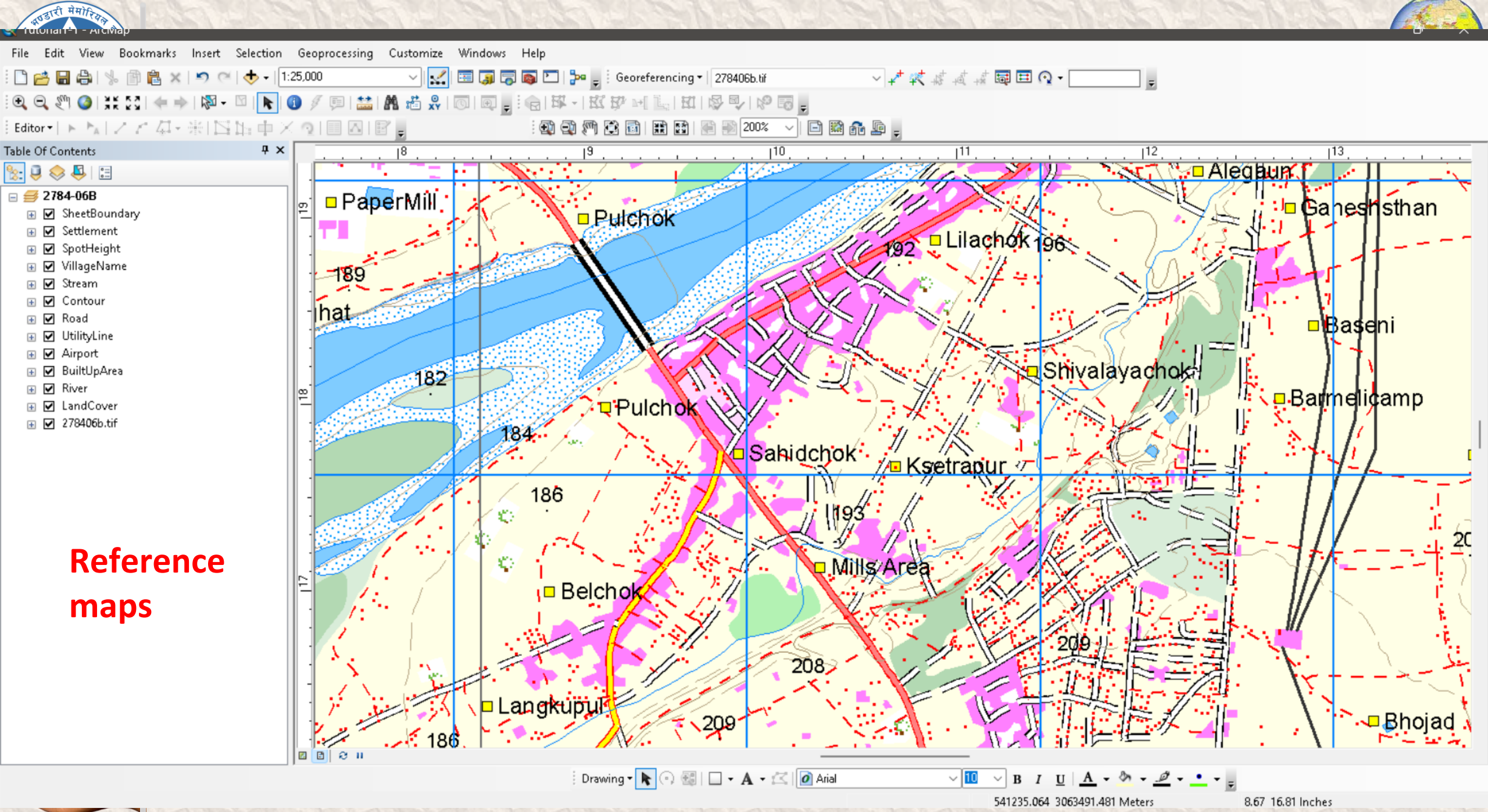

Reference maps

