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Ministry of Urban and Infrastructure

Urban Food Secuirity and Safty Net Office

GIS Operational Manual for UPSNJP Climate Smart Public Work Projects

November, 2023

MUI, UPSNJP

Ethiopia

Contents

Acronyms

CAD – Computer Aided Drawing
CERC – Contingent Emergency Response Component
ESRI - Environmental System Research Institute
FDRE – Federal Democratic Republic of Ethiopia
FUFSSNO – Federal Urban Food Security and Safety Net Office
FY- Fiscal Year
gdb - geodatabases
GIS – Geographical Information System
GUI - Graphical User Interface
KML- Keyhole Markup Language
KMZ - Keyhole Markup Zipped
lyr - layer
OGC - Open Geospatial Consortium
CSPW – Climate Smart Public Work
RHISN – Refuge and Host Integration with Safety Net
shp - shape file
TOC – Table of Content
UD – Urban Destitute
UGI- Urban Green Infrastructure
UPSNJP – Urban Productive Safety net and Job Project
UPSNP – Urban Productive Safety net Project
UTM- Universal Transverse Mercator
WB – World Bank
xlsx - excel file
YE – Youth Employment

Chapter 1: Introduction

1.1. Back Ground

Based on the National Social Protection Policy and Urban Food Security Strategy of Ethiopia, The government with the support of the World Bank (WB) has been implementing the Urban Productive Safety Net Project since 2016/2017 having the vision of alleviating poverty and unemployment. The first Phase Safety Net Project called UPSNP undertaken in selected eleven cities in 2016 - 2020. Scaling up the success experience of the implementation of the first phase, the government expanded the urban productive safety net support and services for poor households, vulnerable, destitute social groups and refuges in the second phase targeting 88 cities selected from all regions of the country under the project called UPSNJP since 2021. The objective of the UPSNJP is to support and lift up poor urban households and individuals from absolute poverty to self-sufficiency through a variety of interventions reflected through the main project components. The UPSNJP program has different components (Safety Net, UD, Youth Employment, CERC and RHISN). Safety net component is being implemented holding different sub components like Climate Smart Public Work, Lively Hood and Citizen Engagements in it. Climate Smart Public Work as a sub component is being undertaken in different activities like urban beautification and greenery, urban non-toxic solid waste and environmental cleaning activities, urban integrated watershed development activities, creating favorable environment for urban agriculture, and urban social infrastructure and services development. It is designed to achieve mainly through deploying beneficiaries based on pre-determined work norms.

These Climate Smart Public Work activities are implemented through different legal and procedural requirements. Some of the steps being undertaken by the cities are site selection for projects, site plan preparation, social and environmental screening, getting approval by government bodies and deploying beneficiaries by selected work forces.

Since UPSNJP Climate Smart Public Works activities need selecting project sites and the preparation of project site plan directly applying GIS soft wares, the need for assisting the users by preparing GIS operational manual for the beginner Climate Smart Public Work expertise has a paramount importance. Though such manual is believed as important working tools for the ongoing project (UPSNJP), still there is no GIS working operational manual prepared to smooth the aforementioned project Climate Smart Public Work tasks. Up on this the Federal Urban Food Security and Safety Net Office (FUFSSNO) has taken the preparation of the manual as one of the prioritized activities among others in the year 2023/24 FY. Hence this first GIS manual document of UPSNJP is prepared to fill the gap aiming at supporting and smoothing the application of Arc Map.

As such this manual aims to guide practitioners/ beginners how to explore ArcGIS Desktop 10.8 version of popular GIS software produced by ESRI (Environmental System Research Institute) for map making and analysis. This manual is meant to show some of the basic Arc Map operations. It will guide how to use the Arc Map tools to create site plan and related issues,

1.2. Objective

1.2.1. The general objective

- ❖ The general objective of this manual is to prepare operational tool which guide the Climate Smart Public Work expertise during the application of GIS software.

1.2.2. Specific Objectives

The specific objectives are:

- ❖ To describe concepts and definition of GIS
- ❖ To Introduce and show users Google Earth tools and its application
- ❖ To Introduce and show users GIS tools applied in Arc Map Software
- ❖ To indicate users step-by-step the application of Arc Map specific to Climate Smart Public Work activities
- ❖ To show Climate Smart Public Works sites plan preparation applying Arc Map tools by preparing models

1.3. Significance

Since GIS software is being used day to day by Climate Smart Public Work expertise it is important to support them preparing operational tool to ease the application of GIS software. This manual may also be important to serve as supportive material by other stakes who under take similar projects.

1.4. Scope

The scope of this operational manual includes concepts related the Arc GIS, showing the application of Google Earth Pro software tools and Arc Map tools specific to activities applied in Climate Smart Public Work site plan preparation. Finally the manual wind up its objective showing models how Climate Smart Public Work site plans are prepared applying Arc map.

Chapter 2: Basic Concepts of Geographic Information Systems (GIS)

2.1. Definitions and Concepts of GIS

GIS has been formally defined by 'The Association for GIS' as a powerful tool that integrates hardware, software, and data with functionality for capturing, storing, checking, integrating, manipulating, analyzing and displaying spatial data. Spatial data are data that are spatially referenced to the earth. Hence, it integrates variety of data with a spatial component regardless of its source. It stores and manages the data, analyzes the data as a whole and displays it in various formats, leverages visualization to make critical business and planning decisions, and saves tremendous time and money.

GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.

Moreover, today's GIS involves collaboration of various technologies and disciplines like geography, cartography, surveying, remote sensing, satellite imagery, photogrammetry, spatial statistics, mathematics, geometry, topology, computer science, information science, library science, web-technology, etc.

ArcGIS is a collection of software products created by Environmental Systems Research Institute (ESRI)--the Microsoft of GIS software--that includes desktop, server, mobile, hosted, and online GIS products. This introduction provides an overview of all of the products, but this manual focuses on the desktop applications, only.

ArcGIS Developed by ESRI. It is use to the Mapping and Analytics Platform. ArcGIS was first released in 1999 and originally was released as Arc INFO, later it's merged into ArcGIS Desktop.

The traditional ArcGIS Desktop applications are:

1. ArcMap: is the main components of ESRI's Arc GIS suite of geospatial programs, often used primarily to create, edit, and analyses maps
2. ArcCatalog: a data management application used to browse datasets and files.
3. Arc Globe: provides real-time pan and zoom of very large (hundreds of gigabytes) of 3D raster, terrain, and vector data sets with no perceivable hesitation on standard PC hardware.
4. Arc Scene: (for 3D visualization) works in a way similar to windows explorer but specialized for GIS data.

Other ArcGIS applications are:

- ArcGIS Online
- ArcGIS Pro
- ArcGIS Enterprise
- ArcGIS Developer.

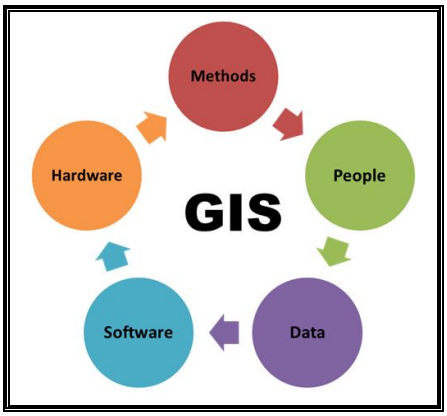
Since Arc GIS applied for different uses, we urge interested expertise, staffs and all interested to use this manual should make themselves ready familiarize with application of Arc Map in particular to UPSNJP Climate Smart Public Work sites issues.

2.2. Basic Questions that GIS answers:

1. Location what is at...? The first of these questions seeks to find out what exists at a particular location described in various ways (e.g., place name, post or zip code, or geographic references).
2. Situation/Condition where does it exist? The second question is the converse of the first and requires spatial analysis to answer. Instead of identifying what exists at a given location, a location is found where certain conditions are satisfied (e.g., an unfrosted section of land of at least 2000 square meters in size, within 100 meters of a road, and with soils suitable for supporting buildings).
3. Trends what has changed since...? The third question involves both of the first two, and seeks to find the differences within an area over time.
4. Patterns what spatial patterns exist? The fourth question is more sophisticated; the question is asked to determine whether cancer is a major cause of death among residents near a nuclear power station or how many anomalies there is that don't fit a predetermined pattern and where they are located.
5. Modeling What if...? The fifth question is posed to determine what happens, for example, if a new road is added to a network, or if a toxic substance seeps into the local groundwater supply. (Answering this type of question requires both geographic as well as other information, and possibly scientific laws.)

2.3. Components of GIS

GIS has different Components: Software, hardware, methods, people and data



2.4. GIS Data Types

There are two different types of GIS data, vector data and raster data. Each type of data has its format.

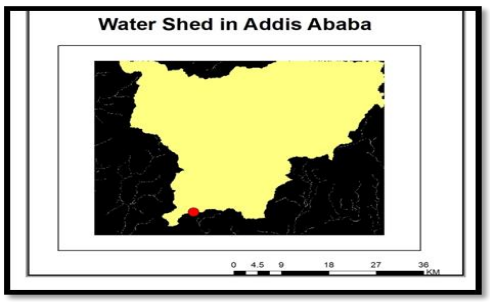
I. Vector Data

Vector data is the spatial data most people are familiar with, as it is the format presented in mapping portals such as Ethiopia administrative boundary map and so on. It consists of **points, lines, and polygons.**

Vector images are high-quality representations of an image or a shape. They can be enlarged or reduced with no loss of quality.

II. Raster Data

Raster data, also known as grid data, is made up of pixels, and each pixel has a value. You will typically find raster data on topographic maps, satellite images and aerial surveys. Raster data is vital for elevation, land use classification, meteorology, disaster management, and so on.



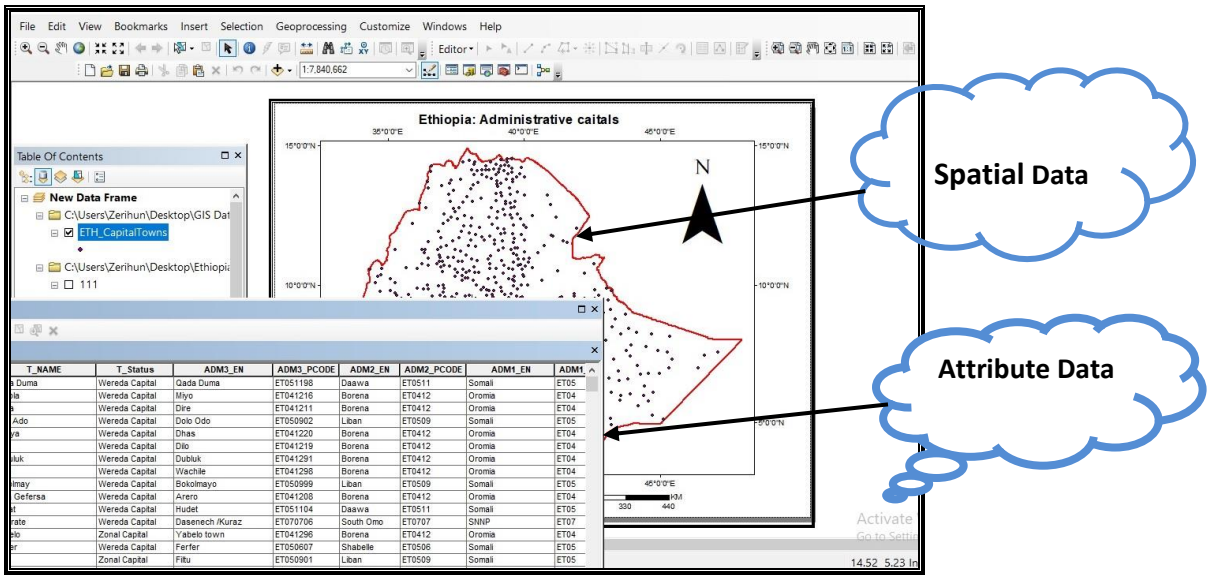
2.5. Representation of data in GIS

GIS can handle two basic data types: **Spatial and non-spatial data**

I. **Spatial data**: - gives the information about geometrical orientation of a feature. The geometrical orientation refers to shape, size, and relative position with respect to other features. All the spatial data will be described by x, y coordinates. Example, land use map, boundary map…

II. Non spatial/ attributes data

Non-spatial data which is also referred as attribute data, gives the information of the spatial features. For example the attributes of Climate Smart Public Work site can be Site type, site name, work force number, diploid PD, annual cash transfer…

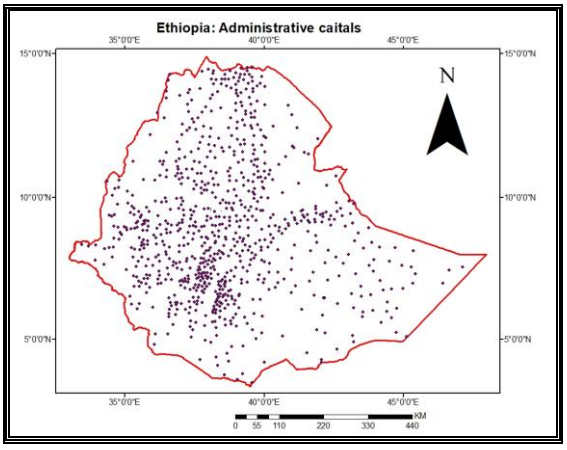


All the spatial data can be represented and entered into GIS database in three basic graphical feature elements.

I. Points
II. Lines/Polylines
III. Polygons.

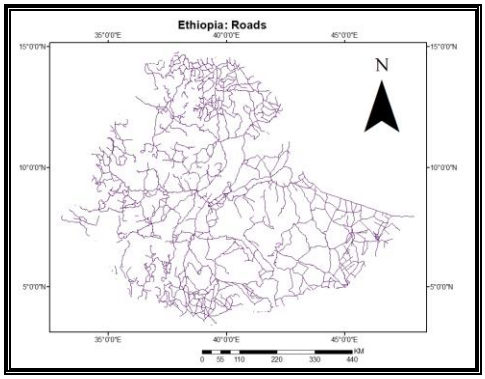
I. Points

Ex: Location of towns, oil wells, rain gauge stations, electrical poles, bore wells, epicenter of an earth quake etc. The following is an example of point feature shown on map.

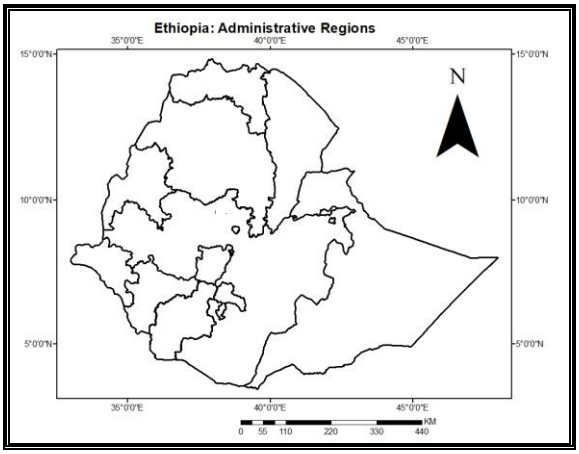


II. Lines

Ex. Solid waste sites, earth work sites, roads, drainage, rail way lines etc represented by line features.



III. Polygons:



2.6. GIS Data Sources

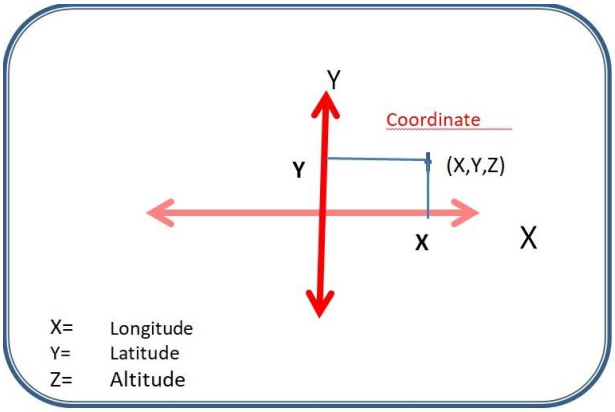
The major data sources of GIS are:

I. Remote sensing

- ❖ Data taken from satellite image (Google Earth)
- ❖ Data taken by Drone Technology
- ❖ Data taken by Air plane

II. Ground Survey

- ❖ XY Data collected by surveying tools



III. Tabular data and Census: The different quantitative and qualitative data managed in tables can be used as data inputs to be added as attribute data.

2.7. Methods of using Data Input

- ❖ Manual Digitizing (vector)
- ❖ GPS (vector: point, line, area)
- ❖ Scanning (raster)
- ❖ Remote Sensing
- ❖ Existing Digital Data (vector and/or raster)
- ❖ Attribute data

2.8. GIS – Operations

Data analysis is a core of GIS-operations that are applied on a raw data set to retrieve derivative information for interpretation and decision-making. It contains various sophisticated GIS activities that are listed below:

- ❖ Overlay analysis
- ❖ Neighbourhood analysis Buffer generation
- ❖ Surface area and distance calculation
- ❖ Network analysis
- ❖ Relational matching
- ❖ Statistical analysis
- ❖ Modelling

2.9. GIS – Applications and Its Importance

The application of GIS in combination with Remote Sensing is very broad. Include tasks ranging from weather prediction, crop yield forecasting and mineral exploration to applications as diverse as forest fire detection and controlling, pollution detection, land degradation assessment and control, land use planning, rangeland monitoring, navigation, assessment of anthropogenic impacts on environment, Natural resources management (mineral resources, water resources, soil resources, ecosystem, landscape and traditional stand and forest management). Synthesized scientific and technical evidences presented in a map form using GIS can simplify decision-

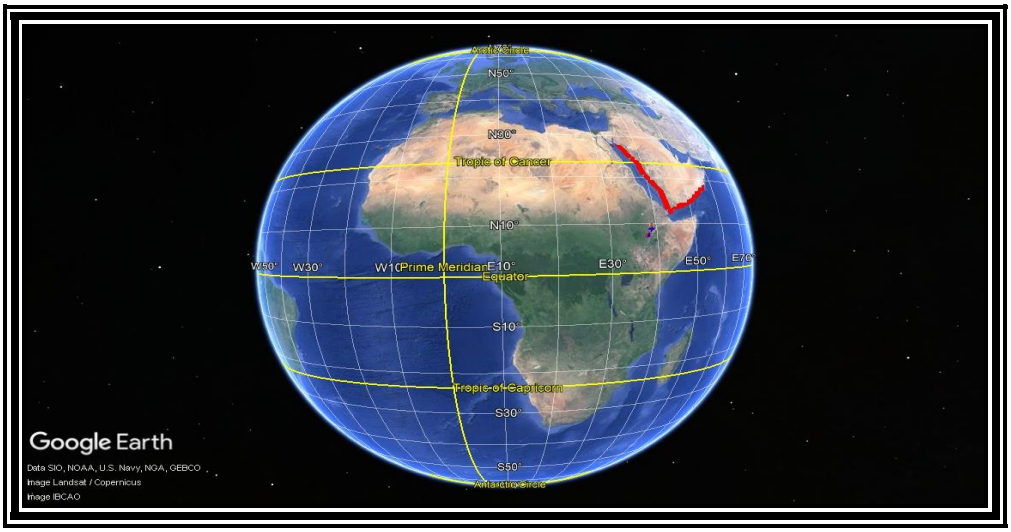
making. GIS aids strategy designing and policy implementations in day-to-day management activities.

2.10. Coordinate systems

GIS software uses the two coordinate systems:

1. **Geographic Coordinate System**
2. **Projected Coordinate System**

Projection is a method by which the curved surface of the earth is portrayed on flat surface. This generally requires a systematic mathematical transformation of the earth's grackle of lines of longitude and latitudes on to a plane.

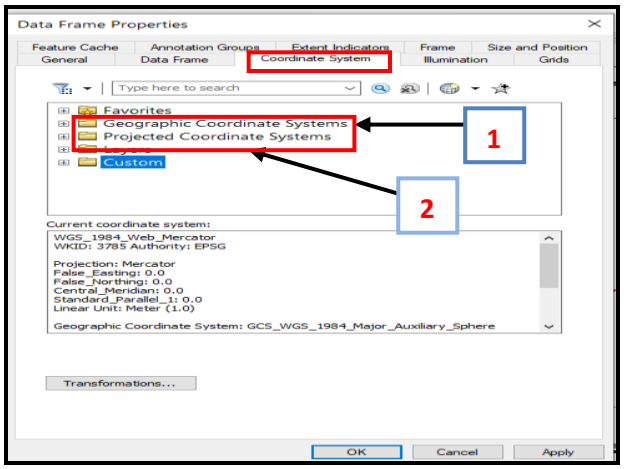


1. Geographic Coordinate System

A geographic coordinate system is a three dimensional positional reference that utilizes **latitude, longitude, and ellipsoidal height**. This positional reference system is among the most used today for global locations.

2. Projected Coordinate System

The most common projected coordinate used in Arc map is Universal Transverse Mercator projection (UTM). It is a global map projection that transforms the three dimensional world in to a two dimensional system. The UTM employs an international plane coordinate system that extends around the world from 84° north above the equator to 80° south below. The UTM coordinate system is set upon a zoned grid, which divides the Earth in to 60 equal zones that are all 6° wide in longitude (east-west). The UTM zones are numbered 1 through 60, starting at the international date line (zone 1 at 180° west longitude), progressing east past the prime meridian (zone 30), and back to the international date line (zone 60 at 180° east longitude).



2.11.Urban Planning and Urban Green Infrastructure Strategies

Urban planning strategy of Ethiopia has given opportunity for all stakeholders working on environment protection creating good ground to be accessed with development land in the urban areas. It enforces urban planners to allot 30% of the total land of the plan boundary for greenery and related uses. The common urban planning trend of Ethiopia is to propose the land use plans having different land use categories with their own share of land. The categories include: Administrative, Residential, Commercial, Industry, road, Public facilities (Cultural, archaeology, Open spaces and environmental sensitive areas (parks, and urban agriculture, recreation, mineral resources). Currently all urban plans in Ethiopia are prepared considering the above strategic issue related to environment.

FDRE Urban Green Infrastructure Development Strategy has been implemented since 2014 aiming at enhancing urban green infrastructure developments and creating resilient cities. The strategy has identified seventeen suitable areas for greenery development of the urban lands. These are: river buffers, lake buffers, road sides, road medians, institutional compounds, communal residents, in and around private house, hill sides, recreational parks, sport fields, plazas and holly days celebrating fields, religious compounds, urban agriculture sites, urban woodlots and green belts, open spaces, cemetery areas, nursery sites and building roofs.

UPSNJP expertise selects project sites under the frame work of UGI strategy, we hope that they will stay with positive response from municipal offices being considered as one of stake to share the endeavors being made creating resilient cities.

2.12. Site Analysis and Site plan

The type, size and nature of the project to be established on a site is decided on a detail analysis of the site conditions. Activities to be considered while performing detail analysis of the site conditions are analysis of topographic/slope, analysis of the impacts of physical conditions, and impacts of legal constraints and the man-made elements on the site. To conduct a site analysis both primary and secondary data which can describe all aspects of the site must be gathered and analyzed. Site analysis includes site features analysis (natural and manmade), land use and

service distribution analysis, infrastructure analysis and environmental analysis. The process of undertaking site assessment plan is a part of preliminary tasks which leads to the design and development of a landscape or project design. Therefore undertaking site survey in using the site map helps to arrive at perfect site analysis. The use of site plan is being applied in undertaking impact evaluation of UPSNJP Climate Smart Public Work project.

Site plan

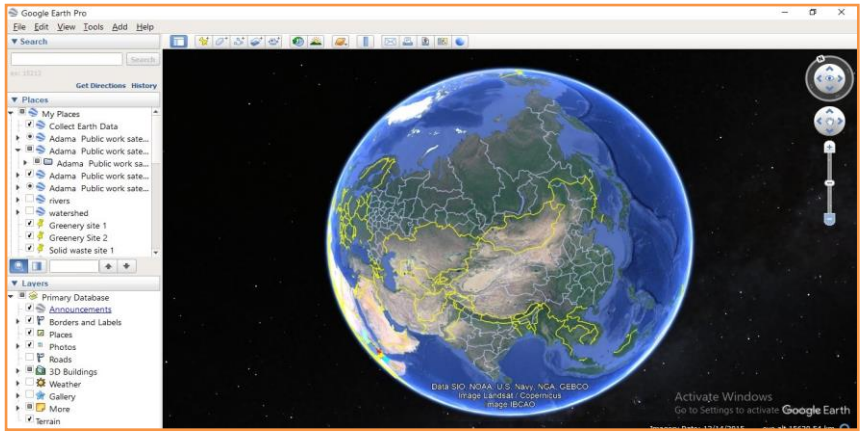
A site plan is an architectural plan, landscape architecture document, and a detailed engineering drawing of proposed improvements to a given lot. A site plan usually shows a building footprint, travel ways, parking, drainage facilities, sanitary sewer lines, water lines, trails, lighting, and landscaping and garden elements. Such a plan of a site is a "graphic representation of the arrangement of buildings, parking, landscaping and any other structure that is part of a development project".

Site planning is an integral part of the land-use planning process; it determines the detailed layout of an area of land so that it functions effectively in relation to a given range of land uses on the site and others around it. It occurs directly before or as part of the detailed design process, depending on the complexity and scale of the site. In the overall planning process site planning occurs after the strategic planning has taken place and after the land use has been decided in relation to social, economic and environmental needs. Site planning is about working out the detail of what should happen on a given area of land, how it should happen and what it will cost to implement and manage the project on that area of land.

Chapter 3: Introducing Google Earth

3.1. Google Earth Pro – Overview

Google Earth Pro is free software that allows visualization, assessment, overlay, and creation of geospatial data. It provides access to high-resolution satellite imagery, geospatial datasets, and planetary-scale analysis capabilities for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface.

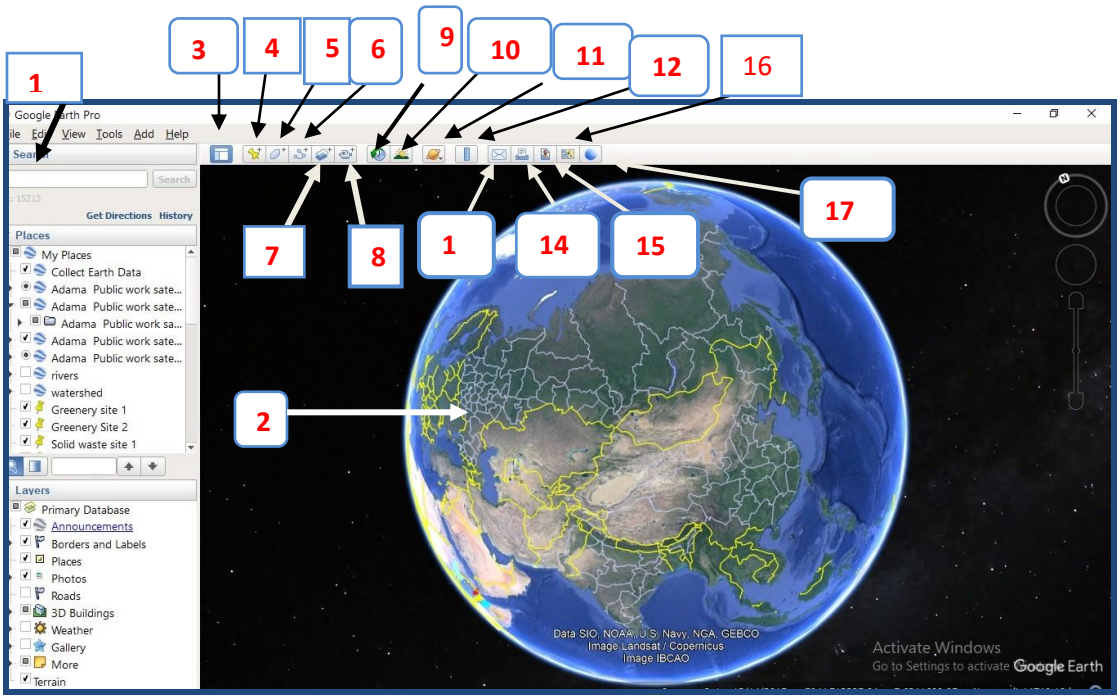


In this manual you will learn how to create place marks (points of interest), analyses elevation changes over the landscape, import images, save files, import shape files, geocode addresses, and create a route

Some of the features available in the main window of Google Earth Pro*:*

1. Search panel - Use this to find places and directions and manage search results. Google Earth EC may display additional tabs here.
2. Overview map - Use this for an additional perspective of the Earth.
3. Hide/Show sidebar - Click this to conceal or the display the side bar (Search, Places and Layers panels).
4. Add place mark - Click this to add a place mark for a location.
5. Add polygon - Click this to add a polygon.
6. Add path - Click this to add a path (line or lines).
7. Add image overlay - Click this to add an image overlay on the Earth.
8. Record Tour
9. Show historical image
10. Show sun light across the land scape
11. Switch between earth, sky and other planet
12. Show ruler - Click this to measure a distance or area size.
13. Email - Click this to email a view or image.
10. Print - Click this to print the current view of the Earth.
11. Show in Google Maps - Click this to show the current view in Google Maps in your web browser.

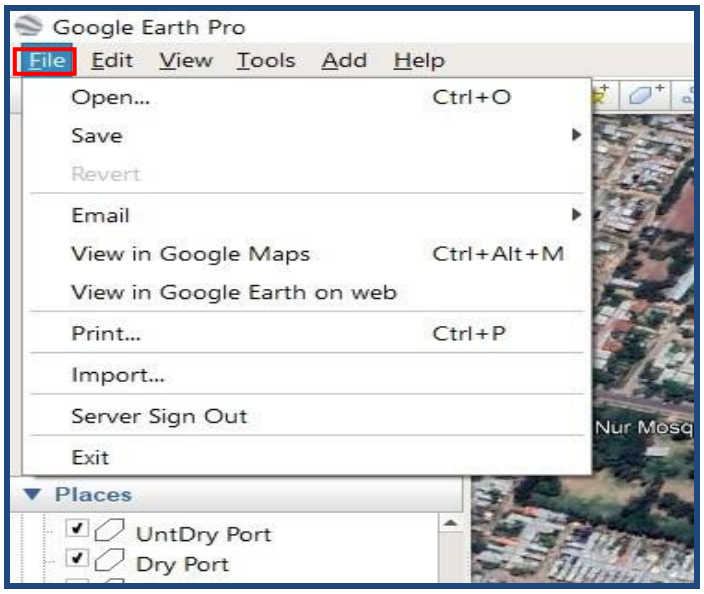
12. Sky - Click this to view stars, constellations, galaxies, planets and the Earth's moon.
13. Navigation controls - Use these to tilt, zoom and move around your viewpoint (see below).
14. Print
15. Save Image
16. View Google map
17. View in Google Earth in web



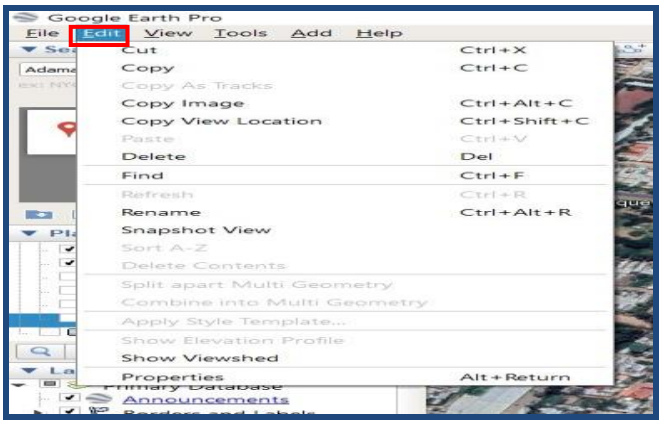
3.2. Introduction to Menu Bars

Google Earth Pro has six major Menu Bars. These are File, Edit, View, Tools, Add, and Help. Each Menu Bars are composed of different Tool bars with different functions.

