

EXERCISE - 1

PREPROCESS OF IMAGE / TOPOSHEET (GEOREFERENCING, PROJECTION AND SUBSET)

Objective: To georeference a toposheet by using graticule ticks/intersections in a known coordinate system and datum by using ArcGIS

Input Data: Survey of India Toposheet No. 65 N/11

Projection & Datum used: Geographical Coordinate Systems & Everest - India and Nepal

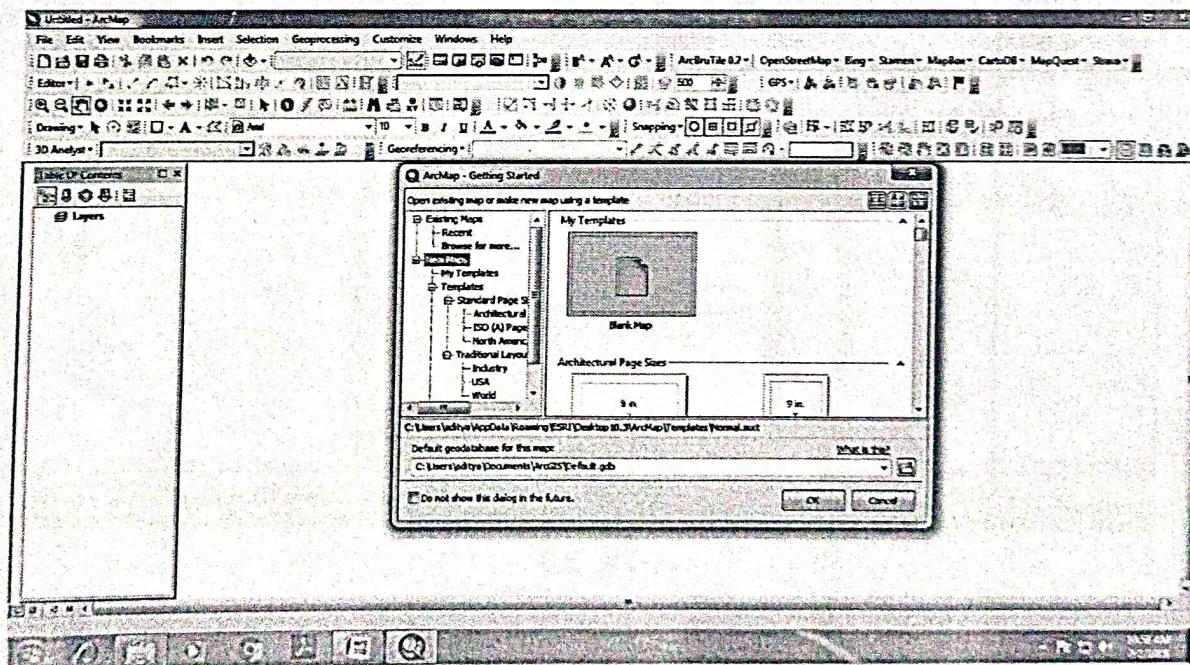
INTRODUCTION:

Georeferencing is a process of establishing a mathematical relationship between the image coordinate system to the real world spatial coordinate system. Georeferencing may involve shifting, rotating, scaling, skewing, and in some cases warping, rubber sheeting, or orthorectifying the data.

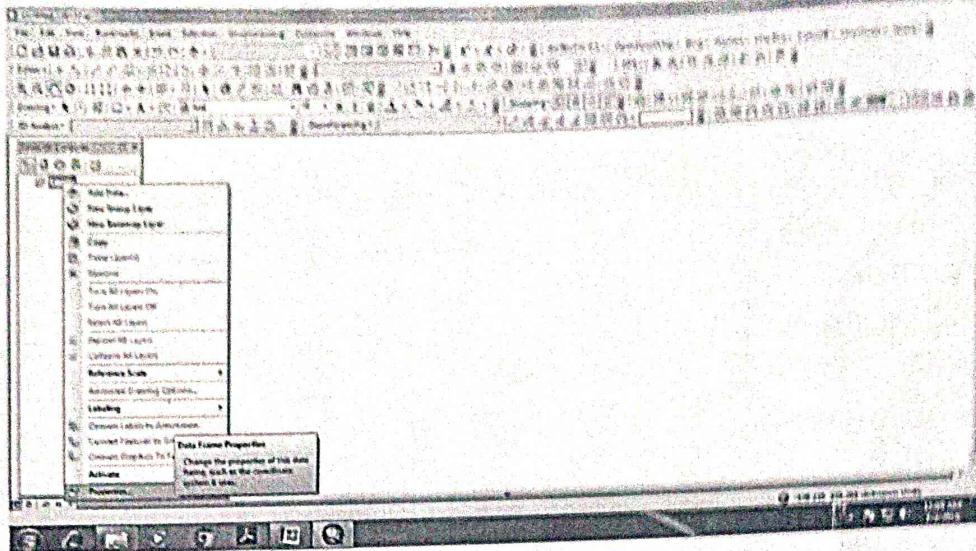
PROCEDURE

Starts with blank ArcMap Window

- ↳ Choose a New map from tree and select Blank map, then click on OK



- ↳ Go to table of Contents ↳ Right click on layers and choose properties



- Click and change the parameters in the Data Frame Properties dialogue box from General and Coordinate System tabs (As shown in below figures 1.1 to 1.4). Finally click on Apply and OK.

