Food and Agriculture Organization of the United Nations

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security in LAO PDR (GCP/LAO/021/LDF)

ArcGIS training materials

gef

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security in the Lao People's Democratic Republic (GCP/LAO/021/LDF)

ArcGIS training materials

by:

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Vientiane, 2020

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Contents

-

Introducing GIS

A first look into the concepts that comprise
a Geographic Information System

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS)
to improve adaptation to climate change and food security in Lao PDR

Dr. Kavinda Gunasekara
Frank Yrle

Overview

Learning GIS Fundamentals

1. Who uses GIS?
2. How layers work in a GIS
3. GIS features & surfaces
4. Spatial relationships in GIS

GIS – Geographic Information Systems

Definition

(def) A geographic information system (GIS) captures, stores, analyzes, manages, and presents data that is linked to locations.

GIS is a set of tools that allow for the processing of spatial data into information.

A good GIS should answer the following questions:

Location – *Where is it?*

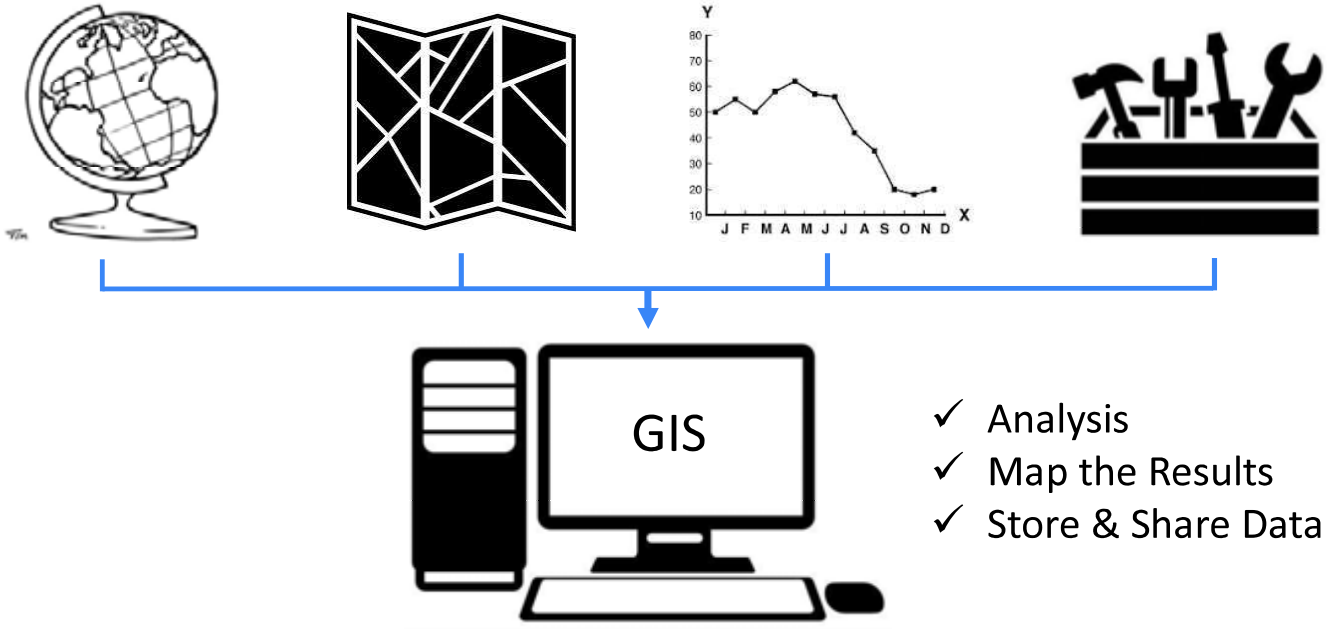
Condition – *What if?*

Trends – *What has changed since?*

Relations – *Which data are related?*

Synthesis of Different Data Sources

All exist in one system



- ✓ Analysis
- ✓ Map the Results
- ✓ Store & Share Data

Applications of GIS

Many disciplines use GIS

Examples of Maps possible with GIS

Analysis of the effects of land use change on protected areas in the Philippines, 2006

Land Use Change

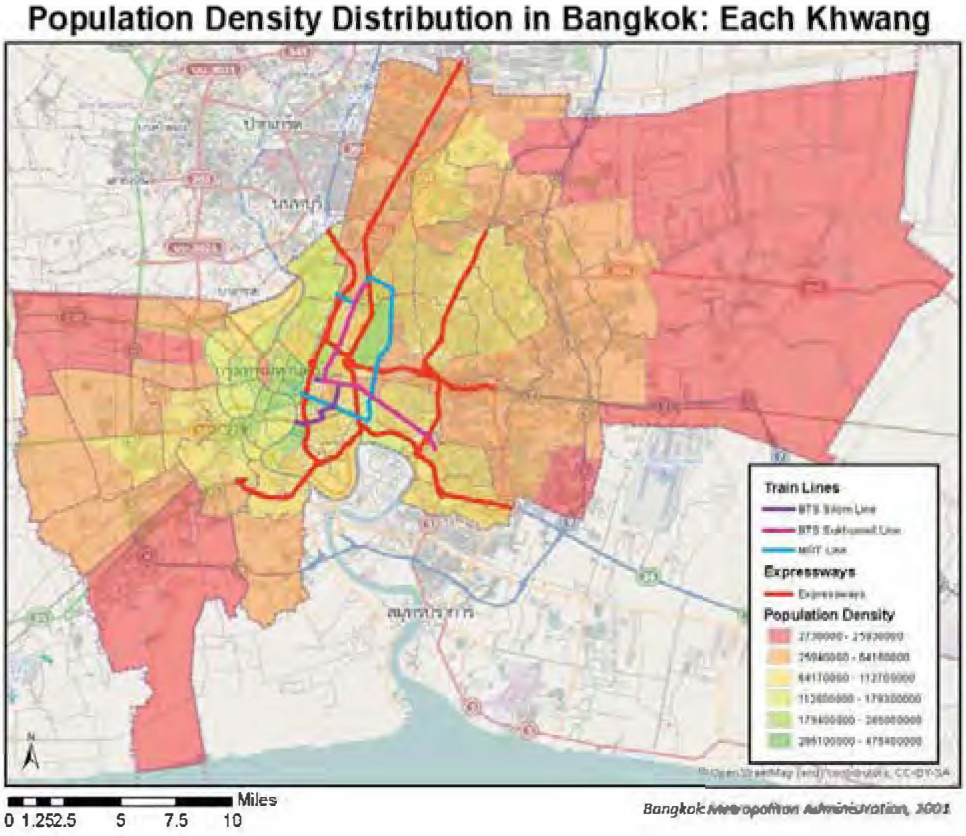
- Tracking how land is used with time series image analysis

Examples of Maps possible with GIS

Population Density

- Distribution of people in relation to area

Ex: Countries, provinces, districts, sub-districts, cities, etc.

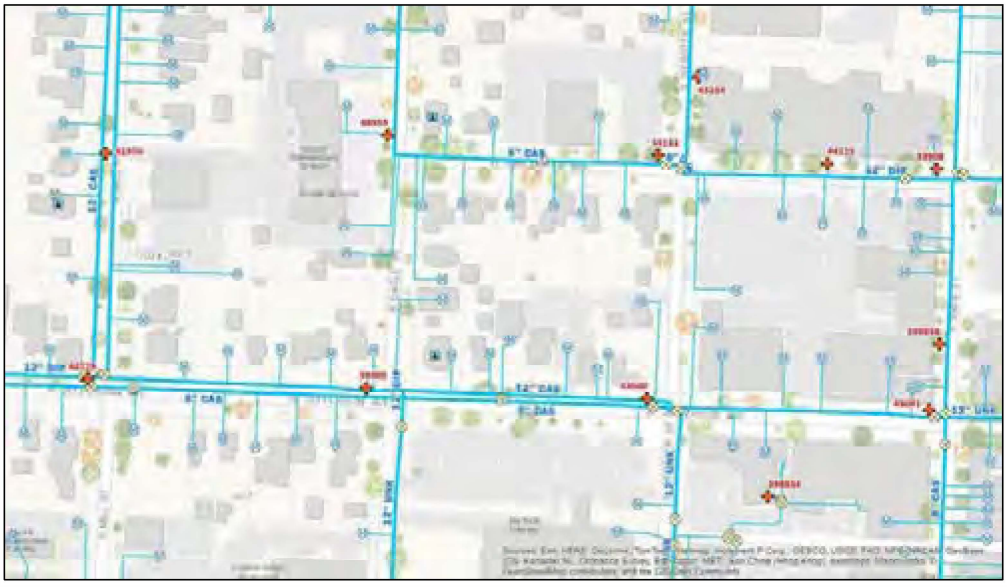


Examples of Maps possible with GIS

Utility Management

- Coordinate, map, & manage, repairs

Ex: Water pipes, electricity infrastructure

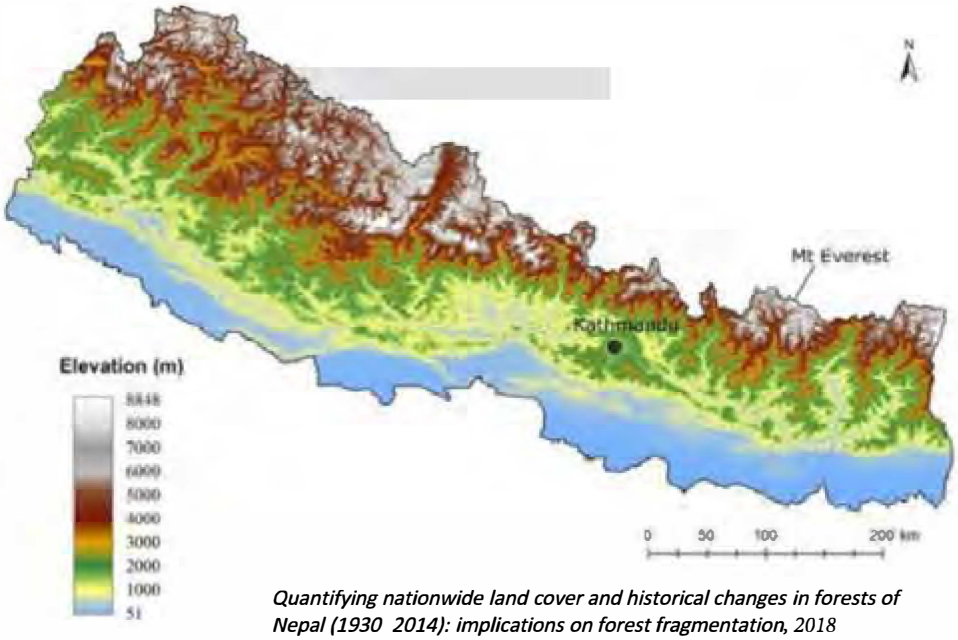


Naperville, Illinois, United States. 2019

Examples of Maps possible with GIS

Elevation Map

- Elevation of Earth features

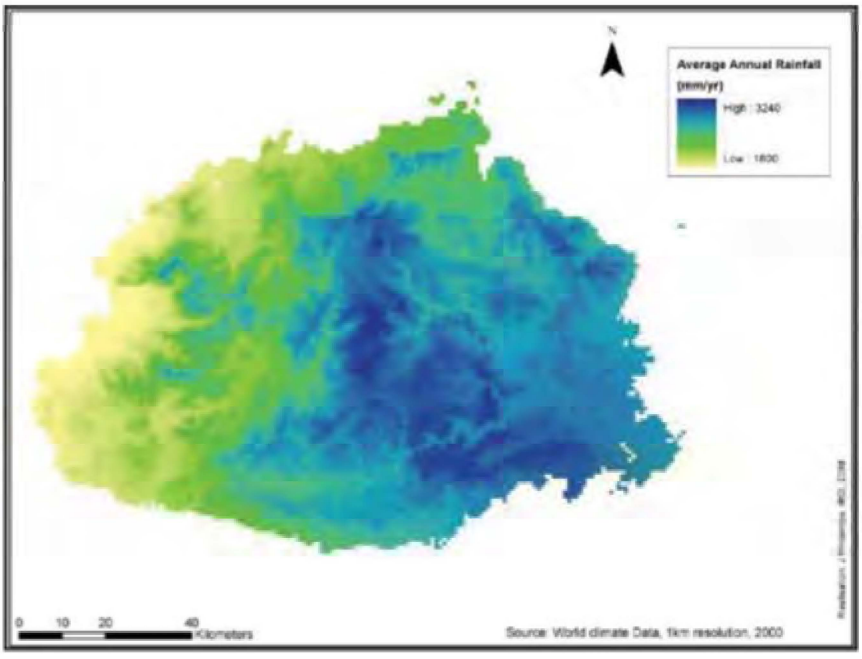


Quantifying nationwide land cover and historical changes in forests of Nepal (1930 2014): implications on forest fragmentation, 2018

Examples of Maps possible with GIS

Precipitation Map

- Amount of rainfall received over an area



World climate data, 2008

Examples of Maps possible with GIS

Rescue Operations

- Planning for Thai cave rescue mission 2018

Planning for Thai cave rescue mission, 2018 *ESRI Thailand*

- Cave interior route & features
- Extent & direction of water flow

Examples of Maps possible with GIS

Figure 2. Classified land use/cover (LUC) map of Surat Thani province in 2007.