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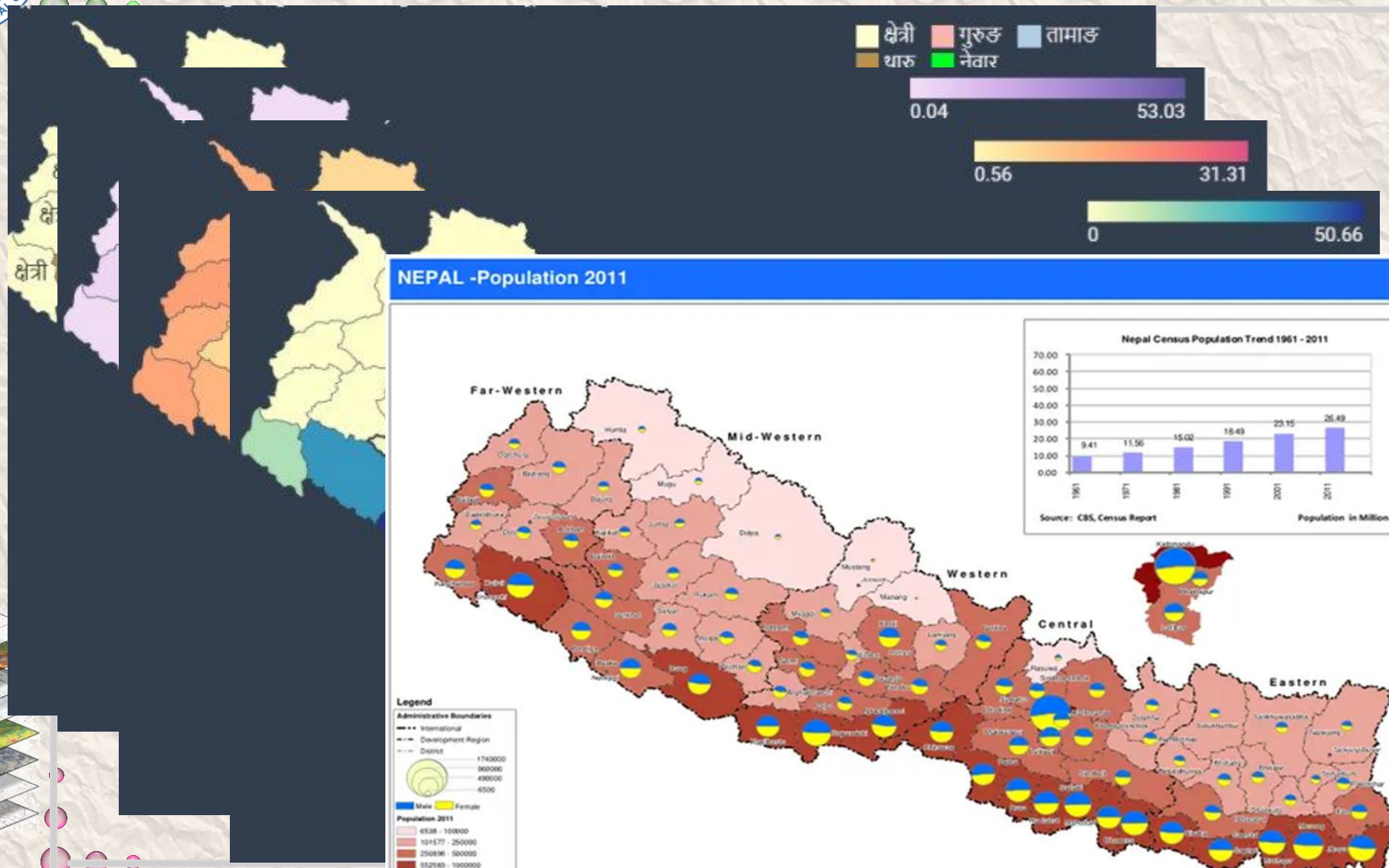