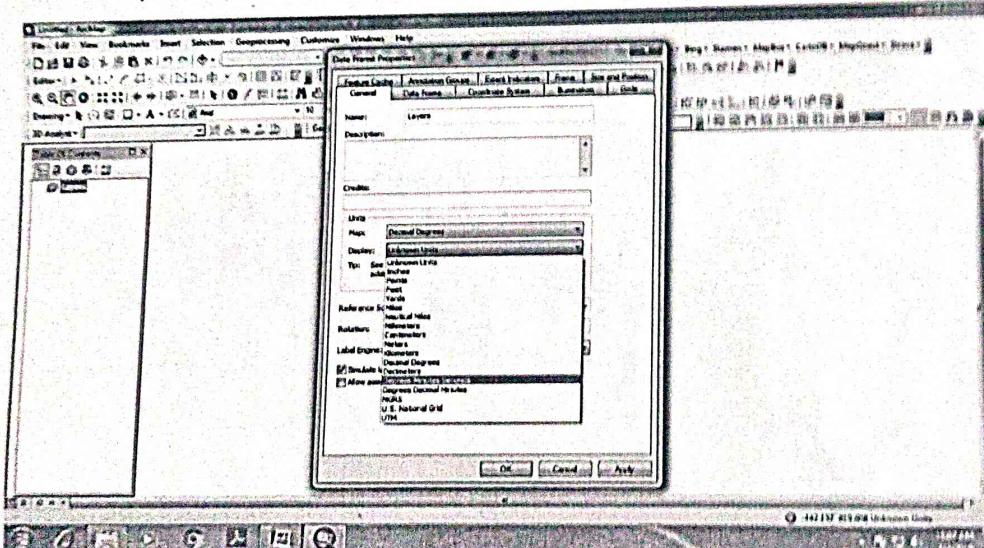


Fig. 1.1

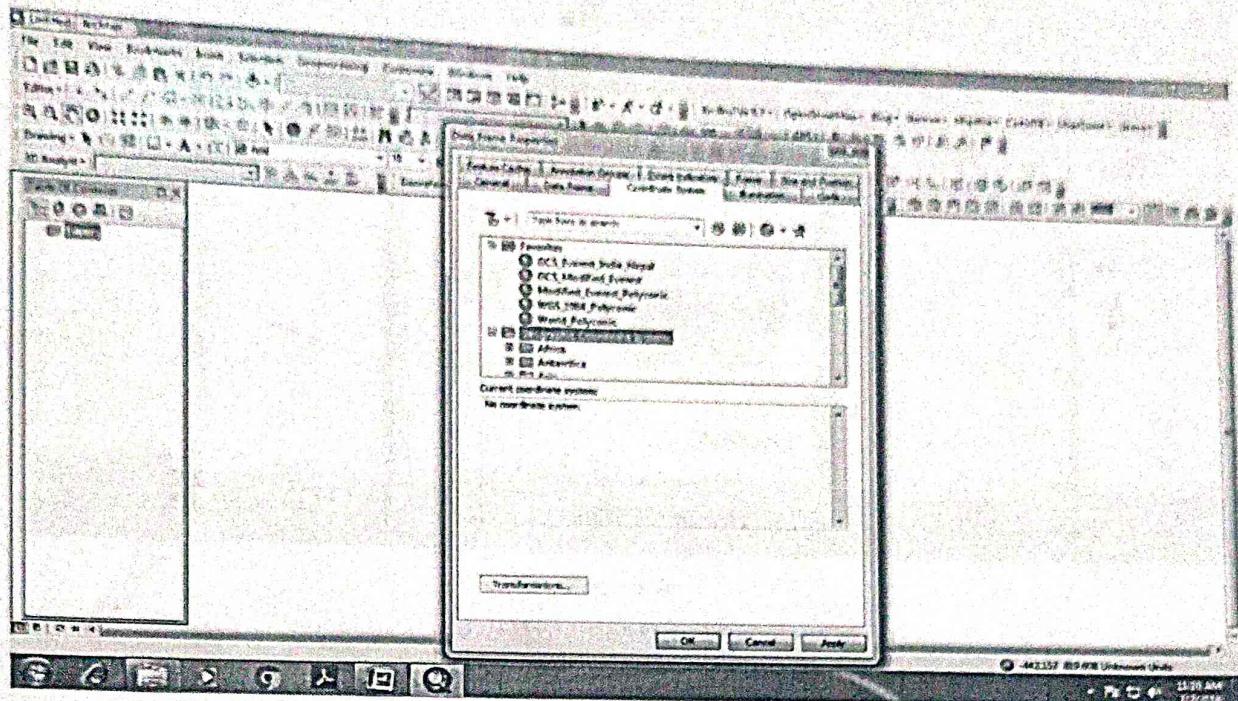


Fig. 1.2

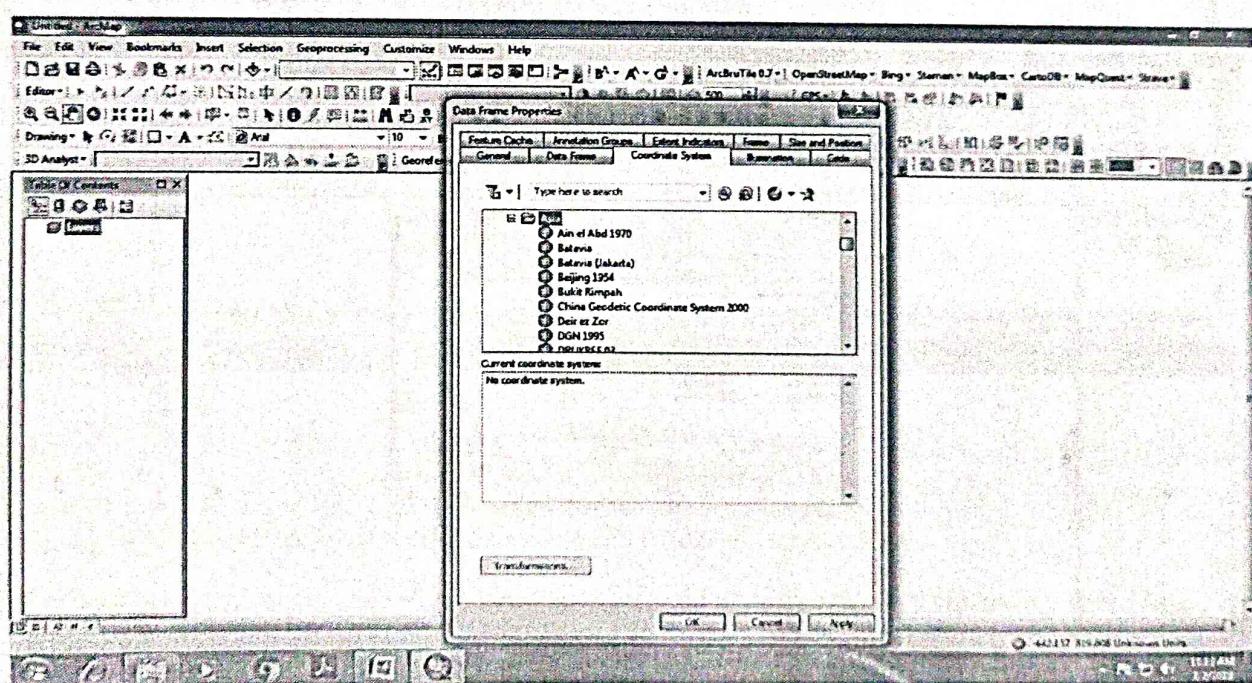


Fig. 1.3

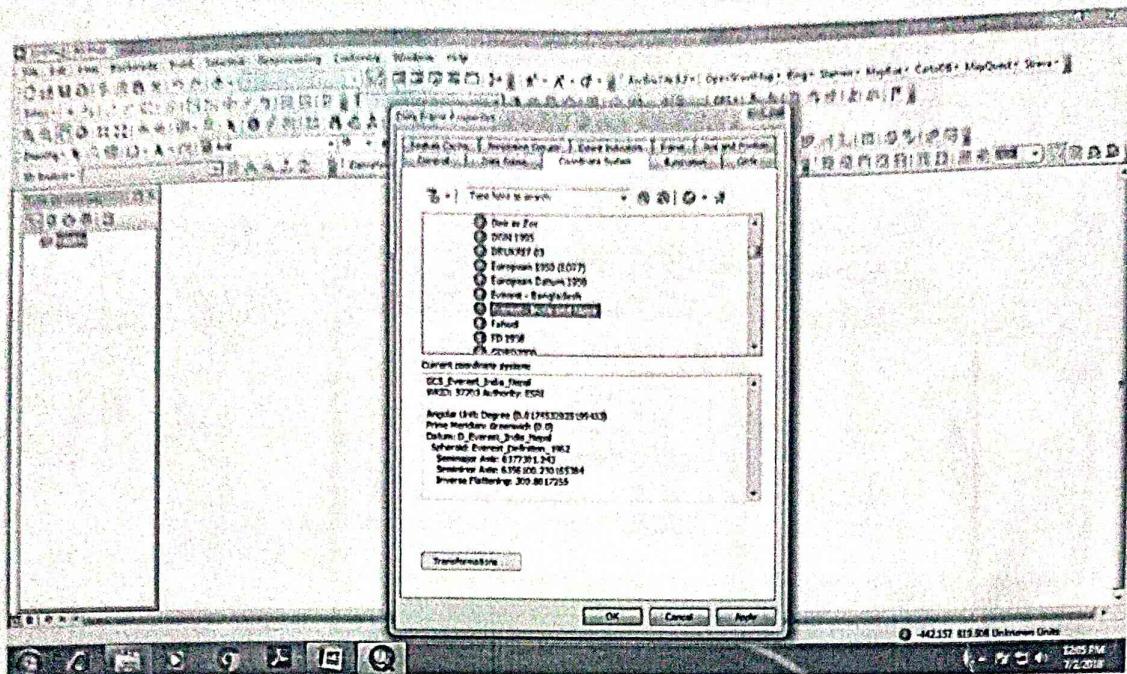
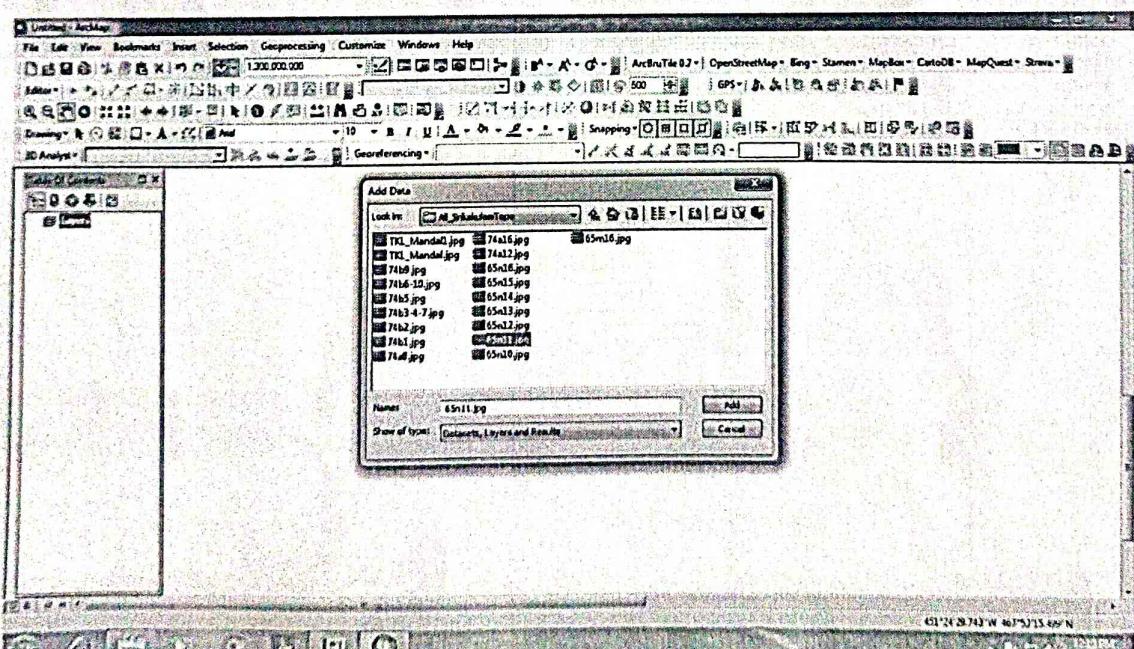


Fig. 1.4

↳ Go to ArcMap window and add the Input data by using the Add Data icon
(As shown in below figures 1.5 to 1.7)