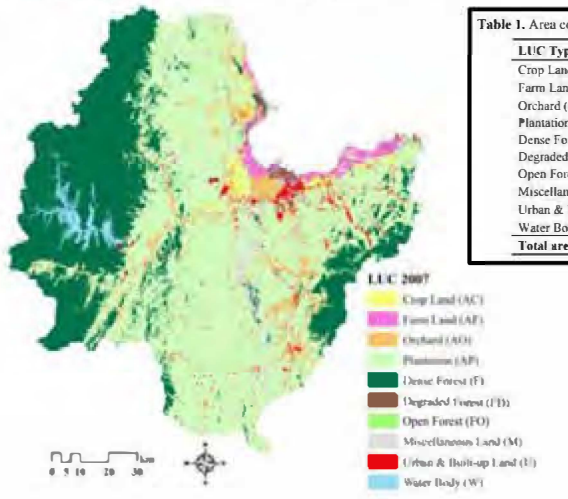


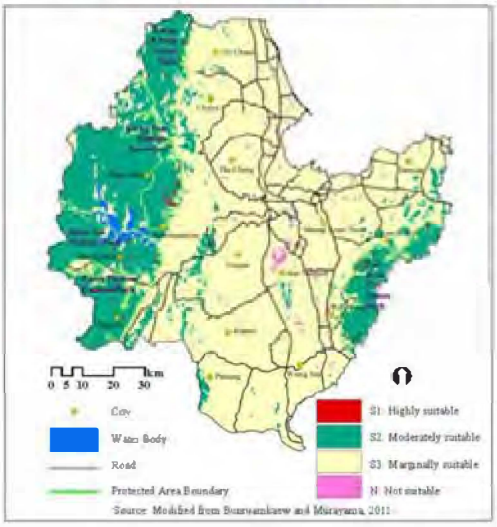
Table 1. Area coverage of land use/cover change (LUCC) classes in 2007.

LUC Type	Area (ha)	Proportion (%)
Crop Land (AC)	24,793.02	1.98
Farm Land (AF)	18,050.94	1.44
Orchard (AO)	43,688.62	3.49
Plantation (AP)	665,634.10	53.21
Dense Forest (F)	381,372.70	30.49
Degraded Forest (FD)	8,893.26	0.71
Open Forest (FO)	825.03	0.07
Miscellaneous Land (M)	45,822.42	3.66
Urban & Built-up Land (U)	33,064.38	2.64
Water Body (W)	28,813.14	2.30
Total area	**1,250,957.61**	**100.00**

Land Use and Natural Resources Planning for Sustainable Ecotourism, 2012

Bunruamkaew & Murayama, GIS in Surat Thani, Thailand

Figure 4. Land suitability map for ecotourism in Surat Thani province [34]

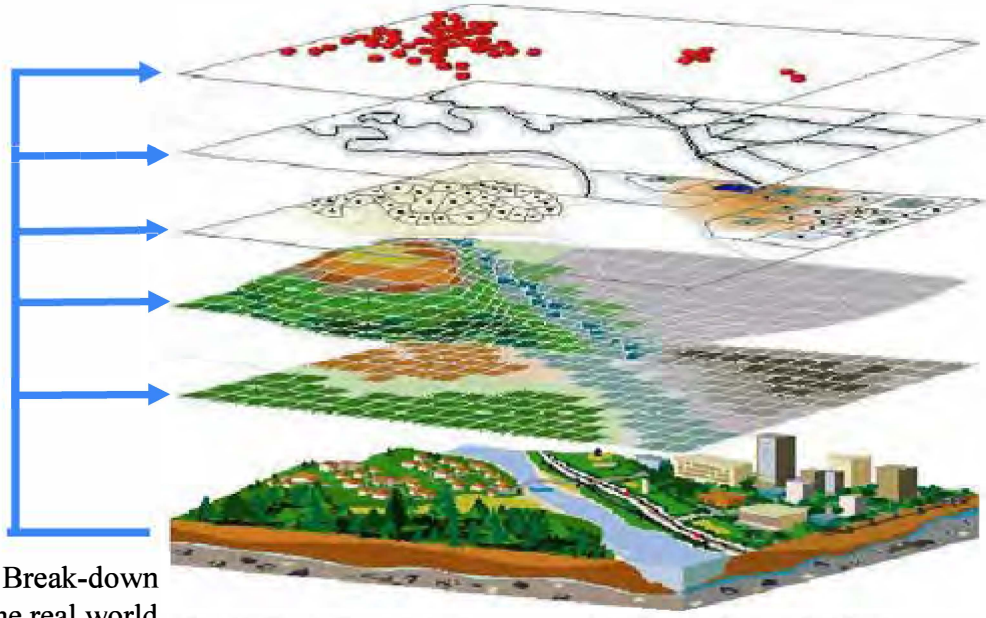


Land Suitability

- Assessment of land cover to determine possible sites for future development

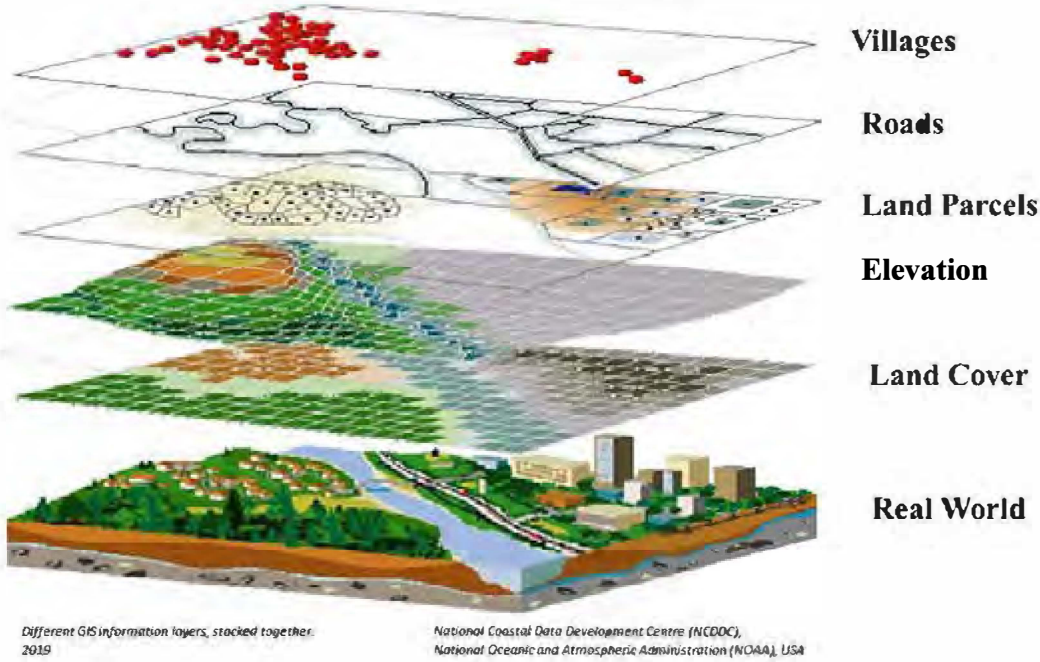
GIS Maps Contain Layers

Interpretation of Real World in GIS



Layers Contain Features or Surfaces

Interpretation of Real World in GIS



Some layers contain features

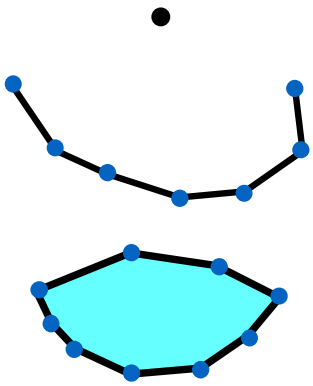
Ex. The roads layer contains many different roads

- Each road is a feature

Features

Features have shape & size

We typically represent features from the real world as three distinct spatial elements in GIS:



Points - simplest element

Lines - set of connected points

Polygons - set of connected lines

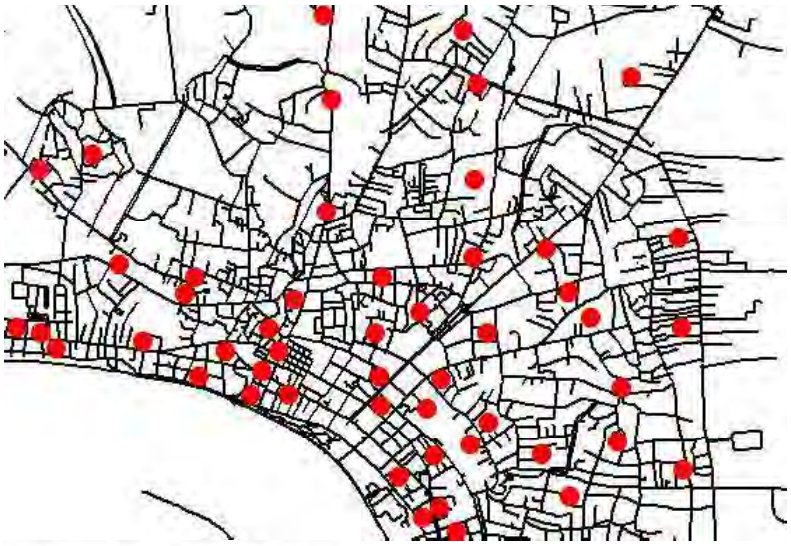
Points, Lines, and Polygons are referred to as vector data

Examples of Features on a Map

Learning GIS Fundamentals

businesses

roads

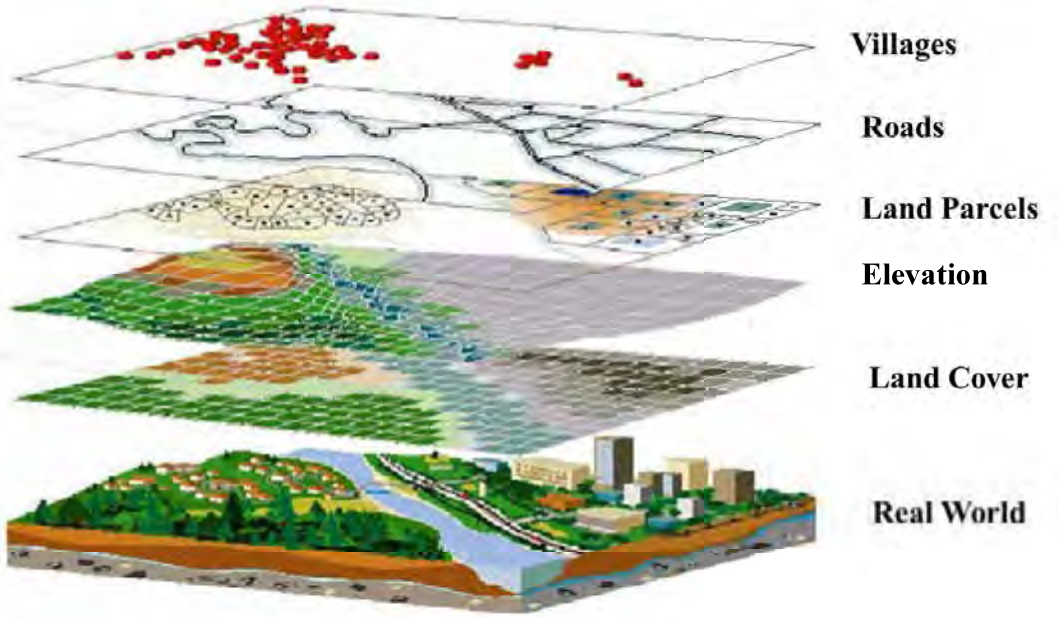


Vientiane capital, Laos map, 2019

Layers Contain Features or Surfaces

Interpretation of Real World in GIS

Some layers are surfaces



Different GIS information layers, stacked together
2019

National Coastal Data Development Centre (NCDDC),
National Oceanic and Atmospheric Administration (NOAA), USA

Ex. Elevation is considered a continuous property that changes from one location to another

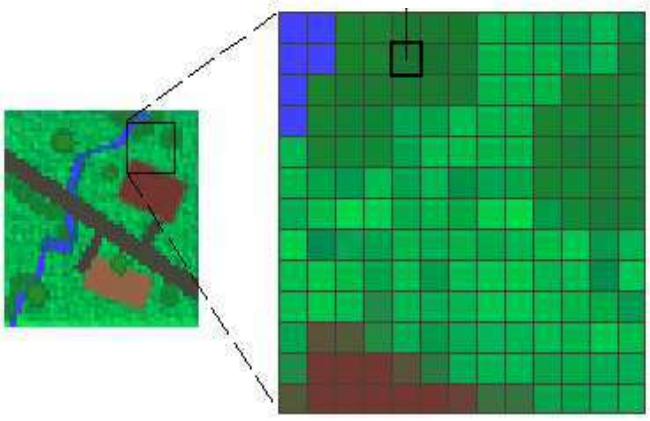
- Each square represents an elevation value

Surfaces

Have numeric data; does not use shapes

The most common surface is a raster.
It is a matrix of identically sized square cells.