Thematic maps

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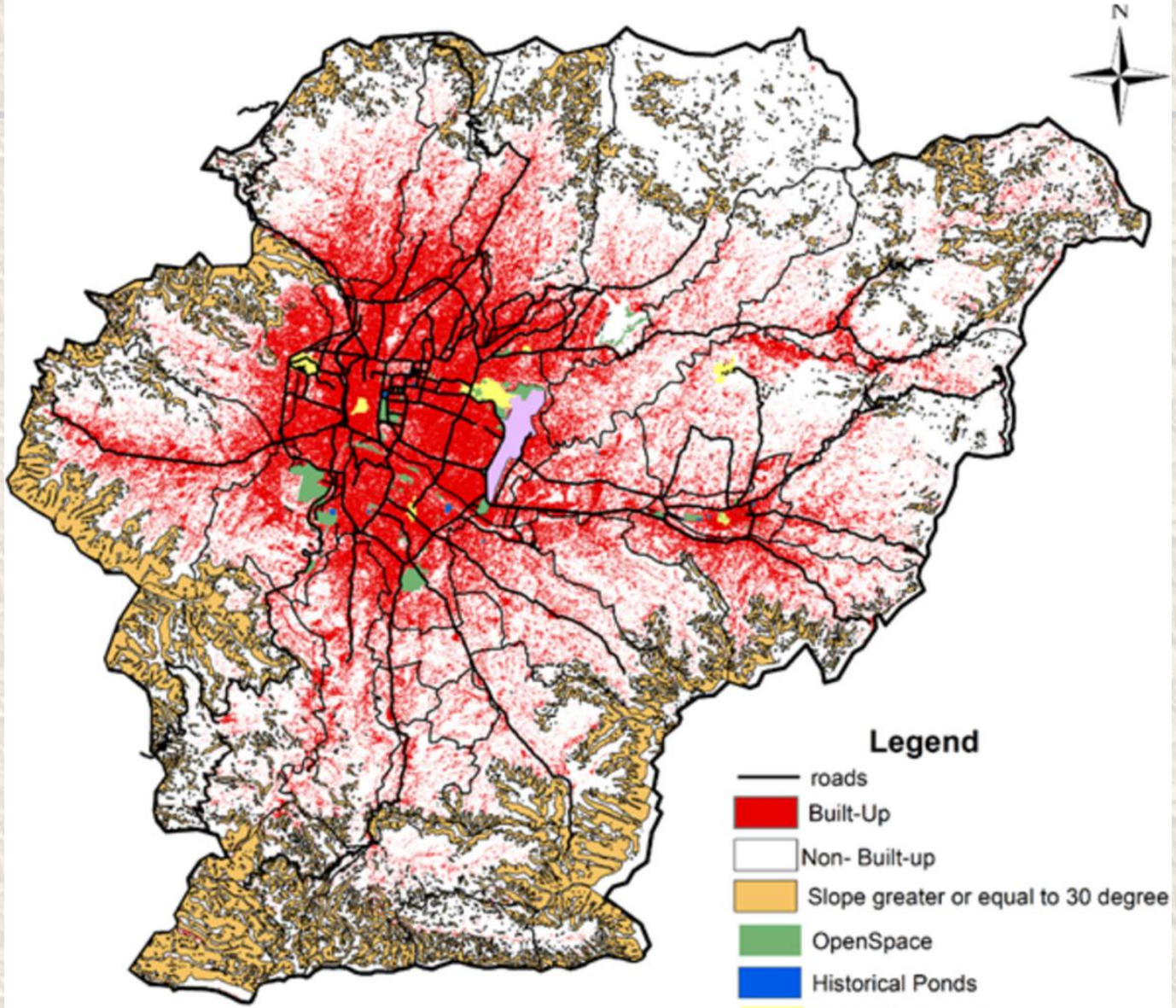
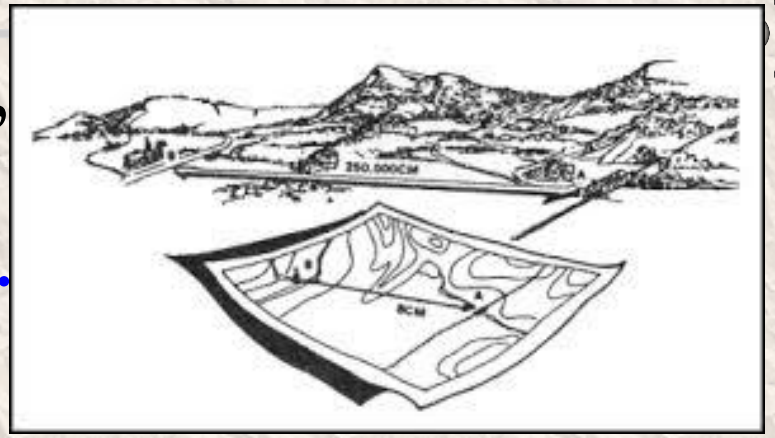
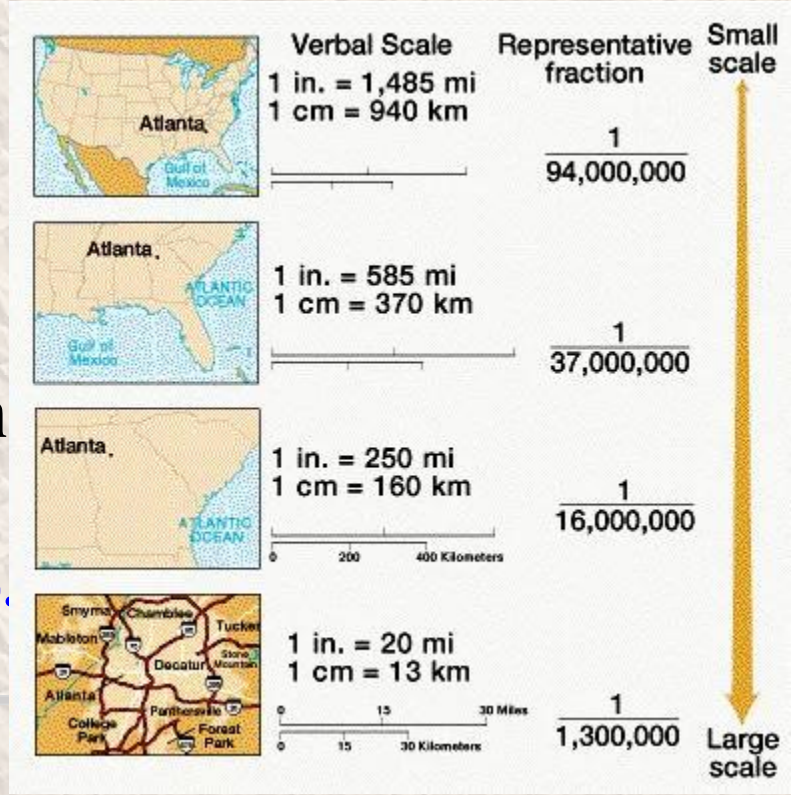
Planning Constraints and Built -up of KV - 2021