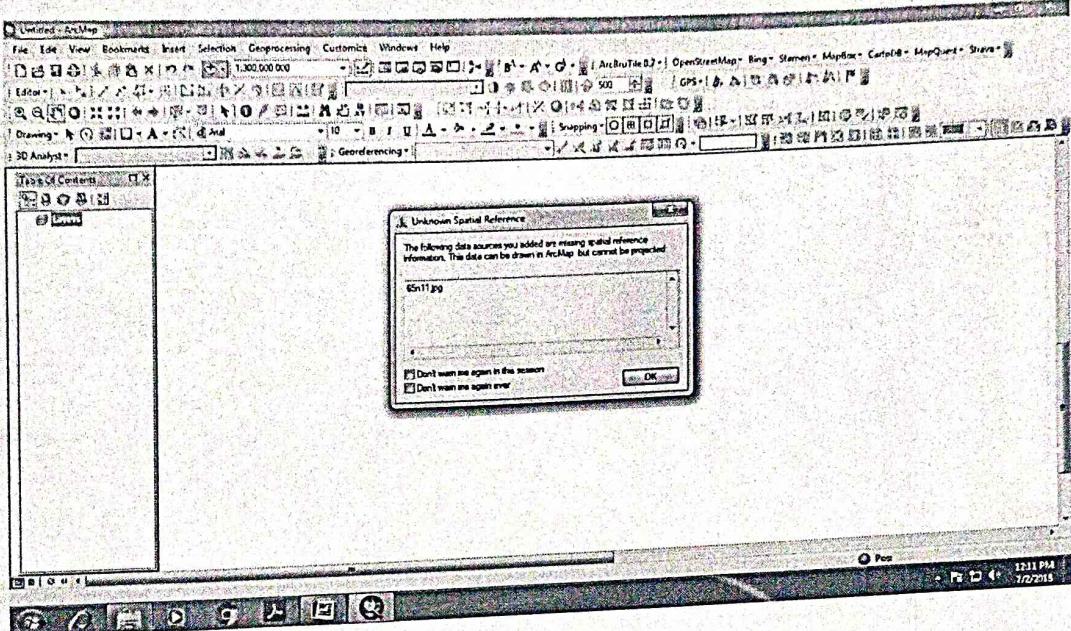


Fig. 1.6

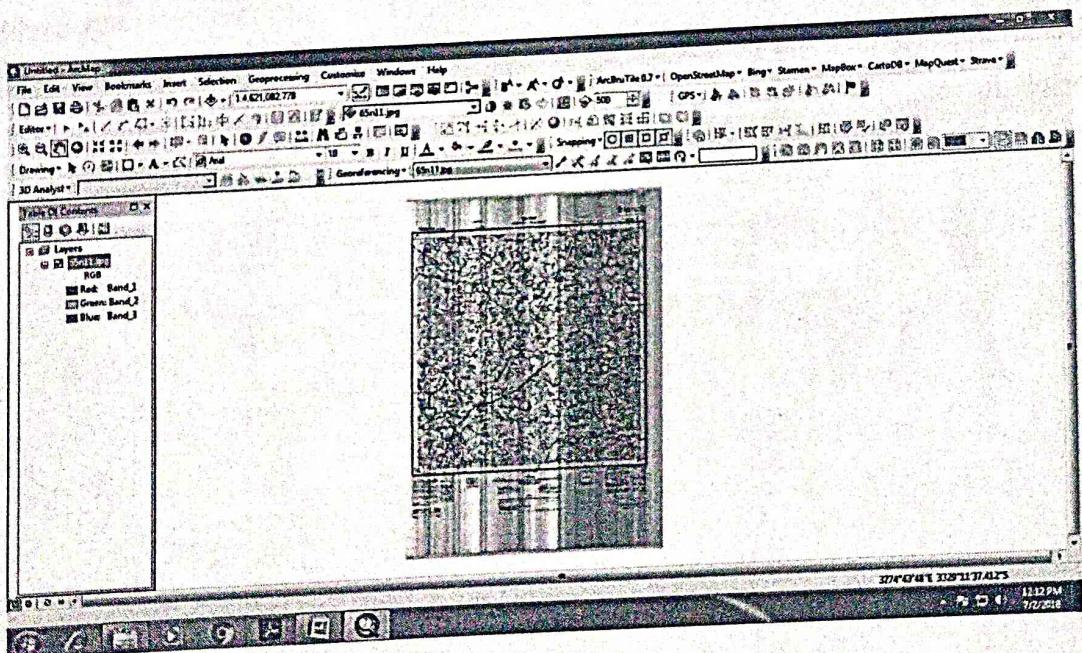
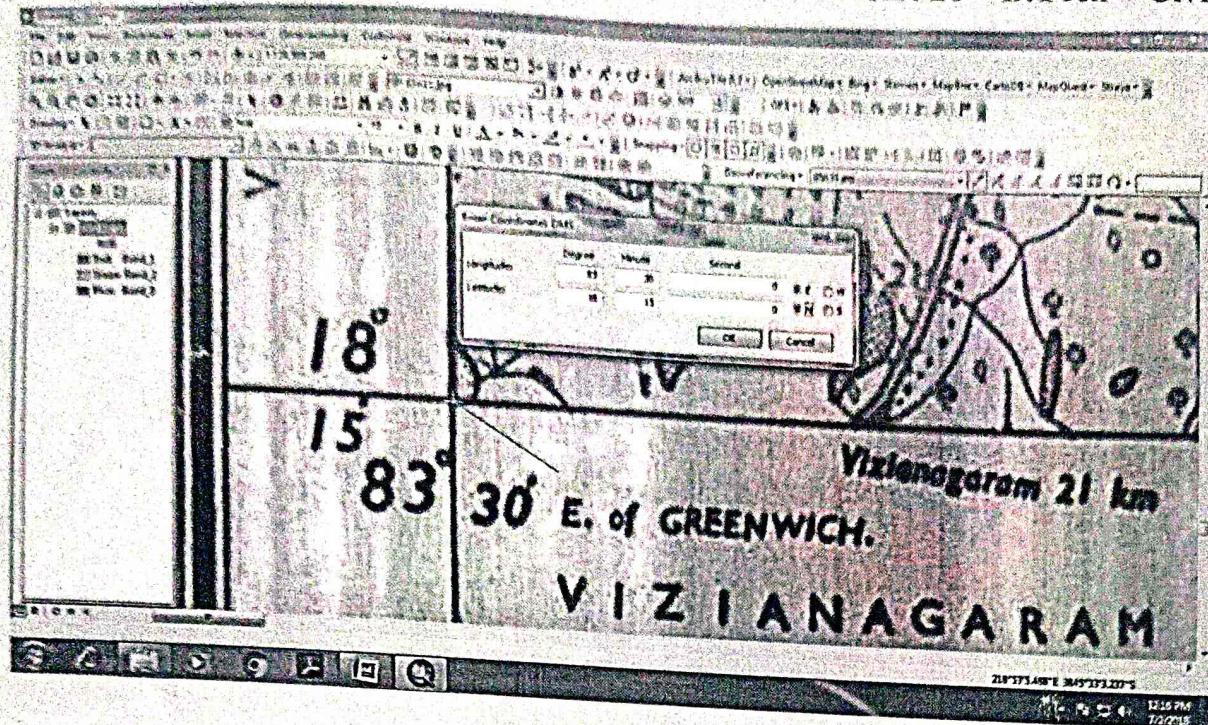


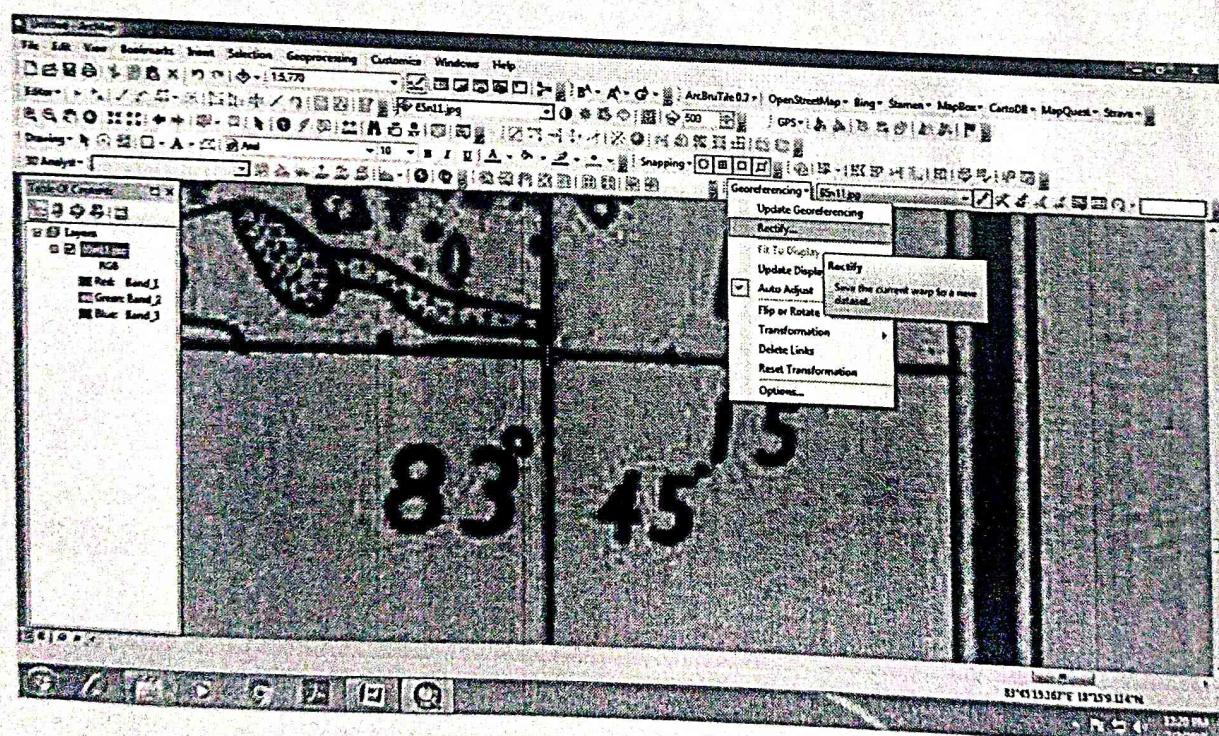
Fig. 1.7

Go to Georeferencing tool and Click on Add Control Points Icon

- ↳ Insert the control points at four intersections of the graticules by using left click and enter the Coordinate information for each and every graticule intersection (Insert should be starts with left bottom corner of the graticule intersection, at a clock wise direction. Because, it's an origin of the input data (As shown in the below figure).



→ When finish inserting the control points of all four corners. Then go to Georeferencing tool and pull down the arrow. Choose rectify option (As shown in below figure).



→ Go to Save as dialogue box and observe the output location for confirmation and click on Save tab key (As shown in below figures 1.8 and 1.9).