Pixel



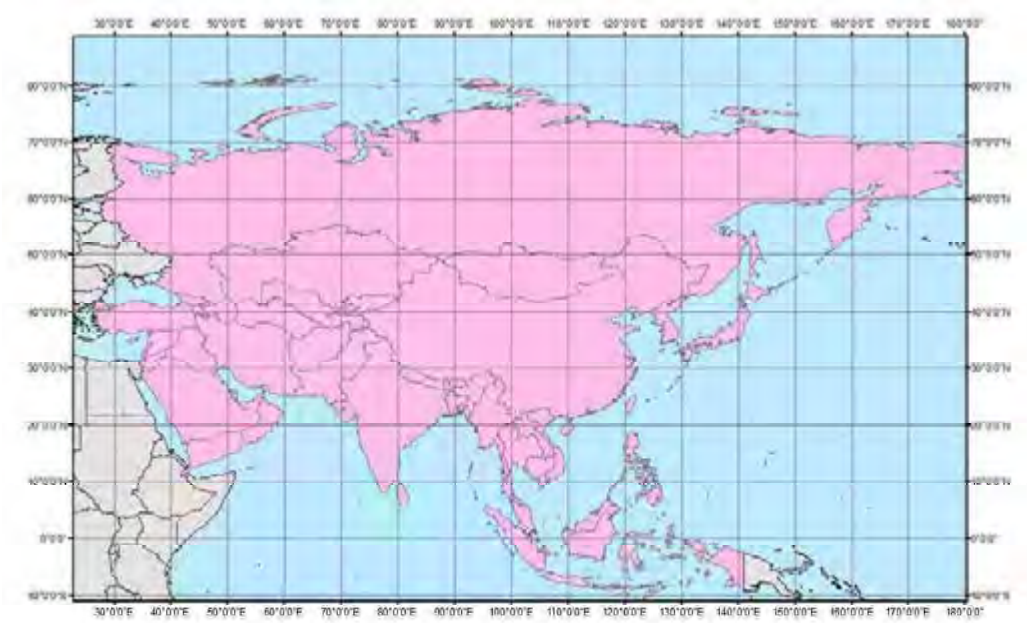
PIXEL (picture element)
The smallest unit in an image.
In raster based GIS systems, attribute information can be assigned to each pixel.

ESRI

Features have Locations

Coordinate Systems

A graticule assists with finding locations on maps



Vientiane
17° 58' **29.4780**'' N
102° 37' 51.1212'' E

Asia map, 2019

Features have additional information

Learning GIS Fundamentals

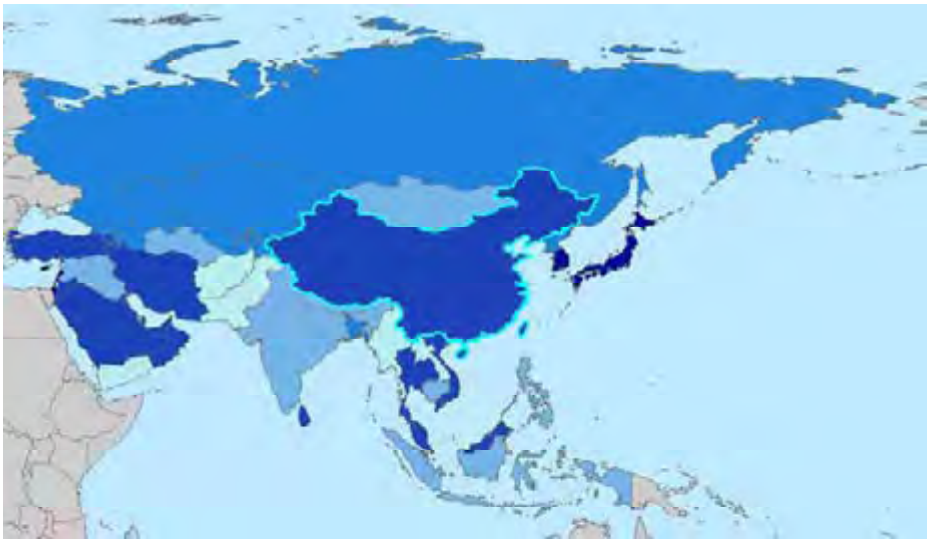
- ✓ Shape
- ✓ Location

Other Information

Table

Life Expectancy

CNTRY_NAME	ISO_3DIGIT	Y2015
Maldives	MDV	77
Oman	OMN	77
Bahrain	BHR	77
China	CHN	76
Vietnam	VNM	76
Iran, Islamic Rep.	IRN	76
Turkey	TUR	75
Malaysia	MYS	75
Thailand	THA	75
Sri Lanka	LKA	75
Kuwait	KWT	75
Armenia	ARM	74

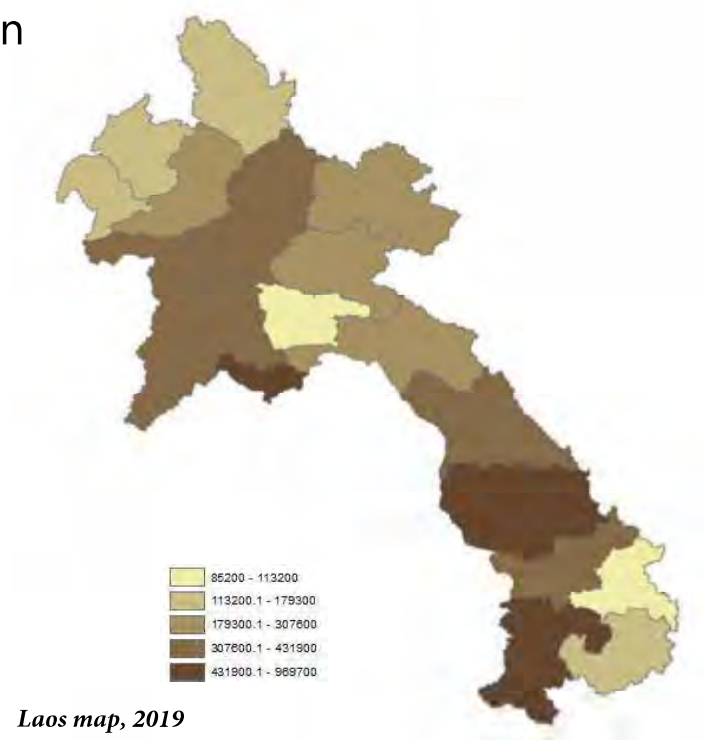


Asia map, 2019

Features have additional information

Learning GIS Fundamentals

Each province corresponds to a color in the legend based on population

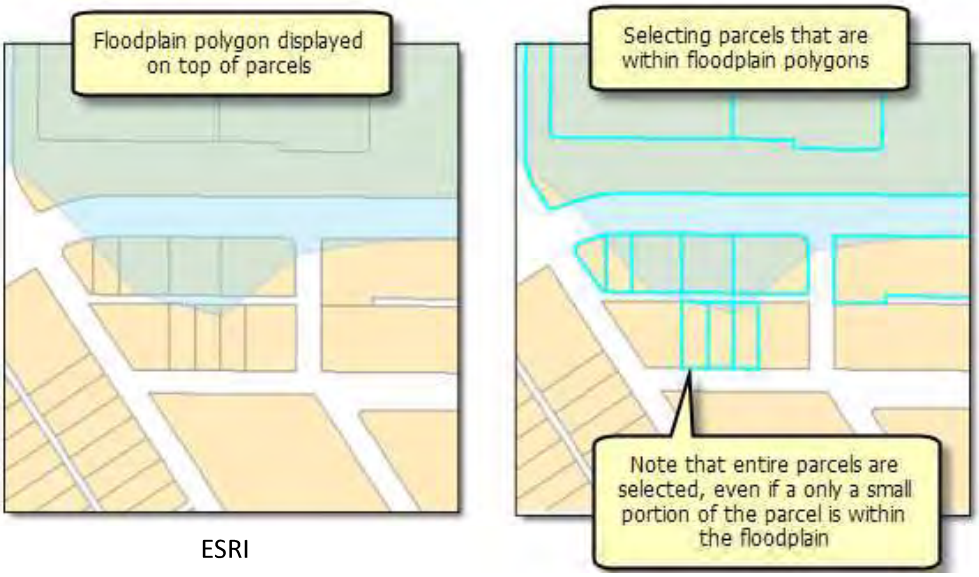


Laos map, 2019

Overlap of features

Finding new insights

- Example of overlay analysis
- One layer is a represents the floodplain
- The other layer contains information about parcels
- Determining which houses lie within floodplain

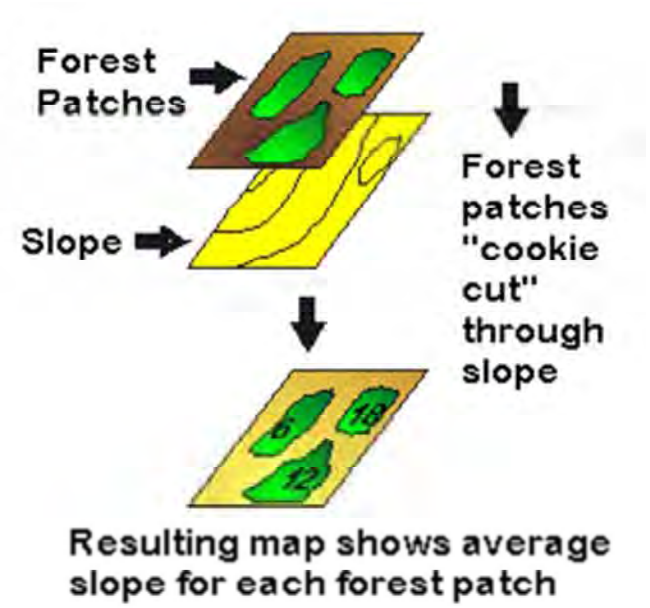


ESRI

Overlap of features

Finding new insights

- Example of Overlap between features
- Determining slope of forest patches
- One layer contains polygons of forest patches
- Another layer represents the slope of the same area
- Overlay functions reveal the slope at each of the forest patches