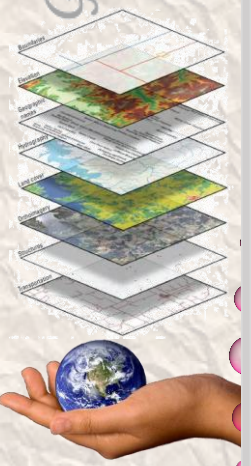


Map Scale and Resolution



- Scale = Map distance vs. ground distance (e.g., 1:50,000).
  - Large scale: Zoomed in, high detail (e.g., 1:10,000).
  - Small scale: Zoomed out, low detail (e.g., 1:5,000,000).
- GIS maps are scalable, but each view has a display scale.
- Symbol sizes and detail must match the intended display scale.
- Resolution = Smallest unit represented (esp. in raster data).
  - High resolution = finer detail (e.g., 10×10 m pixels).
  - Low resolution = generalized view (e.g., 1 km pixels)





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Three ways of expressing

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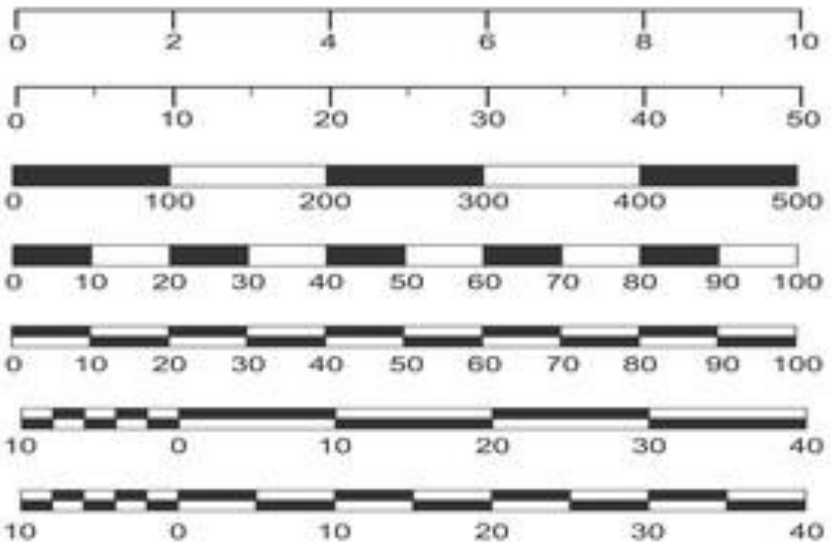
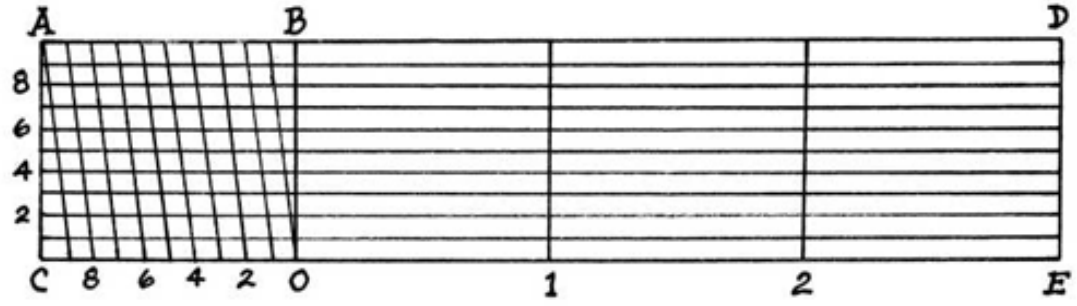
Three Types of Scale

- There are three different ways to write scale.