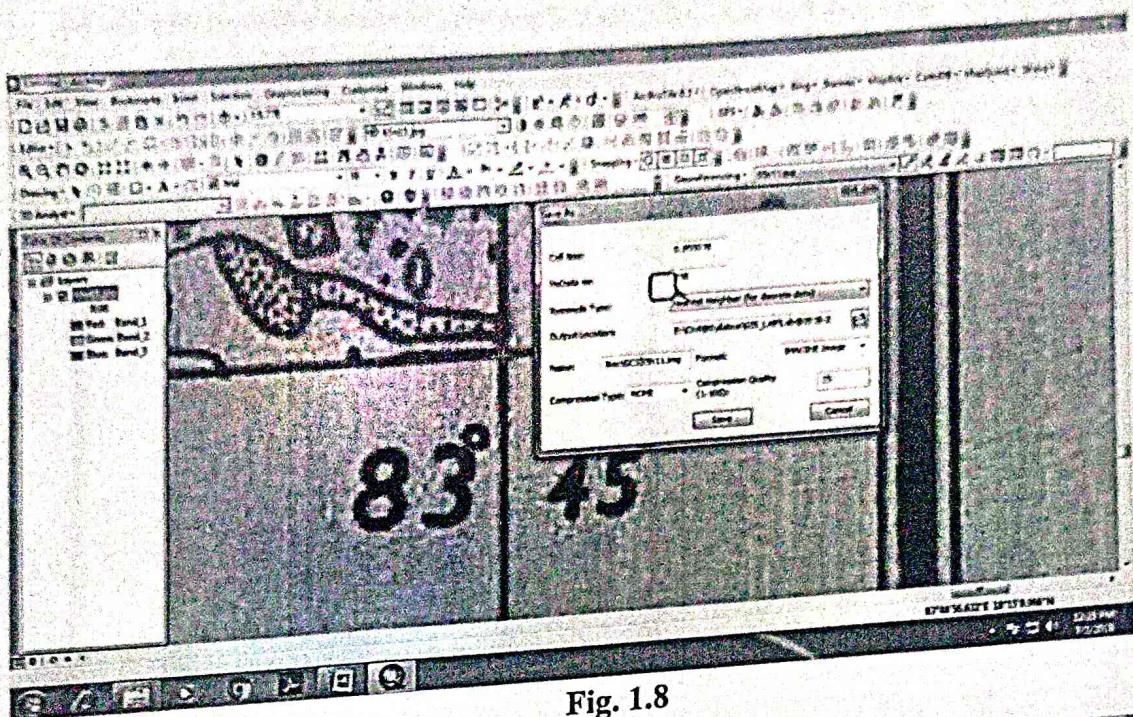


Fig. 1.8

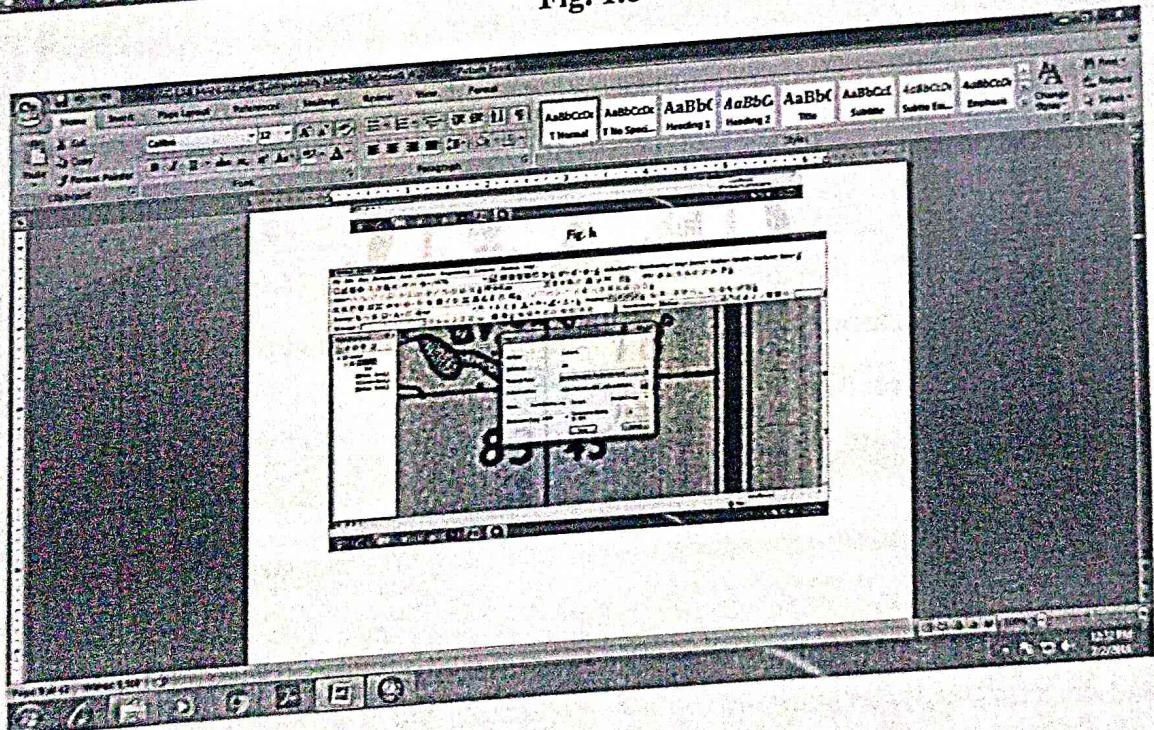
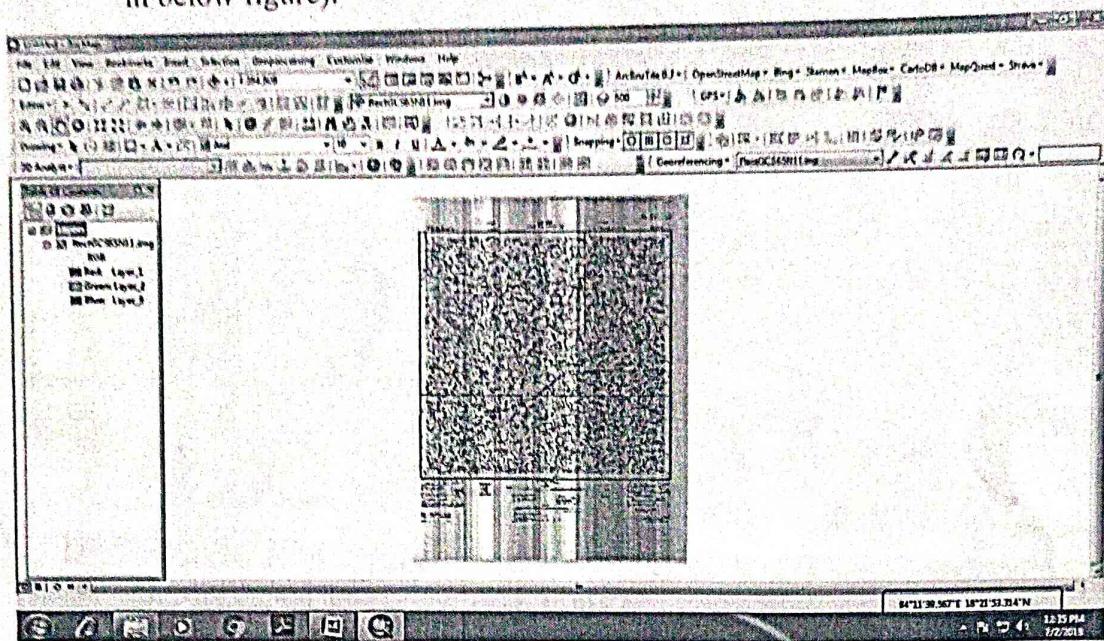


Fig. 1.9

- ↳ Open New ArcMap Window for checking the output file, whether it is properly processed or not. Add the Output file in to the window (As shown in below figure).



Result: The output file is successfully rectified with Geographical Coordinate System (GCS) Projection and Everest – India and Nepal Datum.

PROJECTION/PROJECT RASTER

Objective: To transforms the raster dataset from one projection to another.

Input Data: RectifiedGCS65 N/11 toposheet

Projection and Datum used: Polyconic and Everest – India and Nepal

PROCEDURE

↳ Open ArcTool Box from the Standard tool bar. From that ArcTool Tree Select and Click on Data Management Tools → Projections and Transformations → Raster → Project Raster

↳ Go to Project Raster wizard → Browse input raster and output raster data location

→ Choose output Coordinate system by using Icon

→ Click and choose the Projected Coordinate system → World → Polyconic
 (Note: Double Click on Polyconic text for changing the parameters of projection i.e., Central Meridian and Latitude of Origin and then Apply-Ok)

from Select tab in the Spatial Reference Properties dialogue Box and then Apply, OK&OK (*Figures 1.10 to 1.14*).

