Geohydroinformatics Tutorial

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Contents

List of Figures

List of Tables

Chapter 1

ArcGIS Installation

1. Open folder "1. Desktop", Right-click on "Setup.exe" and left-click on "Run as Administrator"
2. Complete the installation procedure
3. Open folder 2. Registration
4. Open file service
5. In the first line you will see *SERVER—your—computer—name—ANY—27009* or similar
6. Change your computer name by the name of your computer
7. Save and close this file
8. Copy all three files and paste in the following location: C: \Program Files (x86)\ArcGIS\Desktop10.5 \bin
9. Open ArcMap. If successfully installed, you will see a ArcMap screen open.

Chapter 2

ArcMap Interface

2.1 Objectives of the exercise

Make trainees familiar with the basic tools in ArcGIS intended to make trainees competent in exploring the data.

2.2 Data Information

You will use the following data.

1. LocalUnits — Local Units of Nepal — Polygon data
2. DIS_HQ — District Headquarter — Point data
3. MajorRivers — Major Rivers of Nepal — Line data
4. Districts — District Boundary — Polygon Data
5. RoadNetwork2006 — Road Network — Line data

2.3 Steps

2.3.1 Opening ArcMap 10.5

1. Start — ArcGIS — ArcMap 10.5
2. You will see the window as shown in figure 2.
3. On the left side, you see Table of Contents(1).

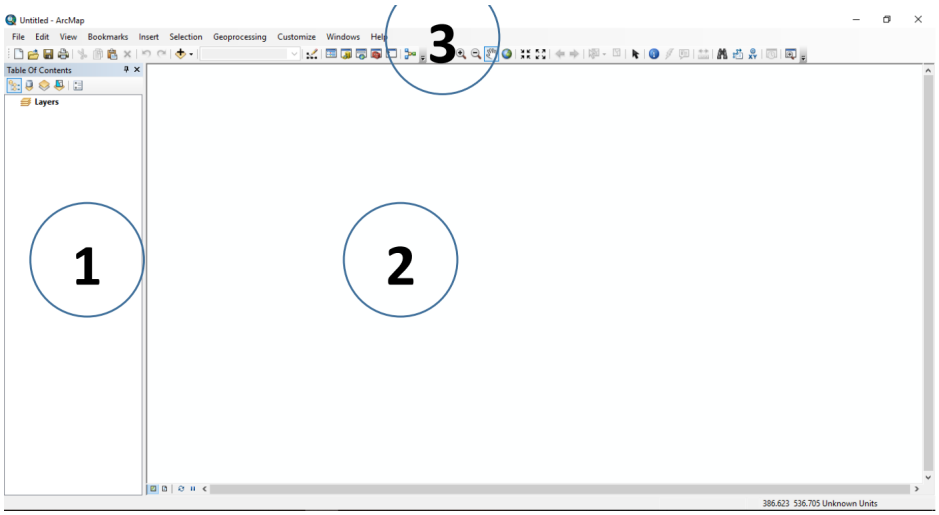

Figure 2.1: ArcMap Interface

4. The large white part is the Map Canvas (2)
5. On the upper part you see several toolbars (3)
6. Among the toolbars, there is a standard toolbar as shown in figure 6

Figure 2.2: Standard Toolbar

7. Hover the mouse over each tool in the toolbar and note their functions.

2.3.2 Adding Data

1. Click on the Add Data icon on standard toolbar.
2. Browse to the data folder and add Districts data.
3. Districts is a vector data in shapefile (.shp) format.
4. You will see the data displayed on the Map Canvas as well as the Districts layer in the table of contents.
5. Each geographical (spatial) data also have attribute information and so does the Districts layer.

6. Right click on the Districts layer in *Table of contents* and click Open Attribute Table.
7. Note the attributes.
8. Tip 1 : You can sort (ascending/descending) any attribute values by double clicking each attribute name.
9. Tip 2 : You can see the total number of data at the bottom of the attribute table
10. Close the attribute table

2.3.3 Basic Navigation Tools

1. Among the toolbars, there is a toolbar called Tools as shown in figure.

Figure 2.3: Tool Toolbar

2. Hover the mouse over each tools and note the names.
3. Now use each of the tools to navigate through the maps. There are tools for zoom, pan, full, extent, etc.

2.3.4 Queries for practice

Explore various tools to determine the following:

1. Find the area of the largest and smallest district of Nepal.
2. What is the area of Nepal?

2.3.5 Adding additional data

Add all the remaining data.

1. Rearrange the layers by dragging the layers in *Table of Contents* to place it one over another in the order that you want.