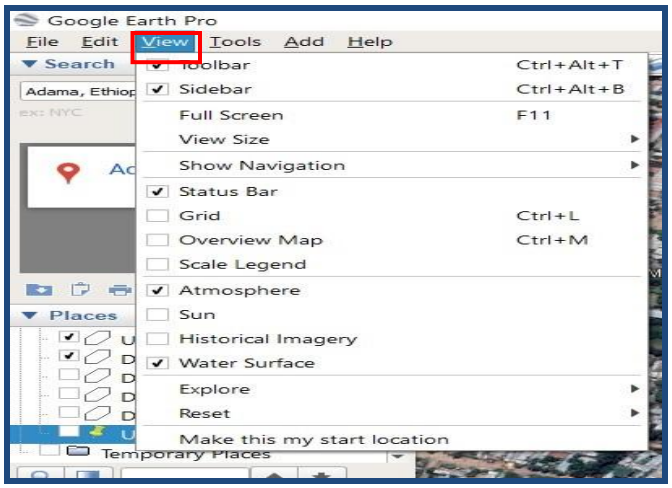
1. File: File menu bar has opening, saving, importing data …. Tool bars



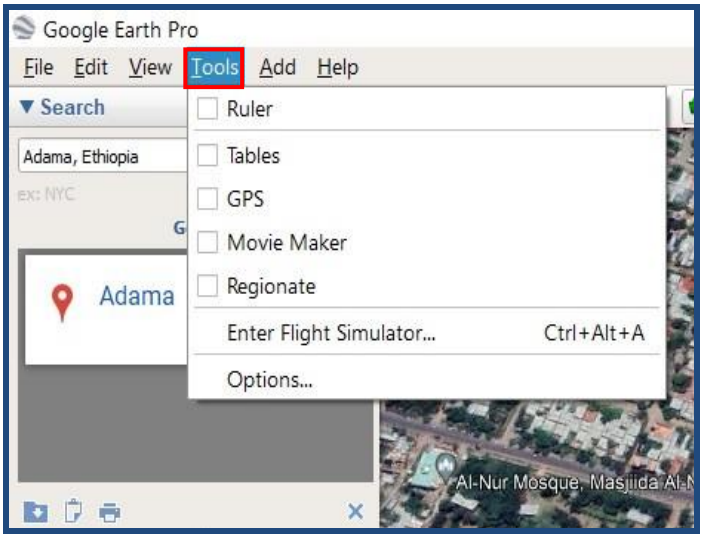
2. Edit Menu bar: Cut, copy, find, rename. delete functioning tool bars are found in this



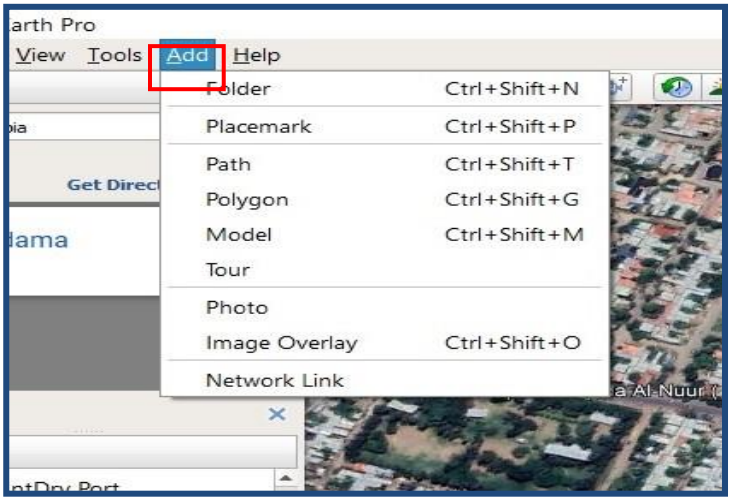
3. View : all features and information that we want to view should be checked on in this



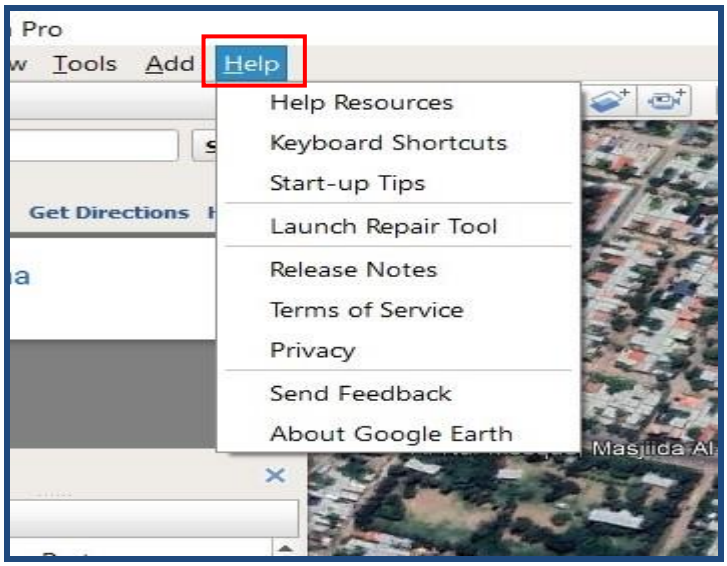
4. Options: tools like GPS, ruler, tables and so on should be checked on here. Under options there are coordinate system and unit measurement commanding tools.



5. Add bars: To add place marks, path, polygon, overlay image… we can use tools under this.



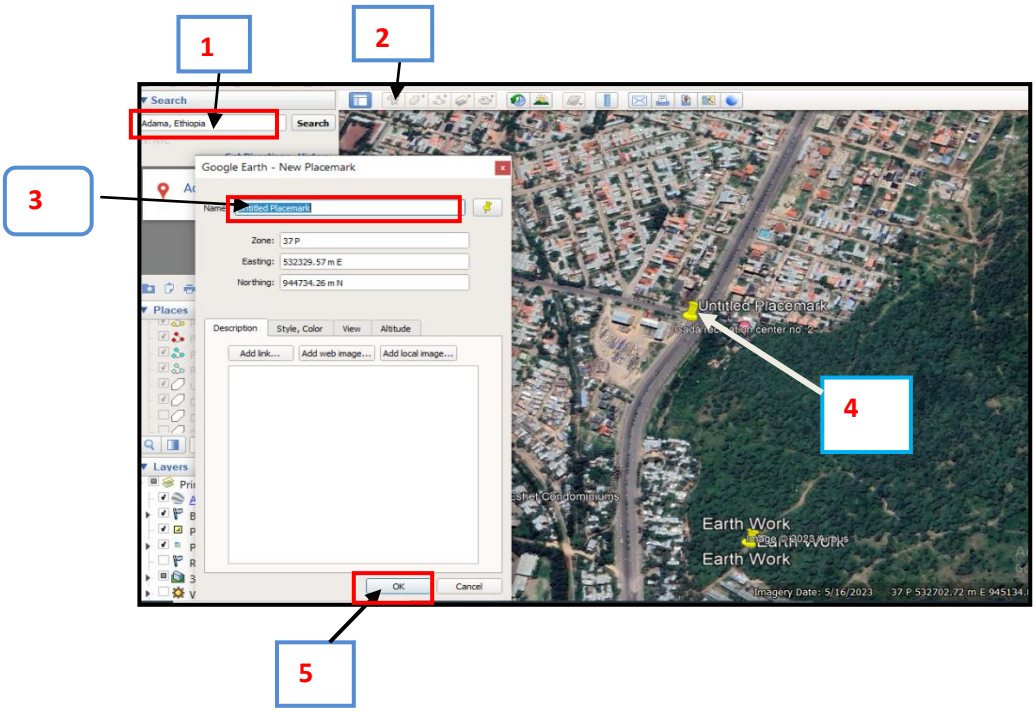
6. Help: click on help to communicate and get from the Google Earth pro



3.3. How to Add Points, Polygons and Paths on Google Earth Pro

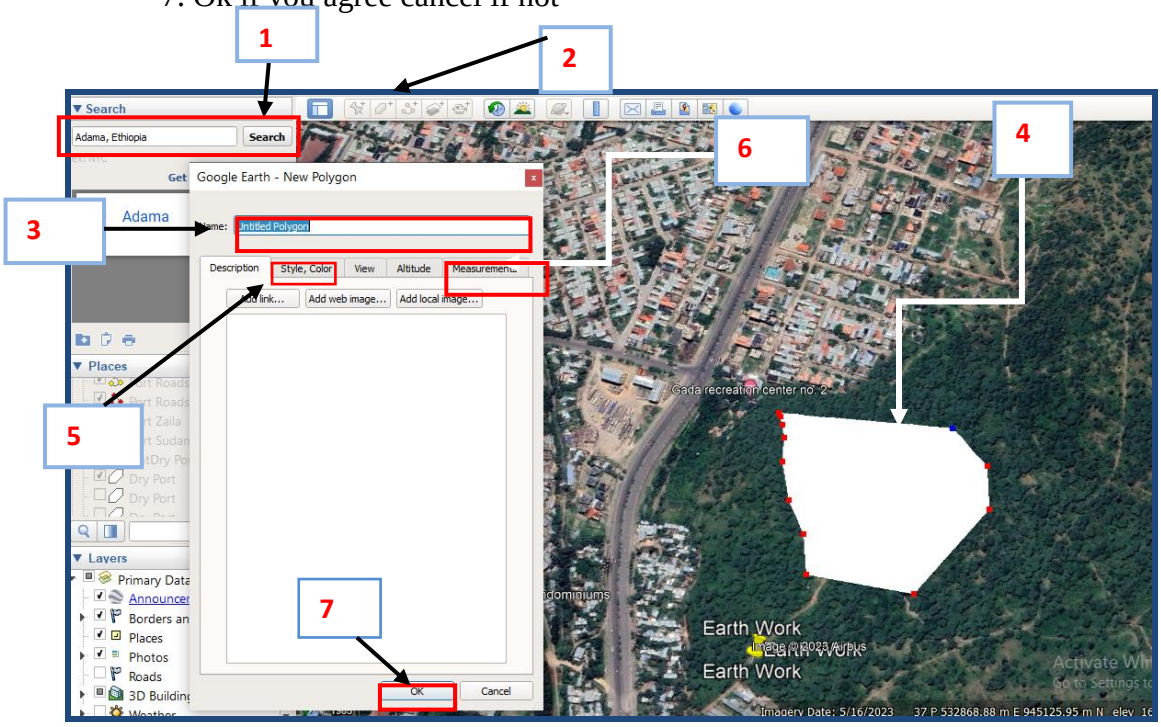
3.3.1 Add Point

1. Search the place by writing name in the search box or zoom in to the place of your interest
2. Click on add point
3. Write the name of the place/ site in the box
4. Drag the pointer to the point where you want to show
5. Ok if you agree or cancel if not



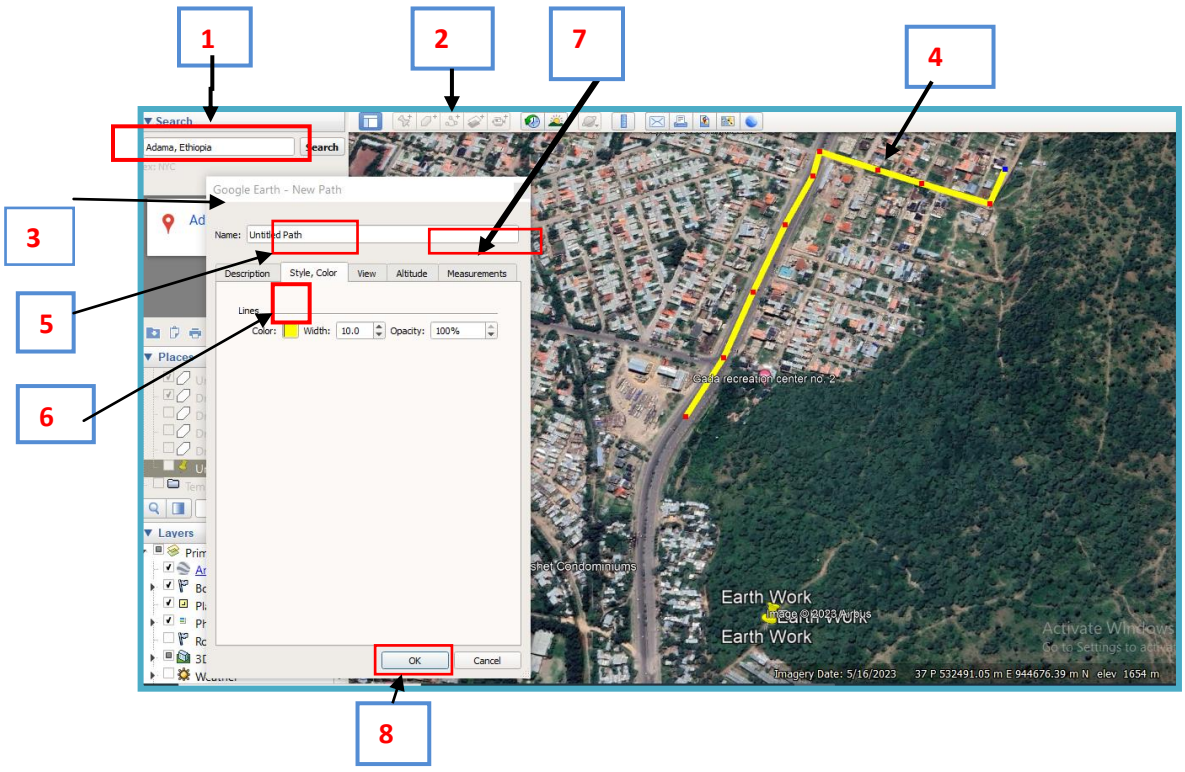
3.2.2 Add polygon

1. Search the place by writing name in the search box or zoom in to the place of your interest
2. Click on add polygon
3. Write the name of the place/ site in the box
4. Create the polygon by dragging the pointer on the place where you want to show
5. Click to select the color style
6. Click to know the measurement
7. Ok if you agree cancel if not



3.3.3. Add Path

1. Search the place by writing name in the search box or zoom in to the place of your interest
2. Click on add path
3. Write the name of the place/ site in the box
4. Create the path by dragging the pointer on the place where you want to show
5. Click to select couloir style
6. Click to select the couloir
7. Click to know the measurement
8. Ok if you agree cancel if not

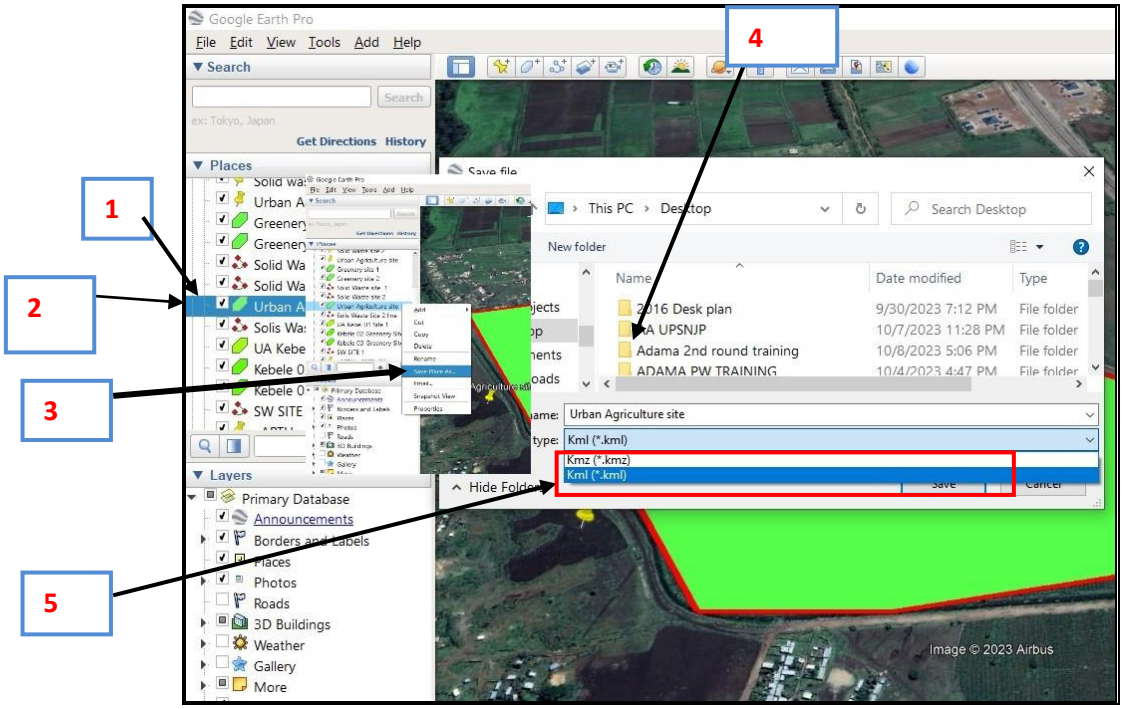


3.3. How to save in KML

Google Earth pro files can be used as an input Arc Map keeping the spatial feature. All added features on Google earth are temporally saved under places box at left side. Features saved under this permanently saved it in to shape file.

Steps to save urban agriculture site

1. Zoom to the feature with name
2. Right click on the name
3. Click on Save my place as
4. Select the folder to save
5. Save in KML giving file name


Google Earth Pro
File Edit View Tools Add Help
Search
Get Directions History
Places
Layers
Primary Database
Announcements
Borders and Labels
Places
Photos
Roads
3D Buildings
Weather
Gallery
More
Save file
This PC › Desktop
Search Desktop
New folder
Name
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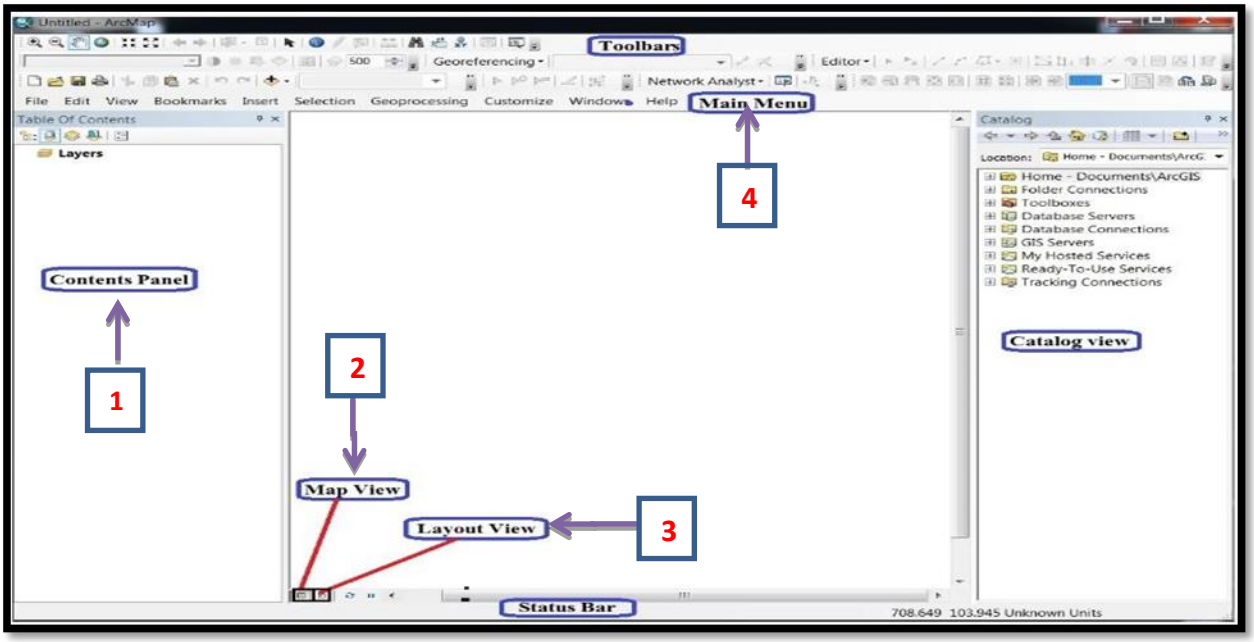
2016 Desk plan 9/30/2023 7:12 PM File folder
A UPSNJP 10/7/2023 11:28 PM File folder
Adama 2nd round training 10/8/2023 5:06 PM File folder
ADAMA PW TRAINING 10/4/2023 4:47 PM File folder
Urban Agriculture site
Kml (*.kml)
Kmz (*.kmz)
Kml (*.kml)
Hide Folders
Image © 2023 Airbus
1
2
3
4
5

KML File


Pro
Urban
Agriculture site

Chapter 4: Operational Manual to Arc Map

4.1. Introducing tool bars, how to use Arc map software



ArcGIS GUI (Graphical User Interface)

1. **Table of contents (Contents Panel)**

ArcGIS Panel basically means Table of Content (TOC).

2. **Map view**

In ArcMap map/data view, the map is the data frame.

3. **Layout view**

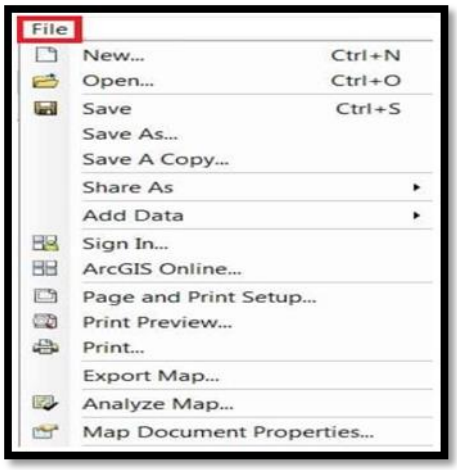
When you're preparing your map's Layout, you'll want to work with your map in page layout view. A page layout is a collection of map elements (such as a data frame, map title, scale bar, north arrow, and a symbol legend) arranged on a page

4. **Menu bar**

The Main menu helps you to perform a group of related tasks.

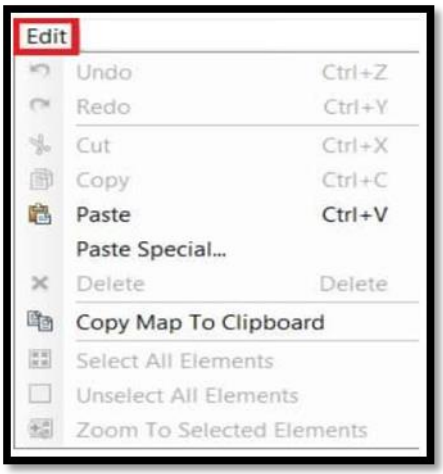
1. **File Menu:**

The File menu allow to **Add Data, Open, Save, Print, Export project**.



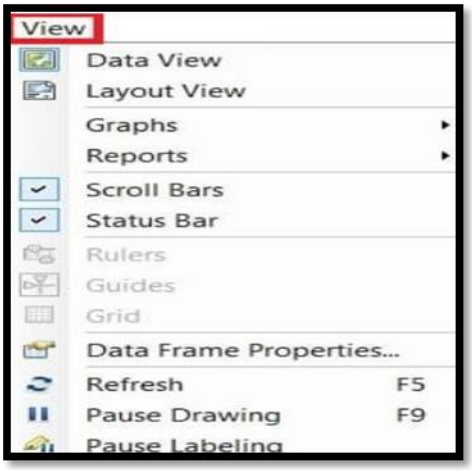
2. **Edit Menu:**

The Edit menu provides most of the native tools needed to edit layer attributes or geometry. It provides tools are: **Cut, Copy, and Paste Features**.



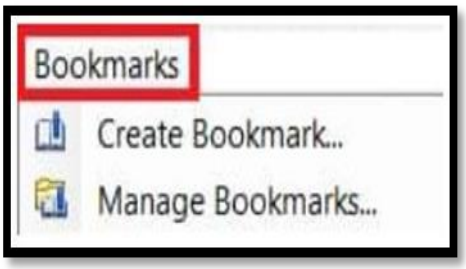
3. **View Menu:**

The View is the most impotent menu bar in ArcGIS. This menu allows switching **data view** to **layout view**, also activating and deactivating **scroll** and **status bar**, creating graphs and reports.



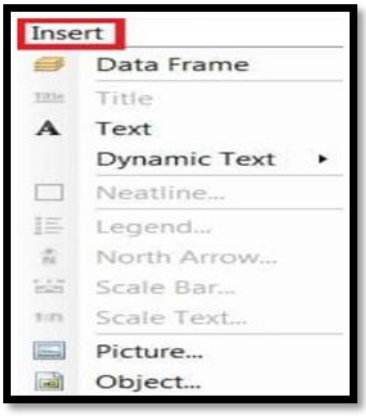
4. **Bookmarks Menu:**

Bookmarks help **Create** and **Manage** your project bookmark.



5. Insert Menu:

Insert menu basically use for **Layout**, like; **Legend**, **North line**, **Scale bar**, etc.



6. Selection Menu:

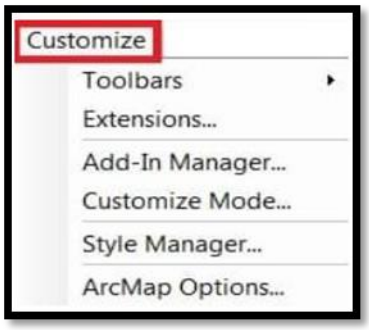
When you select features with the selection tools, the Select by graphs command or the edit tool.

7. Geoprocessing Menu:

Geo-processing menu shortcut of perform of some geo-processing analysis. Like; **Buffer, Clip, Union, Intersect,** etc.

8. Customize Menu:

Customize menu one of the most important menu bar in ArcGIS. You can manage all the Toolbars, activate or deactivate Extensions.

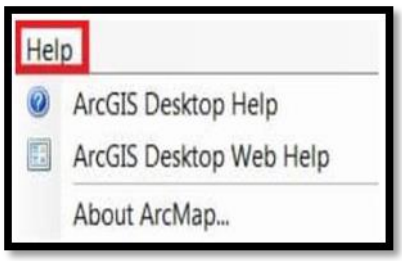


9. Windows Menu:

Windows menu helps to activate some important windows or panel, like; **Table of Contents, Catalog,** and **Search.**

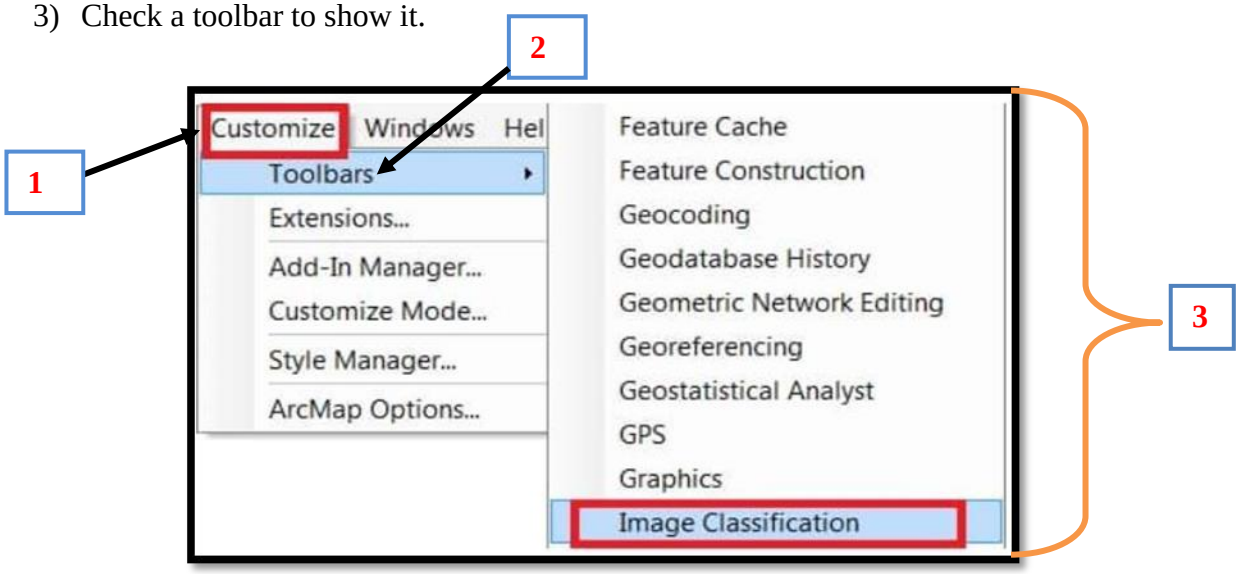
10. Help Menu:

Help menu helps you to learn about ArcGIS desktop.



11. How to Customize Toolbar

1) Click **Customize** on the main menu bar and
2) Point to **Toolbars**.
3) Check a toolbar to show it.

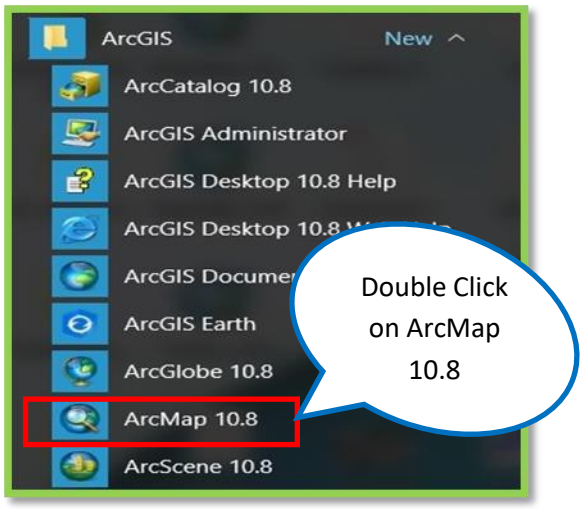


4.3 Launching ArcMap

You can launch ArcMap in more than one way. The most common way is to click on the **start menu** and go to **"All Programs,"** then the **ArcGIS folder**, then **ArcMap 10.8** If you don't see ArcGIS in the list of programs, don't worry, it might still be installed on your computer. Look in **c:\\Program Files for an ArcGIS folder**. Open the ArcGIS folder, then the Desktop 10.8 folder, then the Bin folder inside that. Double-click on the ArcMap.exe file to start ArcMap. If it's not there then ArcGIS is not installed on your computer.

To open ArcGIS 10.8

1. Click the Start button on the Windows taskbar.
2. Point to All Programs.
3. Point to ArcGIS.
4. ***Click ArcMap 10.8.***

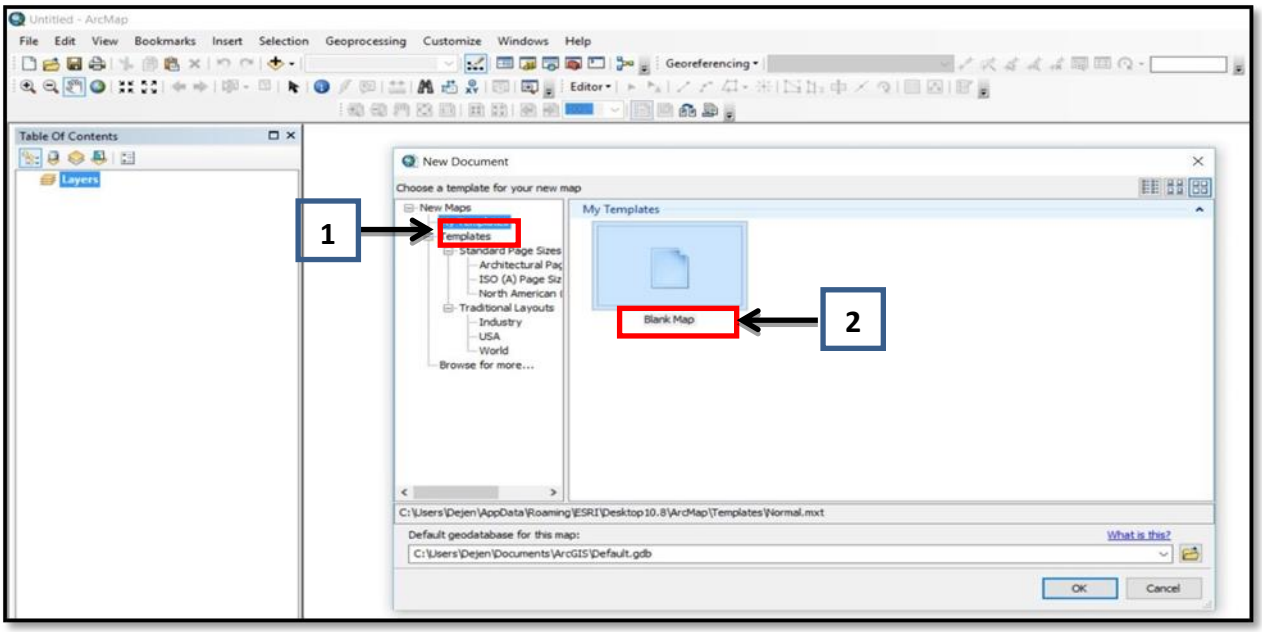


If you want to create a desktop icon for ArcMap (so you don't have to go through all of that again), right click on the ArcMap.exe file and choose "create shortcut." Then copy and paste the shortcut to your desktop.