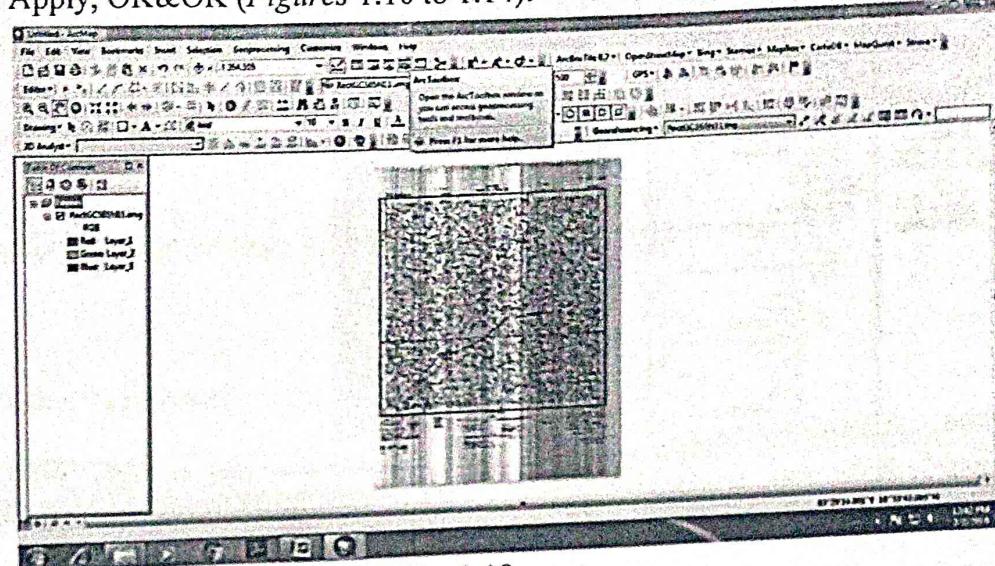


Fig.1.10

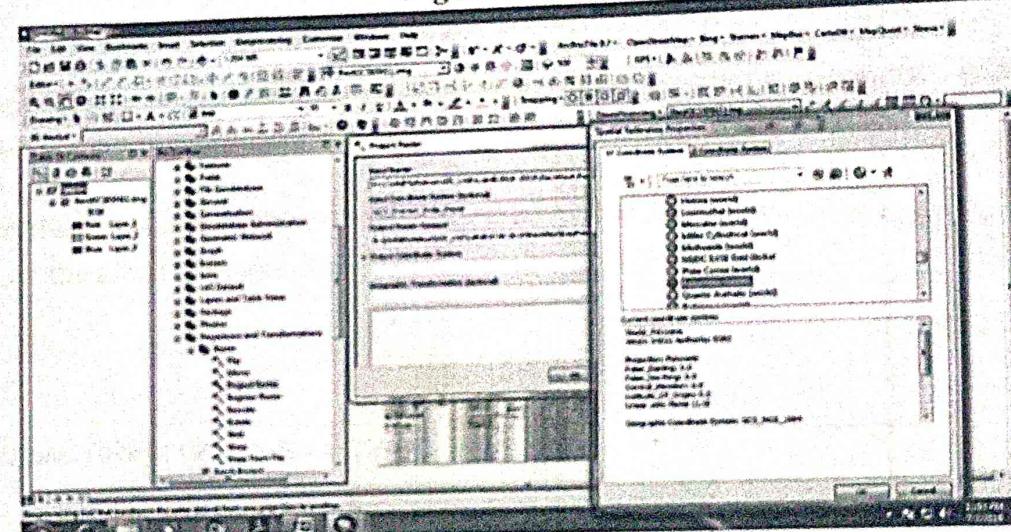


Fig.1.11

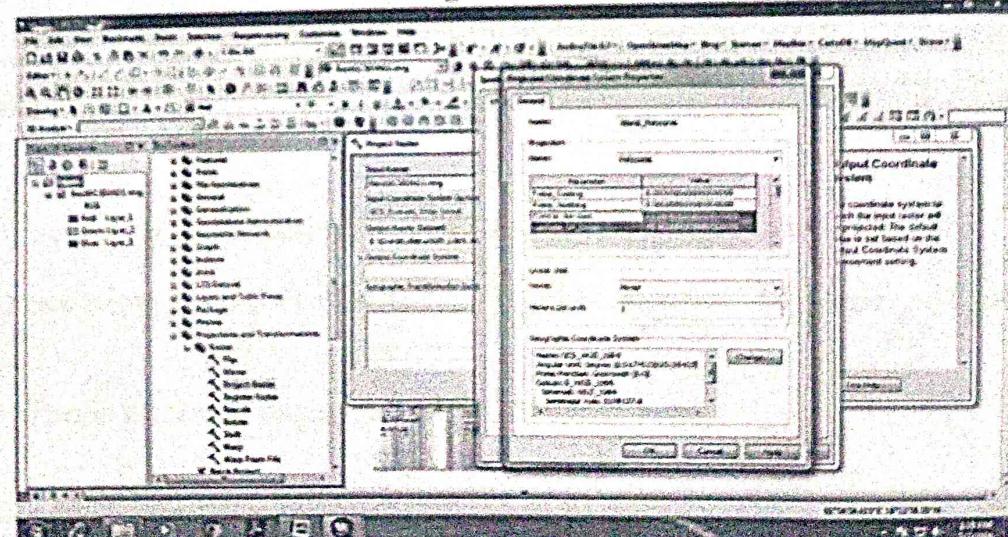


Fig.1.12

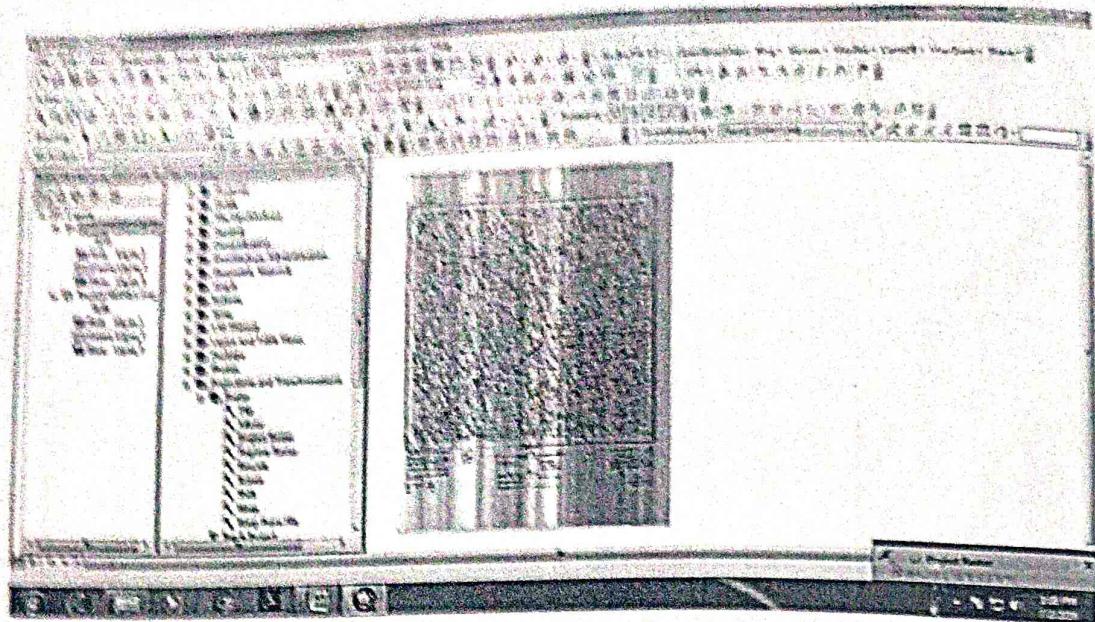


Fig.1.13

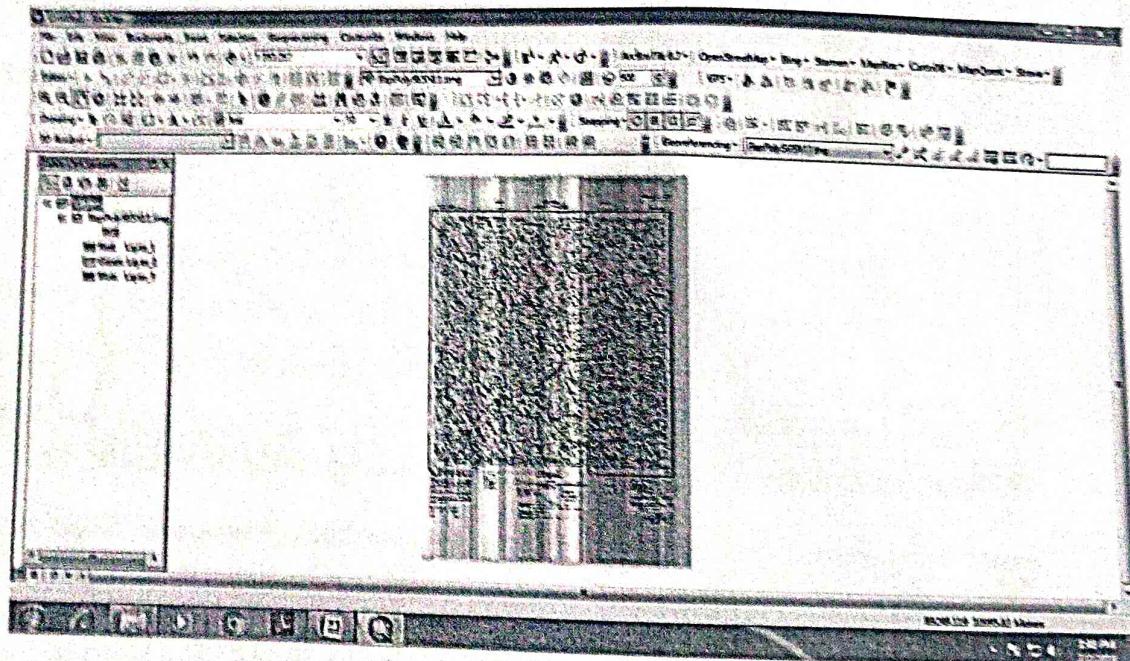


Fig. 1.14

Result: The output file is successfully projected with Polyconic projection (Figure 1.14).

EXERCISE - 2

DIGITIZATION OF FEATURES FROM THE TOPOSHEET

Objective: This task/exercise will teach the functionality of digitizing in order to capture the data.

Input Data: Reprojected poly65N11 toposheet

Projection & Datum: Polyconic and Everest – India and Nepal

INTRODUCTION

Digitizing is the process of converting geographic features on a paper map into digital format. In GIS context digitization refers to creating vector datasets viz., point, line or polygon from raster datasets. It is a way of tracing/recording geographic features in vector format from Georeferenced images or maps. With the help of digitization we can create different set of layers Viz. Rivers, roads, schools, ward boundaries and building blocks from a single map; this process is known as Vectorization.

Vector data is easy to edit, update and is more accurate as compared to raster data. Vector data is more efficient for GIS analysis. Due to these reasons Vectorization is the first step in many GIS projects. However it is a time consuming process and needs a lot of attention to prevent introduction of errors in the datasets. Vector data is mainly of three types

Point: It consists of single points having (X, Y) coordinates, for example lamp posts, bus stops and postbox positions etc.

Line: It consists a series of (X, Y) coordinates in a sequence (from start node to end node with a number of vertices joining these two nodes). For example roads, power lines, ward boundaries and contours etc.

Polygon: It is a series of (X, Y) coordinates in a sequence closing a figure where first and last points are the same. For example lakes, building blocks, village blocks, ward areas and forests etc.

PROCEDURE

Starts with ArcCatalog

- ↳ Open ArcCatalog and browse destination folder (Eg. E:\GIS_Lab\Roll Number) from ArcMap window standard toolbar (*Figure 2.1 to 2.7*).
- Right Click in destination folder then go to New → Shapefile
- Go to Create New Shapefile dialogue box and enter the name of the shape file (Eg. LU_LC), Feature type (e.g. Polyline) and Edit the spatial reference system by click the Edit tab.
- Import the spatial reference system for the new shape file by browsing and adding the Input rectified toposheet → Apply and OK (Twice).