Word Scale	• 1 cm = 250 km
Linear Scale or Bar Scale	
Ratio Scale or Representative Fraction Scale	• 1:25 000 000





Symbol sizes and detail must match the intended display scale

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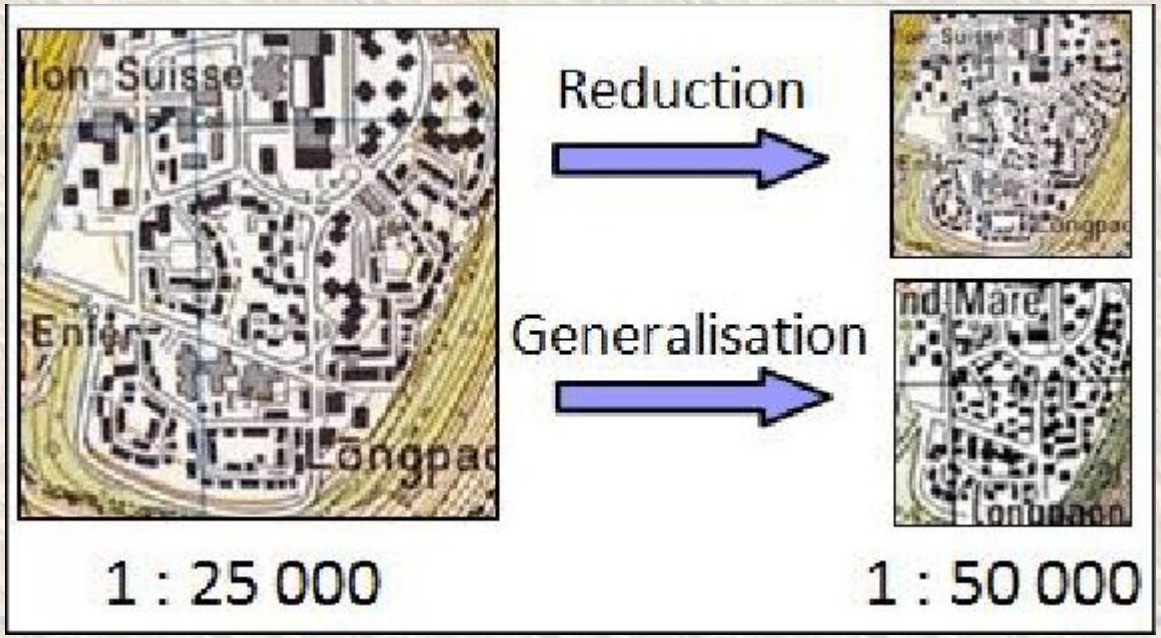
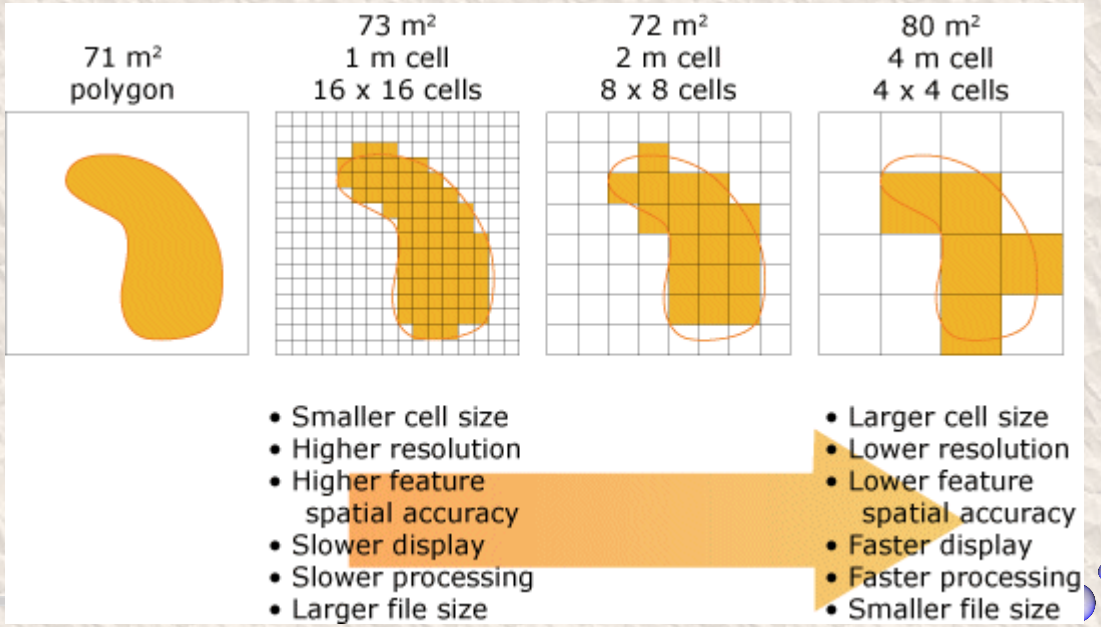
Vector vs. Raster Resolution