When ArcMap opens, it will ask if you want to open a blank map, use a template, or browse for an existing map document.

When you are first creating a map, you will probably start with a blank map so click "OK." If the default is to add an existing project,

1. click on ***"My Templates"***
2. And then ***"Blank Map."***



4.3.1 Adding Data

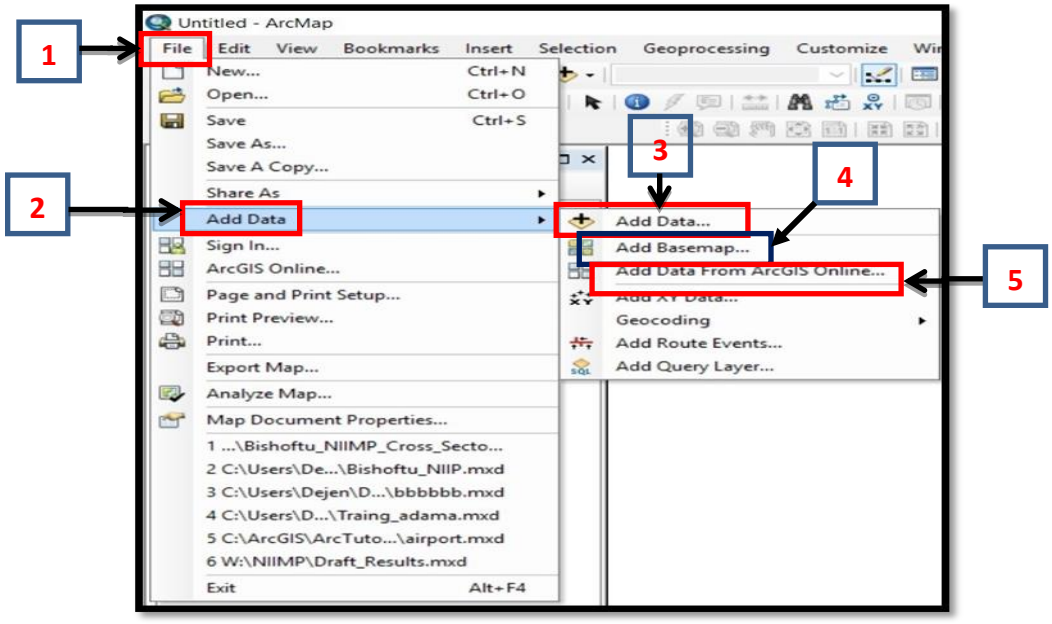
Unless you open an ArcView ***.mxd*** file that someone else created, you will need to add data to get started.

1. ***From the file menu,*** go to
2. ***"Add data"*** or click on the
3. ***"Add data" button*** ( ) on the Standard toolbar.

Navigate to the folder where you have your map layers. With ArcGIS 10.8, you can use the "Add Data" button to access to other options: Add Base map and Add Data from ArcGIS Online.

4. From the ***"Add Base map"*** option, you can import Bing and Google aerial images, street and topo maps, and others.
5. Through ***ArcGIS Online***, you can import data many additional layers that include data.

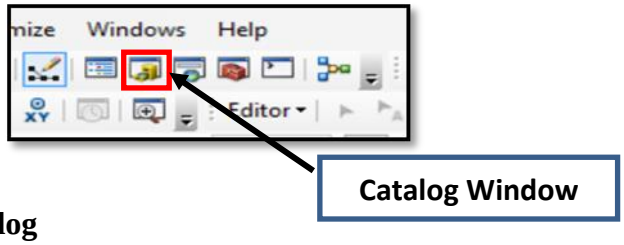
The "Add Data" option allows you to navigate to a folder and add your own map layers.



4.4 Managing Arc Catalog

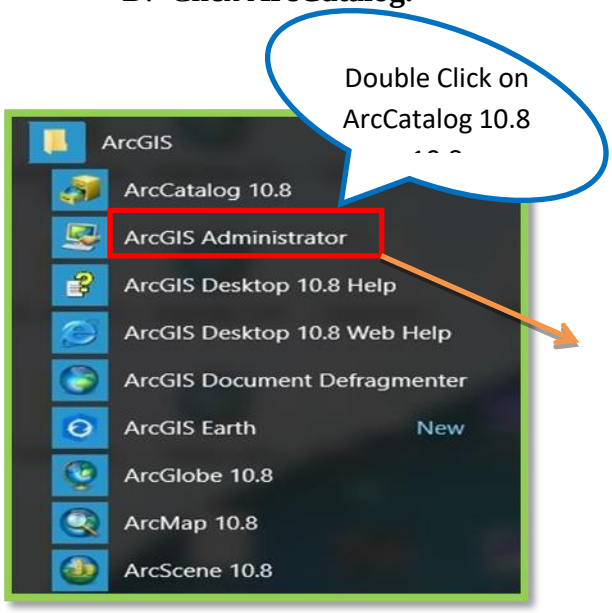
ArcCatalog is a system for managing and organizing map files. You can still open ArcCatalog without opening ArcMap but it is much easier to use from inside ArcMap.

1. To launch ArcCatalog within ArcMap, click on the **Catalog Window**. ArcCatalog will open on the far right.

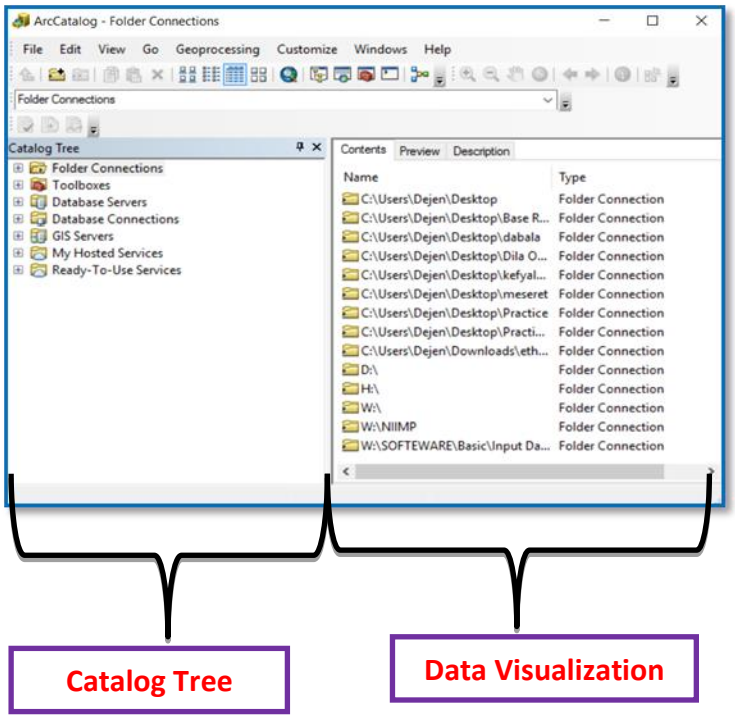


Or **Starting ArcCatalog**

A. Click **Start button**
B. Click **All apps**
C. Click **ArcGIS**
D. Click **ArcCatalog.**



The ArcCatalog window will open to you



Overview of ArcCatalog

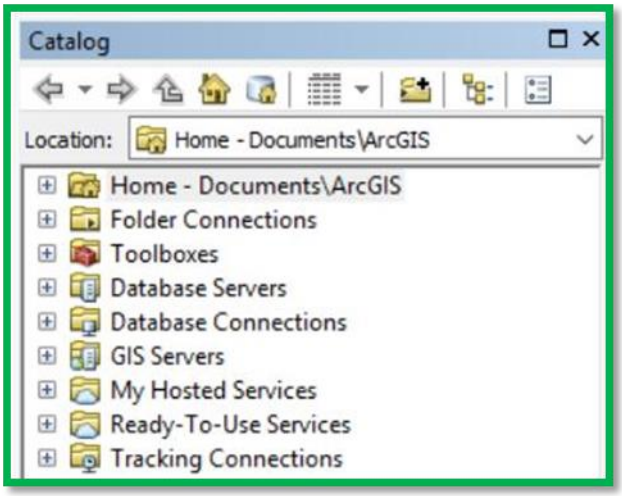
Catalog Tree

The Catalog Tree panel is on the left side in your ArcCatalog application. Its shows you a tree view of your GIS contents.

The Catalog tree allows connecting and managing toolboxes, workspace, and their contents:

ArcGIS Catalog Tree

- **Folder Connections**—Connections to file folders containing datasets and ArcGIS documents.
- **Toolboxes**—Geoprocessing tools and scripts used in ArcGIS.
- **Database Servers**—SQL Server Express instances configured to store desktop or work-group geodatabases.
- **Database Connections**—Connections to databases and enterprise geodatabases.
- **GIS Servers**—Connections to ArcGIS Server and OGC server sites.
- **My Hosted Services**—when you connect to and sign in to a portal, you can access the web layers and web maps you own or that have been shared with you.
- **Ready-To-Use_Services**— when you connect to ArcGIS Online, you can access a set of publicly available, worldwide services.



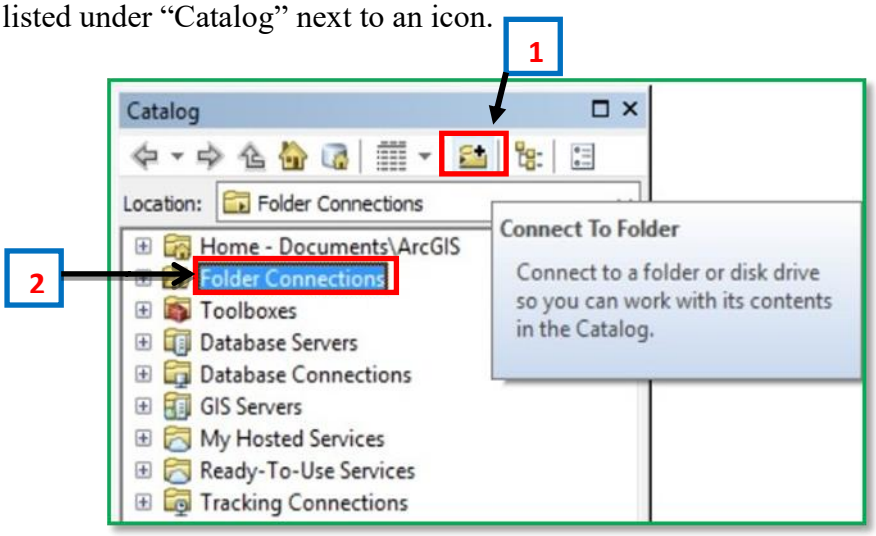
Common ArcCatalog tasks

The following are common operations performed in ArcCatalog with links to more information about them:

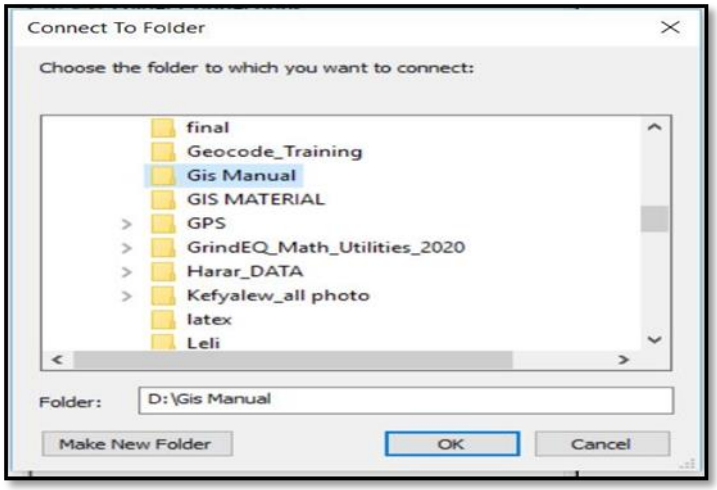
- Make connections to geodatabases, GIS servers, and other data sources.
- View items, their properties, and their contents on the Contents and Preview tabs.
- Manage contents in folders, databases, and geodatabases.
- Work with map documents in ArcCatalog.
- Document your information items and work with metadata.
- Use geoprocessing in ArcCatalog.
- Access and manage GIS services.

You can add map layers from ArcCatalog, but you can also view and add toolboxes, create geocoding services, edit and view metadata among other important "housekeeping" tasks. The tree within the Catalog Window will include a number of folders that are commonly used with ArcGIS. In order to add your own map layers, you will need to "Connect to Folder" to show ArcMap where those other important folders reside.

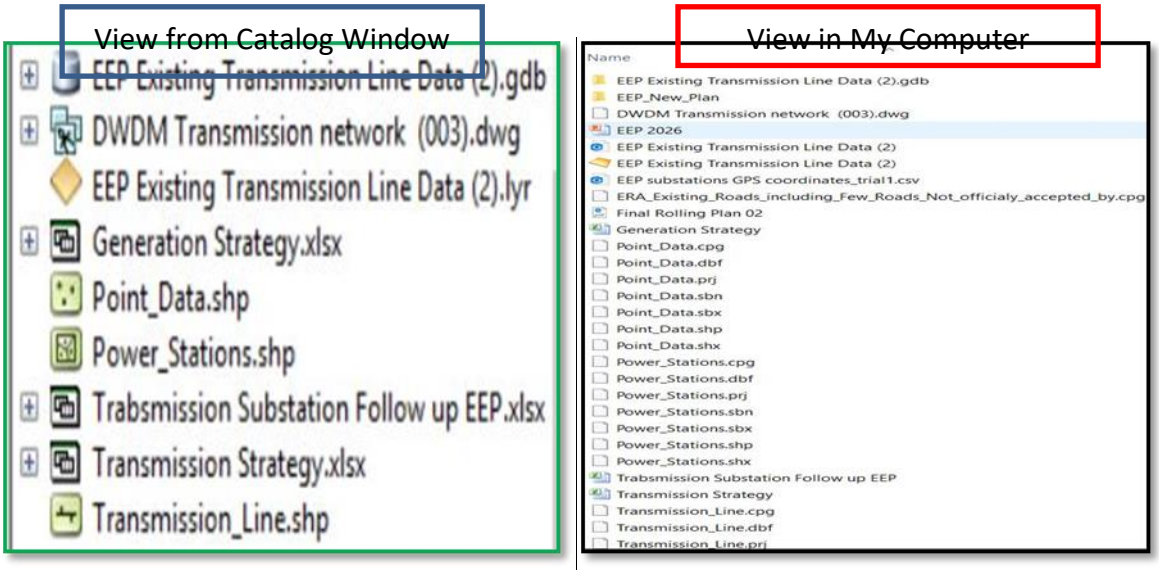
1. To create a connection to a new folder, **click on the "Connect to Folder"**  icon at the top of the Catalog Window.
2. Or right click on the folder named **"Folder Connection"** and choose "Connect Folder." Navigate until you find the folder with your data and click "OK." Your folder should now be listed under "Catalog" next to an icon.



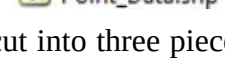
One note of caution: You do not need to do this repeatedly. Once you have established a connection to your folder, you will not need to do it again unless you change computers. If you create a new connection to the folder each time you use ArcGIS, your path options will become unmanageable. If you have one directory where you store all your GIS files, consider connecting to that rather than each individual folder inside.

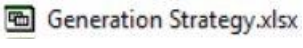


When you view map layers within ArcCatalog, you see them the way ArcGIS sees them. Some of the types of files used in ArcGIS, including shape files, coverage, and grids, are made up of multiple files that only together create a map layer. If you viewed them outside of ArcCatalog (in My Computer, for example), you would see all of the files listed with extensions such as **.gdb (geodatabases), .shp (shape file), xlsx (excel file), lyr (layer).** Within ArcCatalog, you will see only a single file. This is especially helpful when you are moving or copying data.



You can add data to ArcMap by dragging and dropping files from Arc Window. The icons used to represent the data indicate the type of data. A light green icon with lines 

(Transmission_Line.shp) indicates a line shape file; a light green icon with three dots 

(Point_Data.shp) indicates a point shape file; a light green icon with a square cut into three pieces is a polygon shape file. An icon with a white square and two columns of lines 

(Generation Strategy.xlsx) is an Excel data.

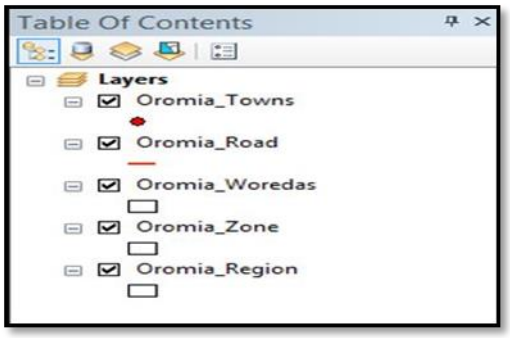
4.5 Working with Map Layers

4.5.1 Change a Layer's Display Order

Changing the order of the map layers in the Table of content (TOC) will change the order in which the map layers are drawn in the map.

A. Make sure the List by drawing order button is selected in the TOC.
B. Check the ***Zone layer*** in the TOC to make it visible.
C. Drag the ***Zone layer*** on the top of TOC.

The arrangement of the layers in table of contents must be logical (the smallest features at the top and the largest at the top, so that the largest feature may not cover the smallest feature).

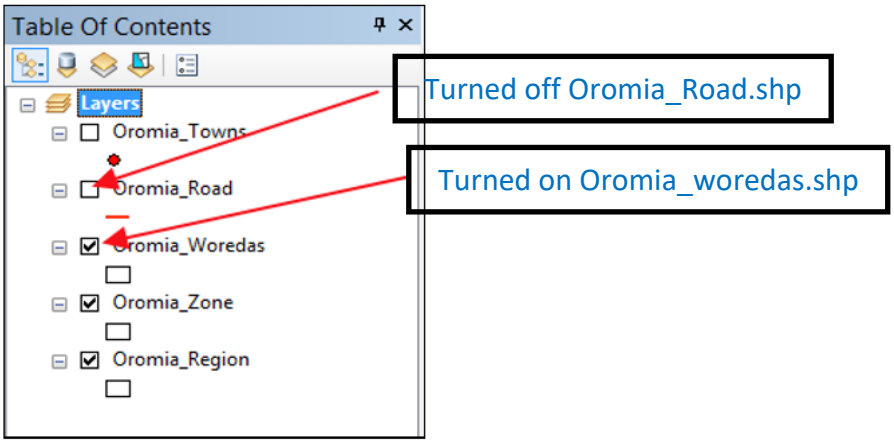


4.5.2 Turning on and off of layers

With List by Visibility, you have visual cues to indicate the layer's visibility. Each type of layer has its own icon, and the symbol is either colored to indicate the layer is on or gray when it is not, so you can quickly look at the icon to determine whether the layers are visible.

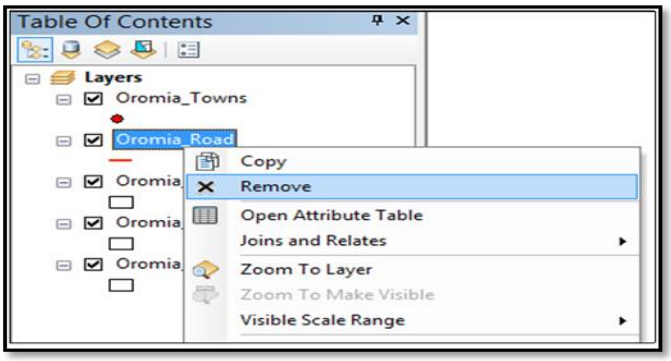
A. By ***check and unchecking the small box*** to the left of the layer in the TOC ***to turn on and off the layers.***

B. If the TOC accidentally closes, click windows, Table of Contents to reopen it.



4.5.3 Removing Layers

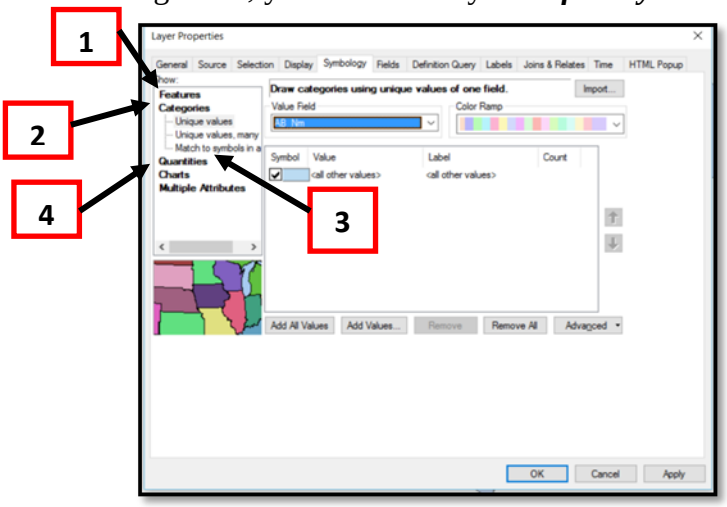
If you don't want the layer to be found in Arc Map you can ***remove it by right click on the layer*** to be removed and click on the remove option. This removes the map layer from the map document but does not delete it from its storage location.



4.5.4 Coloring and Styling Features

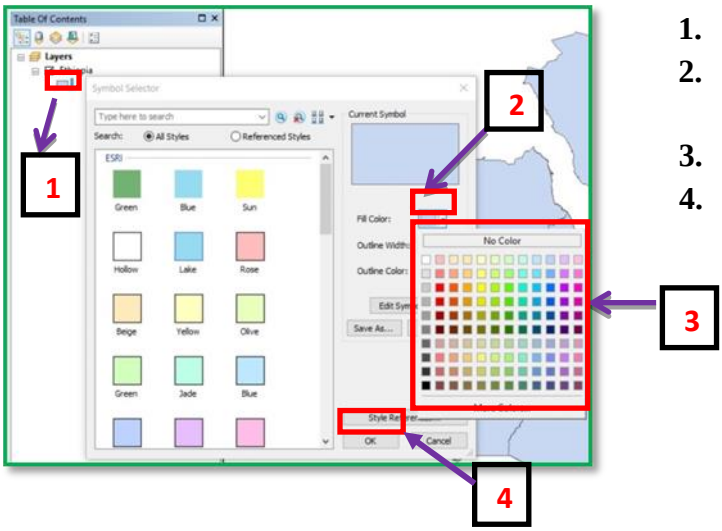
Choosing how to represent your data on a map may be the most important mapmaking task. How you represent your data determines what your map communicates. On some maps, you might simply want to show where things are. The easiest way to do this is to draw all the features in a layer with the same symbol. On other hand you need to display maps in different color or you might draw features based on an attribute value or characteristic that identifies them. For example, you could map roads by type, or map different land use type etc.

In general, you can draw layers in ***four symbol type***:-



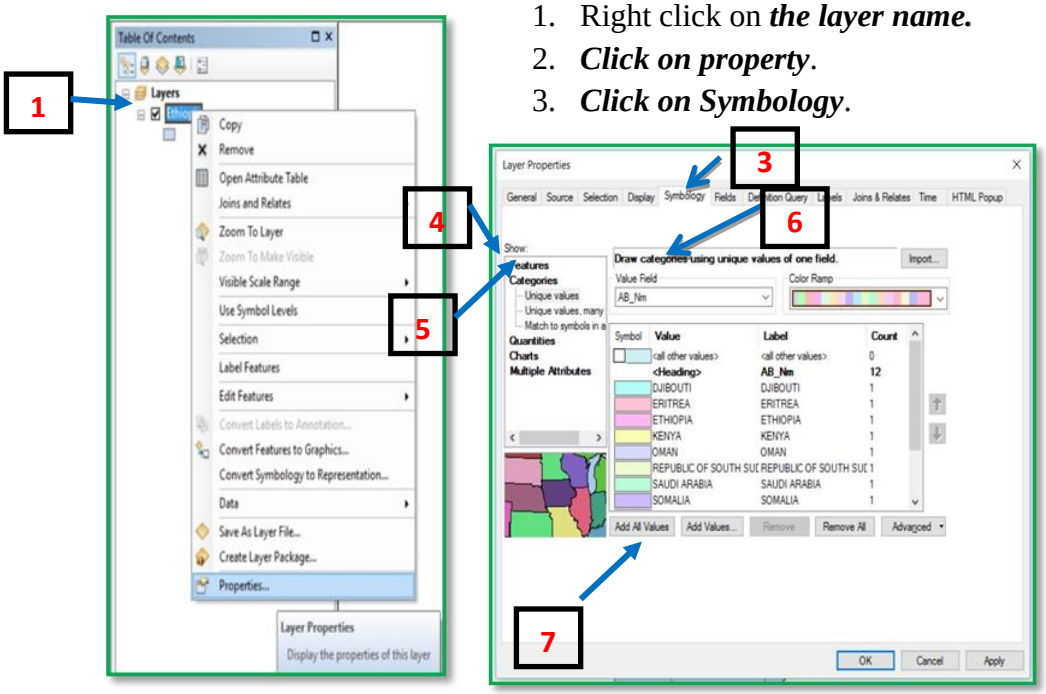
1. ***Features:-*** this uses for single symbol
2. ***Categories:-*** uses to get unique value
3. ***Quantities:*** - uses for graduated color, graduated symbol and proportional symbol
4. ***Charts:-*** uses to display in different symbols

1. Changing single symbol



1. Click on the map symbol.
2. Click on Fill Color button. The color panel will appear
3. Select your color from the color panel.
4. Click Ok. The color symbol of your map changes to the new color.

***2. Changing color by category*: -** it uses for qualitative and homogeneous or no rank /value data



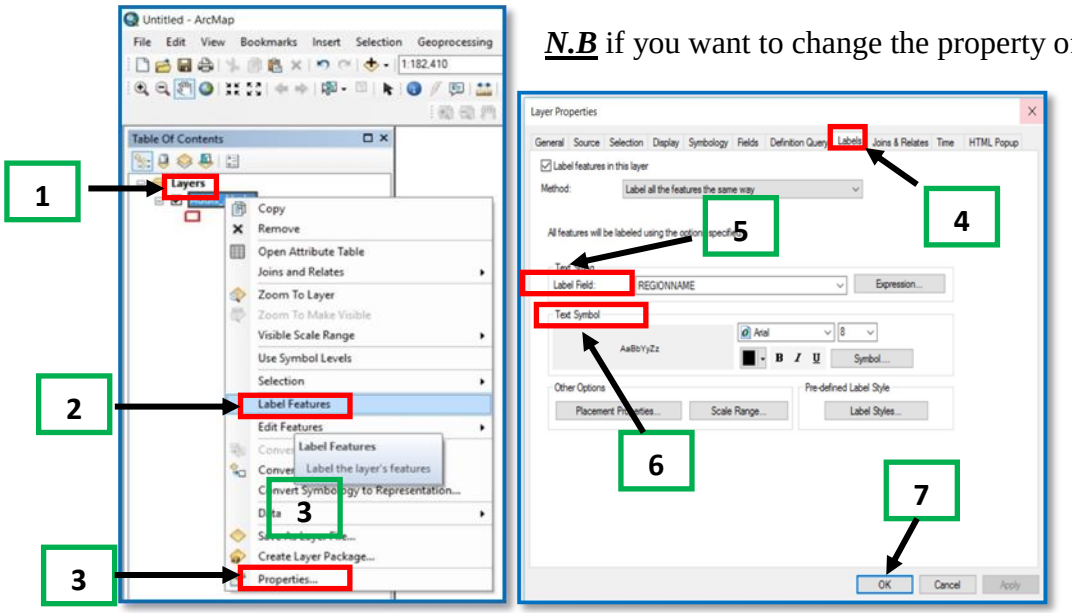
1. Right click on ***the layer name.***
2. ***Click on property***.
3. ***Click on Symbology***.
4. ***Click on category***.
5. Click on ***unique values.***
6. Select the value field in the combo box.
7. Click on ***Add All Values.***

4.5.5 Labeling Layers

Labeling is the process of placing descriptive text onto or next to features on the map. It is useful to add descriptive text to your map for many features. Labeling can be a fast way to add text to your map, and it avoids you having to add text for each feature manually. In addition, ArcMap labeling dynamically generates and places text for you.

To label features: -

1. Right click on the name of the layer
2. Click on ***Label Features***



N.B if you want to change the property of labels

3. Click on ***Properties***
4. Click ***Labels***
5. Change the ***Label Field***
6. Change the size and color of text using ***Text Symbol***
7. Click ***OK***

4.6 Navigate in a Map Document

Another essential function of GIS is to be able to view map data in different scales and to be able to move the extent of the map. The tools toolbar lets you zoom in, zoom out, pan, go to full extends of the map, go to last extend. The data cannot always be explored simply by looking at a map. If you need information about specific features, examine the attributes of a layer. You can explore the data sets in Arc Map using the Tools toolbar used for map navigation and query within the active data frame.

What can you do in the Map Display?

You can do the following!

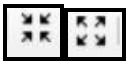
- Identify features
- View the attributes of the data in a layer
- View the properties of a layer
- View the properties of the data frame

Button	Name	Function
	**Zoom In**	Allows you to zoom in to a geographic window by clicking a point or dragging a box
	**Zoom Out**	Allows you to zoom out from a geographic
	**Fixed Zoom In**	Allows you to zoom in on the center of your data
	**Fixed Zoom Out**	Allows you to zoom out on the center of your data
	**Pan**	Allows you to pan the data frame
	**Full Extent**	Allows you to go back to the Full extent mode
	**Previous/Next**	Allows you to go forward to the next extent or Previous extent
	**Select Features**	Allows you to select features by clicking or dragging a box
	**Clear Selected Features**	Deselects all of the currently selected features in the active data frame
	**Identify**	Identifies the geographic feature or place on which you click
	**Find**	Finds features in the map

4.6.1 Interactive Zoom in/out 

There are several tools available for zooming in and out of your map. The continuous zoom tool gives you the greatest amount of control.

1. Click on the zoom in/out button
2. Then left click on your map and hold down the mouse button, and
3. Move your mouse away from you to zoom in and toward you to zoom out.

4.6.2 The fixed zoom in/fixed zoom out 

The fixed zoom in/fixed zoom out tools work like the zoom tools when you click them rather than draw a box. Each time you click, you will zoom in or out a fixed amount.

4.6.3 Panning 

This helps to explore the map in zoomed level

1. Click on the pan button
2. Left-click on your map display and hold the mouse button down Shift your map, your extent (amount zoomed in or out) stays the same while your map moves.

Note: *The pan tool works like the continuous zoom tool when you right click on it. Think of the pan tool as a sticky hand.*

4.6.4 Full Extent 

The full extent button will zoom in or out so that all of your active (checked) can be viewed. You can also zoom in to a single layer by right clicking on the layer in the table of contents and choosing "zoom to layer."

4.6.5 Previous/Next 

The previous extent buttons allow you to return to the extent you had before using one of the zoom tools. The next extent button allows you to jump forward an extent (after you have used the previous extent button). The previous and next extent buttons work similar to the back and forward buttons in MS Internet explorer.

4.7 Displaying Data

4.7.1 Getting Information about Features

Individual features on a map have associated information held in tabular format and known as **attribute table**. To work with feature attributes is one of the most important capabilities of GIS and what makes it so different from a Database system or simple drawing Software like CAD. GIS brings graphic features together with database tables. The Attribute table shows you all the data records stored for all the features in a feature class (or layer). It appears much like a spreadsheet (in MS Excel for example).