2. Check/uncheck the layers in the *Table of Contents* to display or not to display individual layers.

3. For each layer, note the attributes.

2.3.6 Additional practice queries

1. What is the total number of local units?

2. What is the area of your district?

3. What is the distance between Kathmandu and Dharan?

4. If you have to walk around a district along it's boundary, which district would offer you the longest walk?

5. What is the perimeter of Nepal?

Chapter 3

Labelling and Symbolization

3.1 Objective of the exercise

Labelling data and symbolization of data makes it more understandable. In this lesson, the trainees will learn symbolization and labelling of the data.

3.2 Data Information

You will use the following data.

1. LocalUnits — Local Units of Nepal — Polygon data
2. DIS_HQ — District Headquarter — Point data
3. MajorRivers — Major Rivers of Nepal — Line data
4. Districts — District Boundary — Polygon Data
5. RoadNetwork2006 — Road Network — Line data

3.3 Steps

3.3.1 Open ArcMap 10.5

3.3.2 Add data

3.3.3 Labelling

1. Before labelling the data, we need to find the attributes that is stored in the attribute table.Right click on the Districts layer on *Table of*

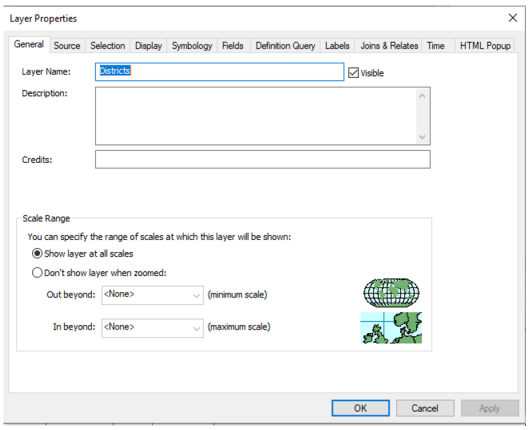

Figure 3.1: Properties Dialogue Box

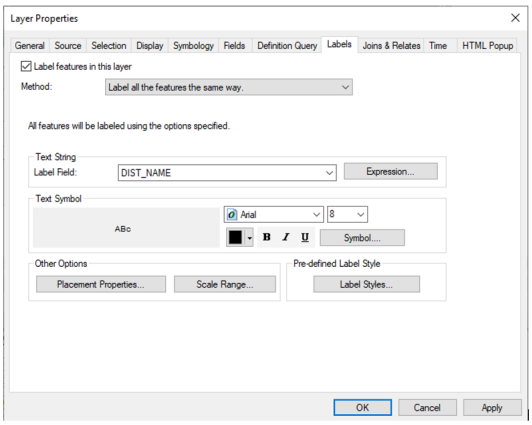

Figure 3.2: Label Dialogue Box

Contents and click Open Attribute Table. Note the attributes and also decide by which value you want to label. For this exercise, we will label the districts by DIST_NAME attribute.

2. Right click on the DISTRICTS layer in Table of Contents and then click on Properties. A dialogue box appears as shown in figure 2

3. Select Labels. You will see a dialogue box as shown in figure

4. In the Label Field select DIST_NAME. Also tick Label features in this layer as shown in the figure above.

5. Click OK. You can see the name of districts labelled above the DISTRICT layer in the map canvas.

6. Change the color and font sizes of the labels by following the same process.

3.3.4 Symbolizing the data

1. Just like in case of labelling the data, we need to find the attributes that is stored in the attribute table in order to symbolize the data.

2. Right click on the Districts layer in *Table of contents* and click *Open Attribute Table*.

3. Note the attributes and also decide by which value you want to label. For this exercise also, we will label the districts by DIST_NAME attribute.

4. Now right click on the DISTRICTS layer in Table of Contents and then click on Properties.

5. Select Symbology

6. Select Categories — Unique values. In the Value Field select DIST_NAME. Then click Add All Values and click OK. Your symbology should have districts with different colors.

3.3.5 Symbolizing Exercise

1. List the districts of the students in your class. Then, symbolize these districts with red color and other remaining districts with yellow color.

3.3.6 Symbolizing data based on quantity

1. Go to Layer Properties — Symbology. Then select Quantities — Graduated colors

2. In the value field, select Shape_area. (Tip : Here, we have classified based on area of each district. Instead, we can also classify based on other attributes such as population, agriculture land, etc. if available in the attribute table).

3. Click OK. You can see visualization on map based on the area.

3.3.7 Exercises

Create a map of Nepal showing the following features:

- Districts
- Highways
- District Headquarters

Select appropriate symbology. Label the Districts.

Chapter 4

Georeferencing

4.1 Objective of the exercise

Hard copy maps are one of the important sources of inputs in GIS. Generally, these maps are scanned so that they can be visualized/analyzed in GIS. However, scanning the maps is not enough to overlay over other features. It is necessary to georeference these scanned maps. In this exercise, you will learn to georeference a map.