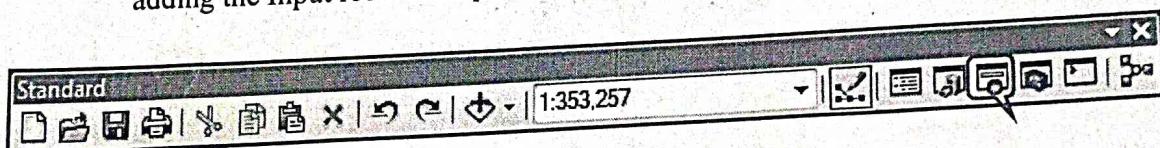


Fig. 2.1

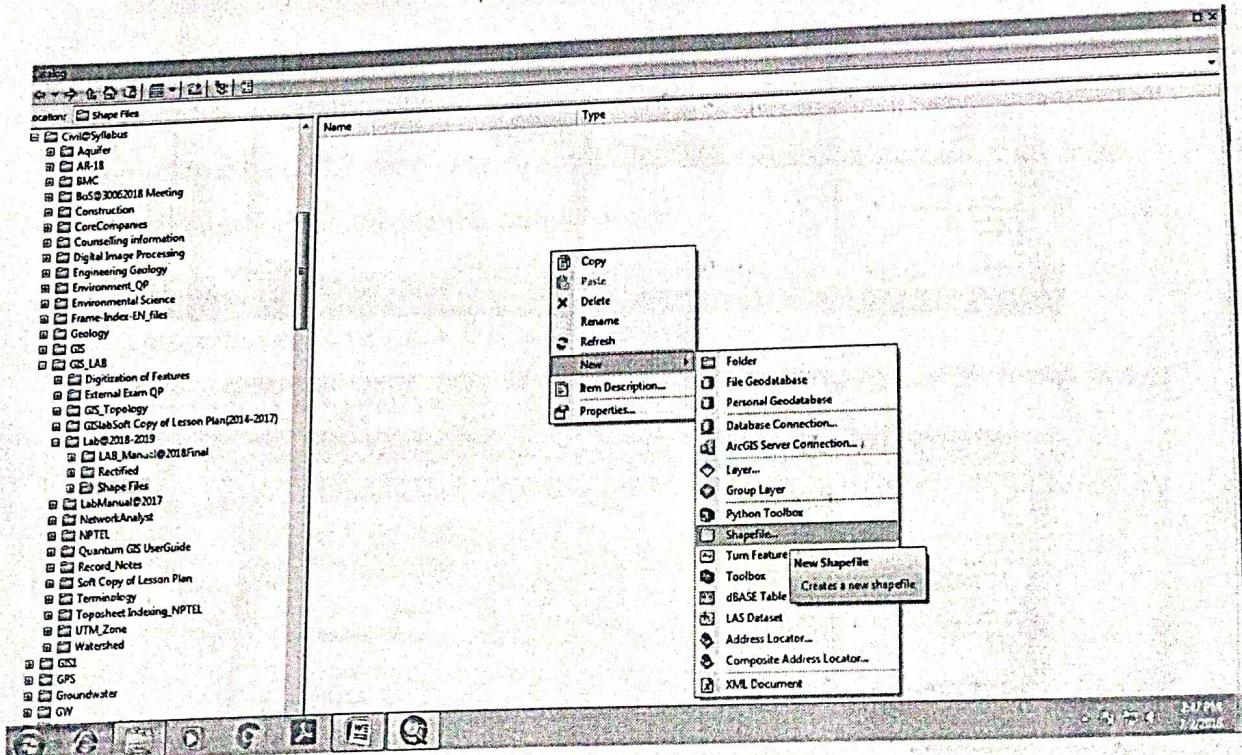


Fig. 2.2

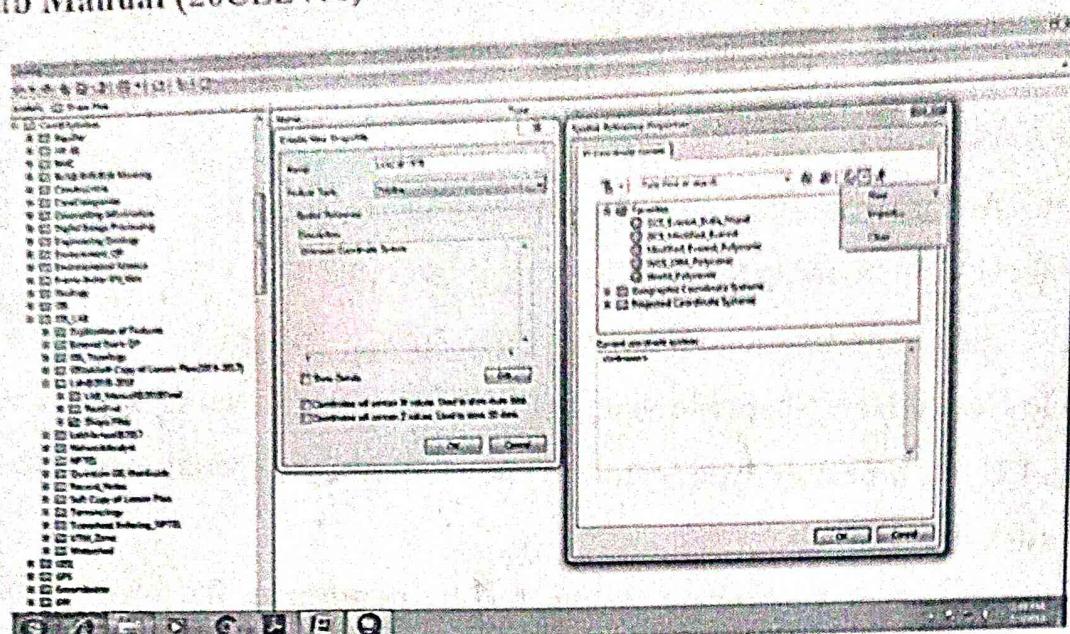


Fig. 2.3

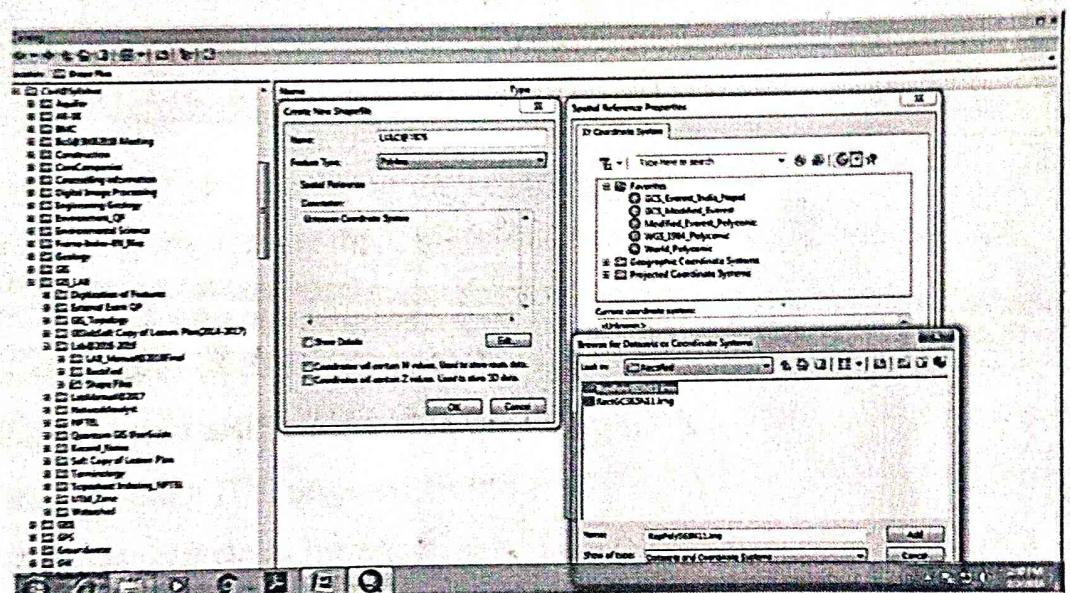


Fig. 2.4

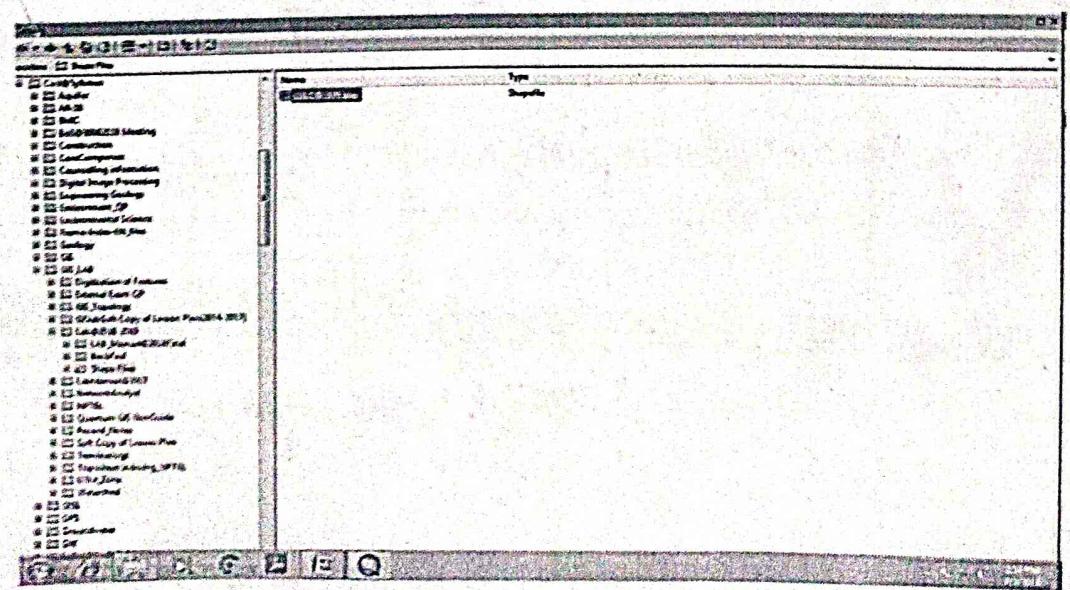


Fig. 2.5

Go to ArcMap and add the both input raster data and new shape file to extract/digitize the features.

- Go to Editor Tool bar select Start Editing as shown in below figure

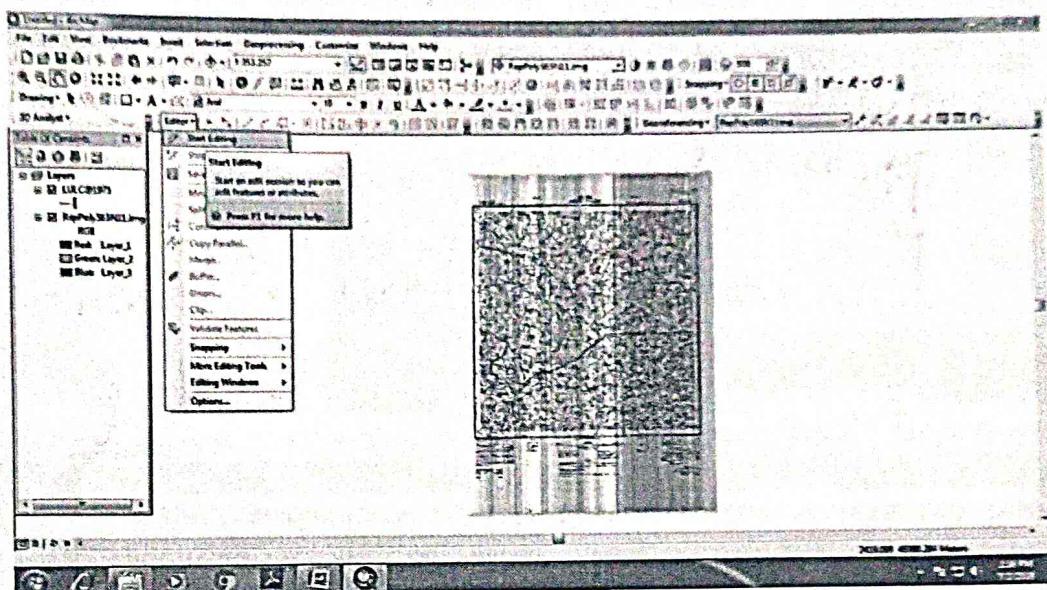


Fig. 2.6

Before starts editing need to take some precautions which includes Shape file properties (i.e., Line colour, Width, Type etc., for visible purpose) and Snap settings for minimizing the editing errors.

- ↳ Go to Table of Contents and Right click on shape file symbol to change the properties and then click OK as shown in below figure.

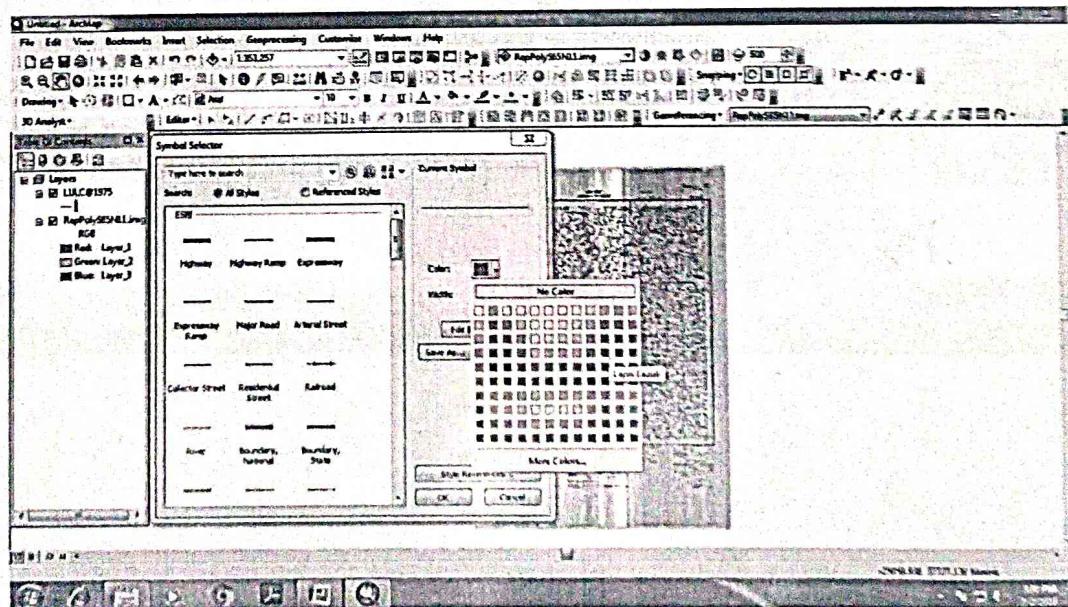


Fig. 2.7

↳ select and enable the all Snapping options to trace the features (*Figure 2.8*).