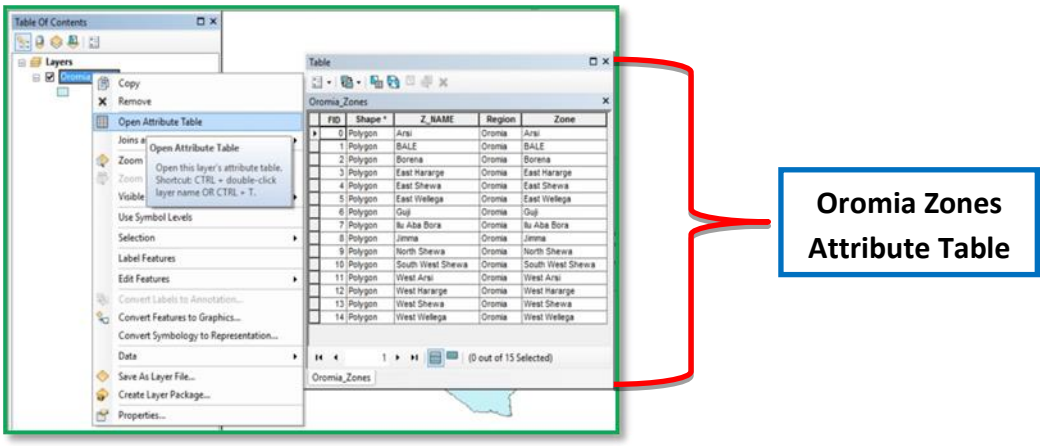
Each row in the table is linked to one feature in the layer. Selecting rows (called records) in the table will select a feature in the layer, deleting a complete row in the table will delete the connected feature in the layer You will use tools to view database tables connected to the features on your map, query them and label the map with the values in the database tables

4.7.2 Display a Complete Attribute Table

The complete attribute table for a layer can be accessed by right clicking on the TOC entry for the layer and selecting open attribute table from the menu.

Steps:

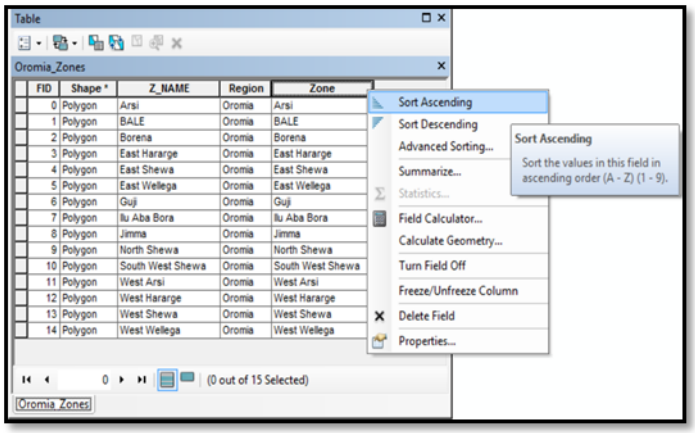
1. Start a new ArcMap Session
2. Browse to folder
3. Select the Oromia_Zones.shp (Shape file) in this context
4. Right click on Oromia Zones in the TOC
5. Click on ***Open Attribute Table*** from the drop down list – this will display the attribute table of the Oromia_Zones.shp shape file.
6. Close table when finished.



4.7.3 Sorting Records in an Attribute Table

Steps

1. Right click the Oromia Zone in the TOC.
2. ***Click Open Attribute table*** from the drop down options.
3. Right click on the heading of the Oromia Zones field (that is, on the word "Zones" at the top of the column).
4. ***Select Sort Ascending.*** All of the Zone names are now in alphabetical order.

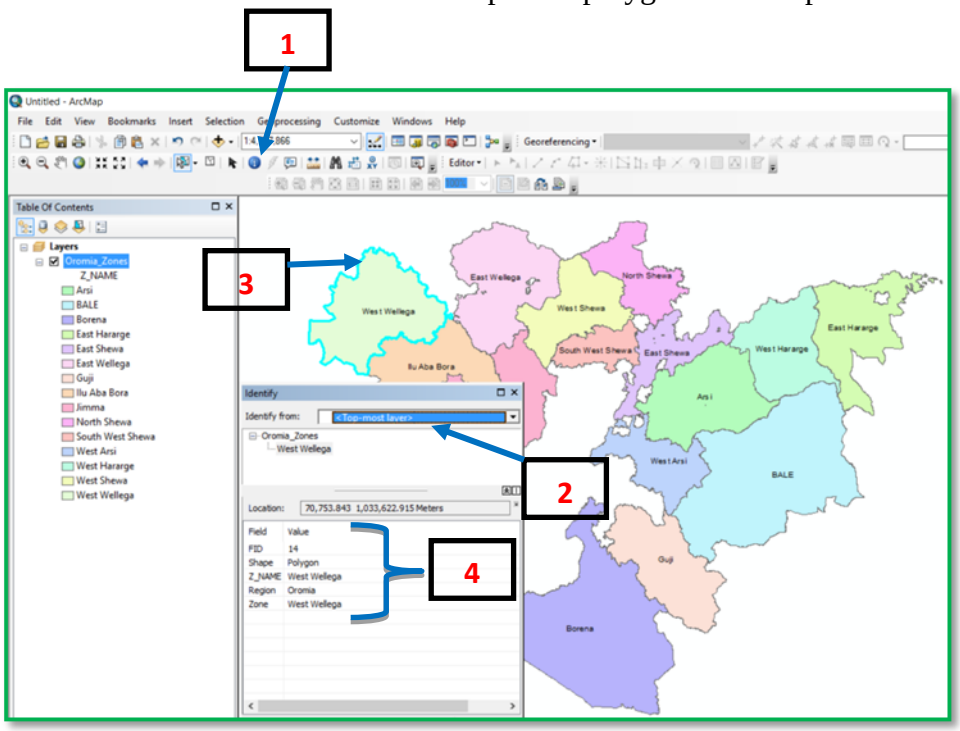


4.7.4 Attribute Data and Spatial Querying

4.7.4.1Using Identify Button

Identify button uses to see individual features information from your map. To use identify button:-

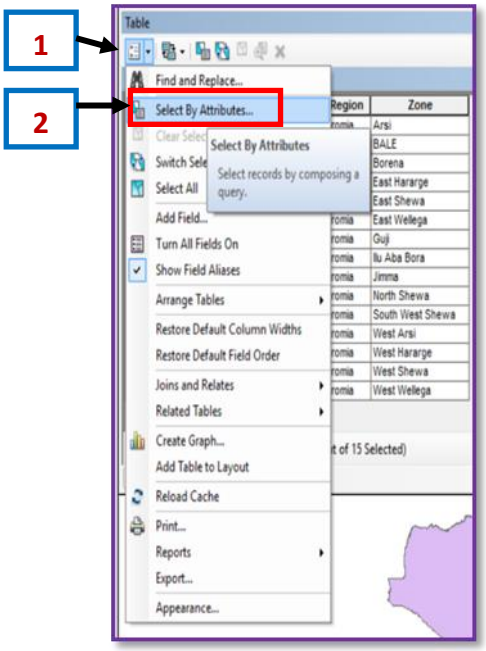
1. Click on ***identify button.***
2. Select the layer you want to see its information. (By default ArcMap shows information of the top layer).
3. Click on specific polygon, line or point of your interest.
4. All the available information for that specific polygon. Line or point will display



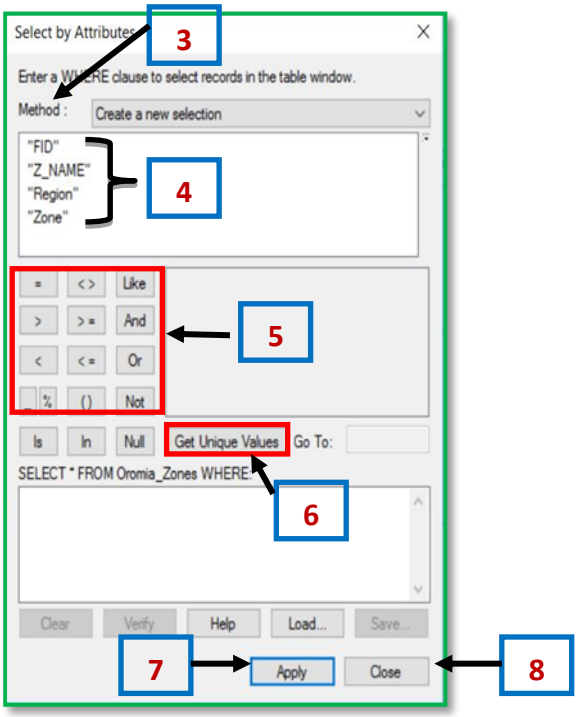
4.7.5 Querying Attribute Table

4.7.5.1 Selecting Records by Attributes

1. Click ***Options in the table*** you want to query.



2. ***Click Select by Attributes.***
3. Click the ***Method*** dropdown arrow and click the selection procedure you want to use.
4. Double-click the field from which you want to select.
5. Click the logical operator you want to use.
6. Click the ***Get Unique Values***
7. ***Click Apply*** and
8. ***Click close***



Your selection is highlighted in the table. Use Apply if you intend to run more than one query or if you want to check your results before closing the Select by Attributes dialog box.

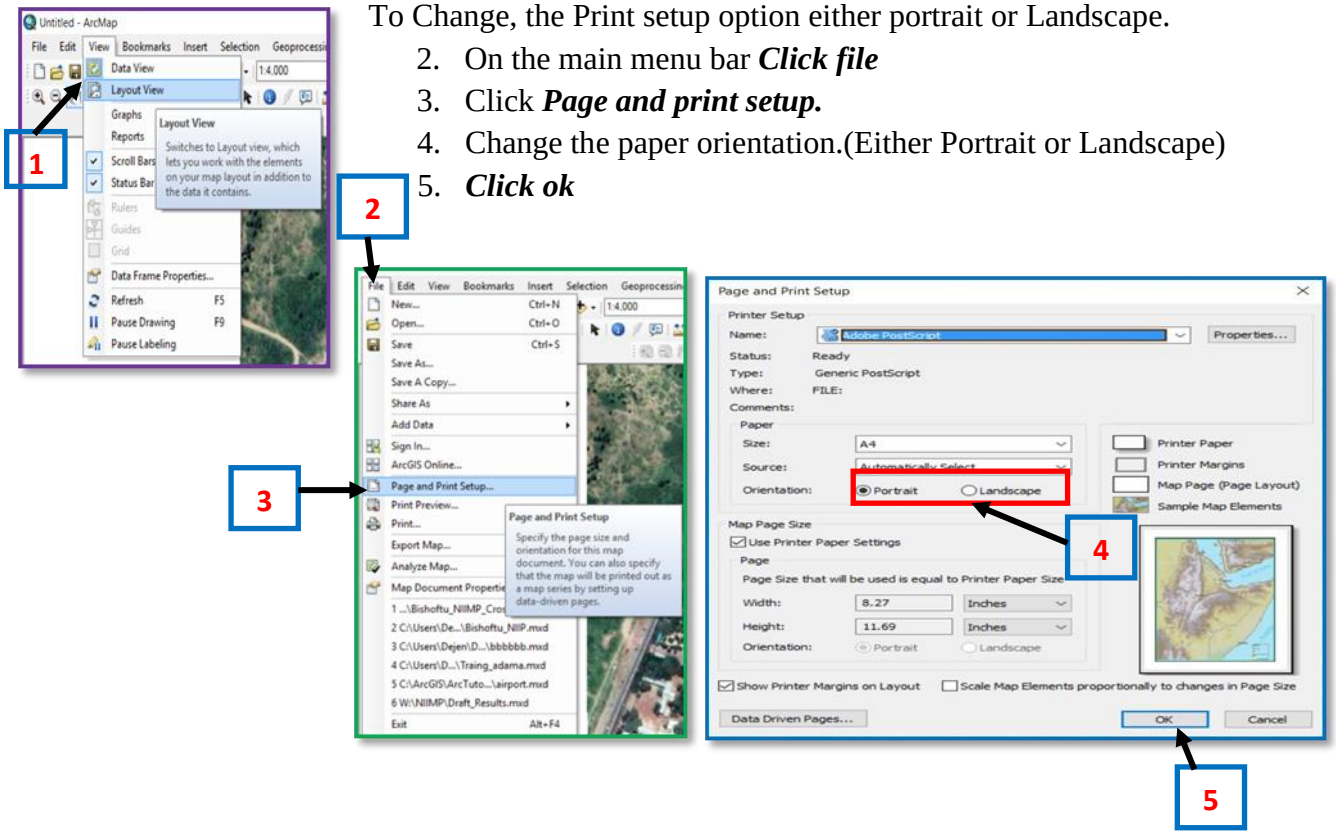
4.8 Creating Map Layout

A Map Layout: - is an ArcMap visualization tool. You can use the map layout to produce understandable map by adding all map elements:

- ***Scale***,
- ***Title,***
- ***Legend,***
- ***North Arrow,***
- ***Neat line***
- ***Grid*** *etc.*
-

4.8.1 Using Our Own Layout:

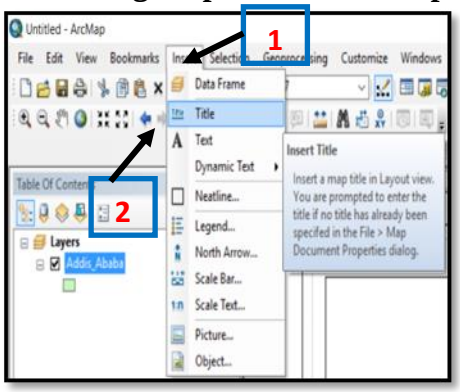
1. ***Click Layout view*** on the top of the main menu of the ArcMap document. Or Click Layout view on the bottom of the ArcMap document. (The view will change from data view to layout view)



To Change, the Print setup option either portrait or Landscape.

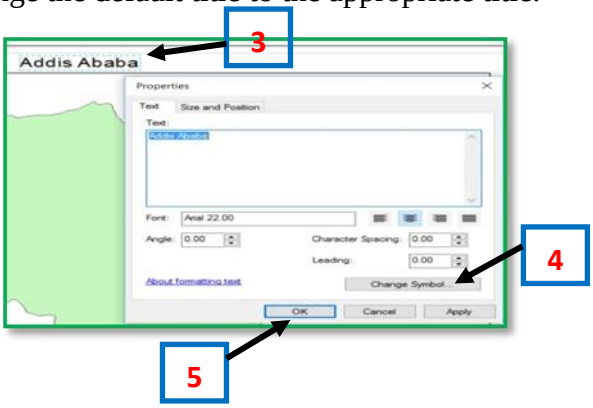
2. On the main menu bar ***Click file***
3. Click ***Page and print setup.***
4. Change the paper orientation.(Either Portrait or Landscape)
5. ***Click ok***

4.8.2 Adding Map Element in Map Layout



4.8.2.1 Adding Title

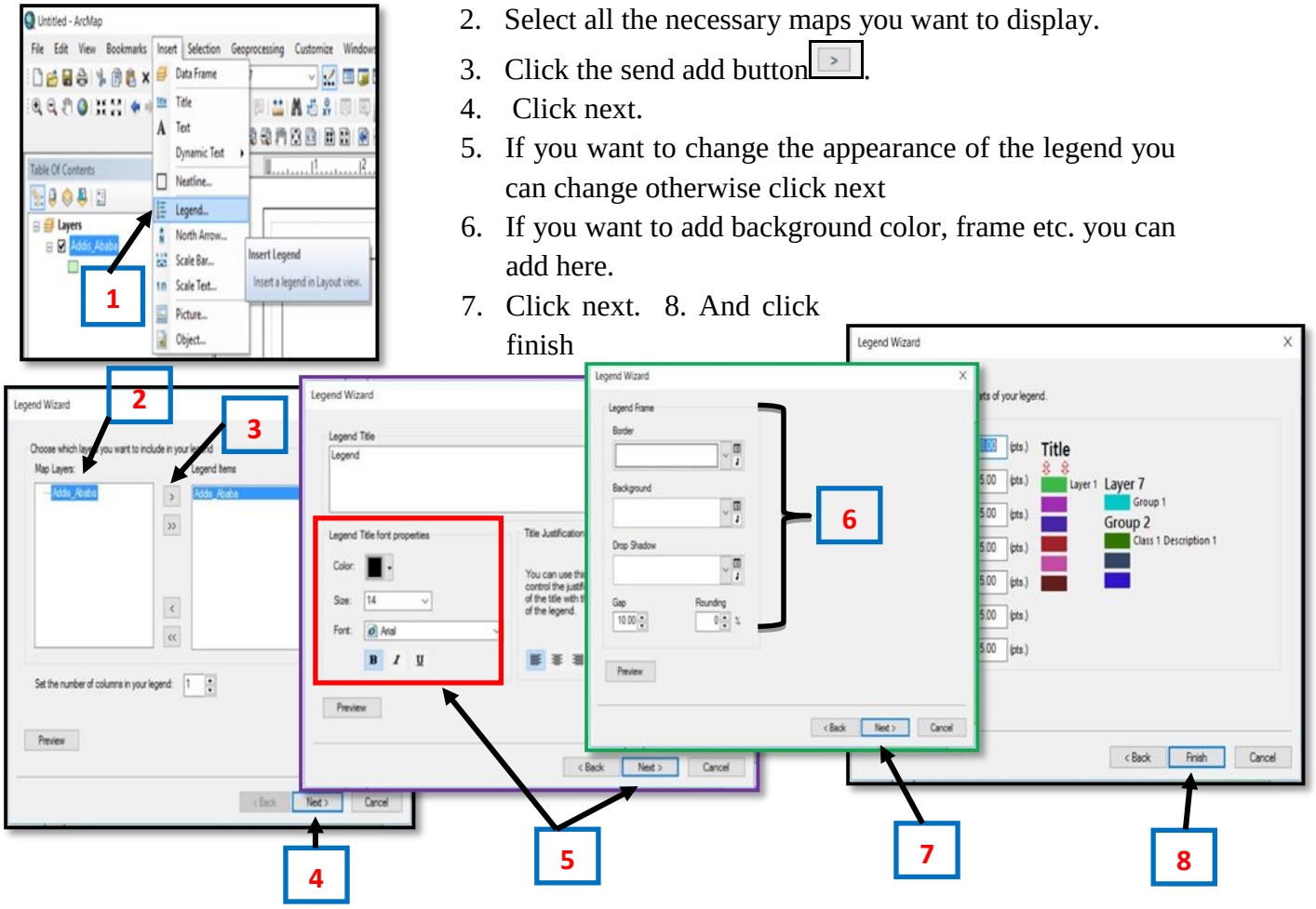
1. ***Click Insert*** in the menu.
2. ***Click Title*** (The tile with the text box will add to your map).
3. Change the default title to the appropriate title.



4. Double click to change the font style and size on the title text box
5. Click Ok

4.8.2.2 Adding Legend

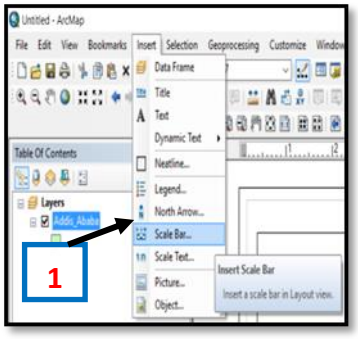
1. Click ***Insert and click legend*** (refer the map in the previous discussion).



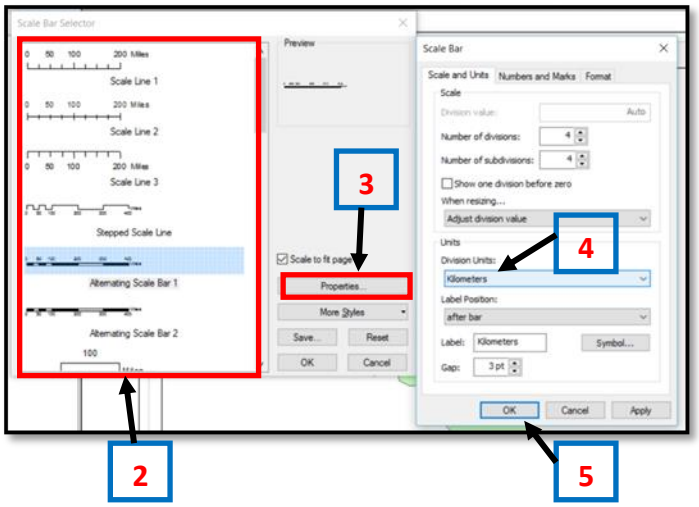
2. Select all the necessary maps you want to display.
3. Click the send add button [>].
4. Click next.
5. If you want to change the appearance of the legend you can change otherwise click next
6. If you want to add background color, frame etc. you can add here.
7. Click next. 8. And click finish

4.8.2.3 Adding Scale Bar

1. Click Insert and ***click Scale bar***.

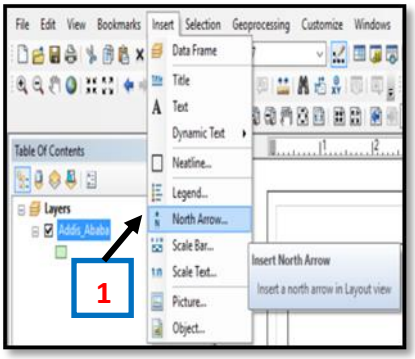


2. Select your favorite type of scale bar.
3. To change the measurement unit, ***click on properties*** the added scale bar in your map layout and Click ok
4. Change the ***division units*** to the kilometer unit
5. ***Click ok.***

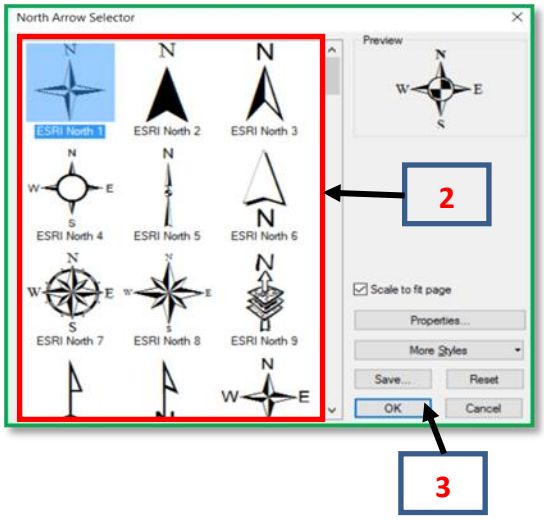


4.8.2.4 Adding North Arrow

1. Click insert and then ***Click North Arrow***.

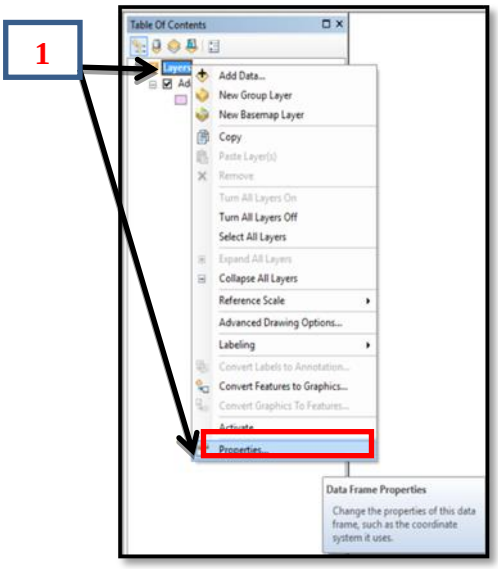


2. Select your favorite type of arrow.
3. ***Click ok*** (the north arrow will added to your map document)

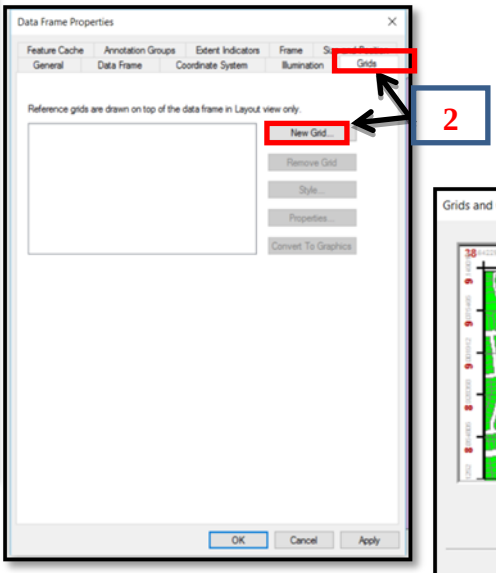


4.8.2.5 Adding Grid

1. Right ***Click on Layers*** and then ***Click on properties.***

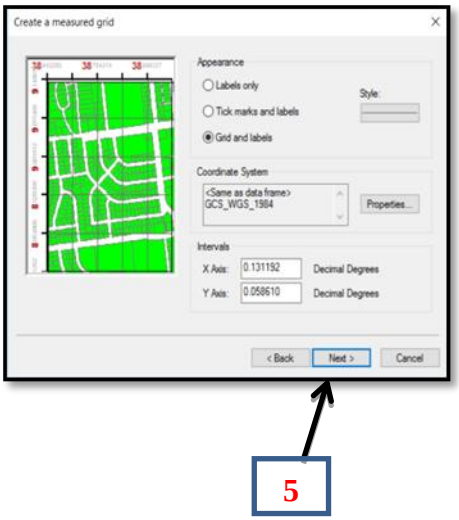


2. From Data Frame Properties ***Click on Grids*** and then ***click on New Grid…***

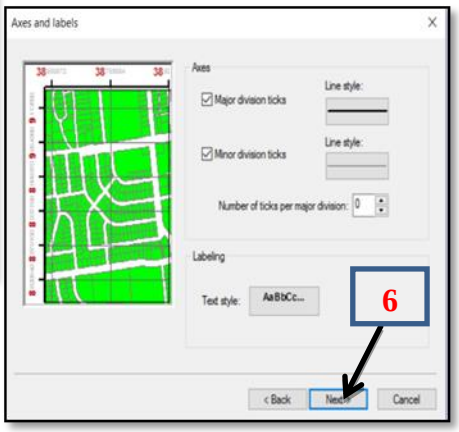


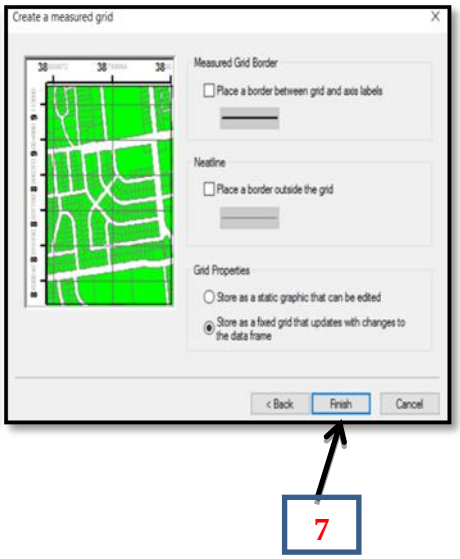
3. From grids and graticules wizard ***select measured grid***
4. ***And click Next***

5. From Create a measured grid ***click Next***



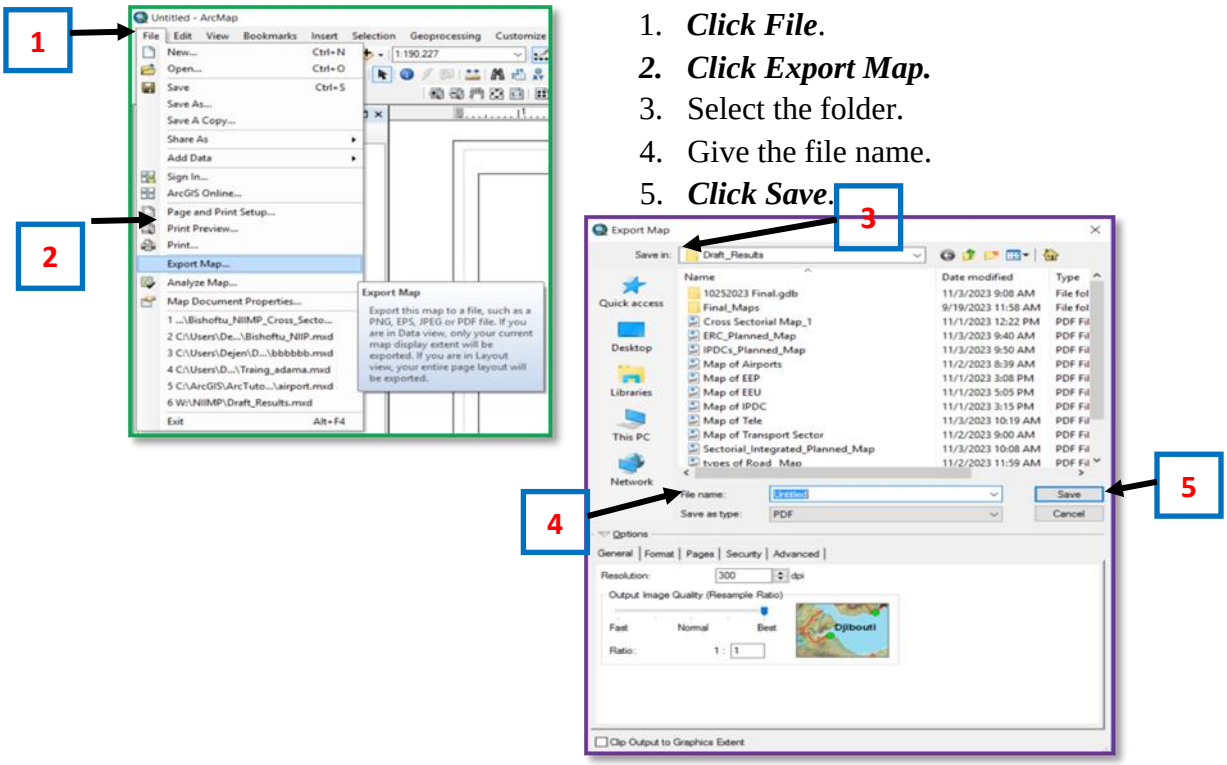
6. And ***click Next*** from axes and labels wizard
7. And finally ***click Finish***





4.8.2.6 Exporting the Map Layout

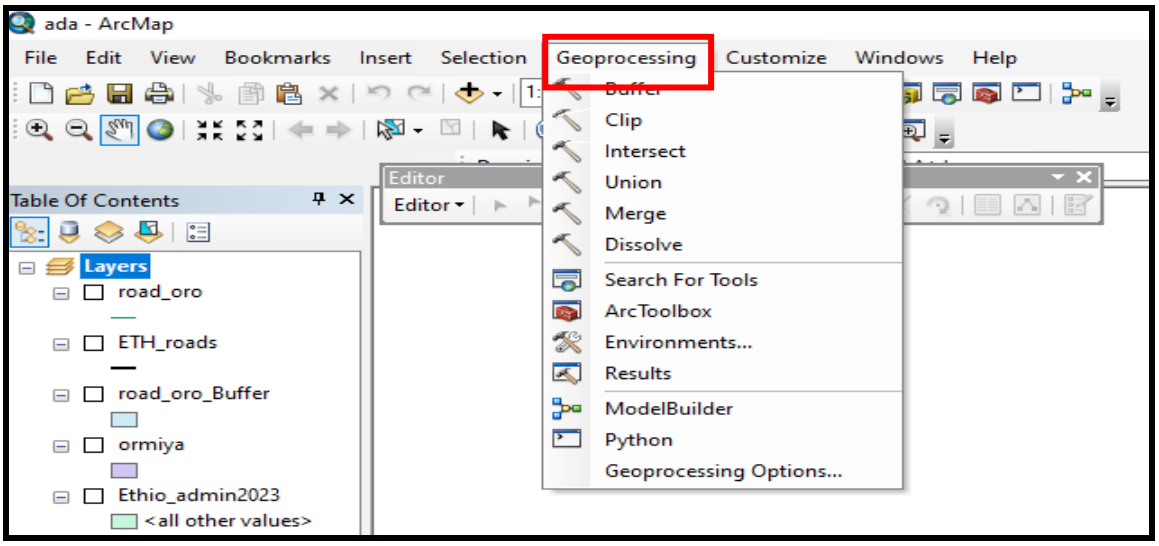
You can distribute your map layout to other people or for documentation purpose or to insert in any report. This can be done by exporting map layout in to the picture format. You have different image format, the JPEG is a compeered format it takes relatively little space.