University of Nebraska, Omaha

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security in Lao PDR

ESRI ArcGIS Environment

A first look into the concepts that comprise a Geographic Information System

Dr. Kavinda Gunasekara

Frank Yrle

Objectives

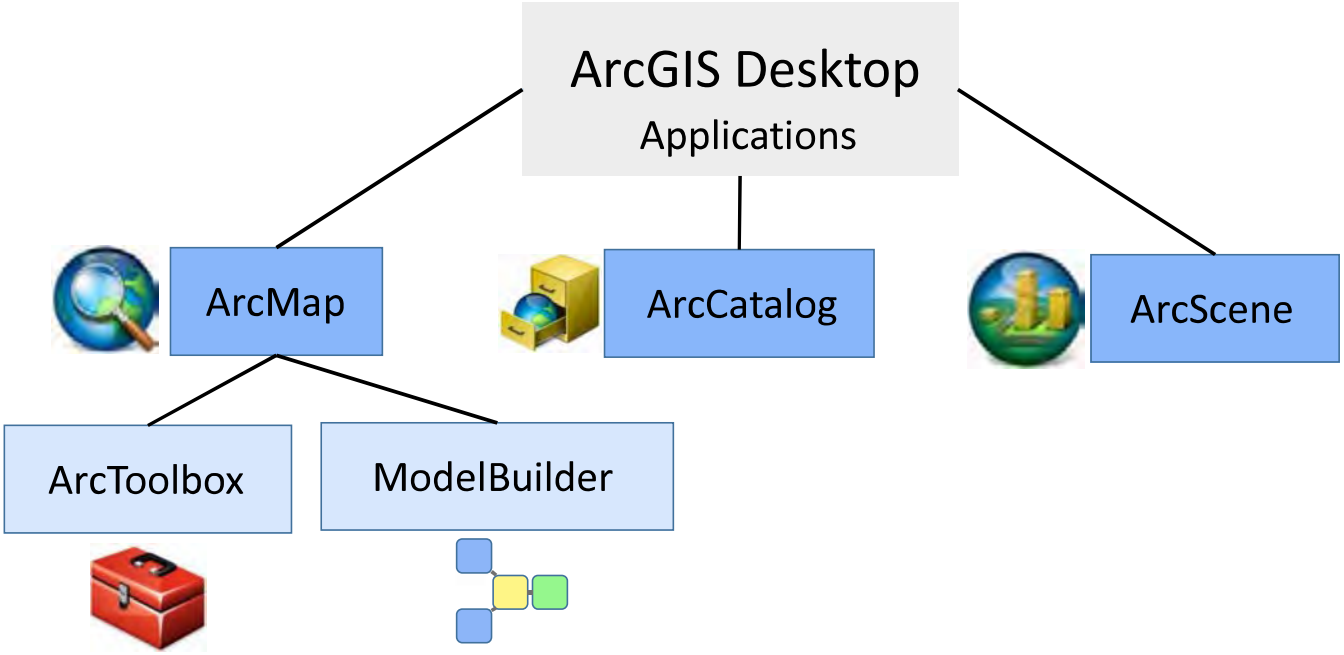
Day 1 Session 2

1. Introduction to the ArcGIS Desktop applications

2. Know the components of the ArcGIS platform

ArcGIS Desktop Environment

Day 1 Session 2



Capabilities of ArcGIS
Definitions

Query

Draw / Edit tools

Spatial Analysis tools

Many spatial file formats

File formats compatible with ArcGIS

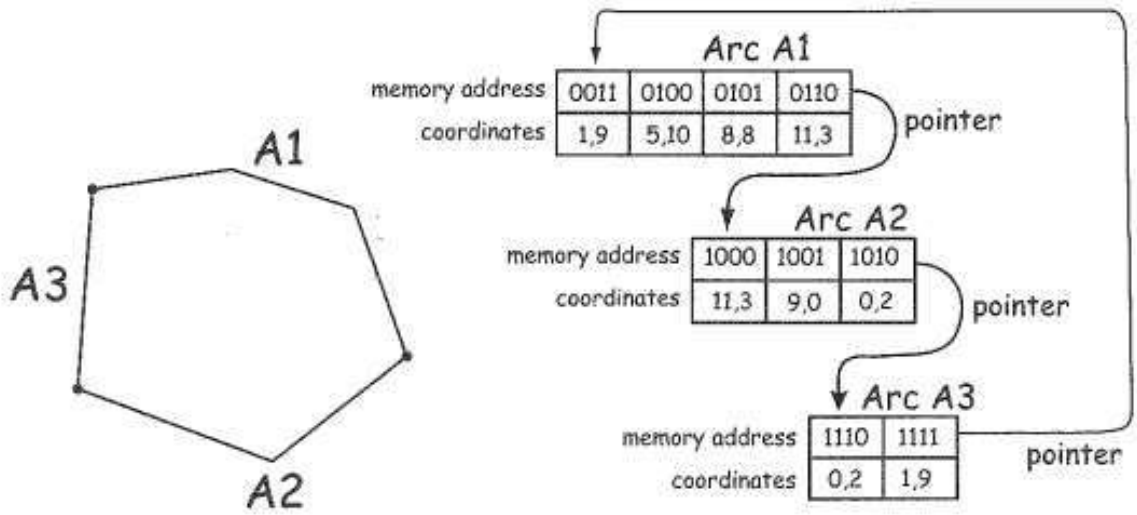
SDC	IGDS
SDE layers	IGES
Shapefiles (.shp)	MIF
Text files (.txt)	MOSS
Excel files (.xls)	SDTS (point, raster, and vector)
TIN	SLF TIGER (through v2002)
VPF	Sun Raster
ADS	ADRG Image (.img)
AGF	ArcSDE raster
DFAD	DTED Level 0, 1, and 2 (.dt*)
DIME	Esri Grid
DLG	Hierarchical Data Format (HDF)
ETAK	LizardTech MrSID and MrSID Gen 3 (.sid)
GIRAS	National Imagery Transmission Format (NITF) (.ntf)
	Tagged image file format (TIFF) (.tif)

Shapefile contents
Many file extensions

File Extension	Description
.shp	The main file that stores the feature geometry; required.
.shx	The index file that stores the index of the feature geometry; required.
.dbf	The dBASE table that stores the attribute information of features; required.
.sbn	The files that store the spatial index of the features.
.sbx	The files that store the spatial index of the features.
.prj	The file that stores the coordinate system information; used by ArcGIS.
.xml	Metadata for ArcGIS—stores information about the shapefile.
.cpg	An optional file that can be used to specify the codepage for identifying the characterset to be used.

Indexing vector files

Process of indexing

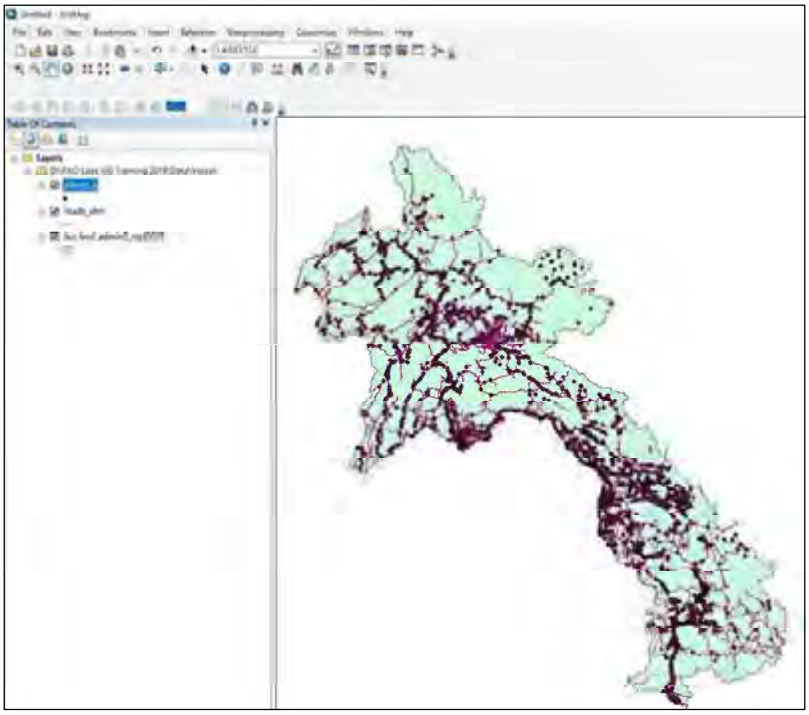


Bolstad 2012
GIS Fundamentals

ArcGIS Desktop

Applications

- ArcMap
- ArcCatalog
- Tools
- ModelBuilder
- ArcScene
- Extensions



Laos map, 2019

ArcGIS Desktop

Applications

- ArcMap
- ArcCatalog
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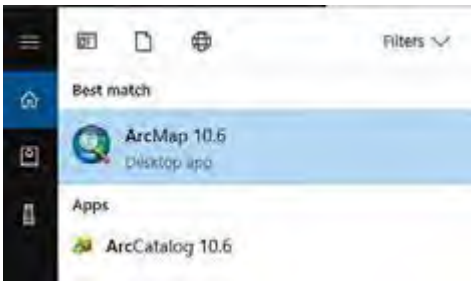
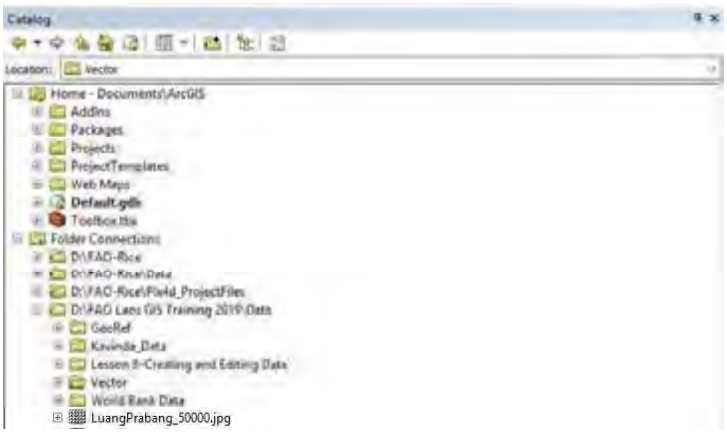
- Extensions





ArcGIS Desktop

Applications

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ArcGIS Desktop
Applications

- ArcMap
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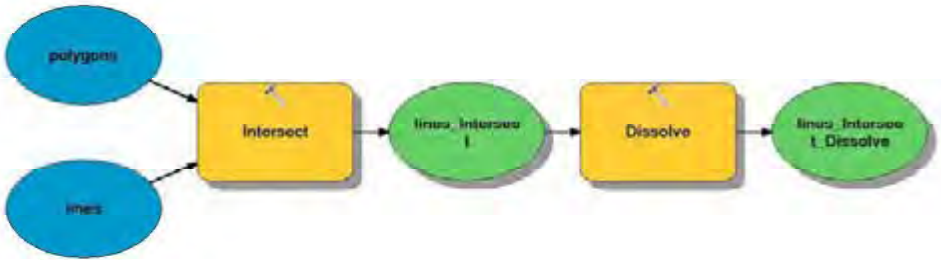
- Tools
- ModelBuilder
- ArcScene
- Extensions



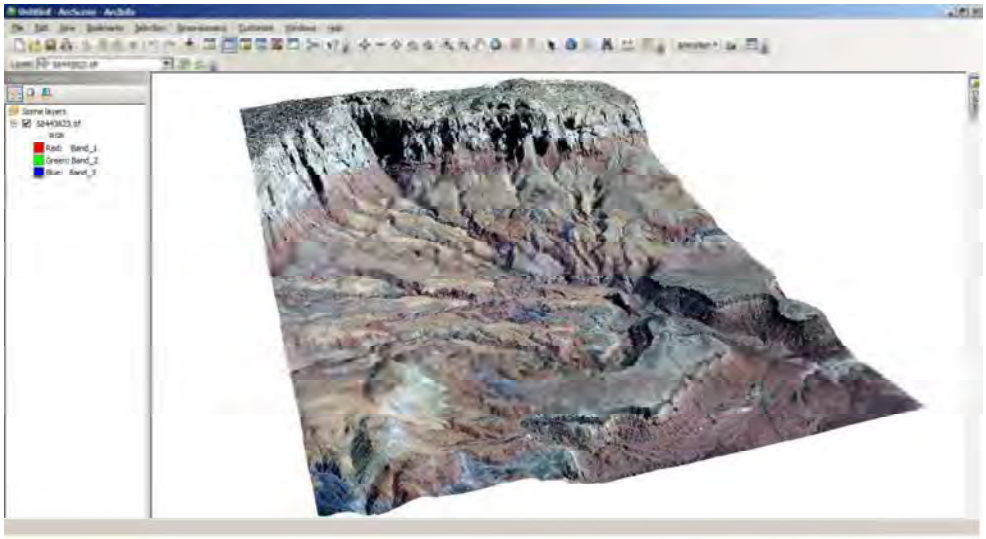
Streamline geoprocessing tasks

Make your own tools

ArcGIS Desktop
Applications

- ArcMap
- ArcCatalog
- Tools
- ModelBuilder
- ArcScene
- Extensions

3D Visualization



ArcGIS Desktop
Applications

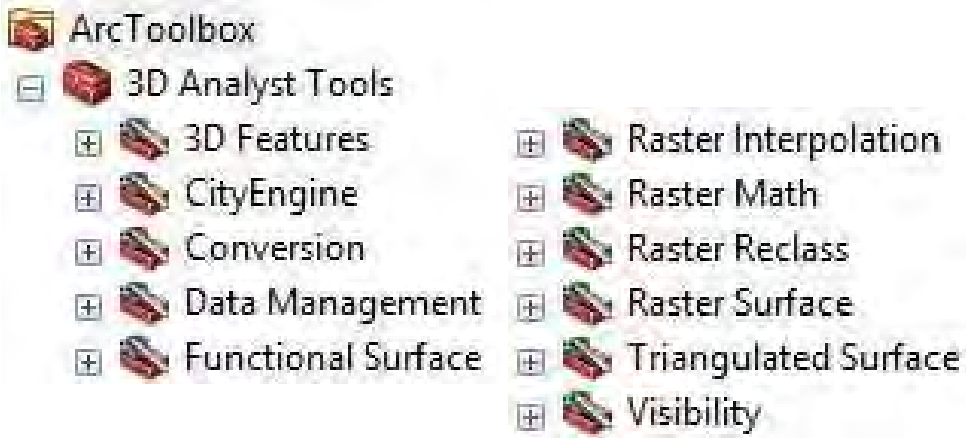
- ArcMap
- ArcCatalog
- Tools
- ModelBuilder
- ArcScene
- Extensions