- Vector data has no fixed resolution but varies in detail/precision.
- Curves and edges are simplified or generalized based on capture scale.
- Example: A river digitized from a 1:50,000 map is more detailed than from 1:1,000,000.
- Generalization is key when moving to smaller scales.





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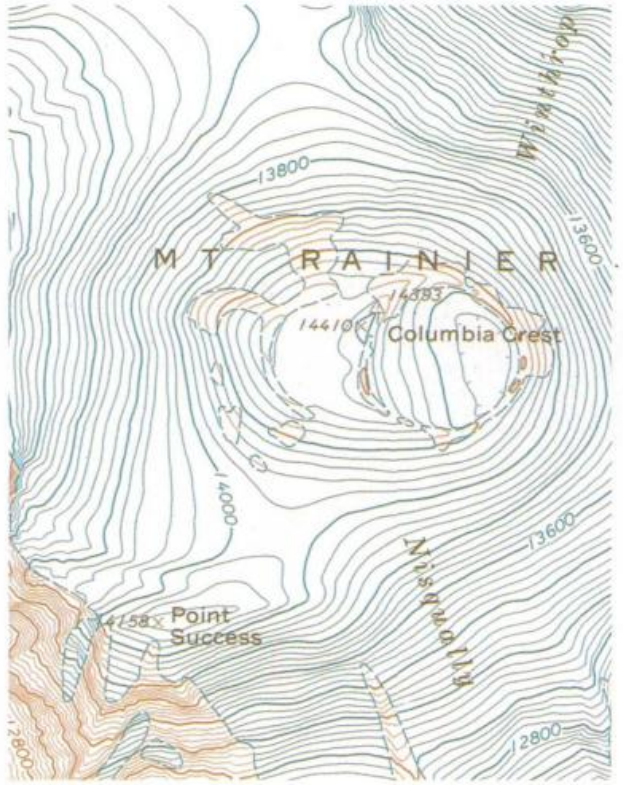
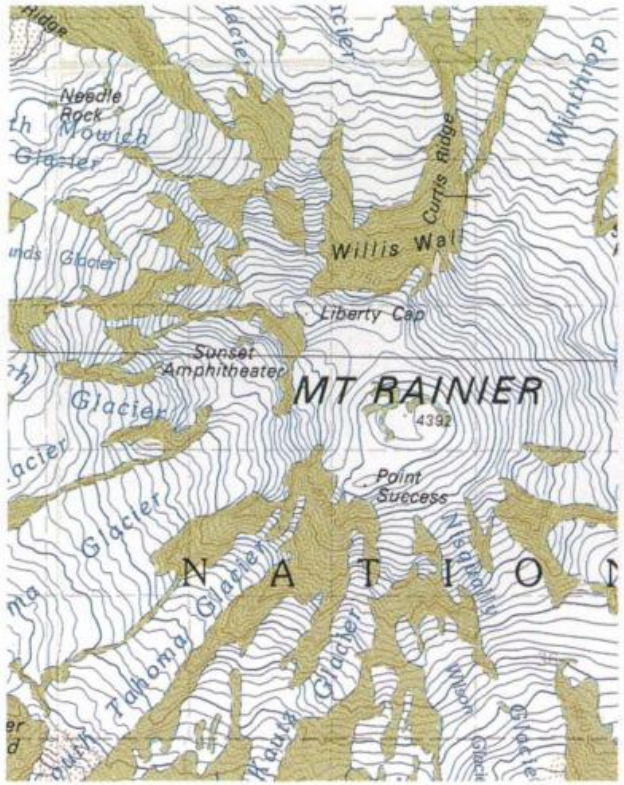
Scale vs. Resolution