1. ***Click File.***
2. ***Click Export Map.***
3. Select the folder.
4. Give the file name.
5. ***Click Save.***

4.9. Geo processing

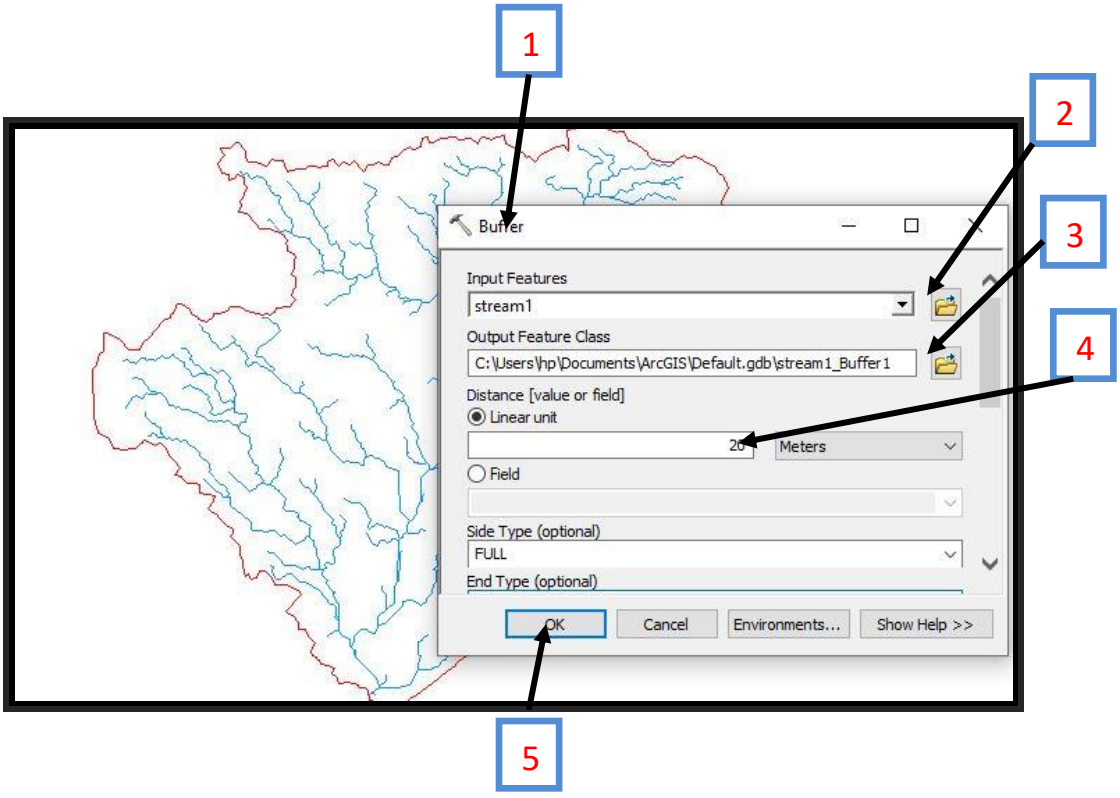
Generally you will need to use geo processing tools in different cases. The geoprocessing tools are buffer, clip, intersect, union, merge, dissolve.

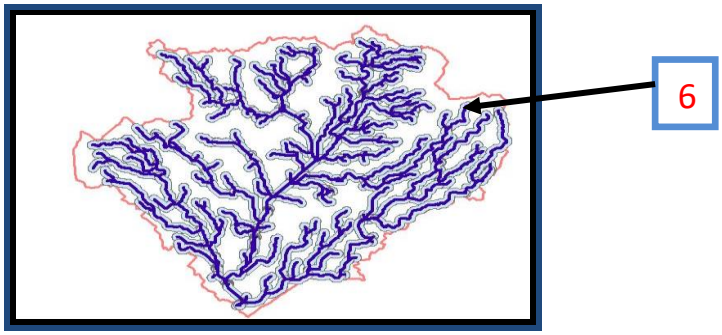


4.9.1 Buffer

Buffer is a zone around a map feature measured in units of distance or time. A buffer is useful for proximity analysis.

1. Double Click on the Buffer from Geoprocessing tool
2. Select input layers.
3. In the Output feature class select the folder where to save the output data
4. fill the range value/field
5. click ok
6. final buffer river of project site

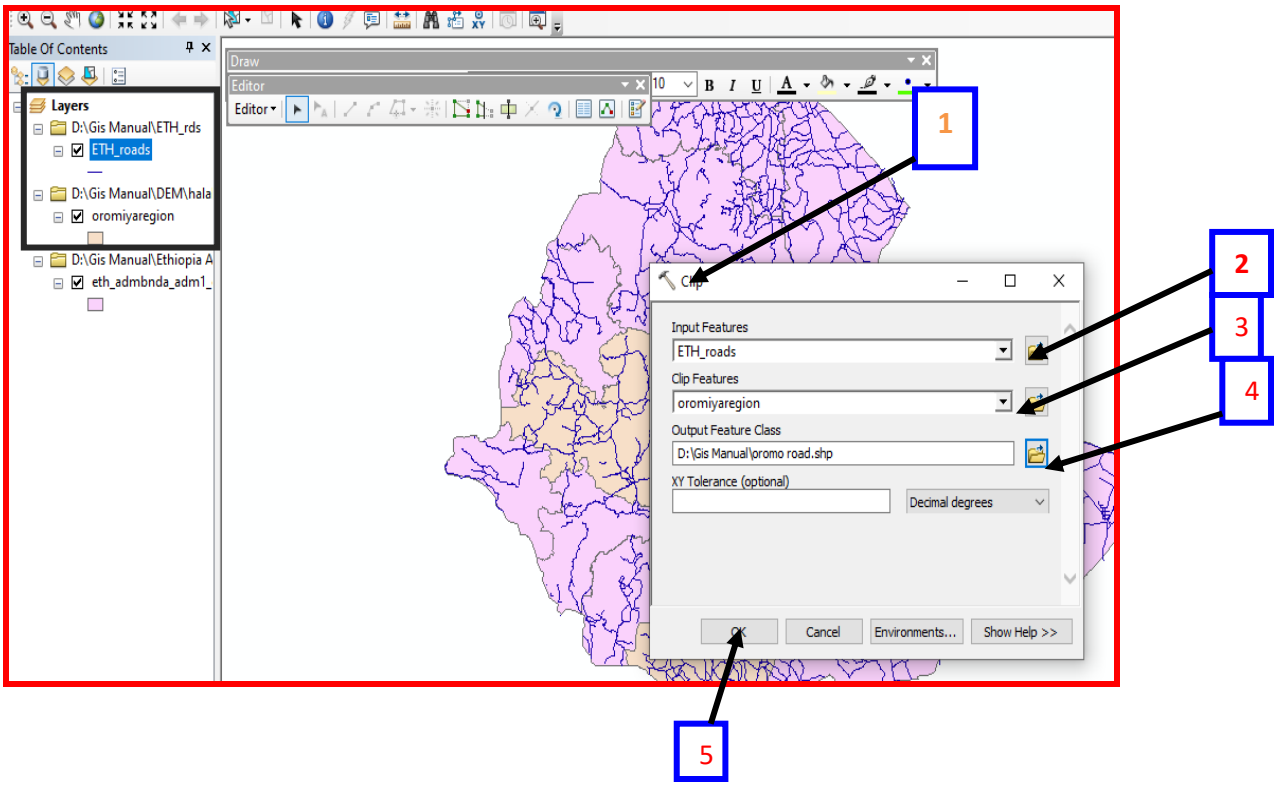




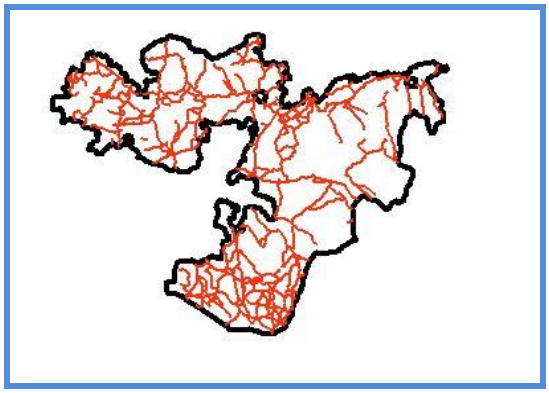
4.9.2 Clipping

Clipping allows you to get a shape file of smaller polygon cut from Shape file of a larger area. In the following exercise you cut the Shape file of Oromia Road from Ethio-Roads .

1. Click on clip
2. In the input Features, select layer to be cut(Eg. Ethio-Roads)
3. Select clipped features (the boundary of Oromia)
4. In the output feature class option, click on the browse folder where to save data.
5. Click OK when you finish



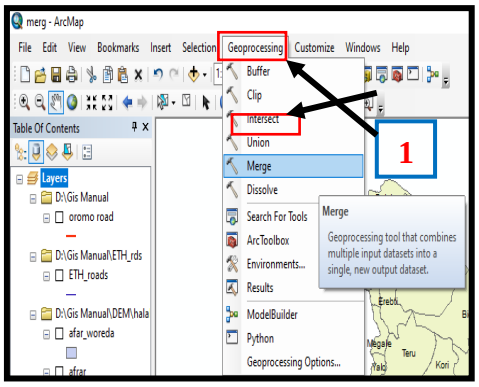
Out Put - Layer



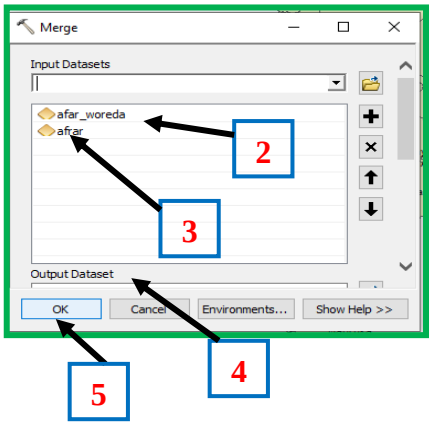
4.9.3 Merge

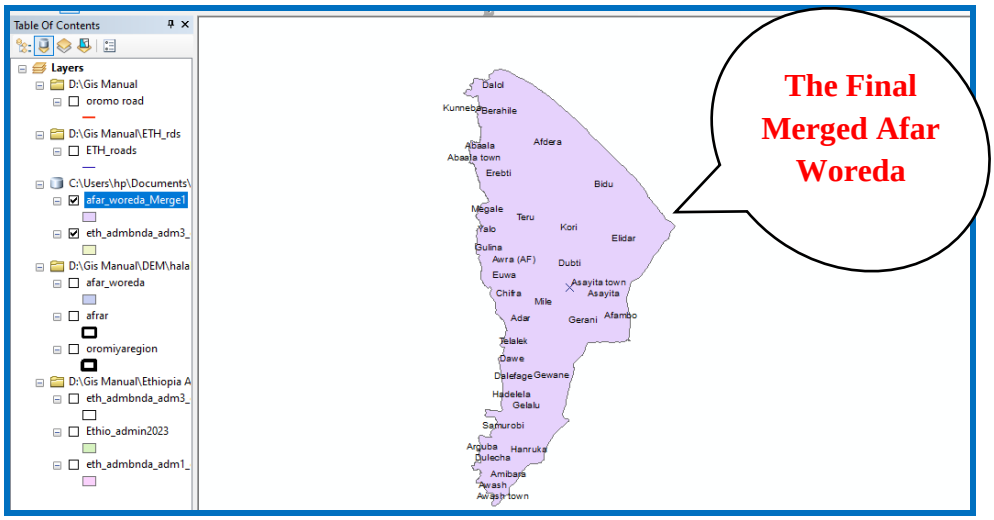
The merge function helps to merge two and more feature layer in to one feature layer. Example Merge all woredas layer of Afar in One layer.

1. Click the Geoprocessing tool and then click on merge



2. Adding the input layers
3. Select the layers you want to merge Click on input
4. Choose the output location
5. click ok
6. Final merged layer

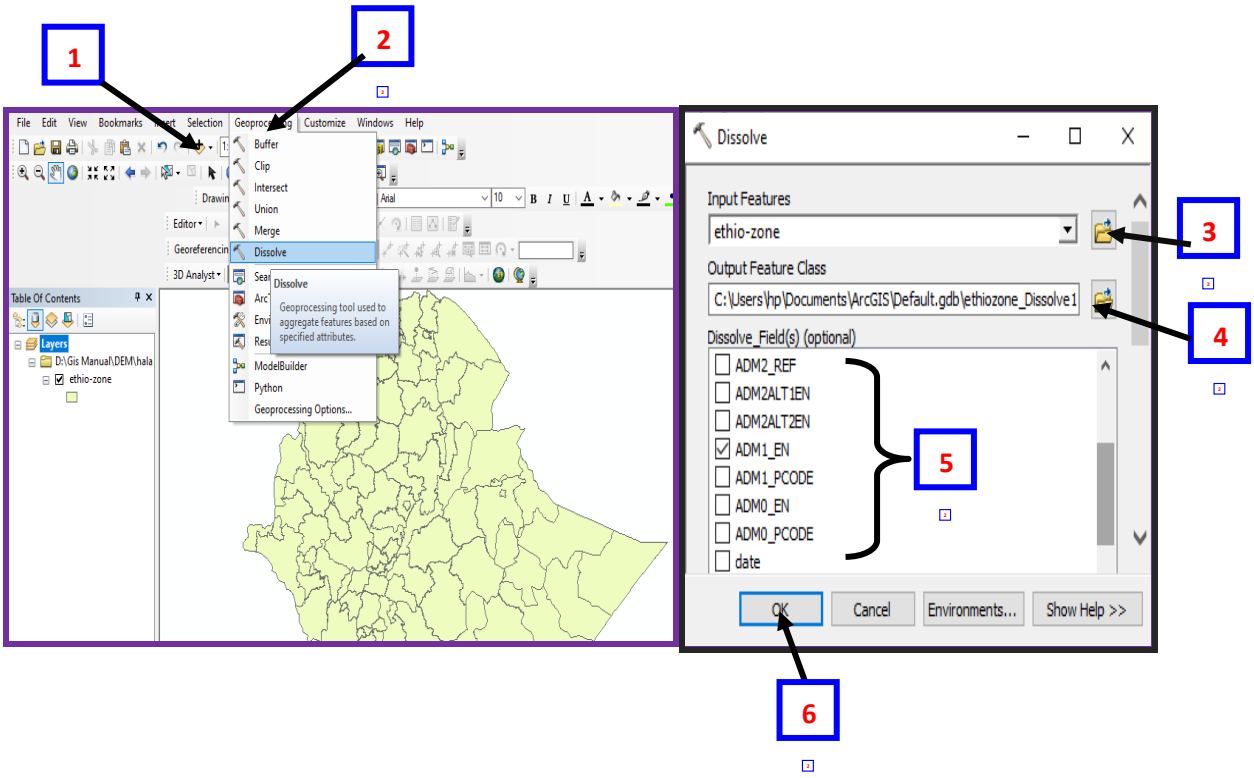


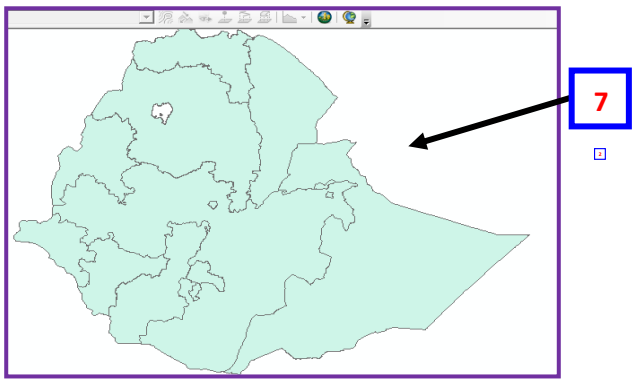


4.9.4 Dissolve

Dissolve used to aggregate/group/ the feature class based on their attribute data i.e you can group uniform/homogeneous/ attribute data in to one single data.

1. Add shape file of the woredas
2. Click the geoprocessing tool
3. Select the input feature class
4. Select output location
5. Selecting the field dissolve options
6. Click ok
7. Final map layer of dissolved feature



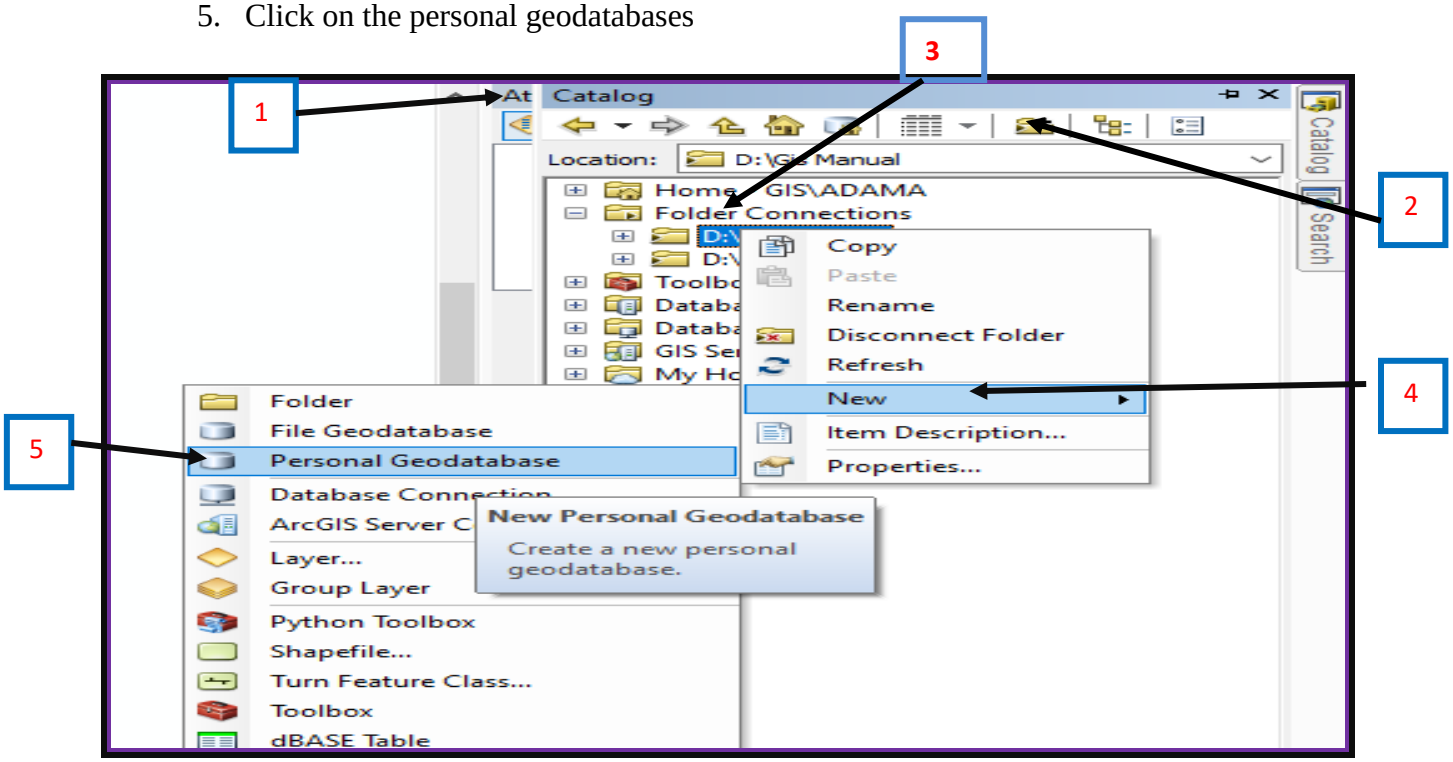


4.10 .Creating and Editing data

4.10.1 Creating Personal Geodatabases

Steps

1. Click on Catalog button
2. Click on Connect to *Folder* →*Connect the folder*
3. Right click on the folder you connected
4. Click on new
5. Click on the personal geodatabases



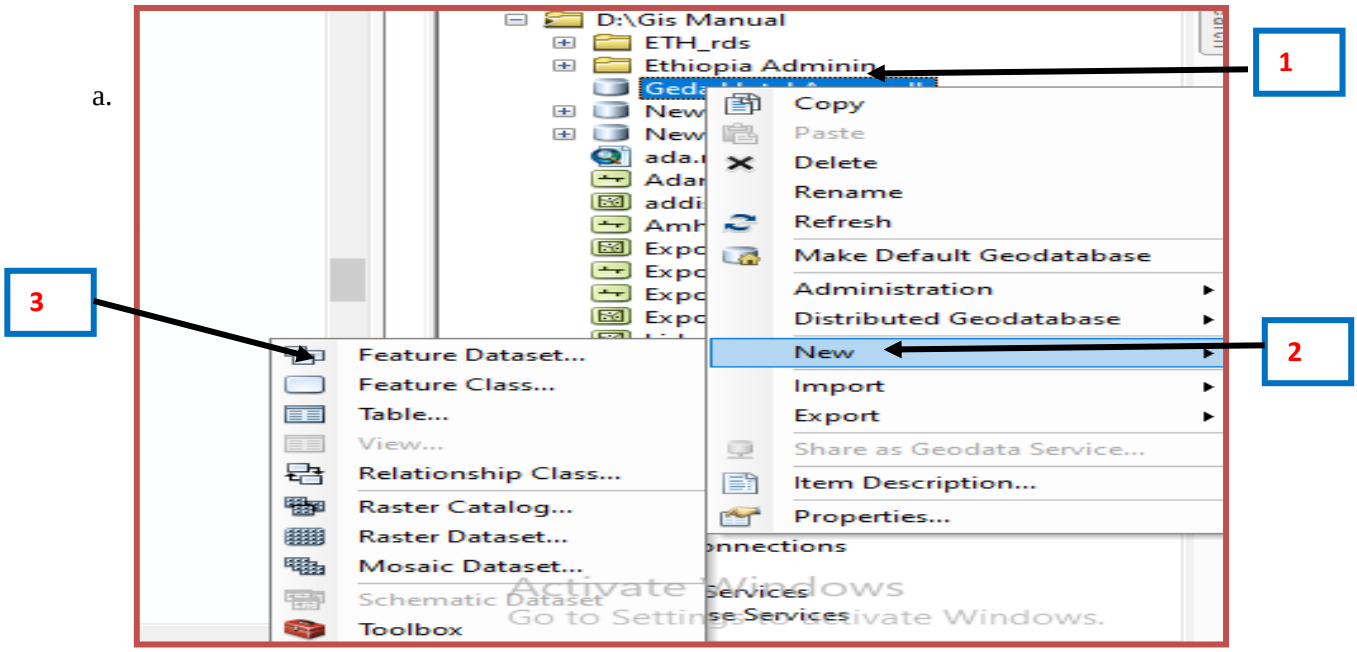
4.10.2. Creating Feature Dataset

Steps

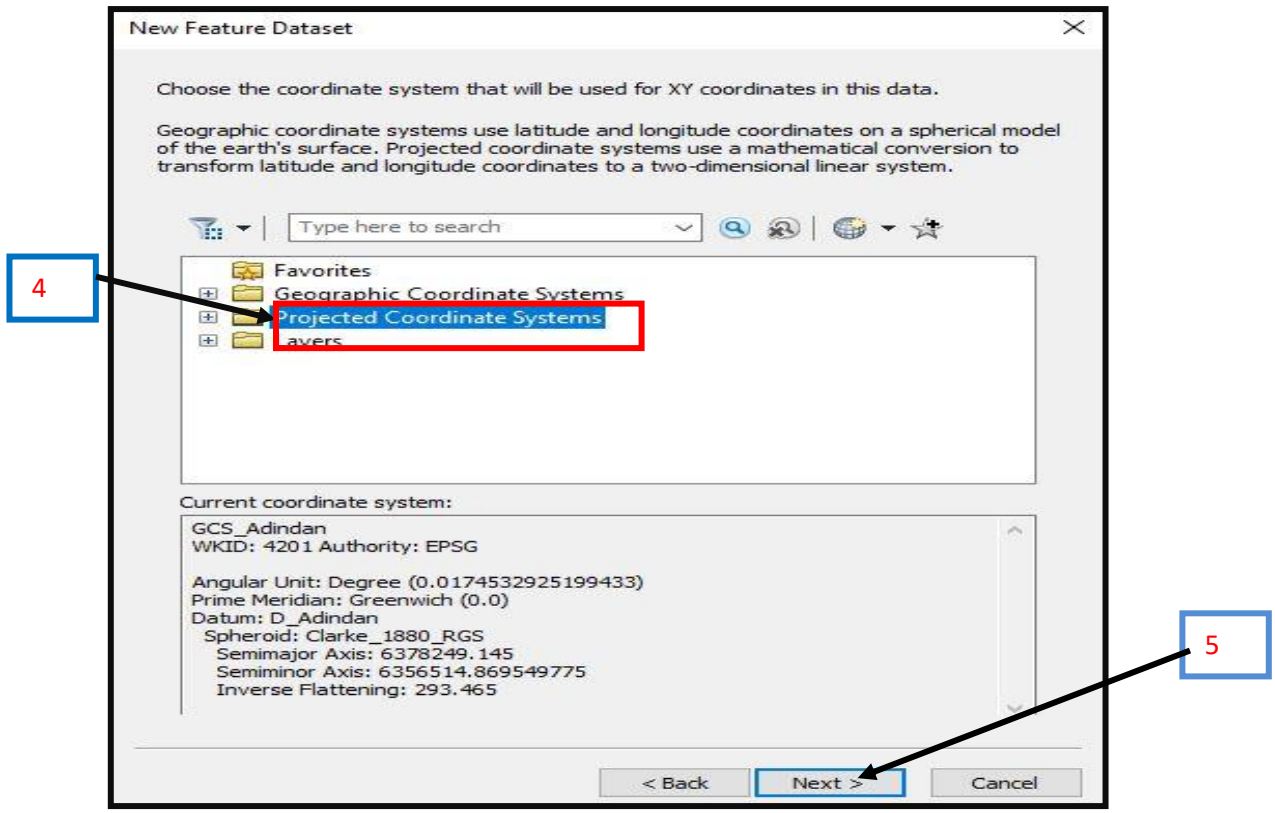
1. Right Click on the personal geodatabases

2. Click on new and then
3. Click Feature Dataset
4. Edit the coordinate systems-(projected or geographic)
5. Click next

a.



W

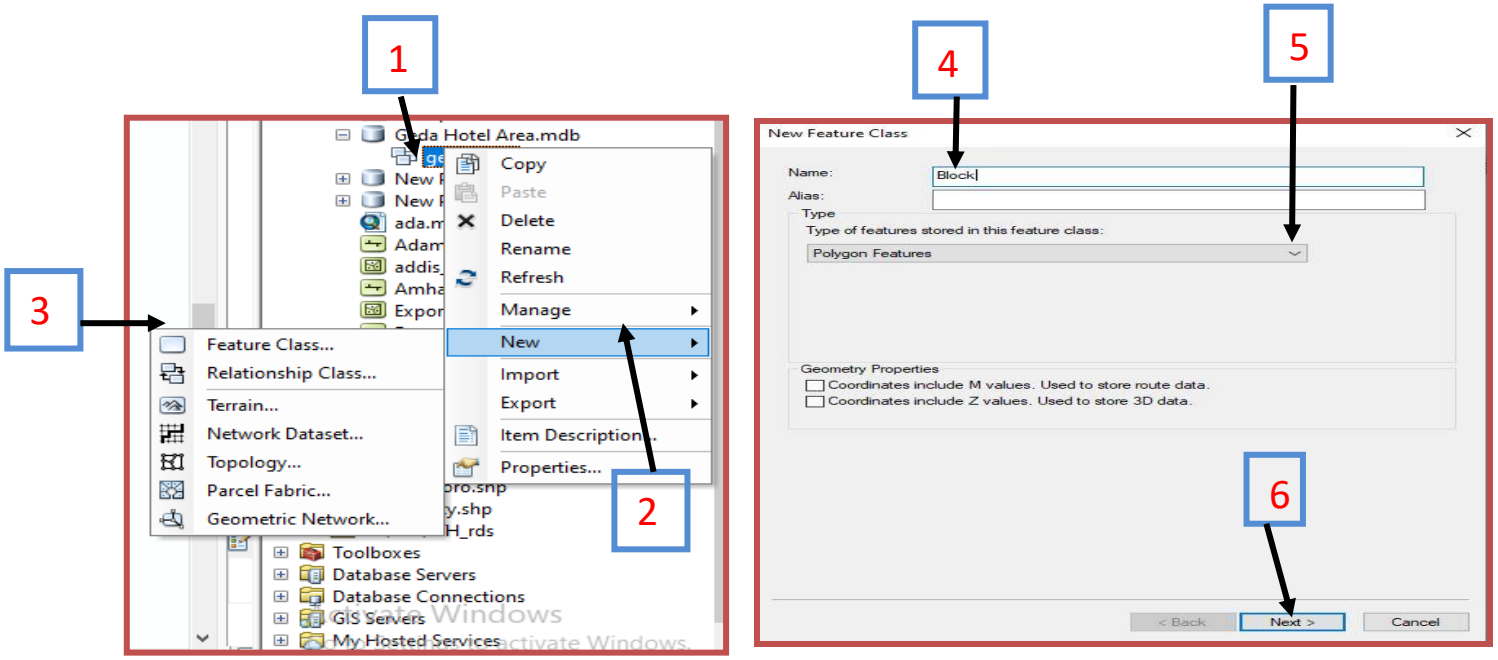


4.10.3 Creating Feature Classes

Until now you have built a feature data set which will hold all geometries to be created in the feature. Following this, you are going to create feature classes (Polygon, point and line)

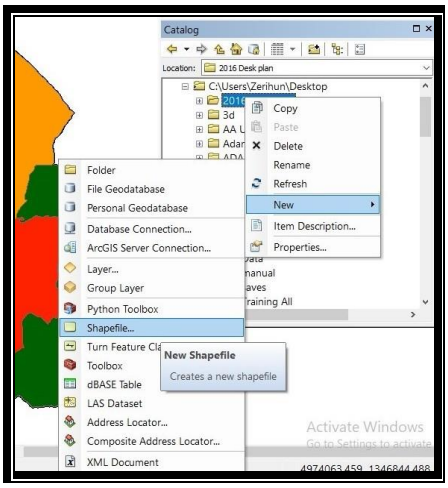
Steps

1. Right click on the **Features data set** that you have created
2. Click on New
3. Click on **Feature Class**.
4. On the New feature class dialogue box, write feature class name on the space Select the type of feature to create.
5. Click Next



NB. Note that we can create a features class simply with only creating a shape file under the connected folder in the catalog.