4.2 Data

The data for this exercise is in the *georef* folder. You will use the following data and information.

1. Tamakoshi.tif — It is a scanned map which is to be georeferenced
2. Coordinates — This file contains the coordinates that you will use to georeference the map.
3. NEPAL_MUTM_CM_EVEREST_1830.prj — Projection system of the map

4.3 Steps

4.3.1 Open ArcMap and Set the Coordinate System

1. Go to View — Data Frame Properties — Coordinate System
2. Import the NEPAL_MUTM_CM_EVEREST_1830.prj from *Georef* folder as shown in fig 2

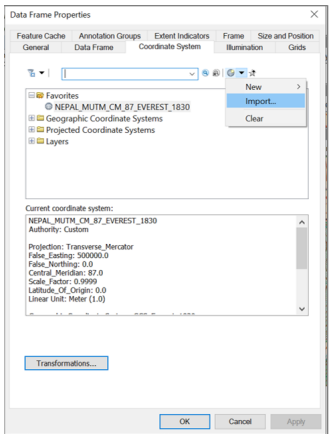

Figure 4.1: Import Coordinate System

4.3.2 Add the scanned map

1. Add the scanned map into ArcMap — Tamakoshi.tif

2. Check the coordinates (right-bottom) on Arcmap as you move the mouse over the image.

4.3.3 Add Georeferencing toolbar

1. Select Customize — Toolbars — Georeferencing to add the Georeferencing toolbar as shown in figure

2. Hover over each tool icon in the Georeferencing toolbar and note their name itemSelect *Georeferencing* and uncheck Auto Adjust

4.3.4 Georeferencing

1. Select *Add Control Points*, zoom to the intersection of grid lines towards each corner of the image. We know the coordinates of these point of map

2. First click on left mouse key, then click on right mouse click and select Input X and Y.

3. Put the coordinates as per the excel file: Georeferencing Coordinates

4. Once done, click *Georeferencing* — *Update Georeferencing*

5. Now you can check the coordinates. Now, the coordinates are real world coordinates.

6. Add Rivers from *nepal_data* folder. The rivers (vector layer) must overlay over the map.

4.3.5 Georefencing Exercise

1. Use the raster map, coordinate data and coordinate system file in *exercise_georef* folder to georeference the *lamabagar.tif* map.

2. Once done, check it by overlaying with the river vector layer from *nepal_data* folder.

Chapter 5

Geodatabase Creation

5.1 Objective of the exercise

Spatial files can be managed as individual files such as shapefiles or as a database. ArcGIS supports Geodatabase for management of data in a form of database.

5.2 Data

Use the *tamakoshi.tif* map which is in the *georefer* folder after georeferencing it.

5.3 Steps

5.3.1 Creating Geodatabase

1. Open ArcMap
2. Open Catalog from main menu Windows — Catalog
3. Open a folder connection to the folder where you wish to save the geodatabase as presented in the Figure 5.1
4. Once a Folder Connection is done, Right click on the Folder — New — File Geodatabase. Provide a suitable name to the geodatabase.
5. Right click on the File Geodatabase — New — Feature Dataset
6. Select or import NEPAL_MUTM_CM_87_EVEREST_1830 as coordinate system

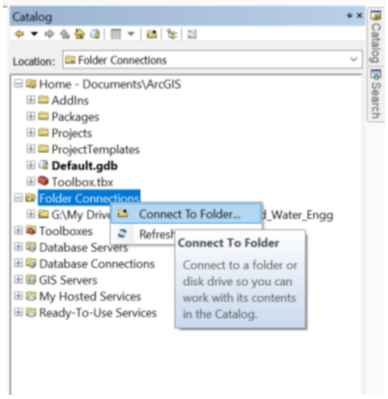

Figure 5.1: Folder Connection to create Geodatabase

7. Continue and Finish

8. Now go to the just created Feature Dataset — New — Feature Class. Give a name and select the type of feature class. For now select Point as type. Continue and finish.

9. Create two more Feature Class with types Line and Polygon.

5.3.2 Editing Features

1. Add the *Georeferenced Tamakosh i.tif* map

2. Open the editor toolbar from *Customize — Toolbar — Editor*

3. Select the feature class you want to edit

4. Now start to *digitize* over the georeferenced map.

5. After completion, press *F2* to save the edits or you can select *Editor — Save Edits*

6. When you are done, select *Editor - Stop edits*. When promted select *Save the edits*.

7. Now edit other feature classes. You must edit at least a point layer, one line layer and a polygon layer.

5.3.3 Exercise

You are assigned to digitize River, House and Landuse layer from the lamabagar.tif map. Create a geodatabase then a feature dataset. Assign coordinate system as in earlier exercise. Now digitize the layers.