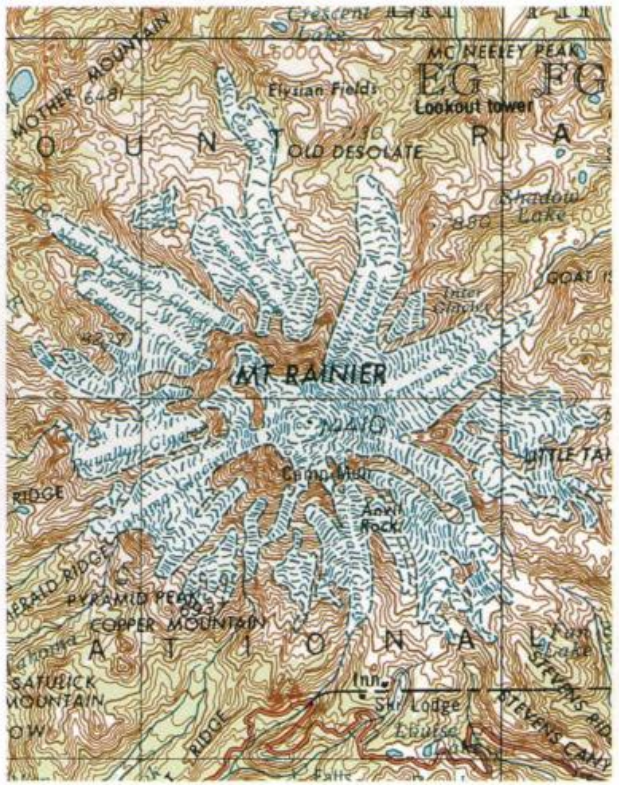
- Scale and resolution are interlinked.
  - Small-scale maps can't show high-resolution features without clutter or false precision.
- Good practice: Match data resolution with map scale to ensure clarity and accuracy.



1:24,000 scale



1:100,000 scale



1:250,000 scale

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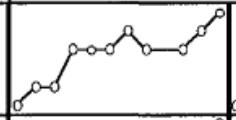
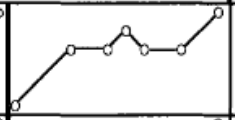
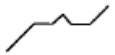
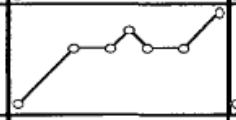
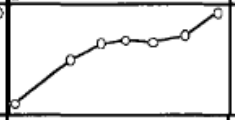
Scale vs. Resolution