1. **Create Folder under connected folder**

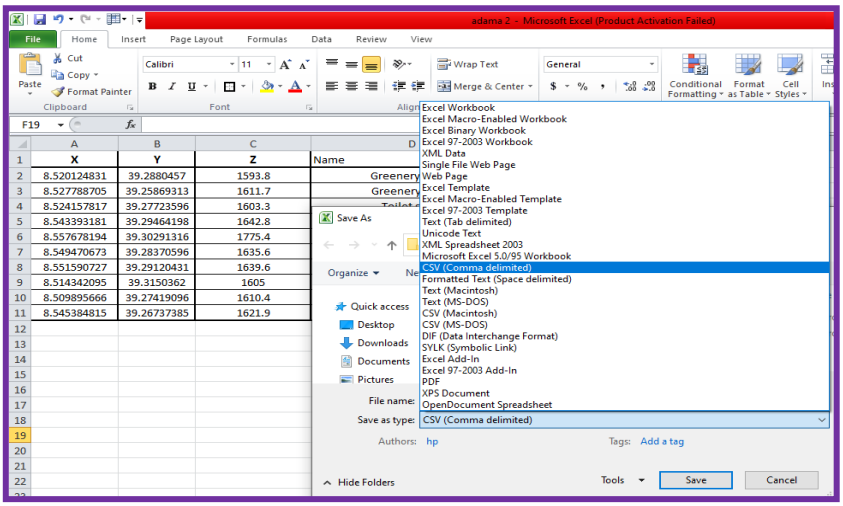


2. **Write Click →New → Shape file**
3. **Write the type of feature in the box**
4. **Select the feature type in the second**
5. **Ok**

4.11 Working with XY Point Data

4.11.1 Adding XY data into the Arc Map

1. Convert the excel of format of GPS (X,Y) points data in to CSV(comma delimited)



2. Click File menu

3. Add Data

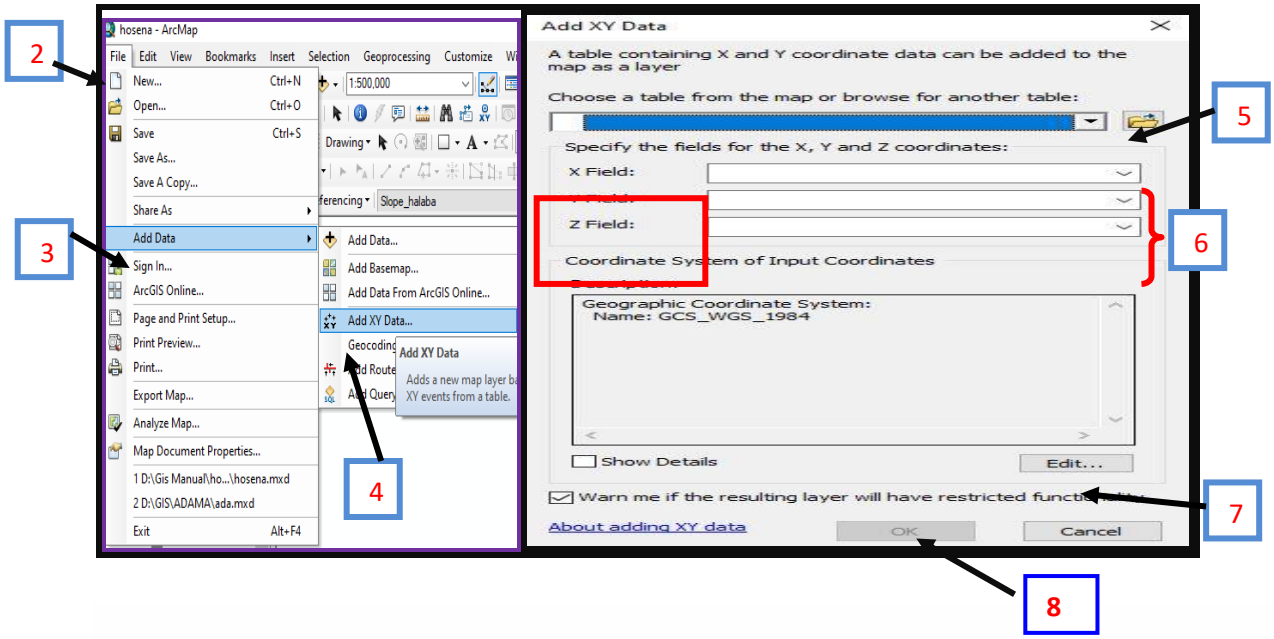
4. Click on the Add XY Data.

5. Select the table that contains x,y coordinate data

6. Identify the columns that hold the x- and y-coordinates (and, optionally, the z-coordinate).

7. Specify the coordinate system.

8. Click ok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3
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8
hosena - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize
New... Ctrl+N
Open... Ctrl+O
Save Ctrl+S
Save As...
Save A Copy...
Share As
Add Data
Sign In...
ArcGIS Online...
Page and Print Setup...
Print Preview...
Print...
Export Map...
Analyze Map...
Map Document Properties...
1 D:\Gis Manual\ho...\hosena.mxd
2 D:\GIS\ADAMA\ada.mxd
Exit Alt+F4
Add Data...
Add Basemap...
Add Data From ArcGIS Online...
Add XY Data...
Add XY Data
Add Data
Add Basemap...
Add Data From ArcGIS Online...
Add XY Data...
Add XY Data
A table containing X and Y coordinate data can be added to the map as a layer
Choose a table from the map or browse for another table:
Specify the fields for the X, Y and Z coordinates:
X Field:
Z Field:
Coordinate System of Input Coordinates
Geographic Coordinate System:
Name: GCS_WGS_1984
Show Details
Edit...
Warn me if the resulting layer will have restricted functionality
About adding XY data
OK
Cancel

4.11.2. Creating Point, Line and polygon Features (Digitizing)

Creating features is one of the important activity managed in Arc Map. It is also known as digitizing features. Feature creation is made to locate features on Arc Map. Let Us see an example digitizing line and polygon Features.

The inputs used to create features are

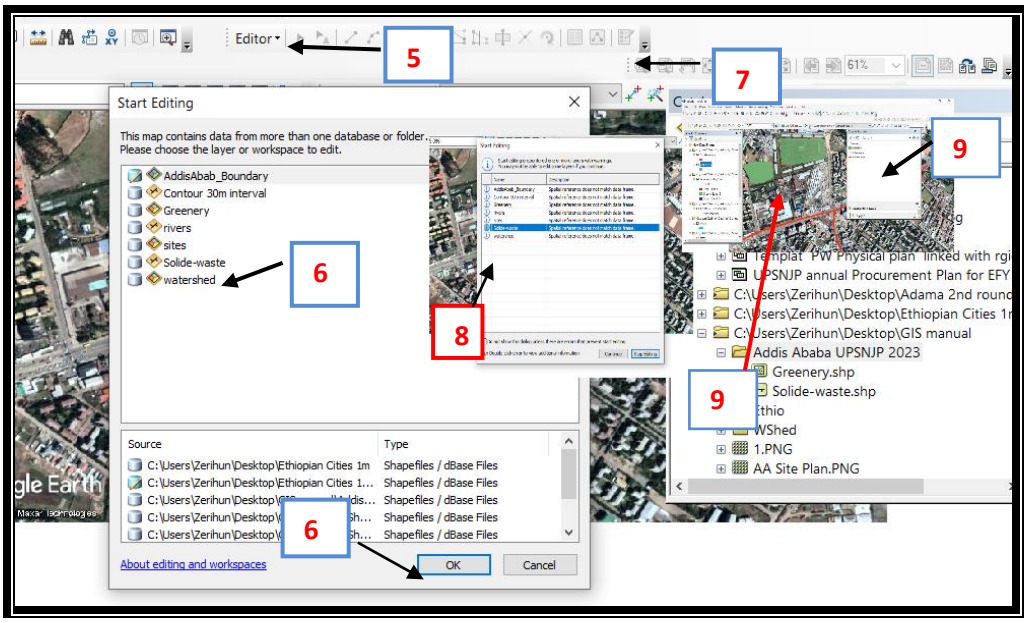
- GPS point Data collected for the purpose or
- Images of the area or
- Online Base map ….

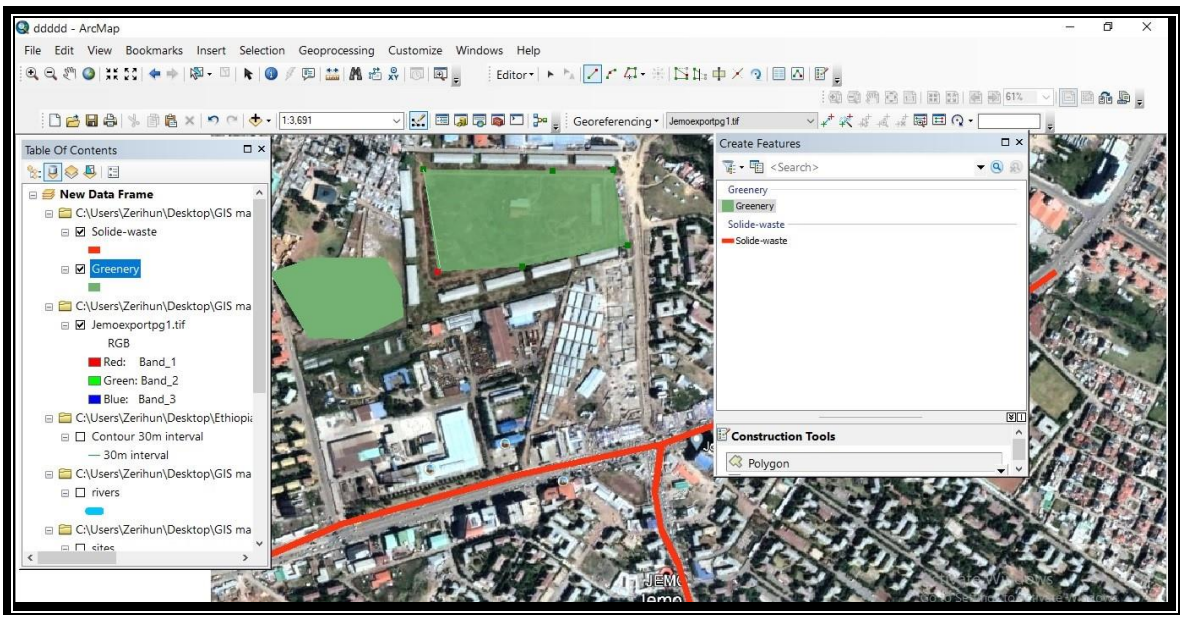
Activities

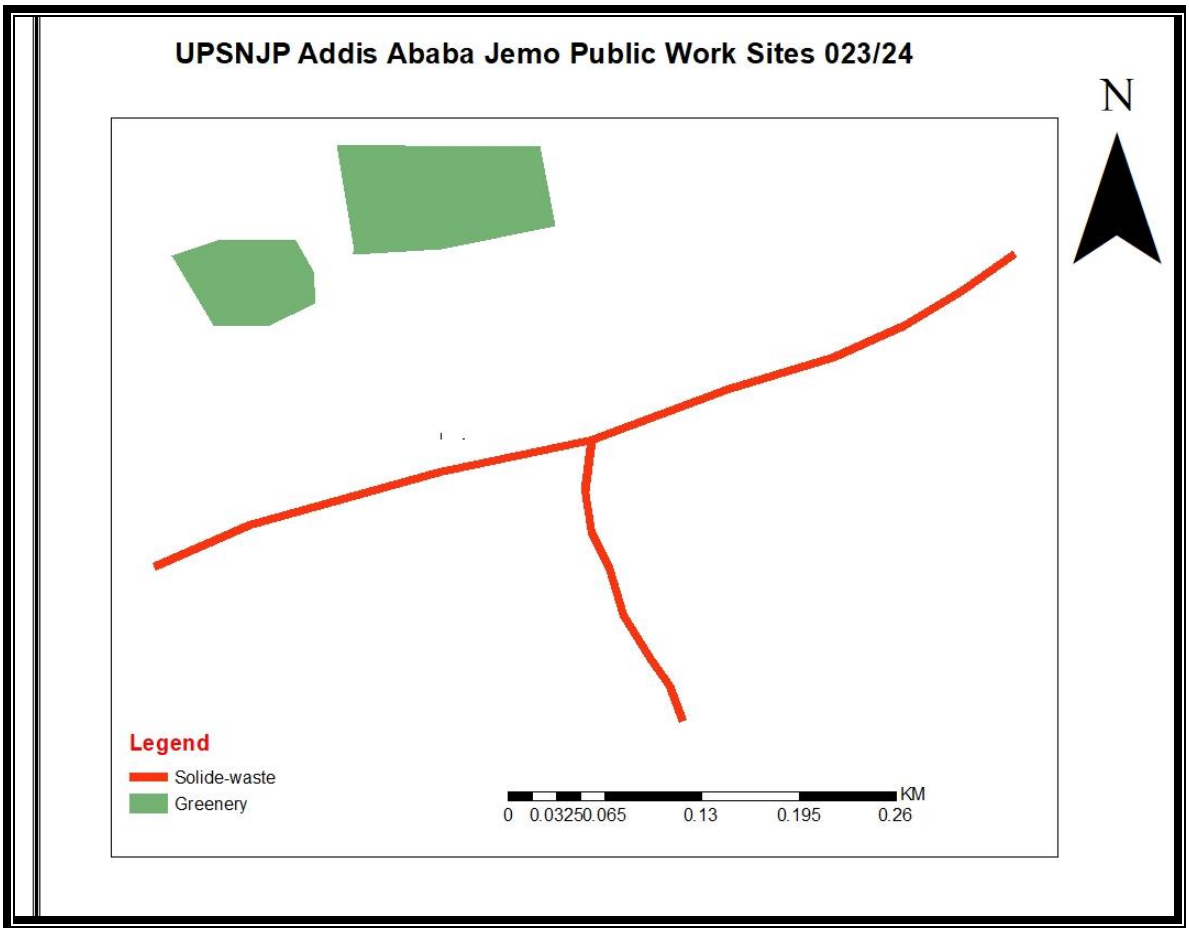
- Collect GPS points or
- Take Geo referenced image or
- Add Base Map (on Line)

Steps

1. Add the input data - image
2. Open Catalog ⟶ Connect folder (see in Chapter 4 above)
3. Create Personal data base or Folder
4. Create shape files of the project types (Solid waste, Greenery, water shed, …)
5. Click on Editor ⟶ Start Editing
6. Select the shape file ⟶ Ok
7. Click on Create Features
8. Click on the shape file ⟶ Continue
9. Start creating features by clicking on the drawing tools of the shape file
10. Stop Editing ⟶ Save


Editor
5
7
9
Start Editing
This map contains data from more than one database or folder.
Please choose the layer or workspace to edit.
AddisAbab_Boundary
Contour 30m interval
Greenery
rivers
sites
Solide-waste
watershed
6
8
9
Source
Type
C:\Users\Zerihun\Desktop\Ethiopian Cities 1m
Shapefiles / dBase Files
About editing and workspaces
OK
Cancel
C:\Users\Zerihun\Desktop\GIS manual
Addis Ababa UPSNJP 2023
Greenery.shp
Solide-waste.shp
1.PNG
AA Site Plan.PNG

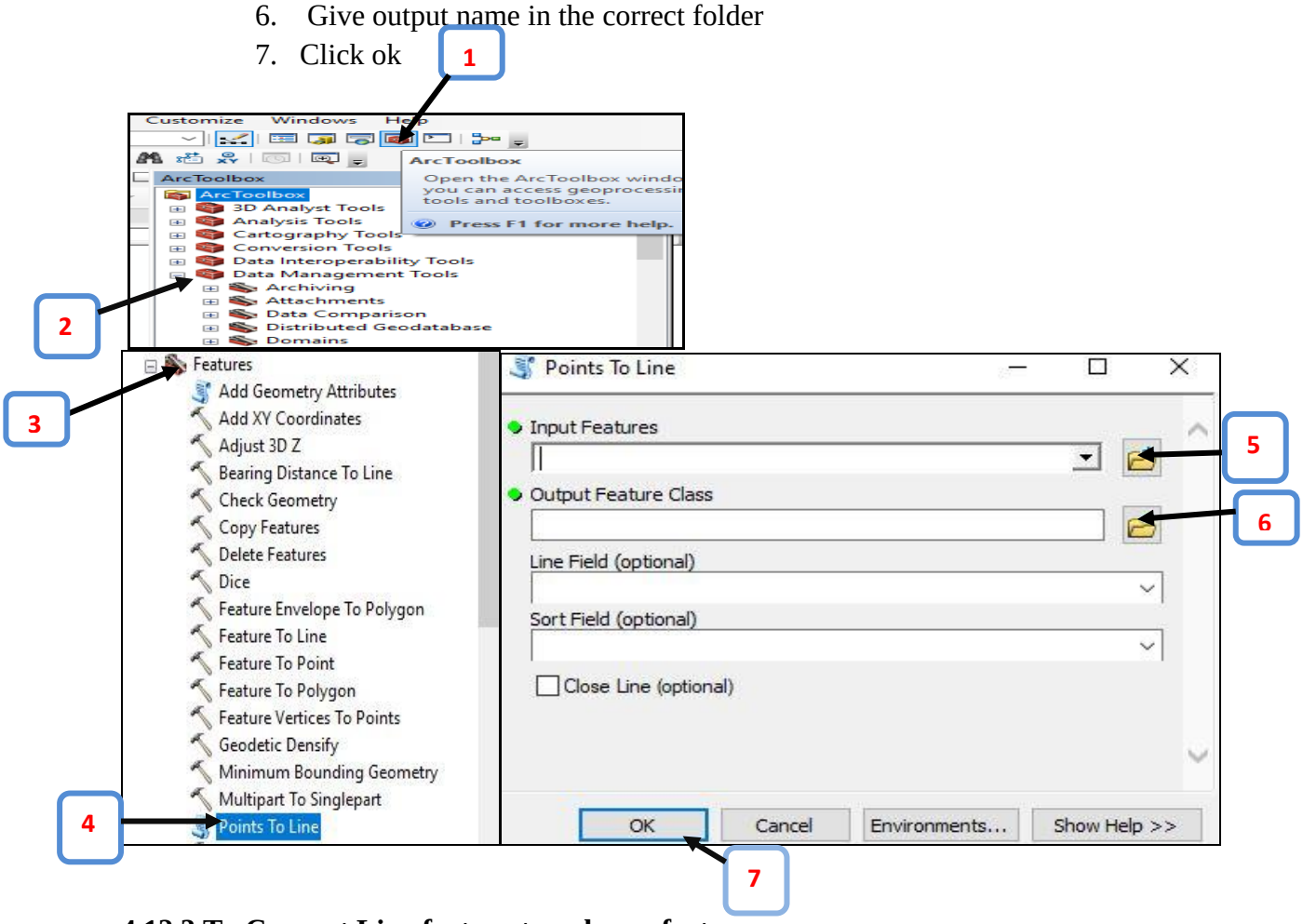

ddddd - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
Table Of Contents
New Data Frame
Solide-waste
Greenery
Jemoexportpg1.tif
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Contour 30m interval
30m interval
rivers
Create Features
Greenery
Solide-waste
Construction Tools
Polygon


UPSNJP Addis Ababa Jemo Public Work Sites 023/24
N
Legend
Solide-waste
Greenery
KM
0 0.03250.065 0.13 0.195 0.26

4.12 Conversion Tools

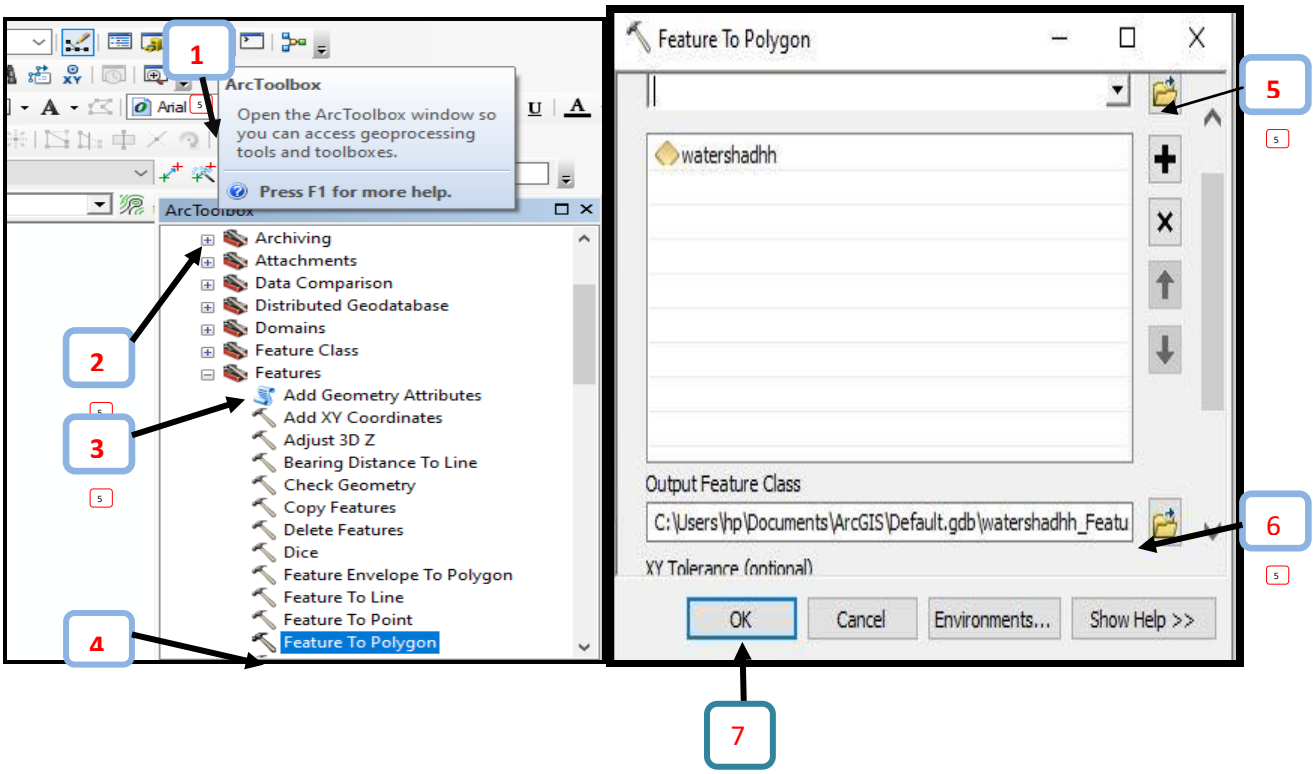
4.12.1 Convert GPS point data to line feature

1. Click the Arc Tool Box
2. Click Data management Tools
3. Click features
4. Click Point to Line tool
5. Select the point input feature
6. Give output name in the correct folder
7. Click ok



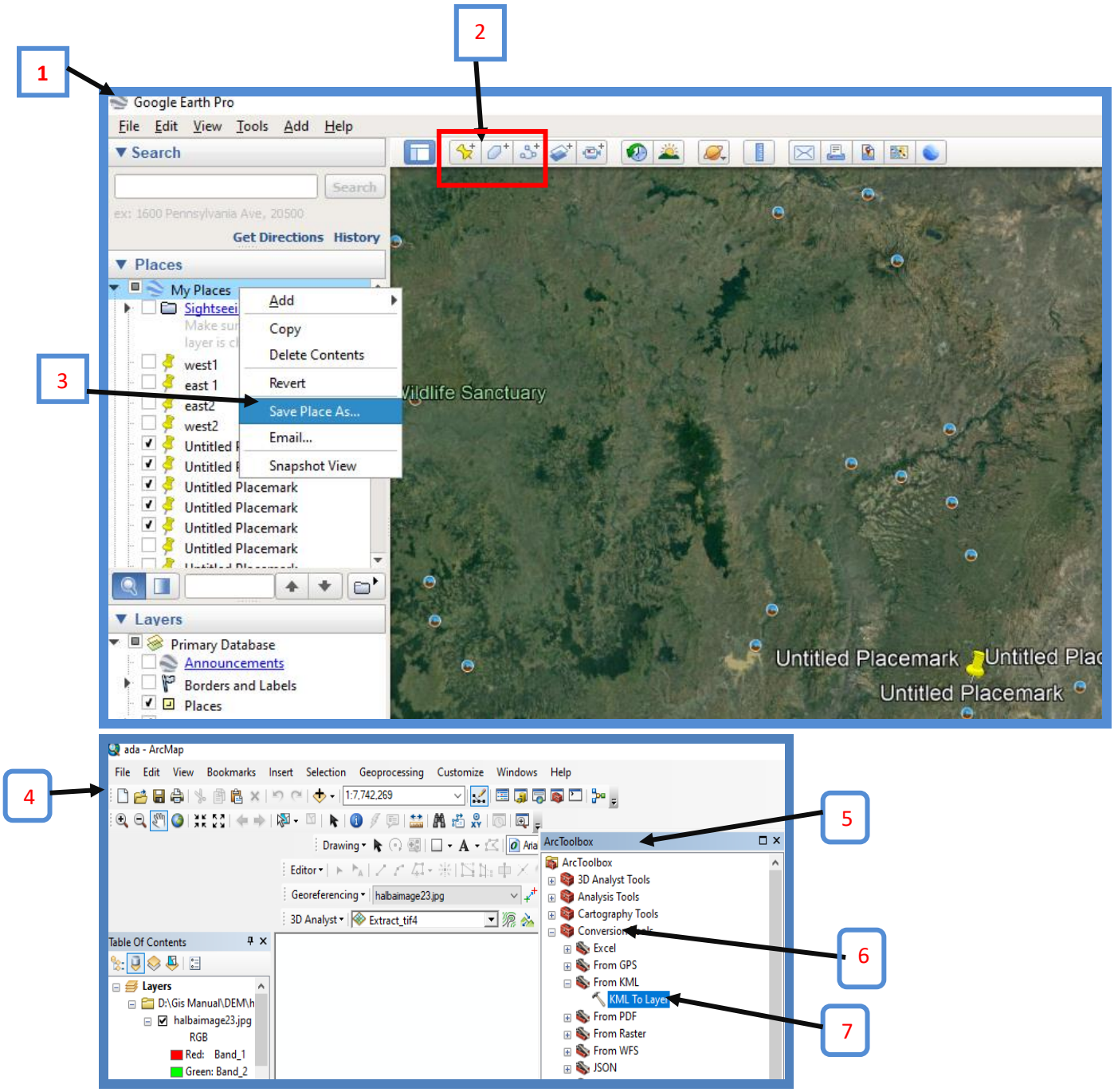
4.12.3 To Convert Line feature to polygon feature

1. Click the ArcTool Box
2. Click Data management Tools
3. Click features
4. Click Feature to Polygon tool
5. Select the Line input feature
6. Give output name in the correct folder
7. Click Ok



4.12.4. Converting KML to Layer

1. Open Google Earth pro
2. Create feature (polygon, point or path) on Google Earth (see chapter 3)
3. Save the feature in KML in created folder (see chapter 3)
4. Open arc map
5. Click on the Arc toolbox
6. Click on the conversion tool
7. Click on from the KML- to feature
8. Input KML
9. Select the Output folder to save
10. Name the output feature
11. Ok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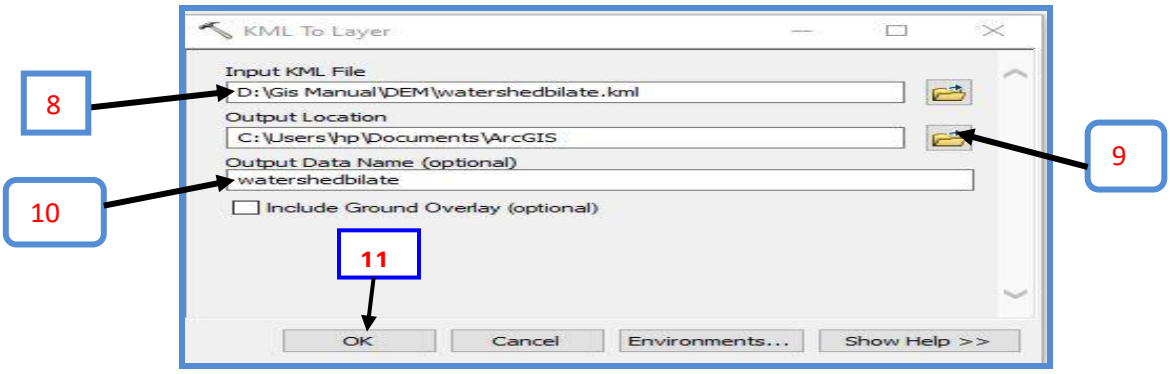
Google Earth Pro
File Edit View Tools Add Help
Search
Get Directions History
Places
My Places
Add
Copy
Delete Contents
Revert
Save Place As...
Email...
Snapshot View
Layers
Primary Database
Announcements
Borders and Labels
Places
Untitled Placemark
ada - ArcMap
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Excel
From GPS
From KML
KML To Layer
From PDF
From Raster
From WFS
JSON
Table Of Contents
halbaimage23.jpg



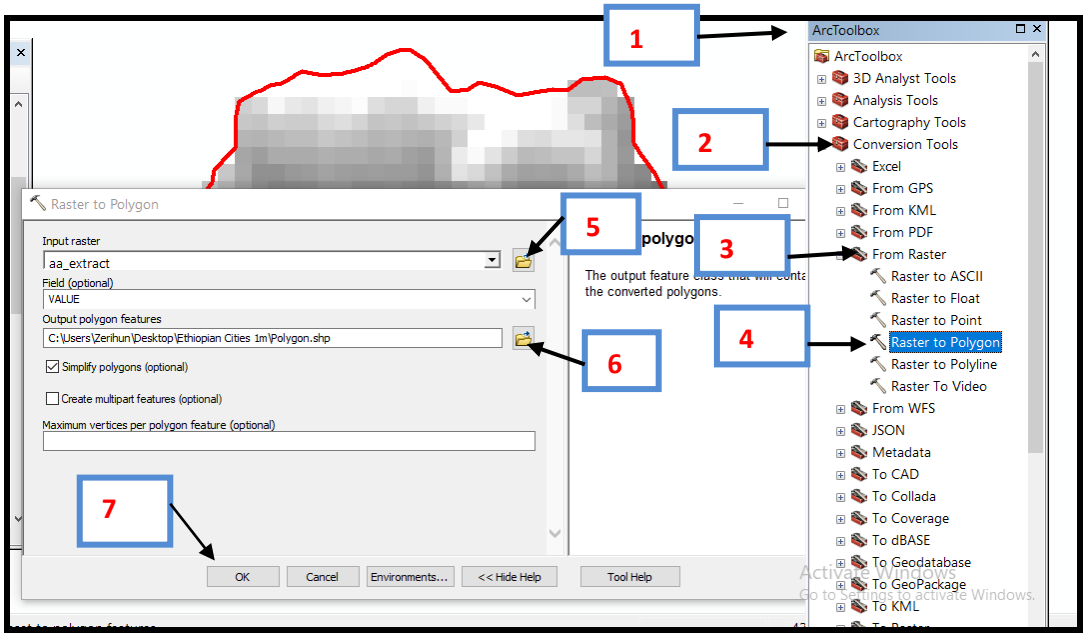
4.12.5. Converting Raster to Vector (Point, Polygon, and line)

Inputs

1. Raster Image
2. Boundary layer

Steps

1. Click on Arc Toolbox
2. Click on conversion
3. Click on From raster
4. Double Click on raster to polygon
5. Select the input data
6. Browse the folder to save
7. Ok



4.13 Data Management Tools - Projecting and Transformation

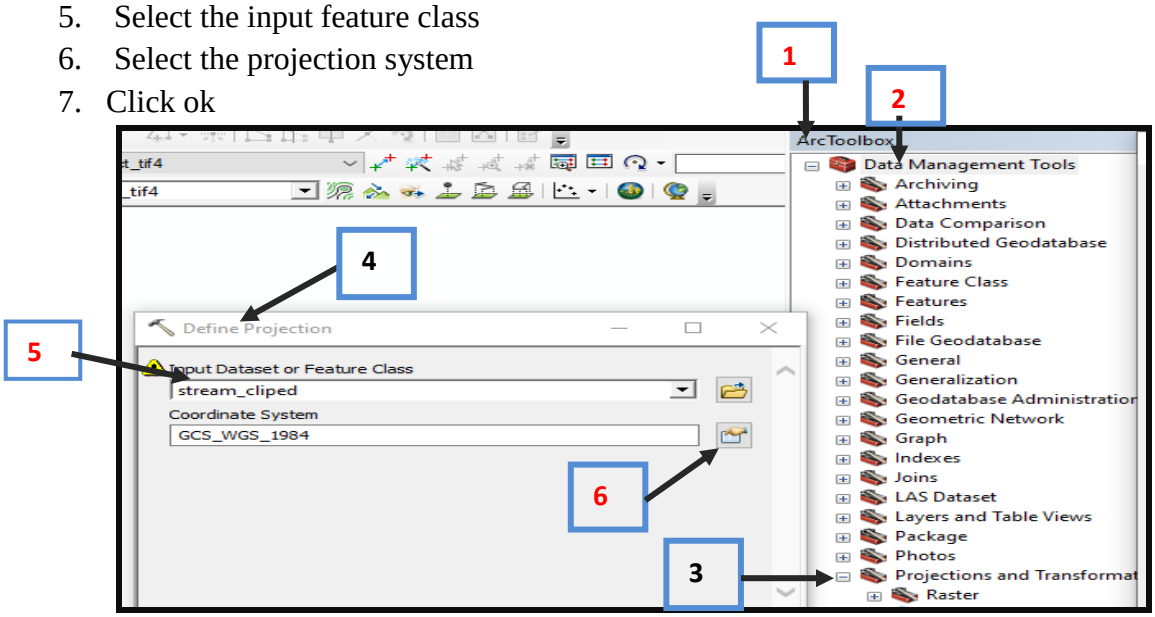
4.13.1 Projection and Transformation

Every spatial dataset has a coordinate system, which is used to integrate it with other geographic data layers within a common coordinate framework. When you obtain spatial data from different sources, sometimes it may be with unknown coordinate system. In such cases the coordinate should be defined. We should also convert geographic coordinate system in to UTM if we need to calculate distance and area.