Spatial Analyst

ArcGIS Desktop
Applications

- ArcMap
- ArcCatalog
- Tools
- ModelBuilder
- ArcScene
- Extensions

3D Analyst



ArcGIS Desktop

Applications

- ArcMap
- ArcCatalog
- Tools
- ModelBuilder
- ArcScene
- Extensions

Network Analyst

Getting to Know the ArcMap Interface

A first look into the concepts that comprise a Geographic Information System

Dr. Kavinda Gunasekara

Frank Yrle

Overview
Getting to know the ArcMap Interface

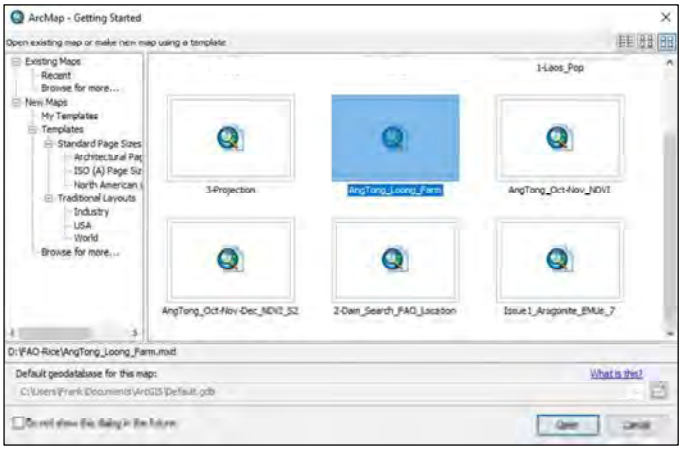
1. Becoming acquainted with ArcMap structure
2. Visualizing Data
3. Basic Tools for Maps
4. Additional tools

Overview
Coordinate Systems & Projections

1. Examining coordinate systems
2. Projecting Data
3. Defining a map projection
4. Georeferencing a raster

Opening ArcMap
Getting Started

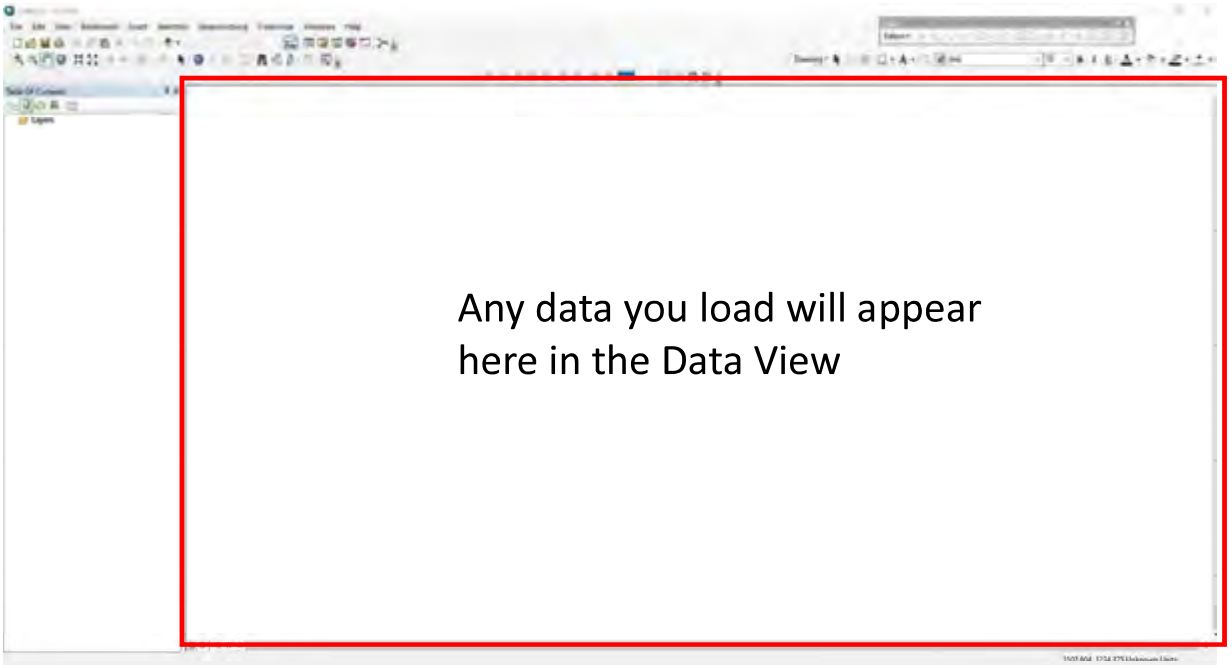
When you first open Arcmap you will be greeted by the Getting Started window. This is handy for loading a recent project that you were previously working on.



For now, click Cancel to start on a new project.

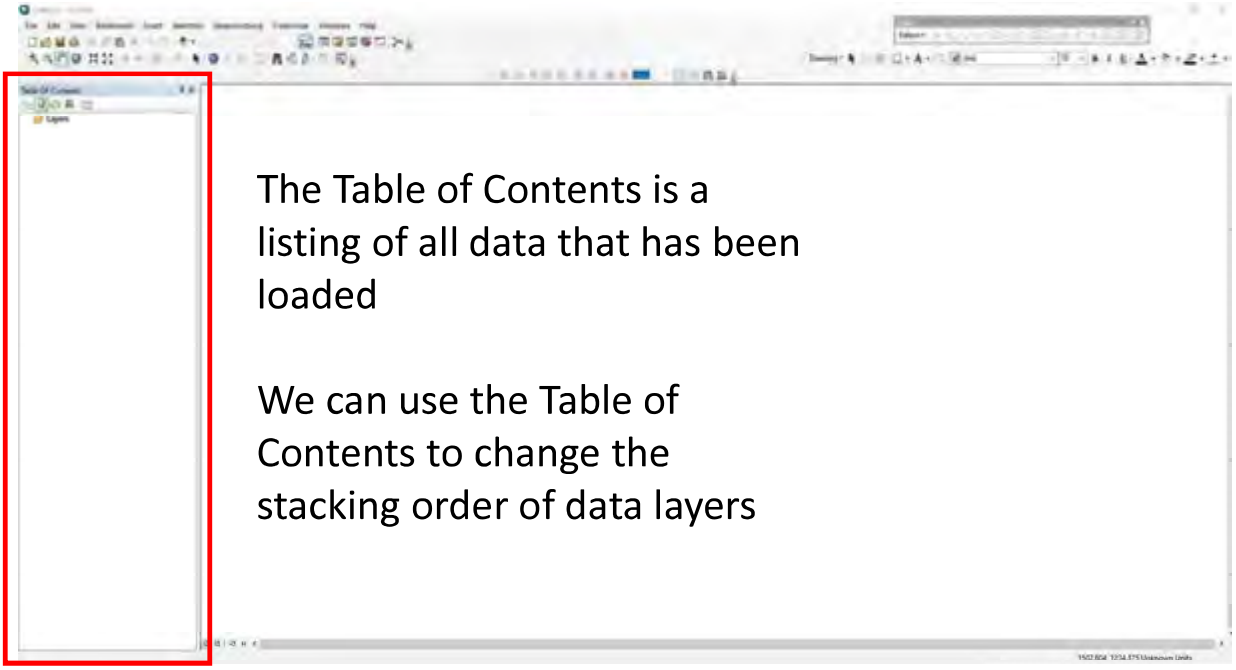
Opening ArcMap
Exploring Features Available

After clicking cancel you will be taken to the ArcMap Data View



Opening ArcMap
Exploring Features Available

After clicking cancel you will be taken to the ArcMap Data View

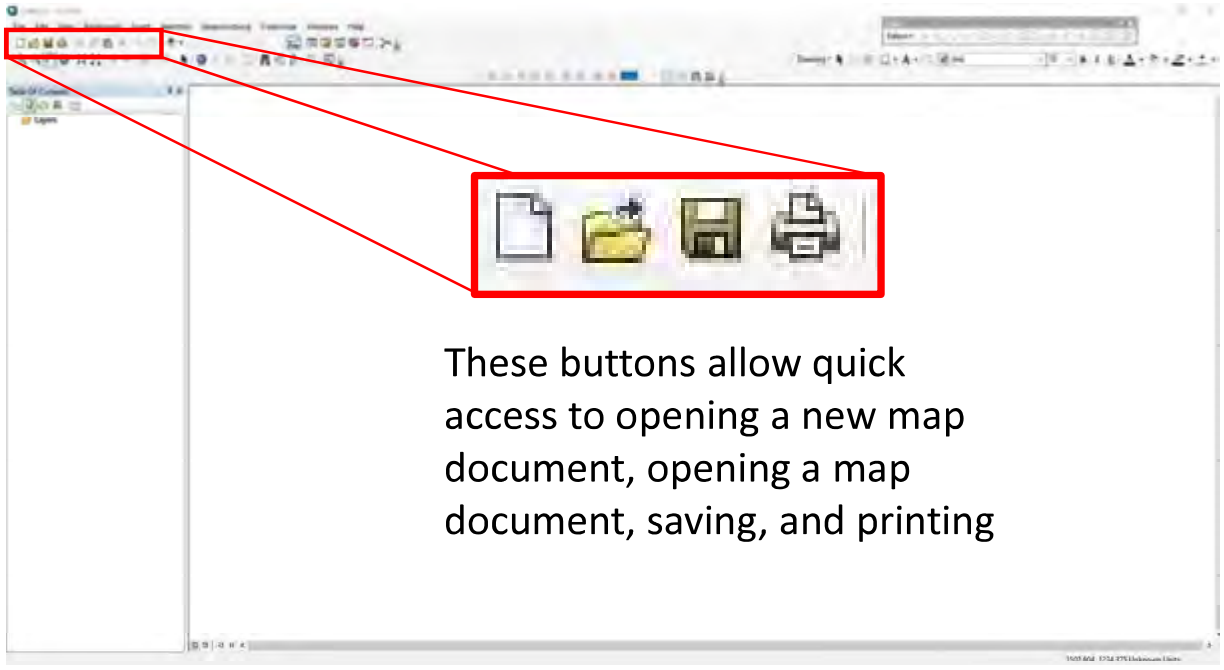


The Table of Contents is a listing of all data that has been loaded

We can use the Table of Contents to change the stacking order of data layers

Opening ArcMap
Exploring Features Available

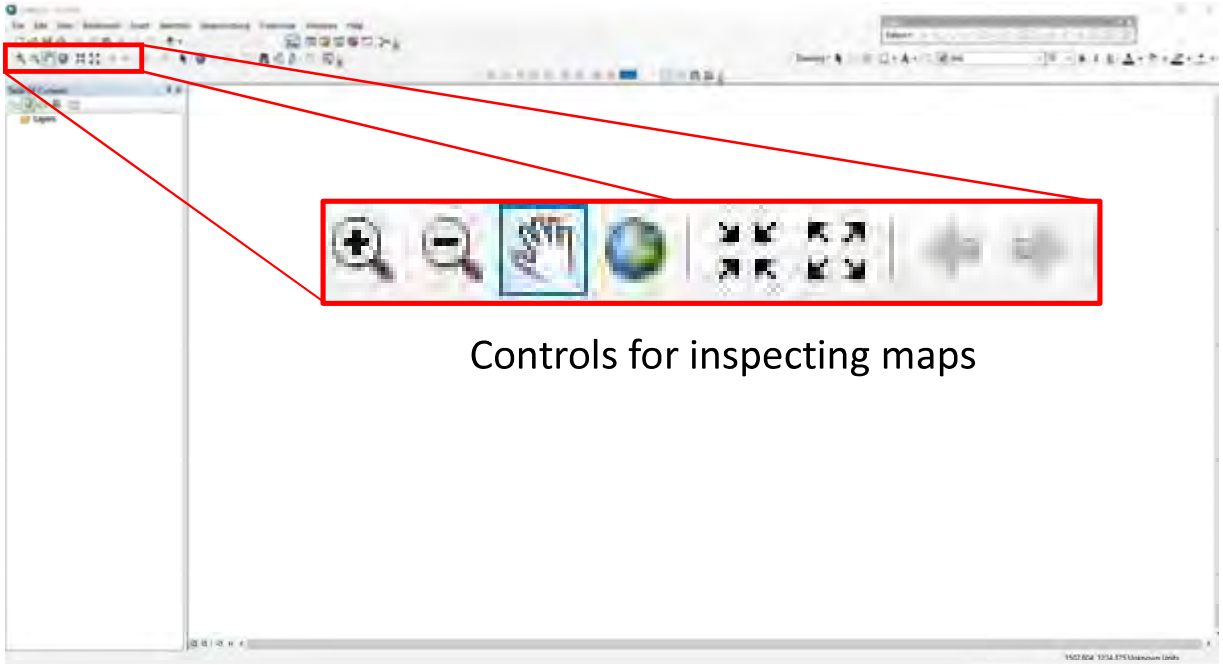
After clicking cancel you will be taken to the ArcMap Data View



These buttons allow quick access to opening a new map document, opening a map document, saving, and printing