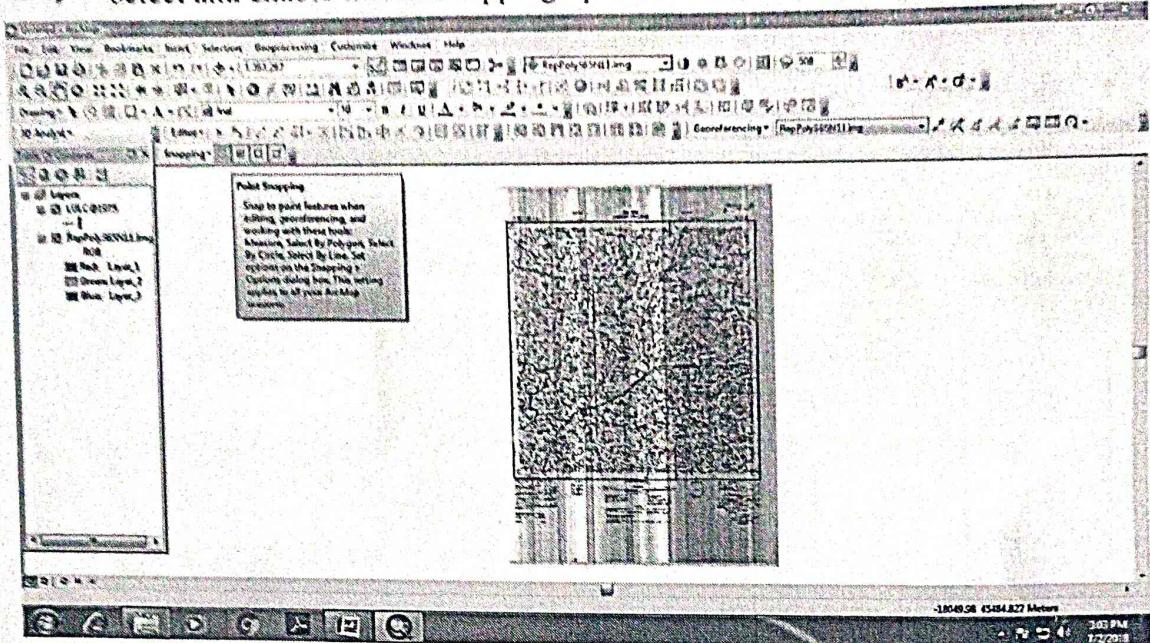


Fig. 2.8

↳ Digitization of the features by using the editing window from the Editor Toolbar and choose create new features as shown in *figures 2.8 and 2.9*

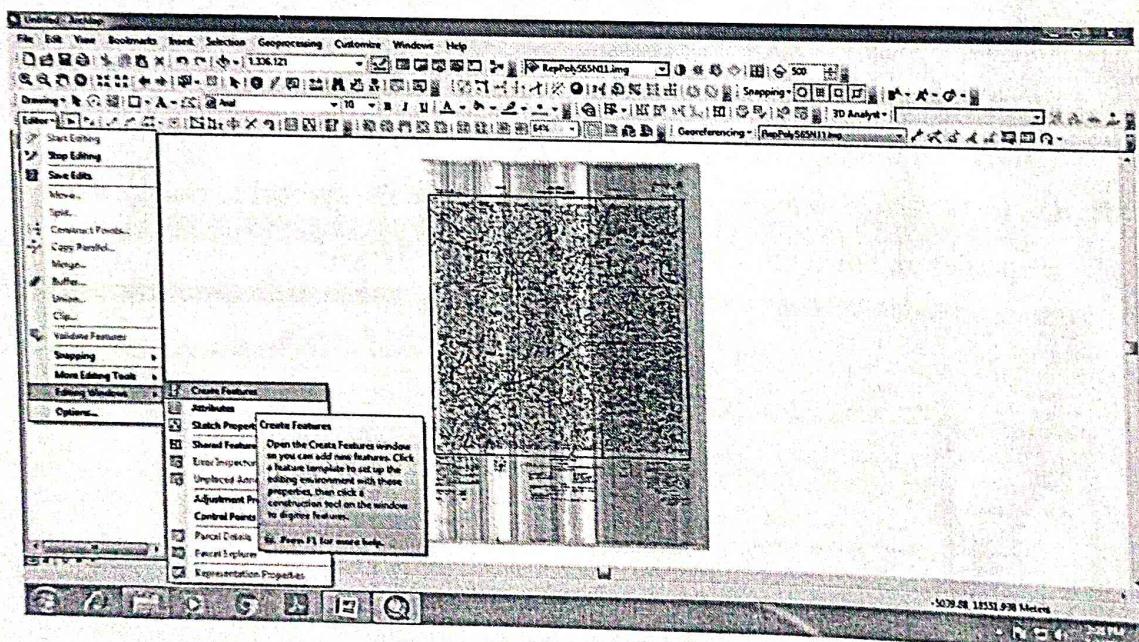


Fig. 2.9

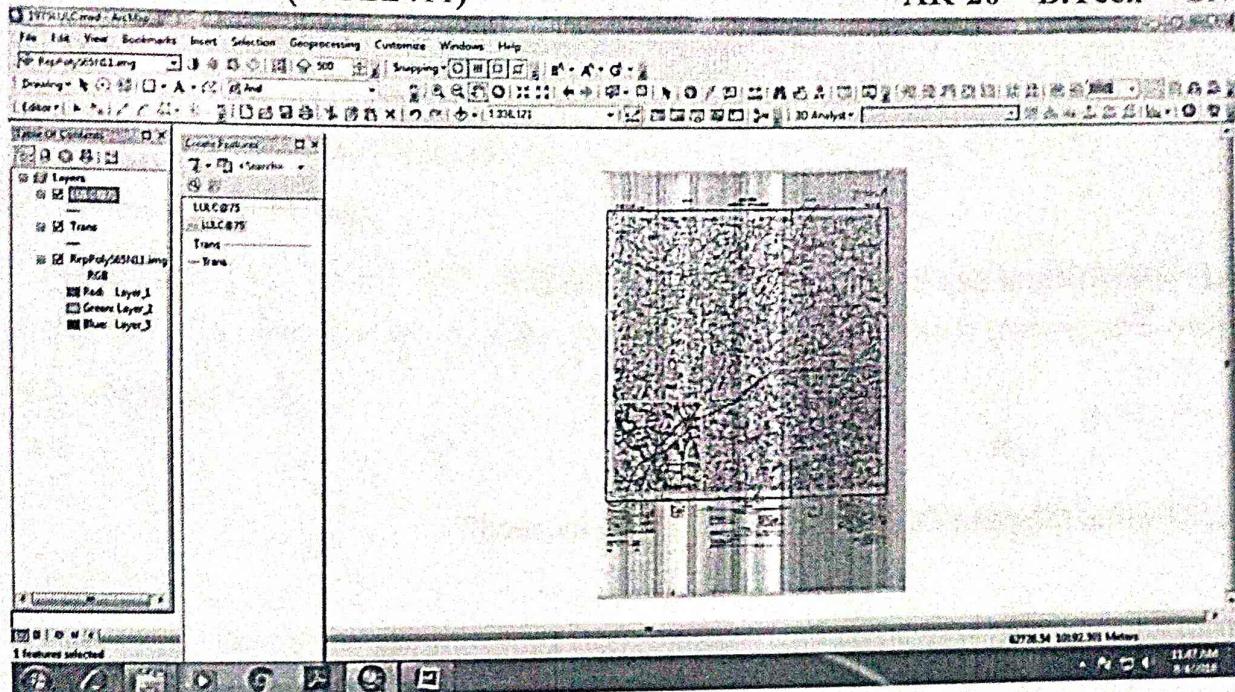


Fig. 2.9

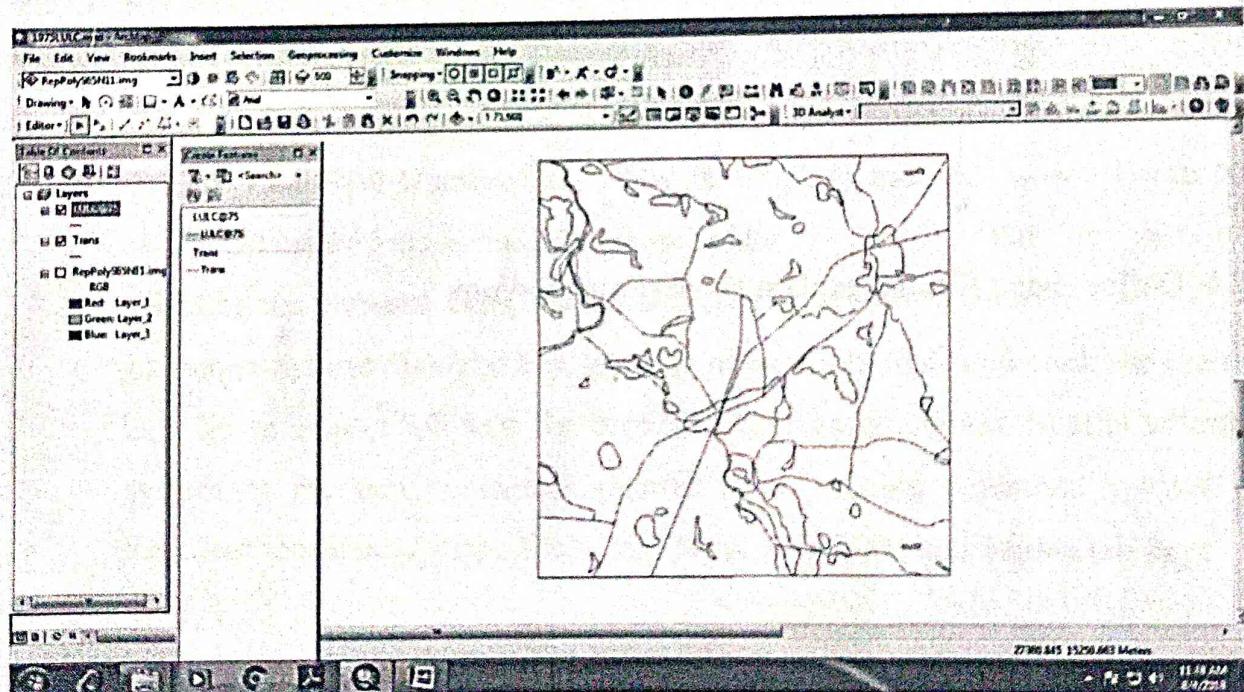


Fig. 2.10

Result: The output digitized LULC features (*Figure 2.10*).

EXERCISE - 3

TOPOLOGY OF DIGITIZED FEATURES

Definition of Topology:

Topology is the science and mathematics of relationships used to validate the geometry of vector entities, and for operations such as network tracing and tests of polygon adjacency.

By:

Paul A. Longley et al., pp. 184.

Objective:

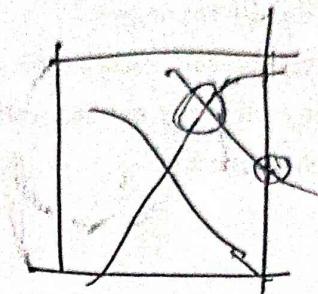
To establish the spatial relationships between connecting or adjacent vector features i.e., points, polylines and polygons.