4.13.2 Define Projection

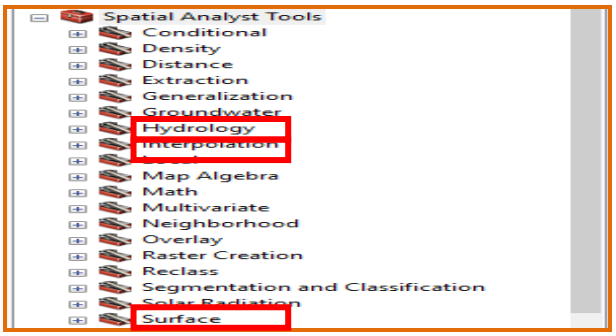
The define project function helps to inform /introduce / the Arc Map about the coordinate system/ the projection type/ of your data. This process can be done if and only if you are sure about the projection of your data.

1. Click on Arc toolboxes
2. Click on Data Management Tools
3. Click on Projection and transformation
4. Double click on the Define projection function
5. Select the input feature class
6. Select the projection system
7. Click ok



4.14. Spatial Analysis Tools

There are different tools in the spatial analysis tools of arc map. Let us see some of them with their uses.



4.14.1. Hydrology - Watershed Delineation

What is a Watershed?

- Watershed is a topographically delineated area drained through a common confluence point on a stream or river,
- An area that drains rainfall runoff water to a common outlet,

Inputs

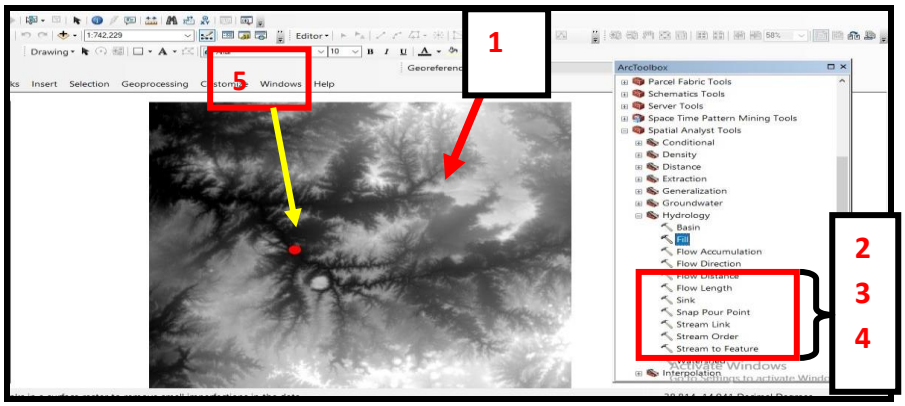
- Hydrology DEM of the area taken from USGS web page **https://earthexplorer.usgs.gov/**
- Outlet shape file

Activities

- Add the inputs
- In the Arc toolbox → Spatial Analysis → Click on Hydrology
- Filling the DEM
- Flow direction
- Flow accumulation
- Watershed

5.3.5 **Steps to Watershed delineation using Dem**

1. Spatial Analysis tools → Hydrology
2. Double Click on fill the DEM
3. generating flow direction from the fill DEM
4. generating flow accumulation from the flow direction
5. add or creating outlet point shape file and locate the outlet point
6. Re class the stream in Map Algebra
7. Delineating watersheds
8. Export the stream and watershed data to constant layer
9. conversion to vector of both water shade and stream
10. save the shape files
11. Export the map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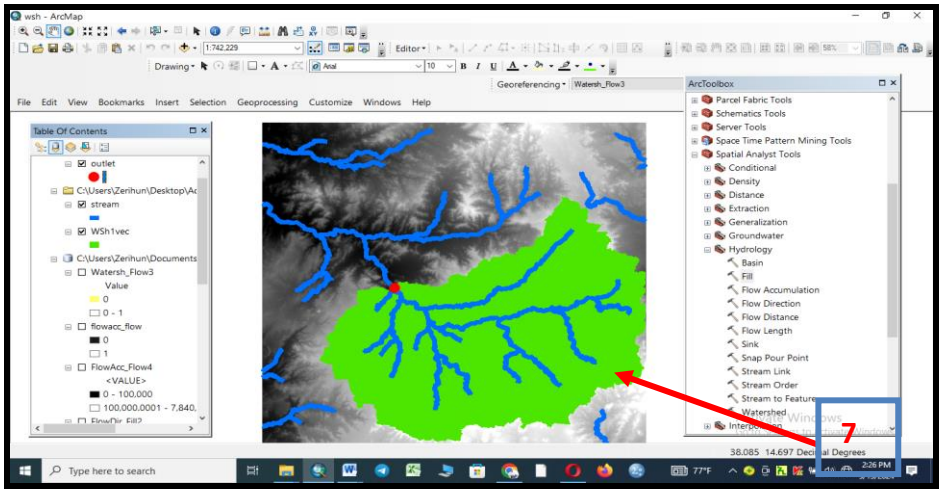
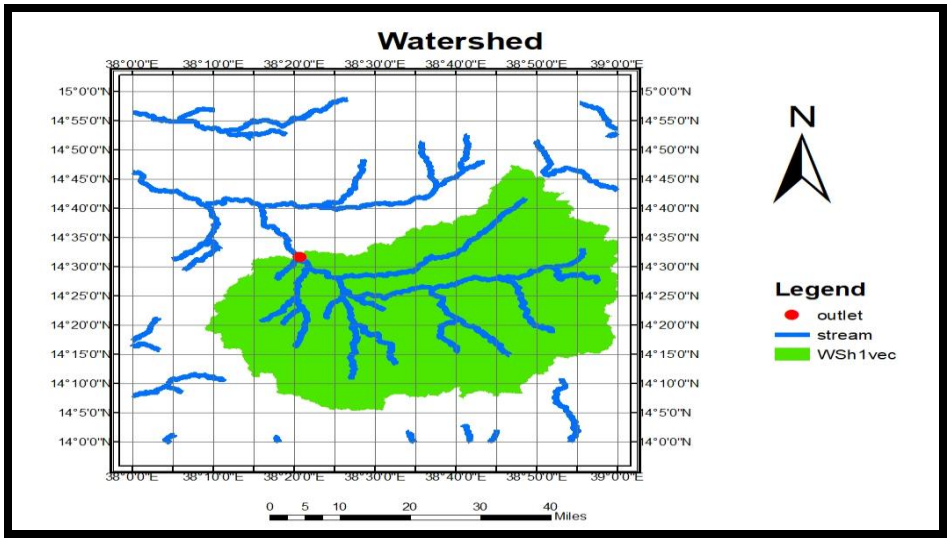
ArcToolbox
Parcel Fabric Tools
Schematics Tools
Server Tools
Space Time Pattern Mining Tools
Spatial Analyst Tools
Conditional
Density
Distance
Extraction
Generalization
Groundwater
Hydrology
Basin
Fill
Flow Accumulation
Flow Direction
Flow Length
Sink
Snap Pour Point
Stream Link
Stream Order
Stream to Feature
Interpolation


wsh - ArcMap
ArcToolbox
Table Of Contents
outlet
stream
WSh1vec
Watersh_Flow3
flowacc_flow
FlowAcc_Flow4
7

Output Map


Watershed
38°0'0"E
38°10'0"E
38°20'0"E
38°30'0"E
38°40'0"E
38°50'0"E
39°0'0"E
15°0'0"N
14°55'0"N
14°50'0"N
14°45'0"N
14°40'0"N
14°35'0"N
14°30'0"N
14°25'0"N
14°20'0"N
14°15'0"N
14°10'0"N
14°5'0"N
14°0'0"N
N
Legend
outlet
stream
WSh1vec
0 5 10 20 30 40
Miles

4.14.2. Surface - Generating Slope

Inputs

1. The Digital Elevation Model (DEM)

   We can get it from https://www.diva-gis.org/gdata

2. Boundary shape file (The boundary of the development site or city)

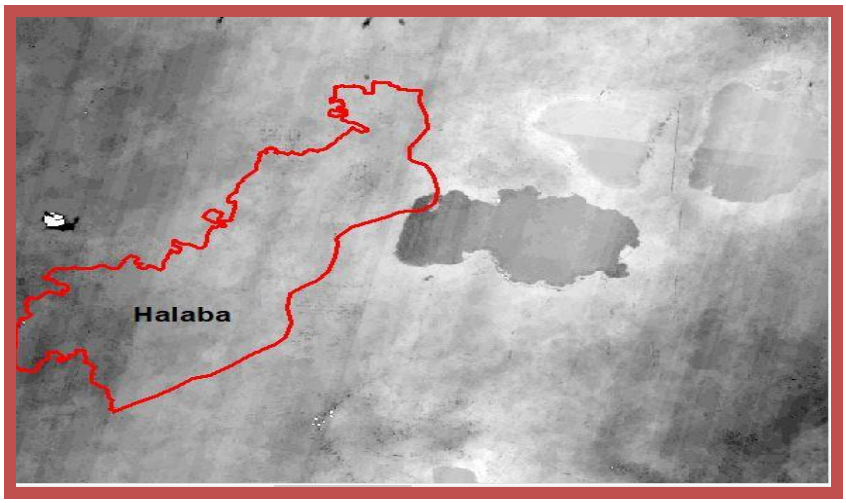
Activities

1. Add DEM Data of Ethiopia
2. Add the Boundary shape file of the area of your interest
3. Extract by mask in Spatial Analysis toolbox
4. Generate Slope

Steps to Create Slope

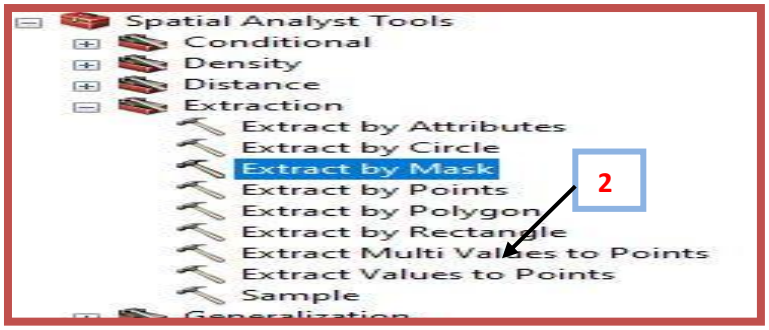
Extract by Mask

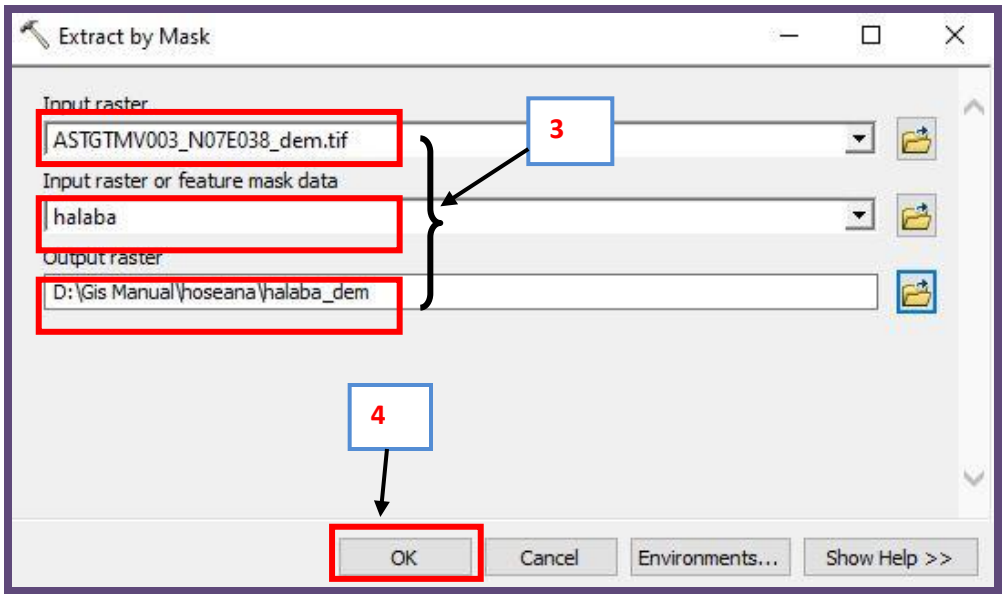
1. extract the area of your interest from Ethio-DEM



Steps.

1. Click on Arc Toolbox
2. Click Spatial Analyst Tool ⟶ Extraction ⟶ Extract by Mask
3. Fill the inputs
4. Click "Ok" to extract
5. Halaba_DEM is automatically is extracted and listed in the table of content
6. To see the Added DEM, un check all except "Halaba_DEM''





Generating Slope

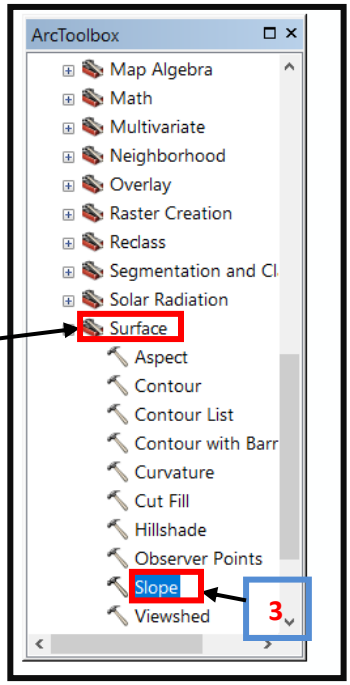
Slope is one of the tools used in the landscape analysis.

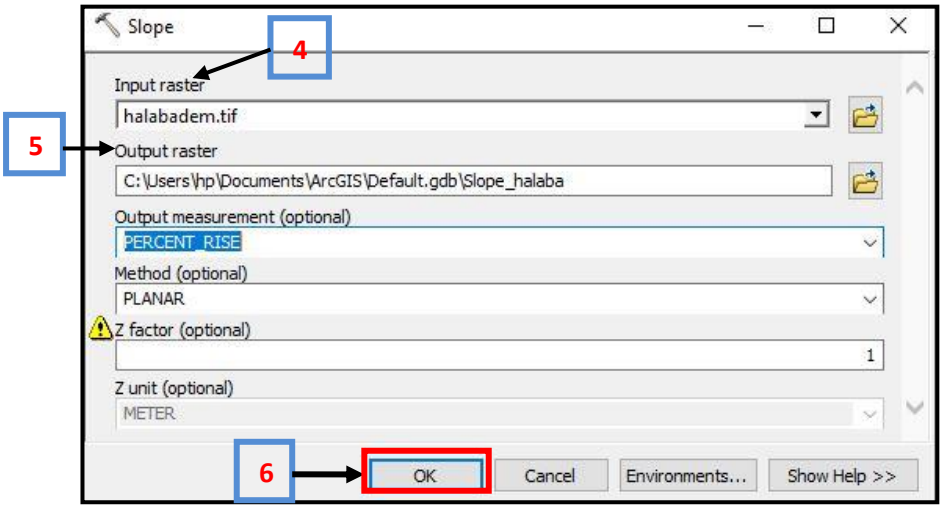
Input

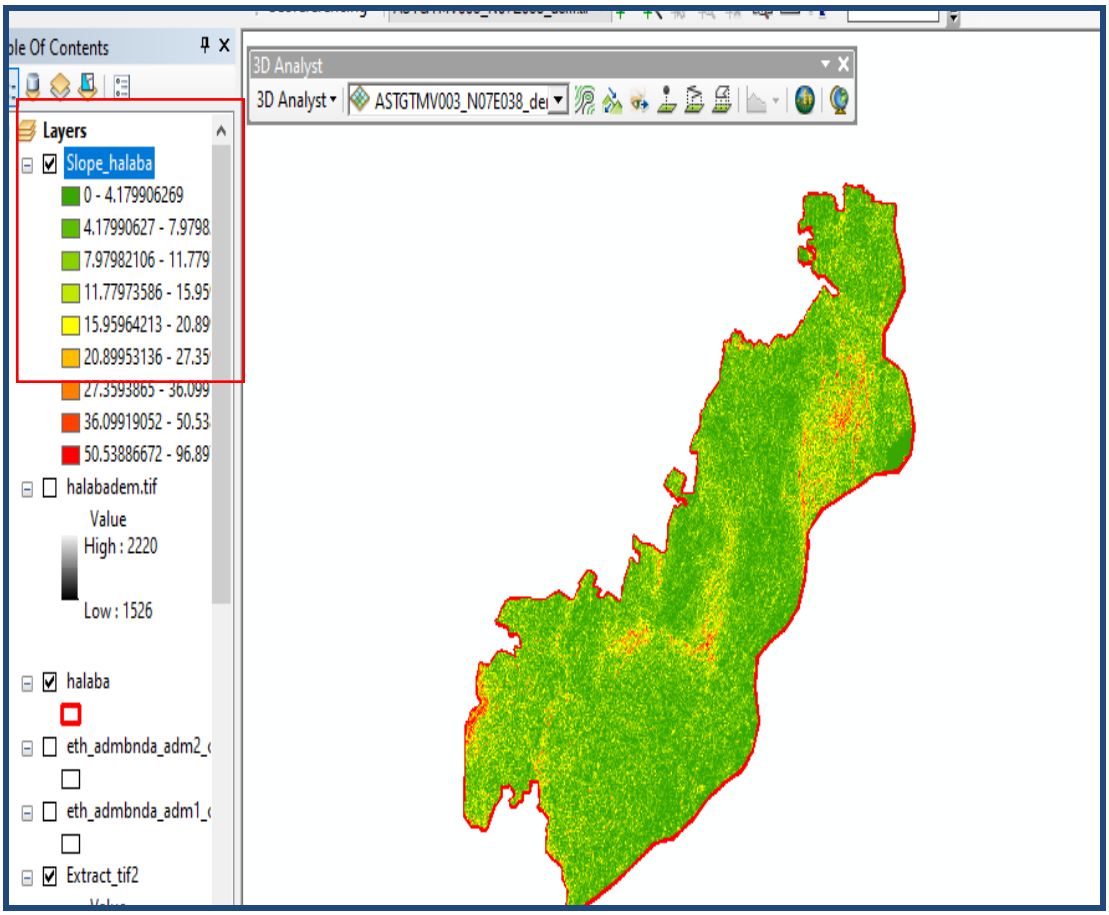
1. **Extracted DEM Data**

Steps to generate slope

1. *Click on Arc tool box* ⟶ *Click on Spatial Analysis*
2. Click on Surface
3. Double Click on Slope
4. Fill the input (with the DEM data)
5. Browse the output folder
6. ***Ok***







4.14.3 Surface - Generate Contour

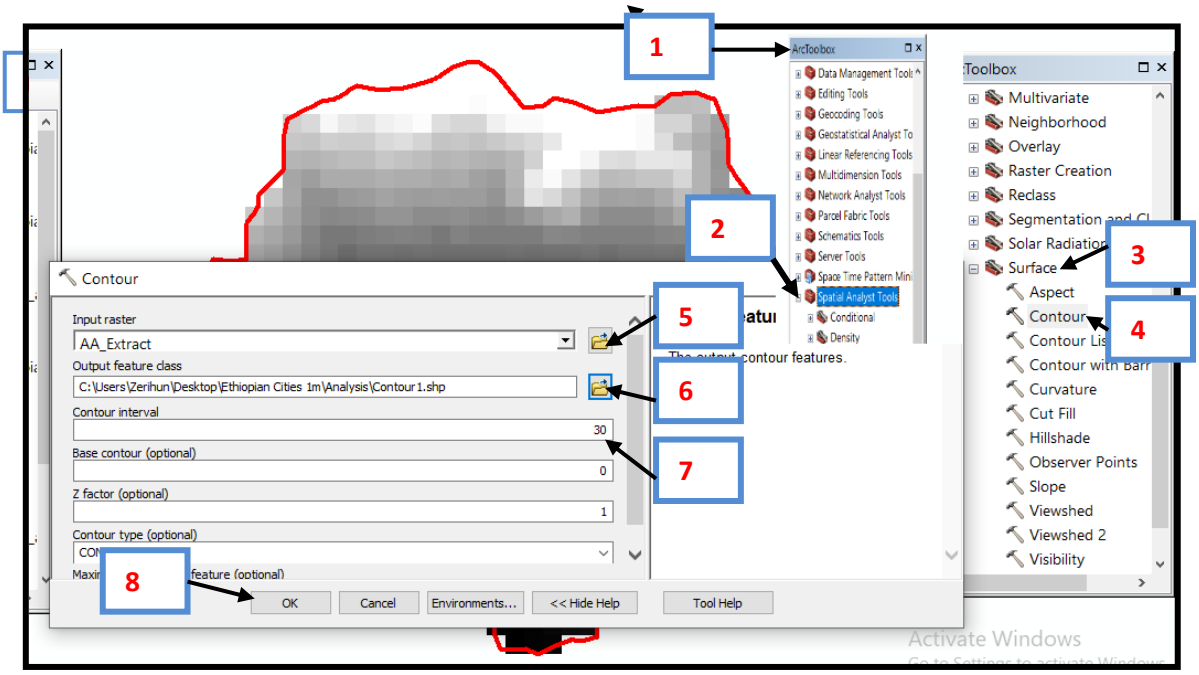
Contours are also used as a tool in the analyses of a landscape.
Input

1. Extracted DEM Data

Steps

Steps to generate slope

1. Click on Arc tool box
2. Click on Spatial Analysis
3. *Click on Surface*
4. *Click on contour*
5. Add Impute DEM Data
6. Browse the output location folder
7. *Fill contour interval*
8. *Ok*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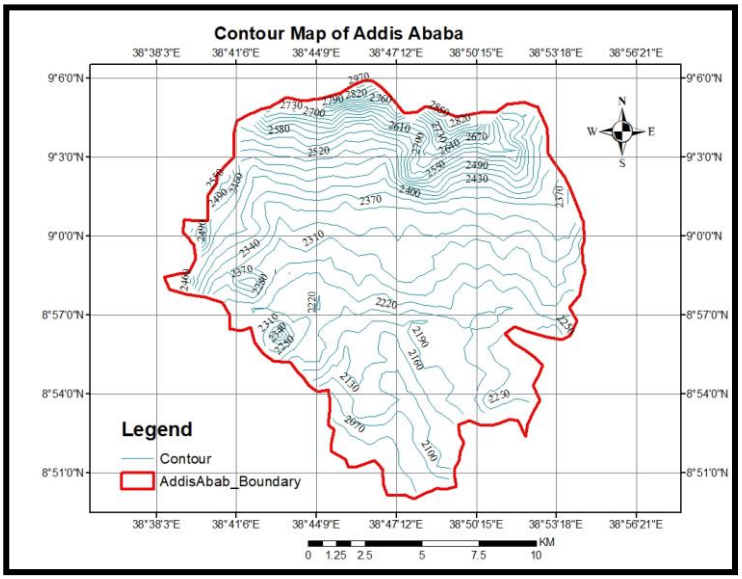
ArcToolbox
Data Management Tools
Editing Tools
Geocoding Tools
Geostatistical Analyst To
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Parcel Fabric Tools
Schematics Tools
Server Tools
Space Time Pattern Min
Spatial Analyst Tools
Conditional
Density
Toolbox
Multivariate
Neighborhood
Overlay
Raster Creation
Reclass
Segmentation and Cl
Solar Radiation
Surface
Aspect
Contour
Contour Lis
Contour with Barr
Curvature
Cut Fill
Hillshade
Observer Points
Slope
Viewshed
Viewshed 2
Visibility
Contour
Input raster
AA_Extract
Output feature class
C:\Users\Zerihun\Desktop\Ethiopian Cities 1m\Analysis\Contour1.shp
Contour interval
30
Base contour (optional)
0
Z factor (optional)
1
Contour type (optional)
OK
Cancel
Environments...
<< Hide Help
Tool Help
The output contour features.
Activate Windows

The Output


Contour Map of Addis Ababa
38°38'3"E
38°41'6"E
38°44'9"E
38°47'12"E
38°50'15"E
38°53'18"E
38°56'21"E
9°6'0"N
9°3'0"N
9°0'0"N
8°57'0"N
8°54'0"N
8°51'0"N
N
S
E
W
Legend
Contour
AddisAbab_Boundary
0 1.25 2.5 5 7.5 10
KM

Chapter Five: Climate Smart Public Work Projects Site Plan Preparation: Models

5.1 Climate Smart Public Works Site

5.1.1. Site Selections and Delineation

The major Climate Smart Public Work categories planned in UPSNJP project offices are:-

1. Solid Waste
2. Greenery
3. Urban Agriculture
4. Water shed Site and
5. Small Infrastructure

When Project sites are selected each year, the activities performed to undertake this task are:

Activity 1. Site Selecting

Activity 2. Undertaking Public Discussion and Ratification

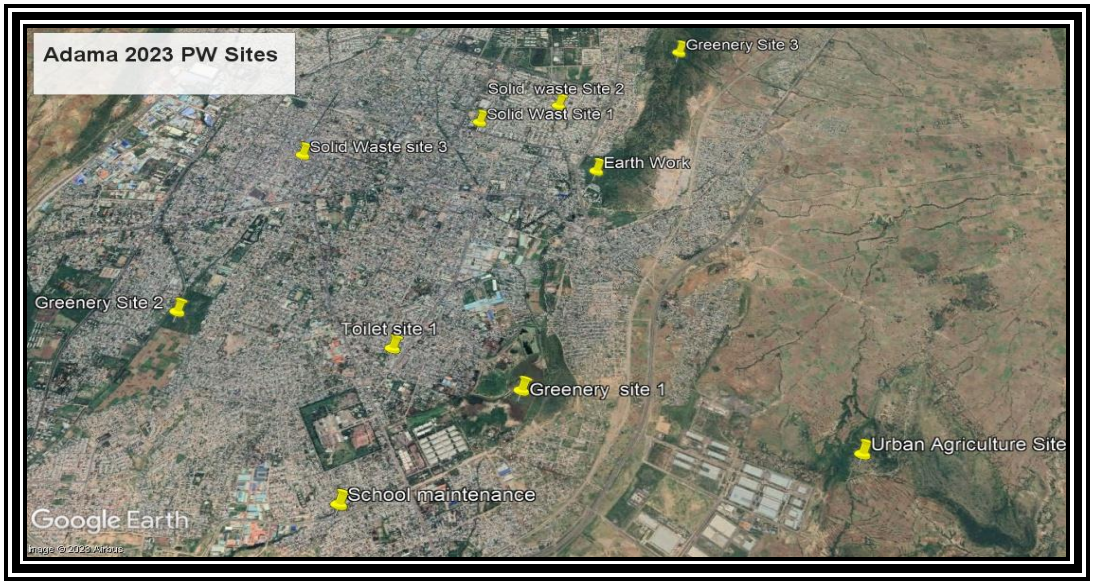
Activity 3. Site Delineation

Activity 1. Site Selecting

Climate Smart Public Work expertise can select sites for discussion performing the following sub activities

1. Ground Surveying
2. Remote sensing data (In our case we can use Google Earth Data as an input)

Performing the above activities both ground survey and using Google Earth Pro we can select all our Climate Smart Public Work sites to make ready for discussion as seen the following sample.



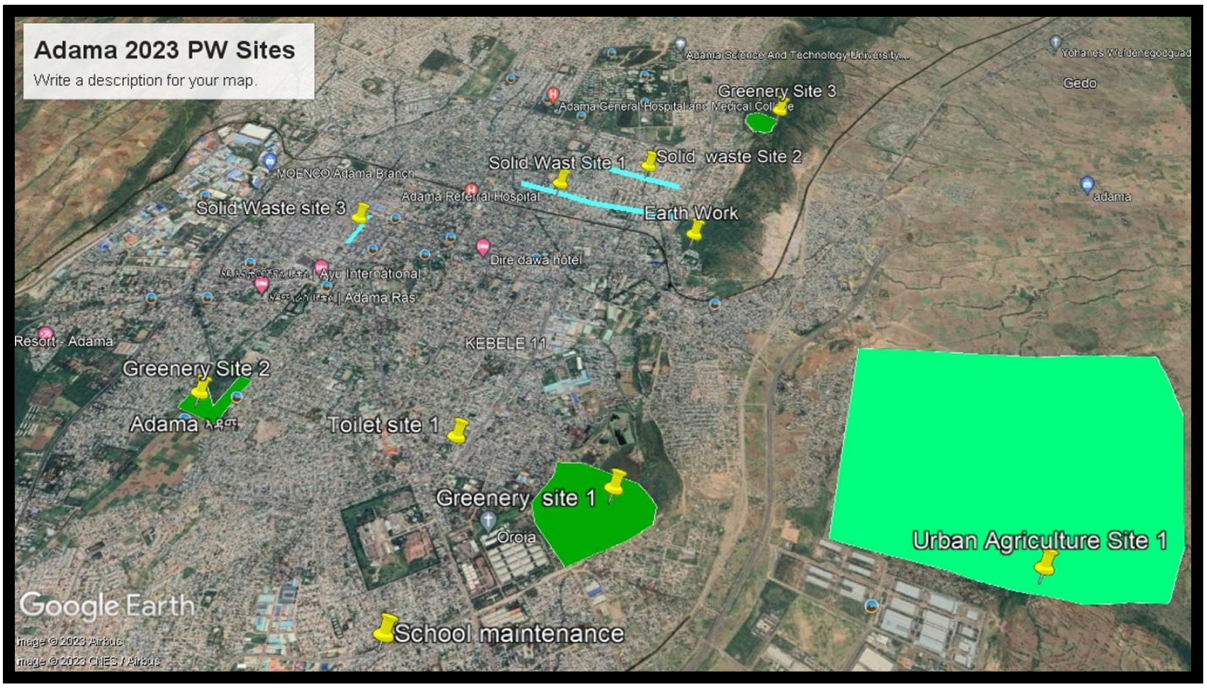
Activity 2. Undertaking Public Discussion and Ratification

Climate Smart Public Work expertise may come with temporary project sites. But the community and other concerned bodies should discuss on these sites in using images as seen sample image above. And the ratification should be made under the will of all stakes.

Activity 3. Site Delineation

After the ratification of the sites, site delineation should be undertaken properly and saved it ***kml file*** format in order to locate the final Climate Smart Public Works sites on Arc map Software.