Opening ArcMap
Exploring Features Available

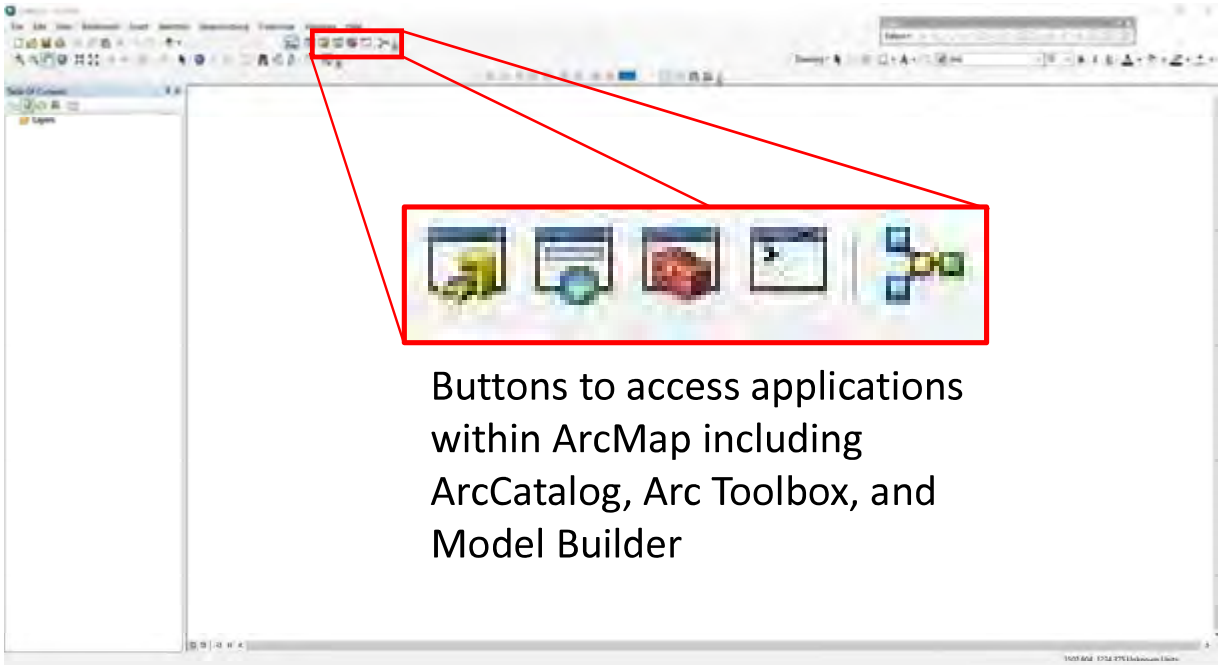
After clicking cancel you will be taken to the ArcMap Data View



Controls for inspecting maps

Opening ArcMap
Exploring Features Available

After clicking cancel you will be taken to the ArcMap Data View

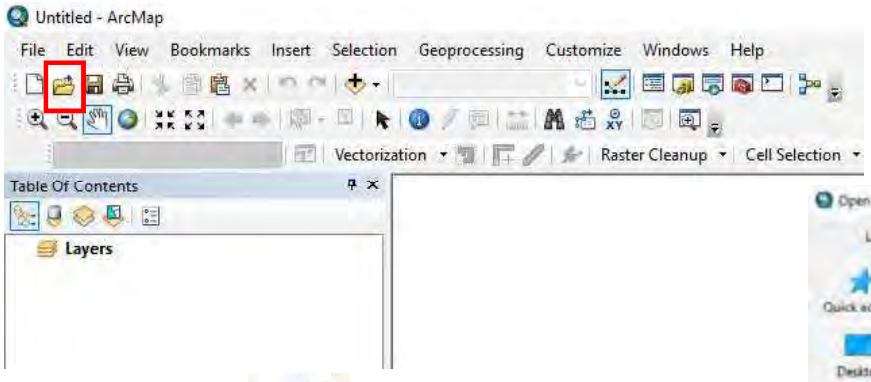


Buttons to access applications within ArcMap including ArcCatalog, Arc Toolbox, and Model Builder

Opening a Map Document

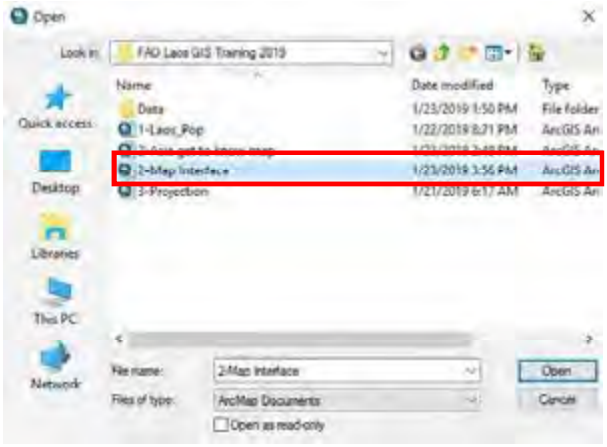
Exploring Features Available

.mxd is the file extension for ArcMap files



1. Press the  button to open an existing map document

2. Open the file:
2-Map Interface.mxd

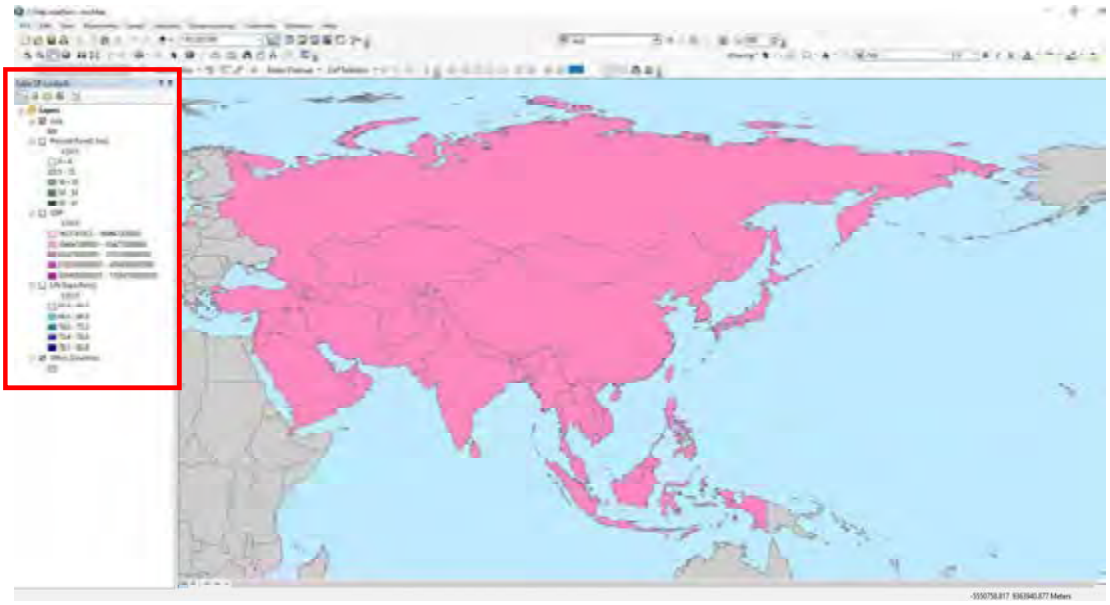


Overview

Exploring Features Available

The Table of Contents shows 5 files in the map document

- Asia
- Percent Forest Area
- GDP
- Life Expectancy
- Other Countries



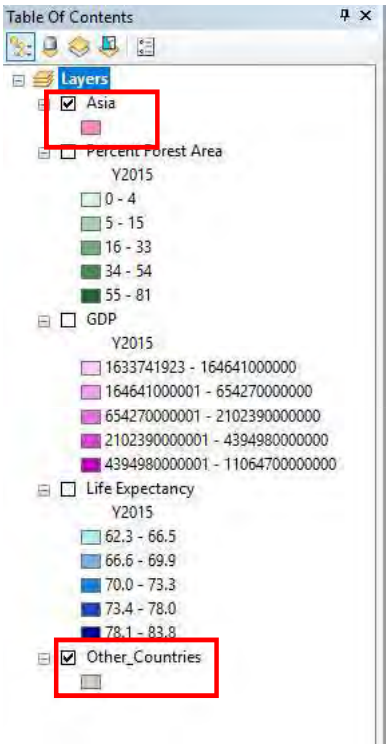
Asia map, 2019

Country statistics data from The World Bank

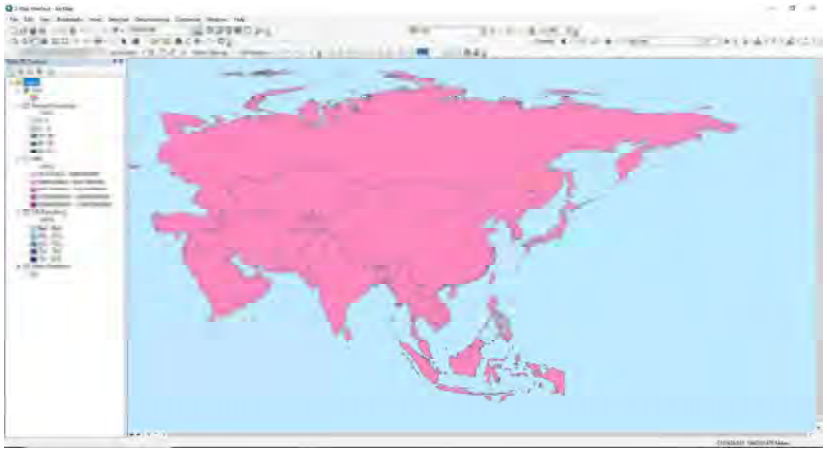
Overview
Exploring Features Available

Asia map, 2019

A closer look at the Table of Contents shows us that the Asia and Other Countries layers are active



Layers can be turned on & off
Check / Uncheck



Asia map, 2019

3. Uncheck the Other Countries box in the Table of Contents

4. Try the same with the Asia Layer

5. When you're finished turn both layers back on

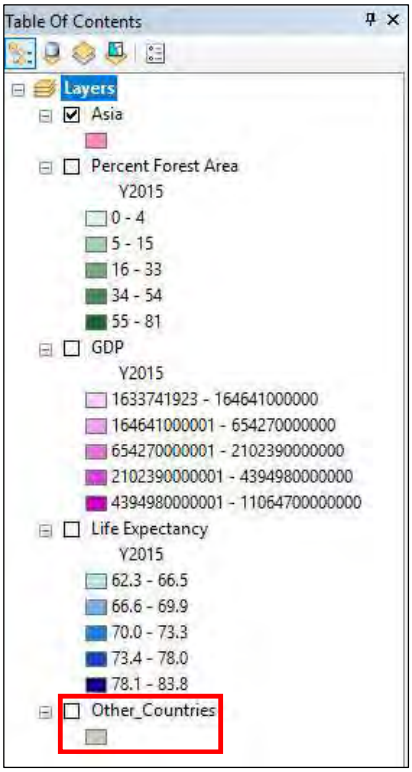


Table of Contents
Listing Methods

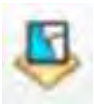
The Blue outline indicates that method is selected

There are 4 options for listing data in the Table of contents

List by Drawing Order

List by Source

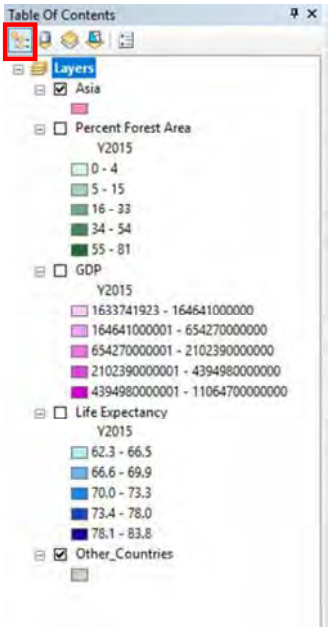
List by Visibility



List by Selection

Table of Contents
Listing Methods

The Blue outline indicates that method is selected



List by Drawing Order

Drag & drop to change drawing order

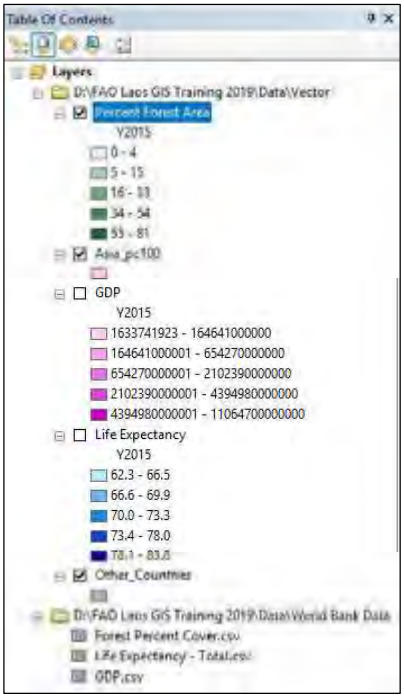
6. Try on your own: Make the Percent Forest Area layer active and drag & drop it above the Asia layer