Input Data: Shape file (Eg.LULC or Trans)

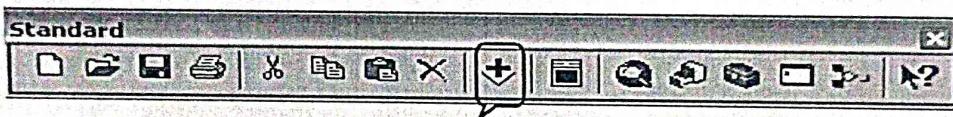
PROCEDURE**Step 1: Process using ArcCatalog Component**

- Open the Arc Catalogue → Go to Destination folder (Eg. E:\GIS_LAB\Roll Number) Use R. Click of mouse → Go to New select and create Personal Geodatabase folder → Go to new by selecting the Personal Geodatabase and create the feature dataset.
- In feature dataset dialogue box give the name Eg.LU/LC and click the next tab key Go to import tab key for browsing and assigning the Spatial reference system to the new feature dataset (Use existing reference system i.e., Rectified toposheet / shape file) Click Next → Next and Finish tab keys
- After creation of feature dataset then select and R.Click on that go to Import and select the Feature Class Single option
- In the Feature Class to Feature Class dialogue box need to browse the input shape file. Output location will comes automatically. Here in this also need to give the name of output feature class and Click OK
- When the file execution is successful. Then once again select the feature dataset and then choose New option. In that select the Topology option. Whenever click on this, New Topology box will be appears. Here Click Next key (Twice) and use Select all option.

- Click twice Next tab key and then Add Rules one by one by clicking the Add Rules option. The rules which are include
 - Must Not Overlap
 - Must Not Intersect ✓
 - Must Not Have Dangles
 - Must Not Have Pseudos
 - Must Not Self Overlap
 - Must Not Self Intersect
 - Must Be Single Part &
 - Must Not Intersect or Touch Interior
- Thereafter click Next and Finish tab keys.
- After creation of new topology. The System will ask a question i.e., Would you like to validate it now there simply we click on NO



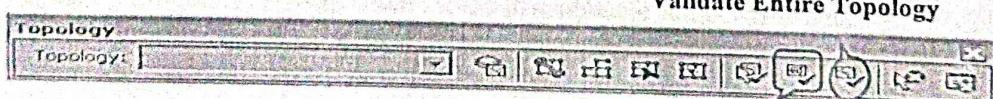
Step 2: Process using ArcMap Component



Add Data Icon

- Add the feature dataset file into the ArcMap window by using Add data Icon
- Go to Editor tool → Start Editing.
- Before editing the Topology file we need to take some of the precautions regarding Snapping options and select all snapping types such as Vertex, End and Edge.
- Now the file is ready to rectify the errors. If the errors are not visible on the screen once we need to click on Validate Topology in Current Extent tool. It is shown in below figures.

Validate Entire Topology



Validate Topology in Current Extent tool

→ Validation of Topology for digitized Features (Figure 3.1 and 3.4).

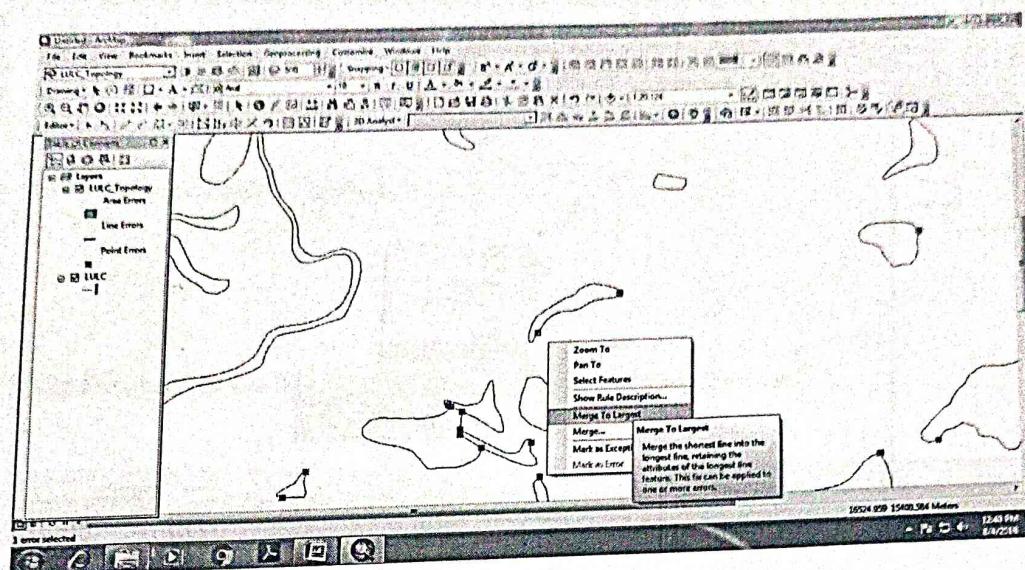


Fig. 3.1

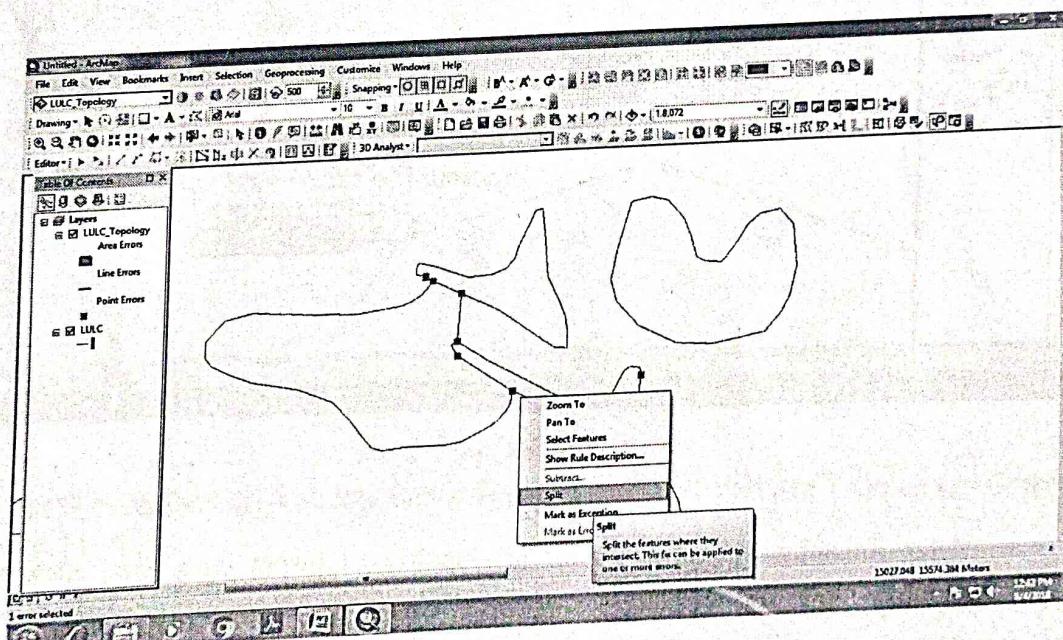


Fig. 3.2

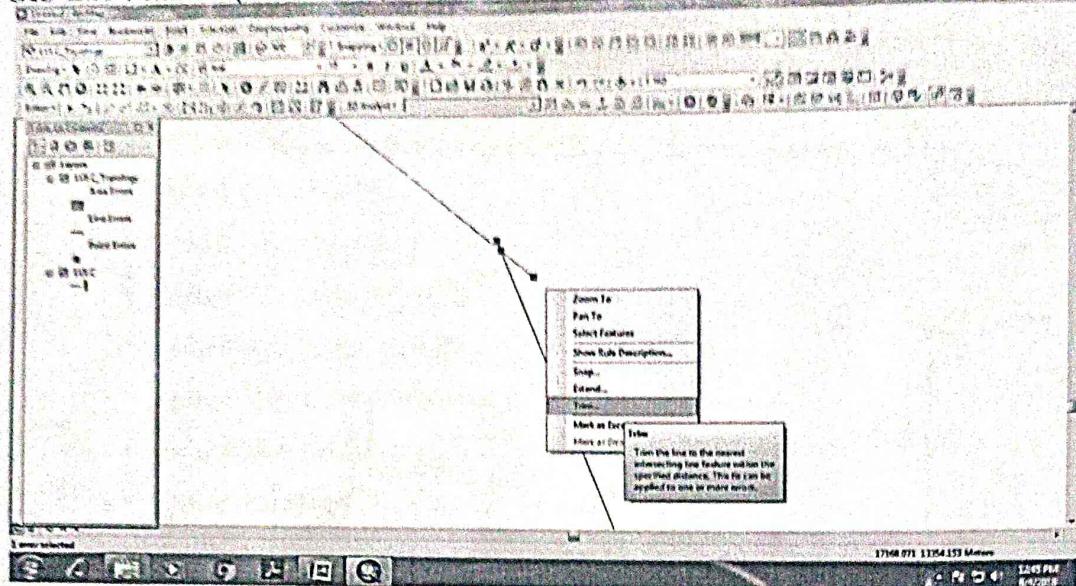


Fig. 3.3

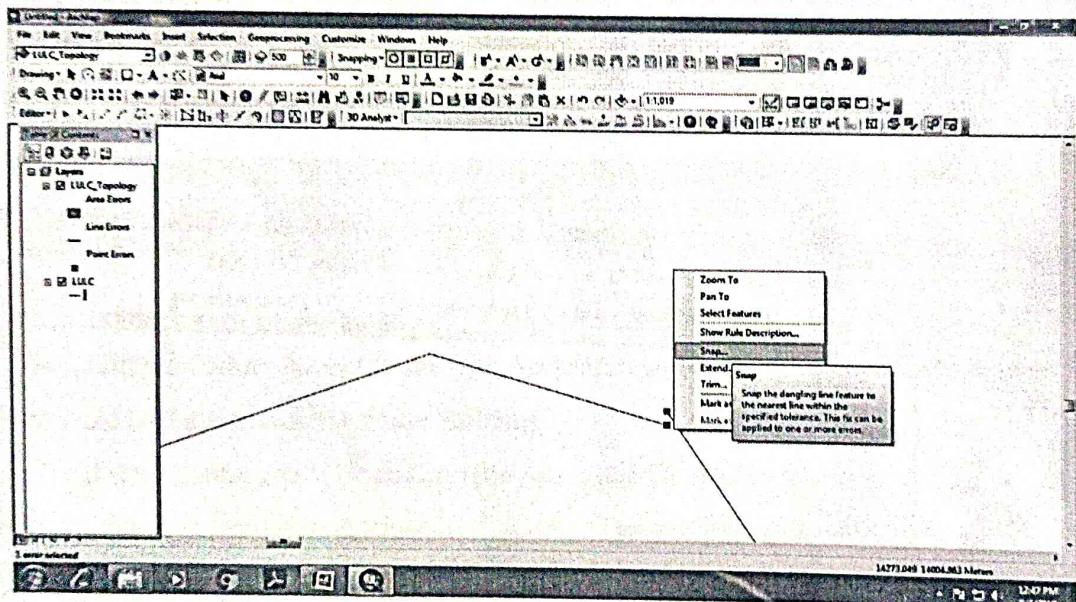


Fig. 3.4

- After finishing the removing of all topological errors then once click on Validate
- Entire Topology using icon. The Icon is shown in the above figure.
- Result: Topologically validated LULC features.