Spatial and Attribute Transformations (Generalization Operators)	Representation in the Original Map	Representation in the Generalized Map	
	At Scale of the Original Map		At 50% Scale
Simplification			
Smoothing			
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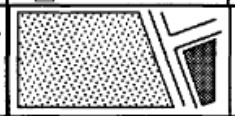
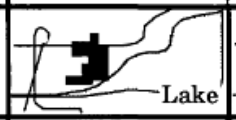
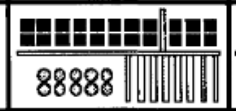
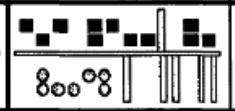
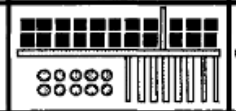
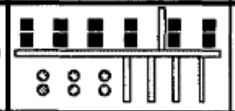
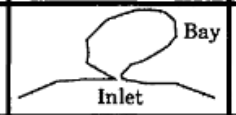
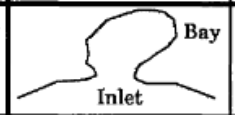
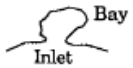
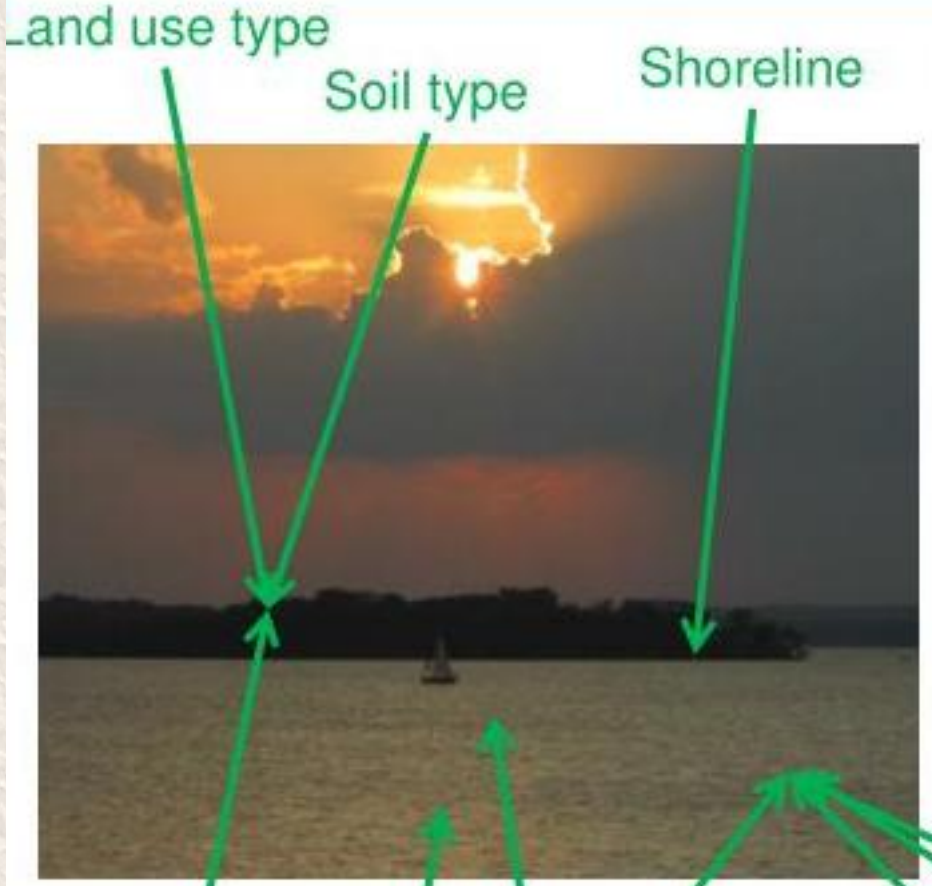
Amalgamation			
Merge			
Collapse			
Refinement			
Typification			
Exaggeration			
Enhancement			
Displacement			
Classification	1,2,3,4,5,6,7,8,9,10,11,12, 13,14,15,16,17,18,19,20	1-5, 6-10, 11-15, 16-20	Not Applicable

Representing Geographic Phenomena



- Geographic phenomena are the study objects of a GIS.
  - The real world is complex. A certain spot contains many different phenomena.
  - Different phenomena require different digital representations and multiple representations are possible for a same phenomenon.

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Representing Geographic Phenomena

- Discrete features → often represented with vector (e.g., buildings, roads).
- Continuous surfaces → typically raster (e.g., elevation, temperature).
- Choice depends on:
  - Nature of data (continuous vs. discrete).
  - Scale and purpose of the map.
- Example: Elevation of the Himalayas
  - at national scale = raster DEM;
  - at district scale = contour lines.

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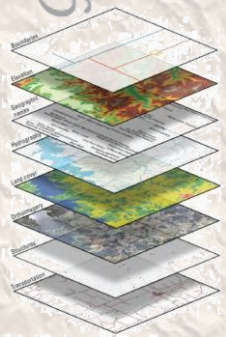

Key Takeaways

- **Features & Attributes: Core of GIS — location + descriptive data.**
- **Thematic Mapping: Visualizes a specific attribute using map symbology.**
- **Layered Structure: Enables overlay, spatial queries, and composite mapping.**
- **Scale Awareness: Align data detail with map's visual purpose.**
- **Resolution Matters: Use suitable resolution — not too coarse or overly detailed.**
- **Representation Choices: Match data type (vector/raster) to phenomenon and analysis goal.**

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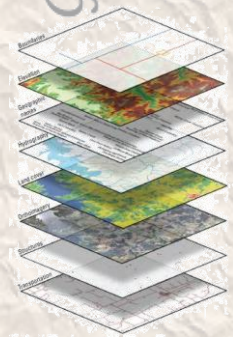

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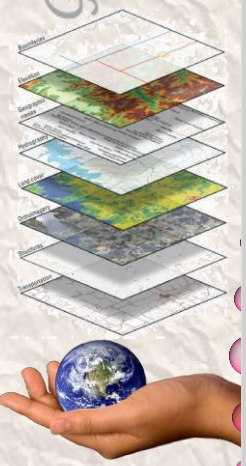

Thank You