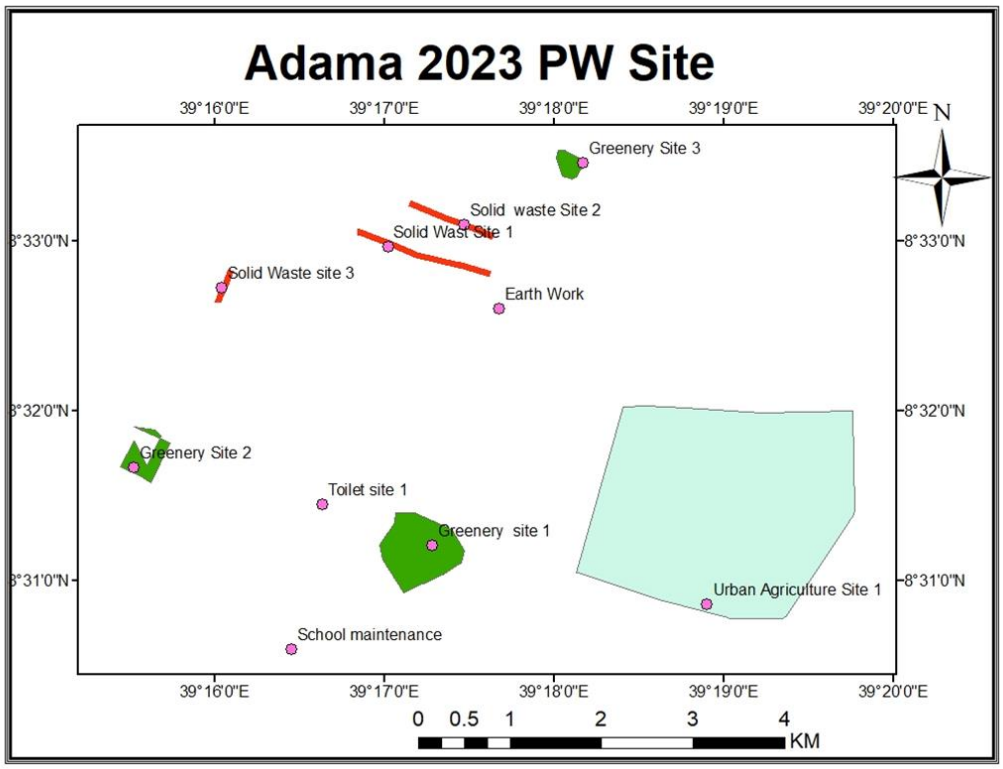
1. Open Google Earth
2. *Delinate the sites usin the tool bars:* ***Add Placemark, path and polygon***.
3. *Click File and click save*
4. *Collect all in one folder under temporary places*
5. *Click Save Place As*
6. *Give file name*
7. *Save as .kml*
8. *Save also Image*
9. *Give file name and save it as JEPG*


Adama 2023 PW Sites
Write a description for your map.
Greenery Site 3
Solid Wast Site 1
Solid waste Site 2
Solid Waste site 3
Earth Work
Greenery Site 2
Toilet site 1
Greenery site 1
Urban Agriculture Site 1
School maintenance
Google Earth

5.1.1 Climate Smart Public Work Sites GIS shape file.

In order to obtain the GIS shape file of the delineated Climate Smart Public Work sites the files saved in KML we can get it performing the following activities

1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***
6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*

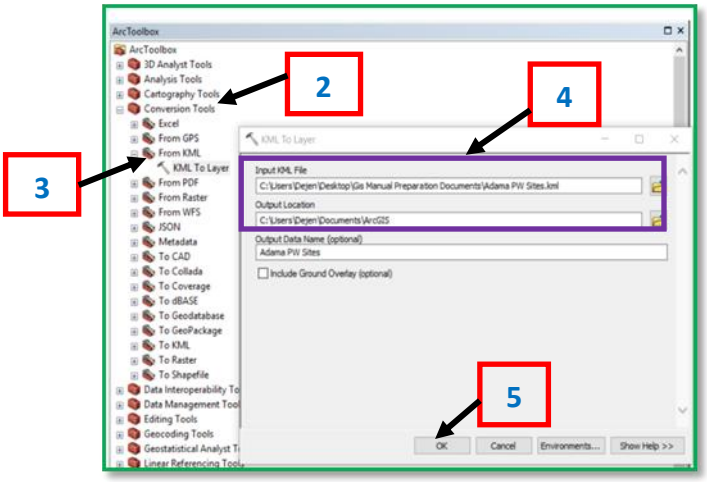


5.2 Climate Smart Public Work Site Plan Preparation: Models

5.2.1 Solid Waste Site Plans

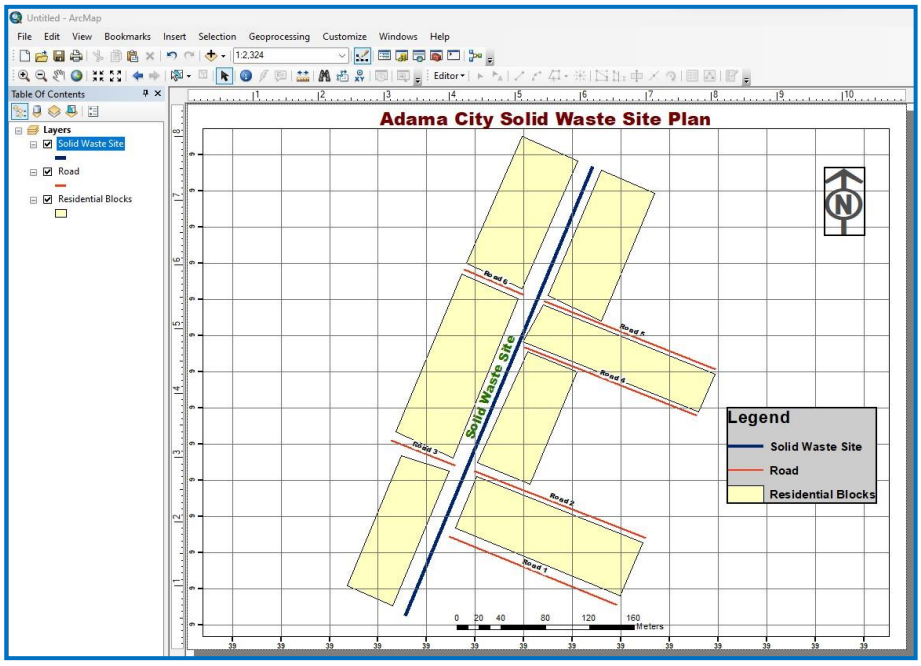
Solid waste management Site plan Preparation should include the cleaning line and the surrounding features which appears to be around the solid waste site. Such features can be the surrounding blocks and other roads, when we extract the solid waste line features from the Google earth, ground survey or from orthophoto we must consider these. Finally we can prepare each of the solid waste site plan of a city accordingly.

5.2.1.1 Preparing the Solid Waste Site Plan Map Using Arc GIS.



1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***
6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*

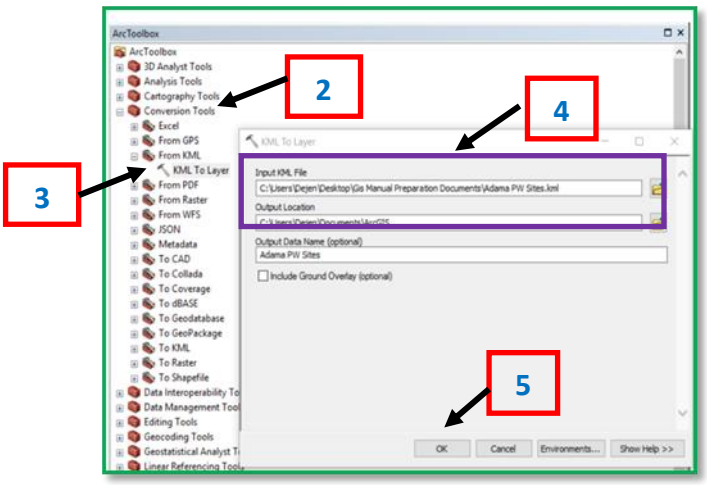
Solid Waste Management Site Plan



5.2.2 Greenery Site Plan

In order to prepare the Greenery Site plan we must show /indicate the surrounding features which appears to be around the Greenery site. Such features can be the surrounding blocks and roads, when we extract the greenery features from the Google earth or from orthophot we must consider this. Finally we can prepare the greenery site plan of a city accordingly.

5.2.2.1 Preparing the Greenery Site Plan Map Using Arc GIS.

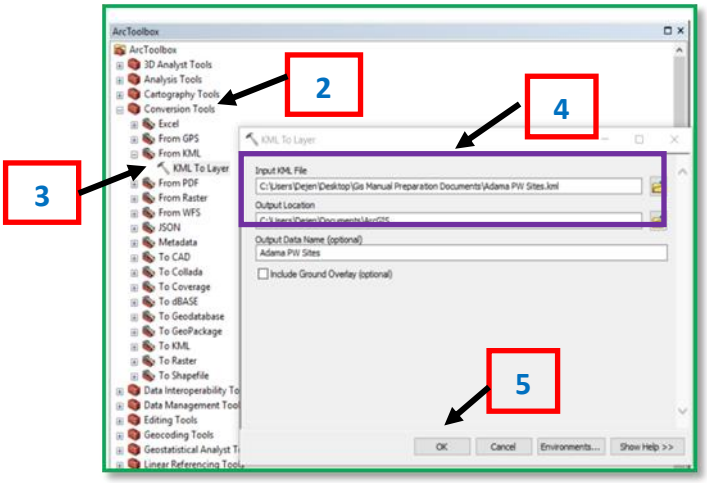


1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***
6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*

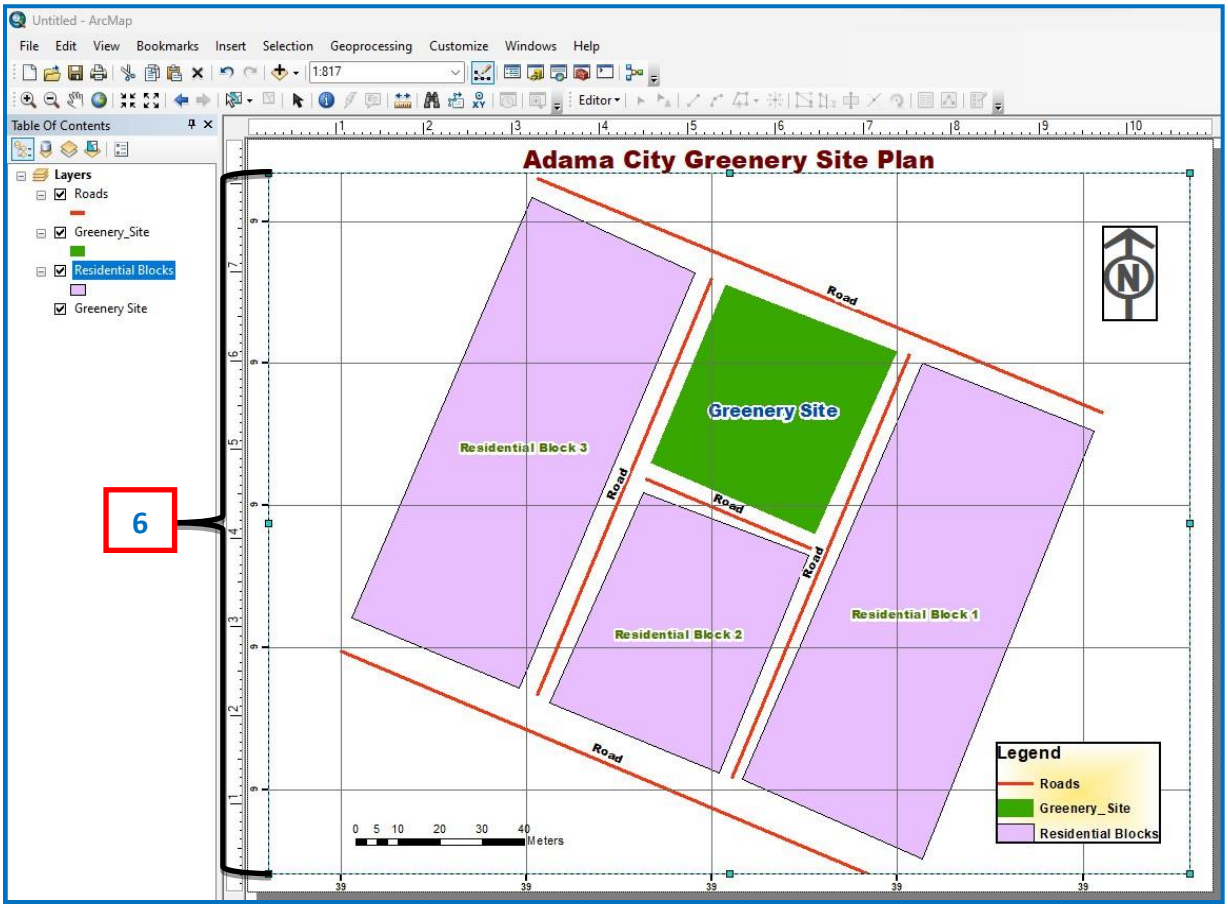
5.2.2 Greenery Site Plan

In order to prepare the Greenery Site plan we must show /indicate the surrounding features which appears to be around the Greenery site. Such features can be the surrounding blocks and roads, when we extract the greenery features from the Google earth or from orthophot we must consider this. Finally we can prepare the greenery site plan of a city accordingly.

5.2.2.1 Preparing the Greenery Site Plan Map Using Arc GIS.



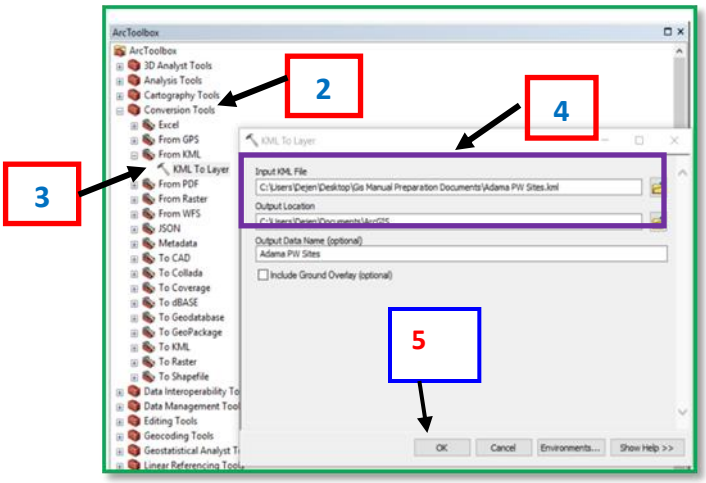
1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***
6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*



5.2.3 Small Infrastructure Site Plan

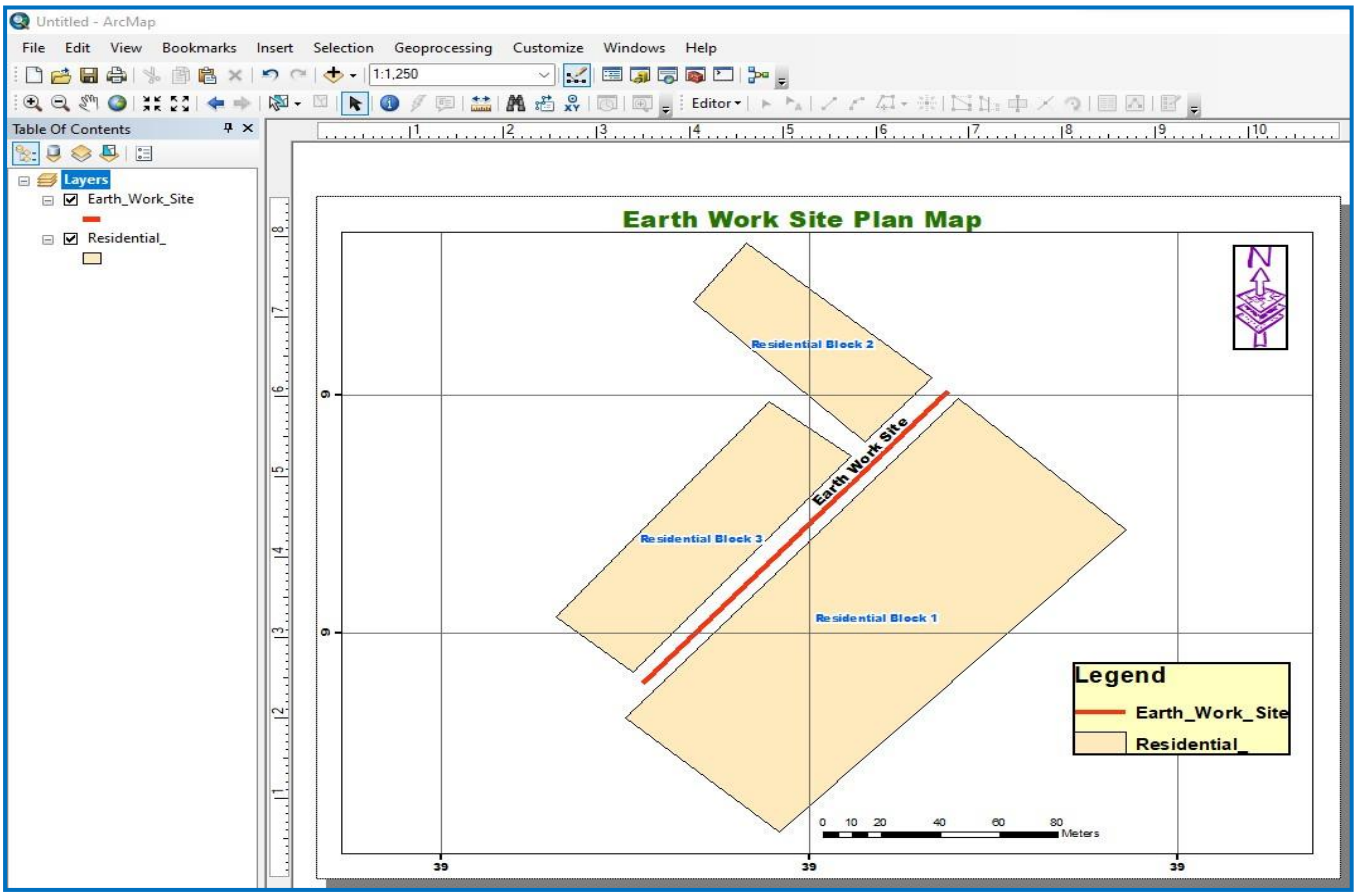
In order to prepare the Small Infrastructure Site plan we must show /indicate the surrounding features which appears to be around the Small Infrastructure site. Such features can be the surrounding blocks and other features, when we extract the Small Infrastructure features from the Google earth or from orthophot we must consider this. Finally we can prepare the Small Infrastructure site plan of a city accordingly.

5.2.3.1 Preparing Small Infrastructure Site Plan Map Using Arc GIS.



1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***

6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*



5.2.4. Watershed Site Plan

Watershed site plan preparation is undertaken in using different inputs. The major are

1. Shape file of the stream from the outlet
2. Shape file of Boundary of the water shed from the outlet
3. Shape file of development site area
4. Shape file of Land scape features

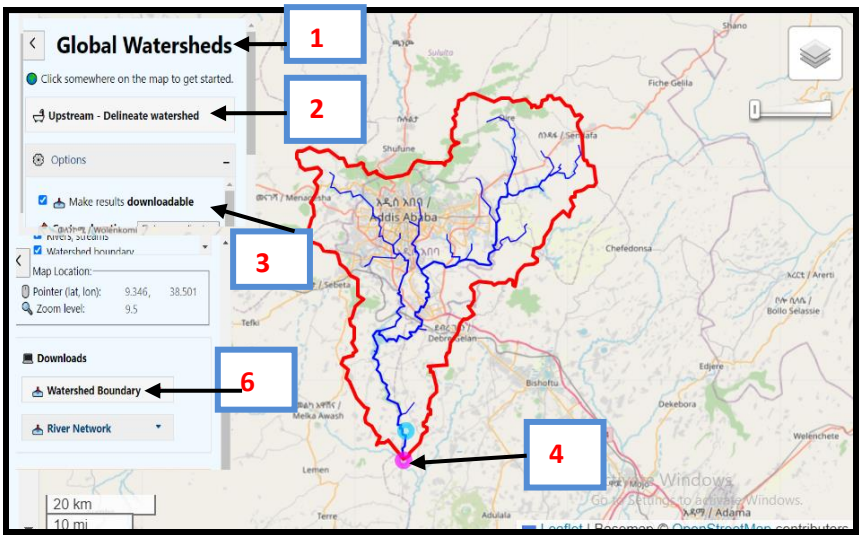
The above input shape files are obtained either in using already created shape files or by creating features. Let us see the methods.

1. Shape file of the stream and boundary of the water shed – These obtained by:
   a. Generating from hydrology raster as seen in chapter 4.13 spatial analysis tools
   b. Directly downloading from global water shed interfaces like - https://mghydro.com/watersheds/
2. Shape file of development site area - is obtained by creating features of the selected watershed site by ourselves.
3. Shape file of Land scape features - we can generate it by ourselves as seen in chapter 4

In this stage let us see how to get water shed shape files by using websites

Steps

1. **Open Global watershed interface**
2. **Select the stream**
3. **Check on the downloads**
4. **Click on the out lets**
5. **Delineate**
6. **Click on shape file and KML to download the stream and the watershed**

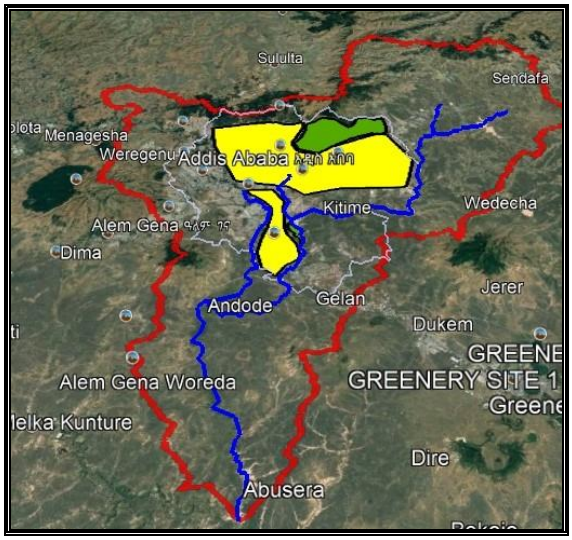


2. Shape file of development site area - is obtained by creating features of the selected watershed site

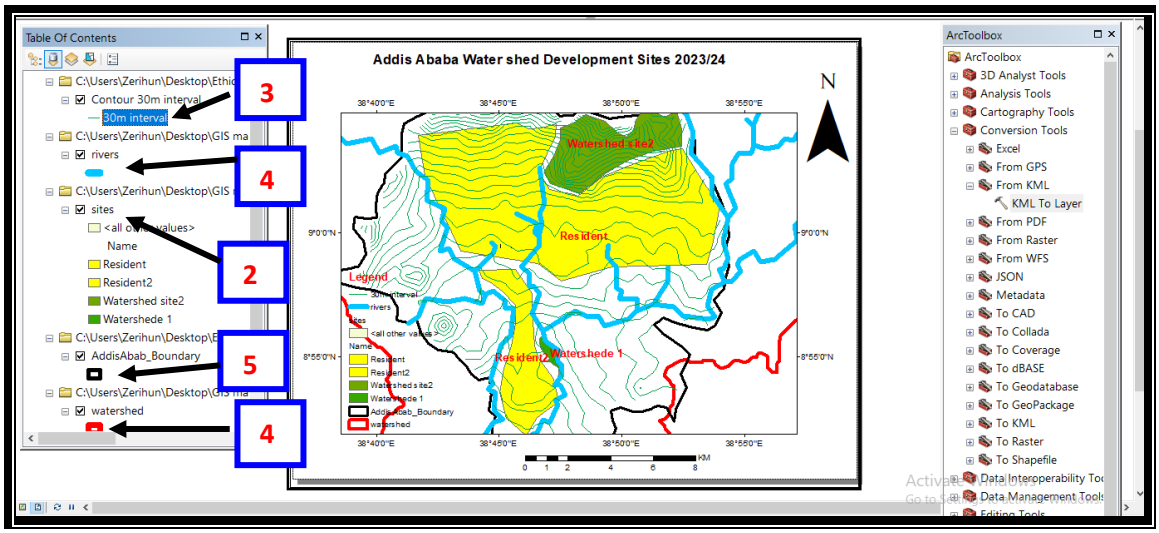
   Activity – Save The development site Features in KML and convert it to layer (see it in chapter 3)

   Steps

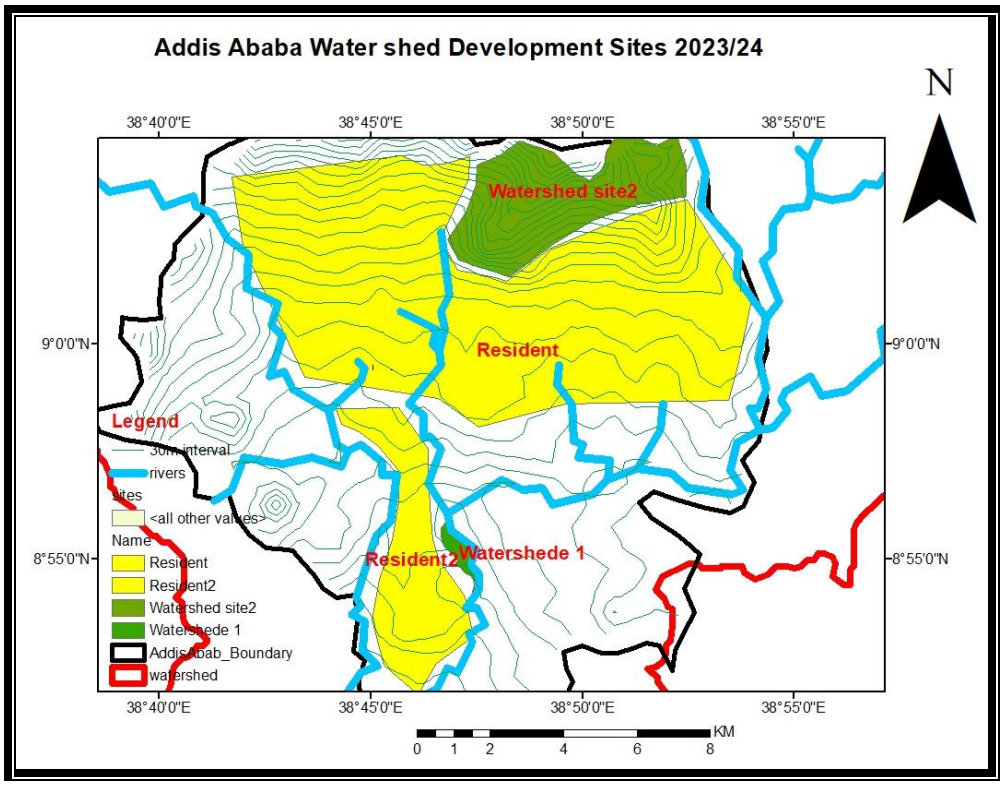
   1. **Create the features of the development sites on Google Earth pro and Save in KML(see it in chapter 3)**



   2. **Open Arc map and Convert KML to layer to get the development site shape file**
   3. **Generate contour or slope map and add it (see in chapter 4)**
   4. **Add all the shape files of river and water shed boundary**
   5. **Add the administrative boundary of the site**
   6. **Export the map of final Site Plan**



The Water shed site Plan (Model)

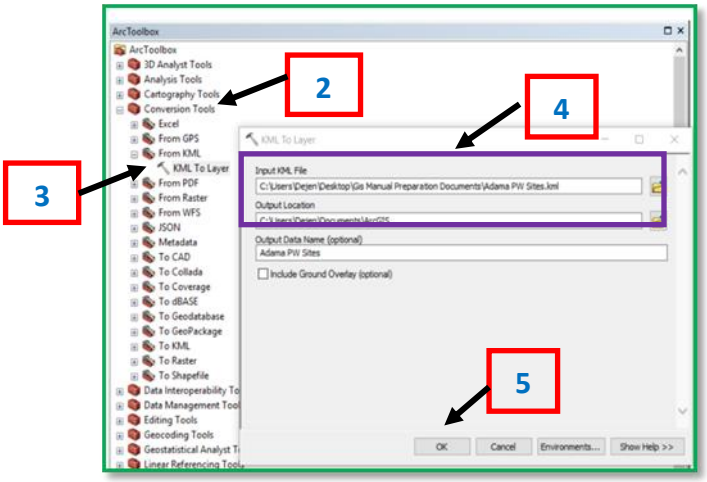


5.2.5. Urban Agriculture Site Plan

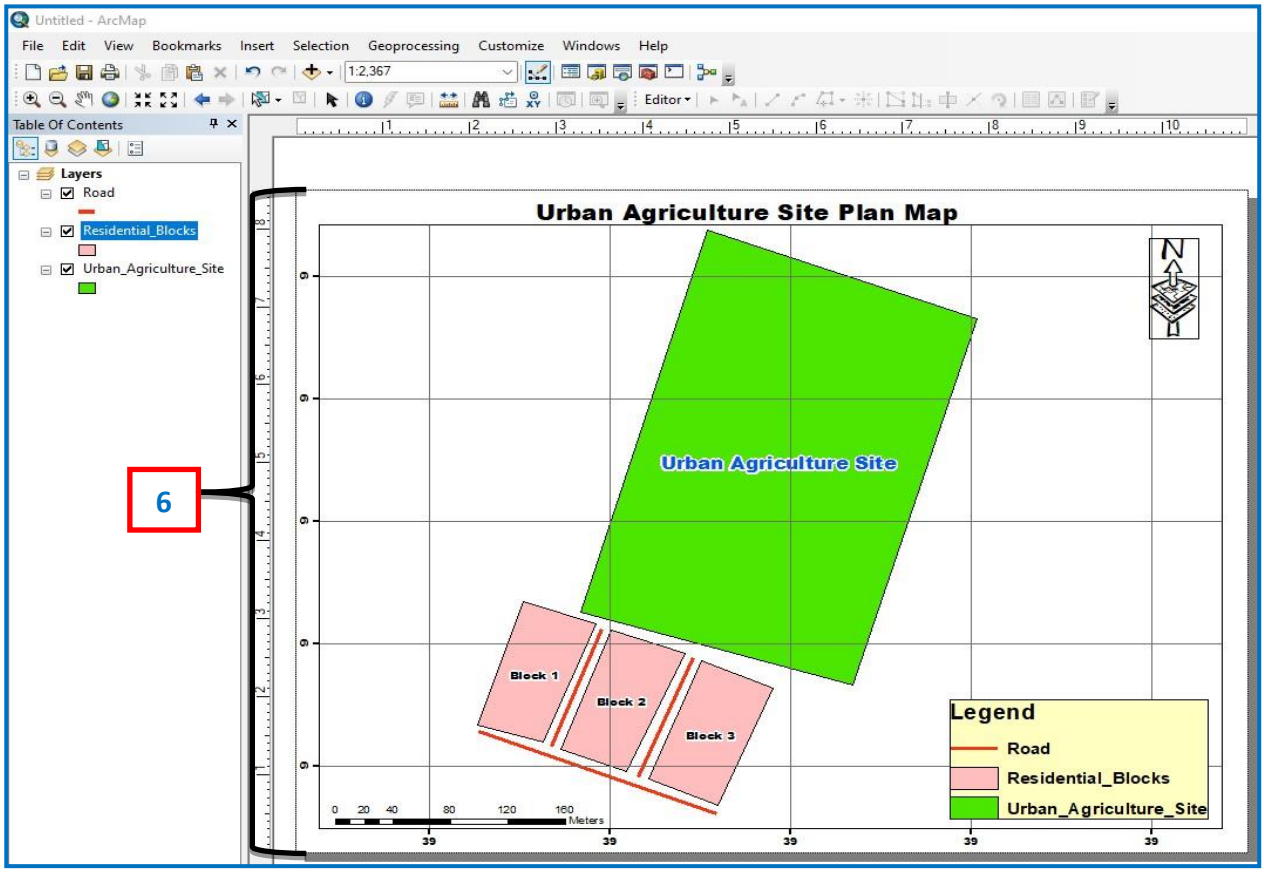
In order to prepare urban agriculture Site plan we must show /indicate the surrounding features which appears to be around the urban agriculture site. Such features can be the surrounding blocks, roads and other features, when we extract urban agriculture features from the Google

earth or from orthophot we must consider this. Finally we can prepare the urban agriculture site plan of a city accordingly.

5.2.4.1 Preparing Urban Agriculture Site Plan Map Using Arc GIS.



1. Open Arc map
2. Open ***Arc toolbox*** and click ***Conversion Tools***
3. Click on ***From KML*** and open ***KML to Layer***
4. Browse the .kml file for ***Input KML File*** and give ***Output Location***
5. ***Click OK***
6. Using map layout we finally prepare the PW site map.*(You can refer Map lay outing on the above chapter)*



Tip

How to Install Setups

There are Google Earth pro setup and Arc GIS setup which needs to be installed in the use of this manual.

1. Installing Google Earth pro
    - Connect internet
    - Down load the setup
    - Double click on the setup
    - Then next, next ….Finish
2. Installing Arc GIS
    - Connect internet
    - Down load the setup
    - Double click on the setup
    - Then next, next ….Finish
    - Take the crack and paste it in the Program file of bin