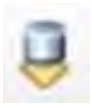
Asia map, 2019

Asia map, 2019

Table of Contents
Listing Methods

The Blue outline indicates that method is selected





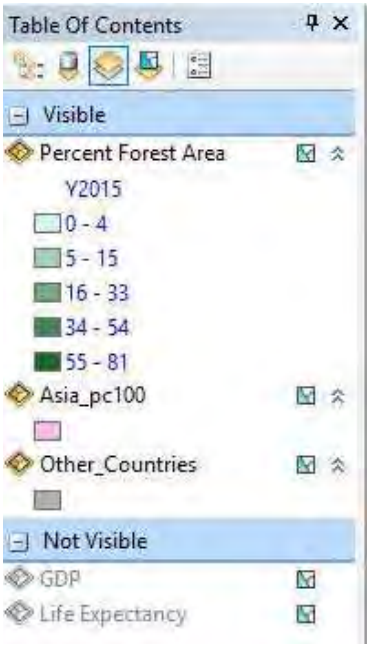
List by Source

Layers are listed by the geodatabase or folder containing the data source they reference

Also lists folders associated with the data

Table of Contents
Listing Methods

The Blue outline indicates that method is selected



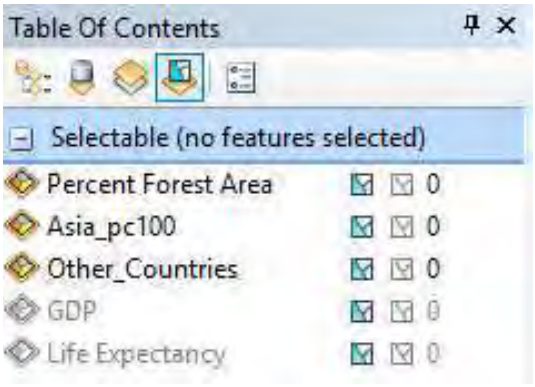
List by Visibility

Layers are listed by whether they are turned on or off

We have not turned on GDO or Life Expectancy layers, so they are listed at the bottom as Not Visible

Table of Contents
Listing Methods

The outline indicates that method is selected



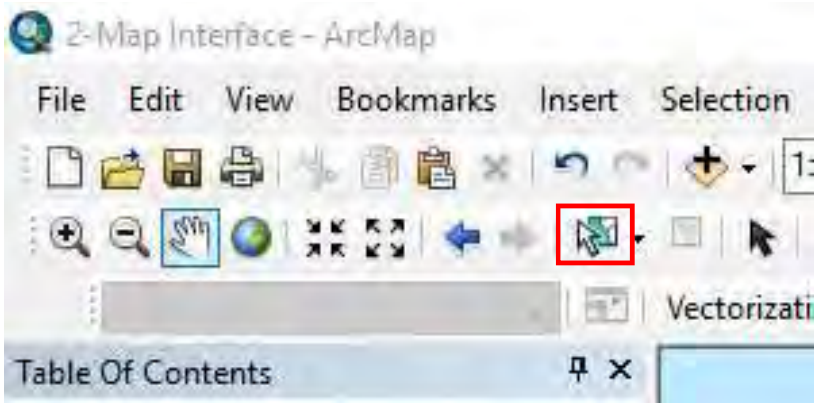
List by Selection

Layers are listed by whether they are selected by the interactive editing and selection tools

No layers are selected as indicated by the menu (no features selected)

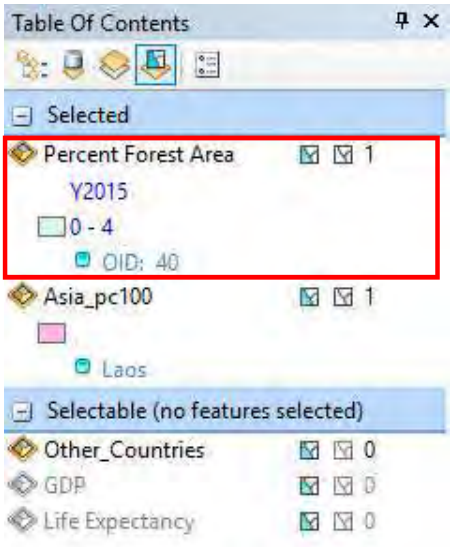
Table of Contents
Listing Methods

The Select Features tool lets us select points, line, and polygons present in the Data View



Click the Select Features tool, then select Laos in the Data View. Laos will be outlined in blue once it's selected

Table of Contents
Listing Methods



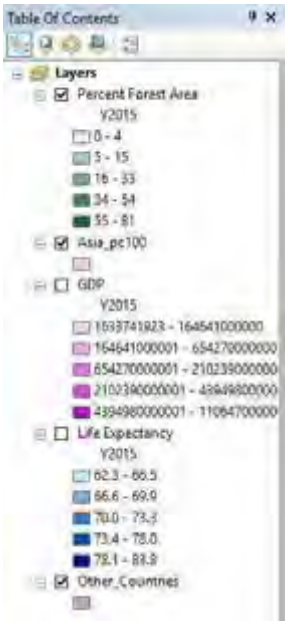
Laos now appears in the selected menu

Laos map, 2019

Asia layer was also activated, so Laos is selected there too

Deselect Laos by clicking the grey square for both layers

Change Name of a Layer
Modify Layer



Return to List by Drawing Order

Let's change the name of the Asia layer. Currently the name is Asia_pc100
Change the name to Asian Countries

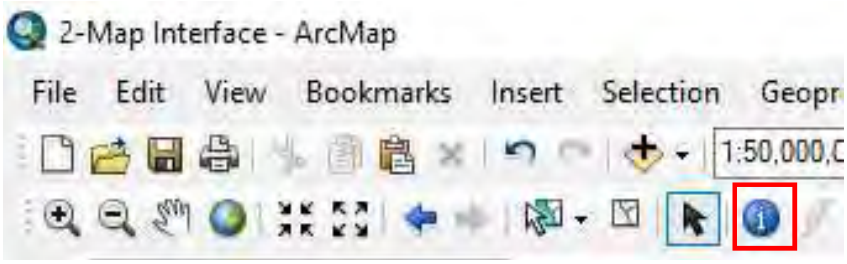
Click Asia_pc100 2x in the Table of Contents
The name will be highlighted in dark blue. You can then type the new name

1-click

2-clicks

Finished

Identify Tool
Gain insight to map layers



The Identify Tool will help us discover information about features without having to open the attribute table

On your own:
Use the Identify Tool to find the 2015 percent forest cover for Laos, Indonesia, Kazakhstan, and Tajikistan

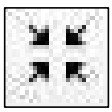
Tools for Exploring the Map
Gain insight to map layers

Zoom In

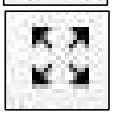
Zoom Out

Press 1x to zoom in a little

Click & Drag to form a zoom box



Fixed zoom in



Fixed zoom out

Incremental zoom in / zoom out

Zoom faster with mouse wheel

Previous Extent

Return to previous view prior to last zoom or movement

Tools for Exploring the Map

Gain insight to map layers

Pan

Click and hold the left mouse button to move across the map

- Can also be achieved by clicking & holding mouse wheel

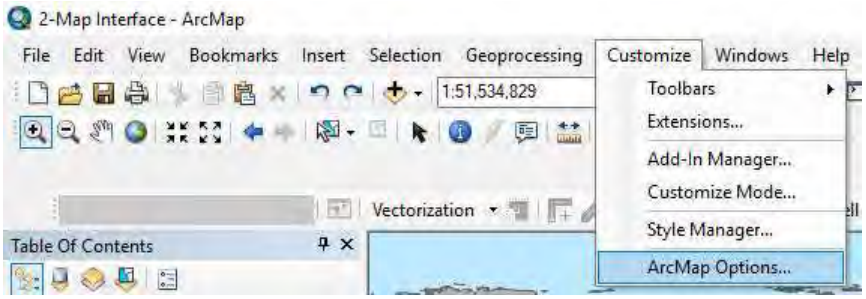
Full Extent

Returns to whole view of the map area after zooming / panning

On your own: Practicing zooming and panning with these tools. When you're finished return to the full extent of the map

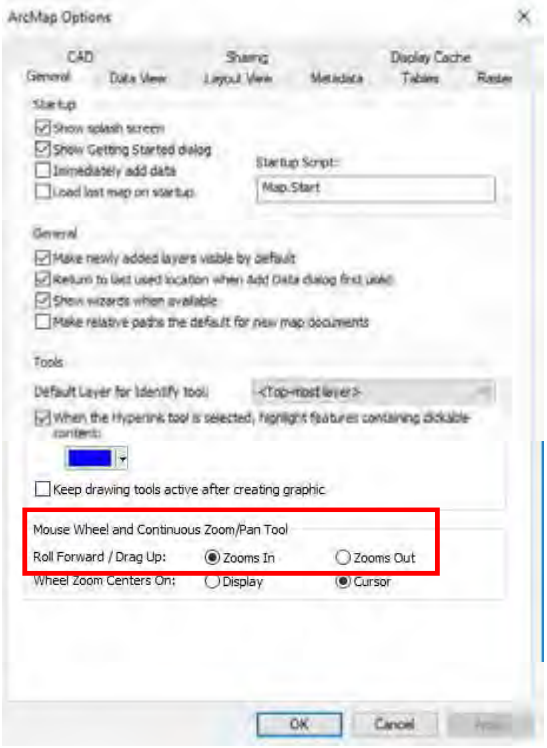
Customizing the wheel zoom

Gain insight to map layers



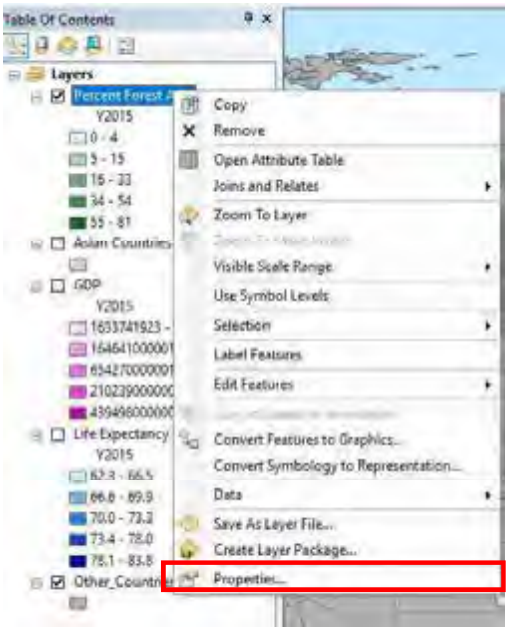
Zooming with the mouse wheel is quick & convenient. However, zooming like that might feel backwards.

To change roll / zoom direction:
Roll Forward
Select Zoom In



Map Tips

Gain insight to map layers

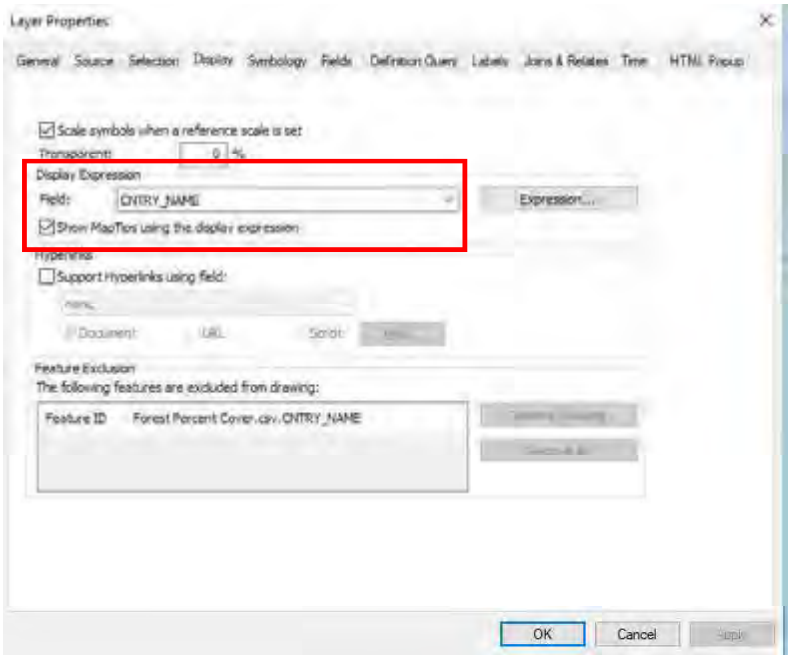


Map Tips – Tool that lets you hover the mouse over a feature to learn about data of your choice.

Access the Properties of Percent Forest Area: Right click the Percent Forest Area Layer and select Properties (or you can double-click the layer name)

Map Tips

Gain insight to map layers



Map Tips – Tool that lets you hover the mouse over a feature to learn about data of your choice.

Check the box to turn Map Tips on for this layer

You can also select the field that will appear for the map tip. Choose CNTRY_NAME

Map Tips

Gain insight to map layers

Map Tips – Tool that lets you hover the mouse over a feature to learn about data of your choice.

Laos map, 2019

The Map Tip shows us the country name because we selected CNTRY_NAME for the Map Tip field

Create a Bookmark

Gain insight to map layers

Bookmarks help us keep track of a place / map extent that we want to go back to.

Laos map, 2019

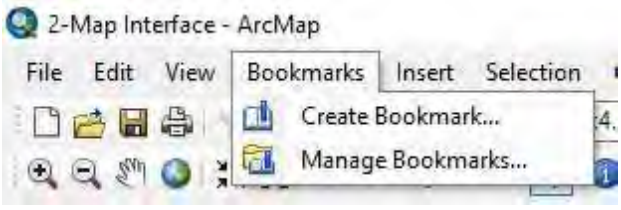
Make a Bookmark for Laos.
Zoom to Laos
Click the Bookmarks tab at the top of the screen
Click Make a Bookmark
Name your bookmark: Laos

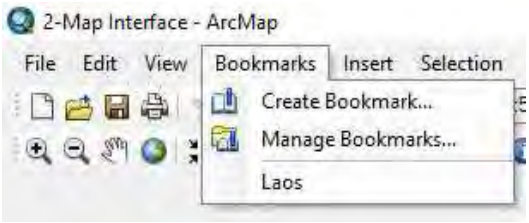
Create a Bookmark

Gain insight to map layers

Bookmarks help us keep track of a place / map extent that we want to go back to.

Laos map, 2019

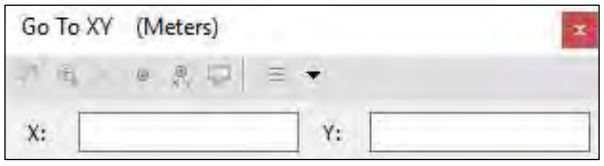


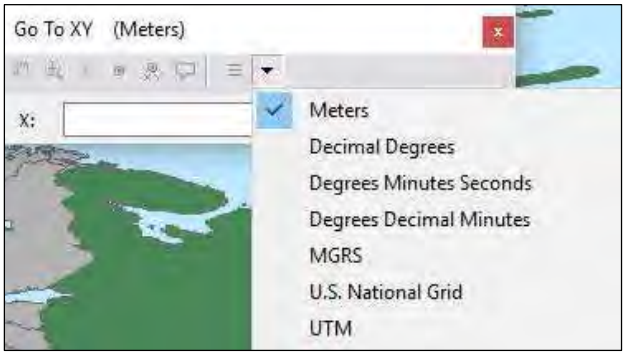


Go to XY

Pinpoint locations with coordinates

Use the Go to XY tool to mark locations on your map – provided that you know the coordinates





Choice of units

Go to XY

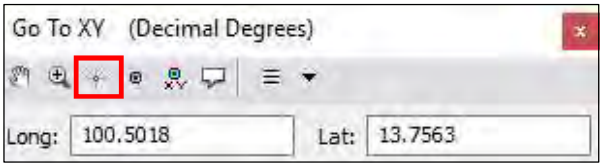
Pinpoint locations with coordinates

Choose Decimal Degrees for units
Enter these coordinates into the Go to XY tool

	LAT	LONG
Bangkok	13.7563°	100.5018°
Vientiane	17.9757°	102.6331°

First try Bangkok

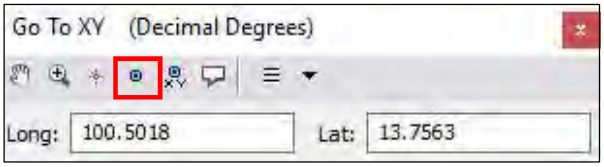
Use Flash to determine if the coordinates are correct



Go to XY

Pinpoint locations with coordinates

If the coordinates are correct, click Add Point on the Go to XY tool



Thailand map, 2019

Next try Vientiane

	LAT	LONG
Bangkok	13.7563°	100.5018°
Vientiane	17.9757°	102.6331°

Measure Distance

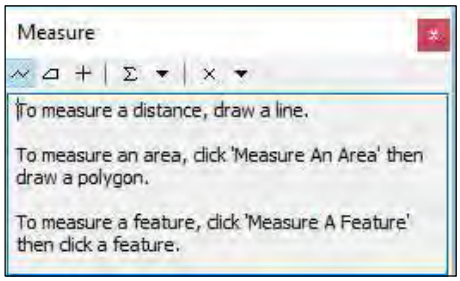
Pinpoint locations with coordinates

Thailand map, 2019

Now that we have two cities marked on the map, let's determine how far apart they are. We will need the Measure Tool

Measure Distance

Pinpoint locations with coordinates

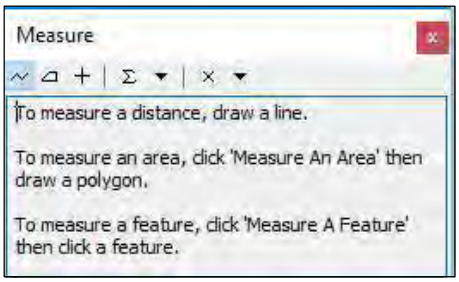


We found Planar Distance to be approximately 526 km

Try Geodetic distance and see if there is a difference.

Measure Distance

Pinpoint locations with coordinates



On your own: Use the measure tool to find the planar distance and the geodesic distance between Vientiane and Istanbul, Turkey

Vector & Raster Analysis Part 1

Basic useful tools in vector & rater operations

(data use in this exercise is only for demonstration purpose only)

Dr. Kavinda Gunasekara

Frank Yrle

Learning topics

Overview o the exercise

1. Layer symbolizing and use predefined legend
2. Dissolve tool and options
3. Clip tool and various ways to utilize the tool
4. Importing GPS data and crating GIS layer
5. Proximity tool and options
6. Several combination of overlay operations to achieve the specific objectives
7. Field calculator
8. Intersect and union overlay operations
9. Merge and append tools

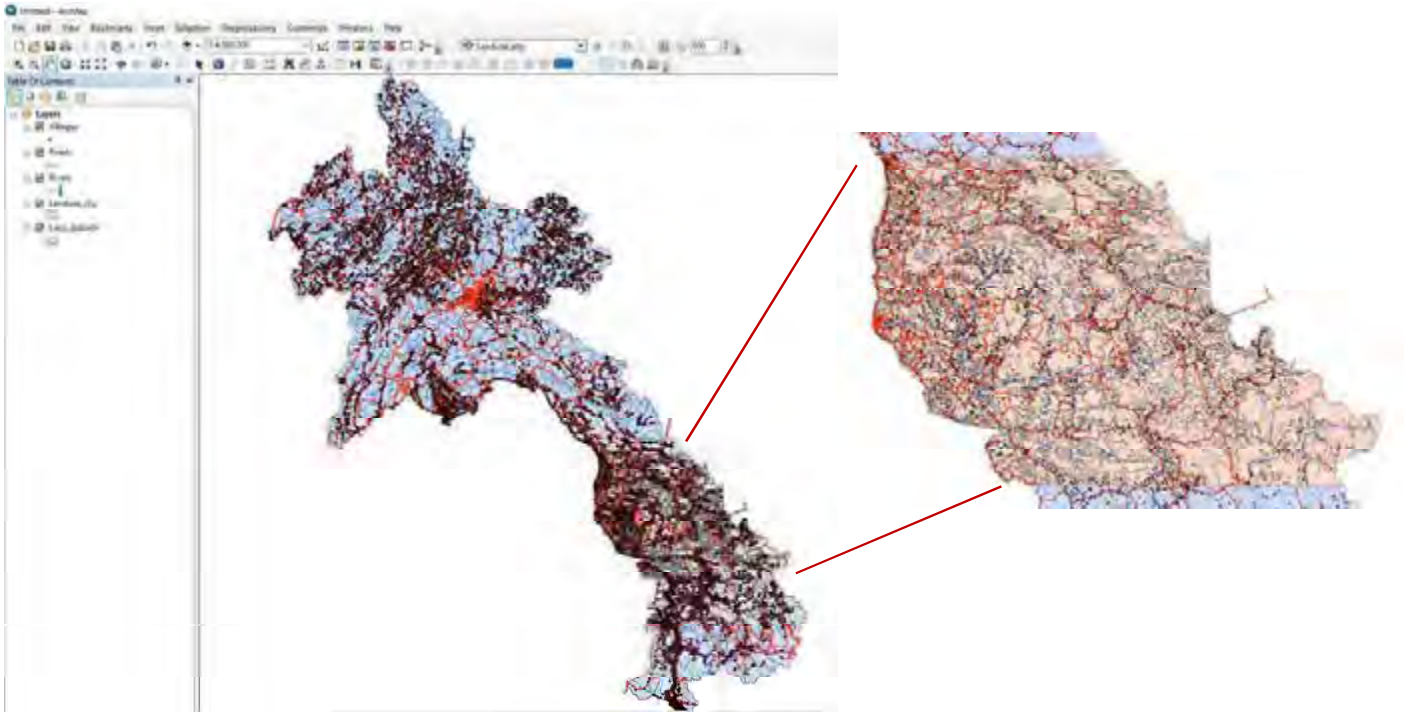
I. Explore the data

Overview of data

1. Shape files
    1. Administrative boundaries
    2. Road
    3. River
    4. Village
    5. Landuse_clip
    6. .layer file: landuse legend
2. Table data
    1. Coordinates of Agro-meto stations
    2. Other attributes of Agro-meto stations

I. Explore the data

Overview of data

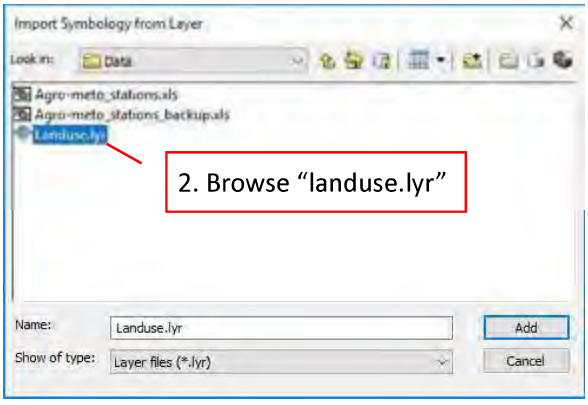


Laos map, 2019

Symbolize Layers

Assign colors based on data categories

1. Check the categories of data and assign appropriate symbols/colors
2. How to assigned predefined legend/colors based on .layer file?



Symbolize Layers

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1. Check the categories of data and assign appropriate symbols/colors
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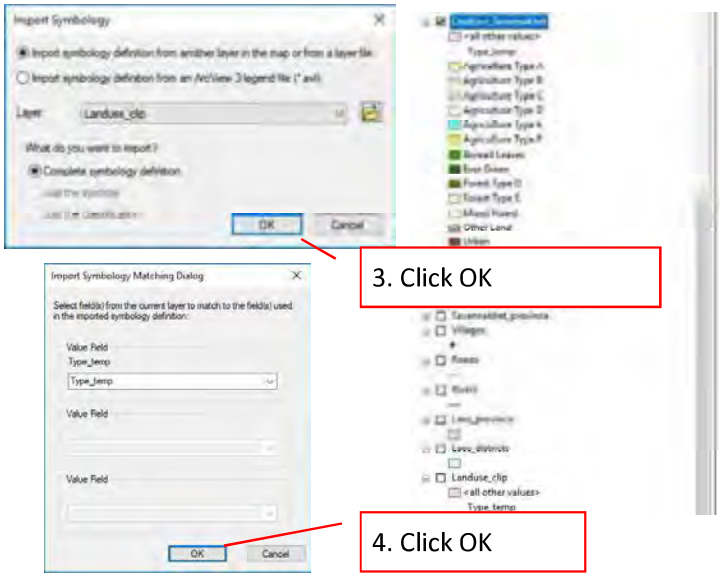
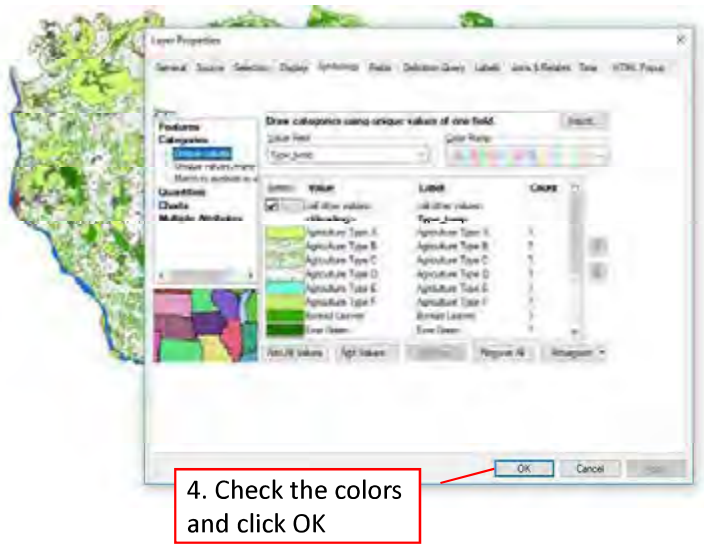
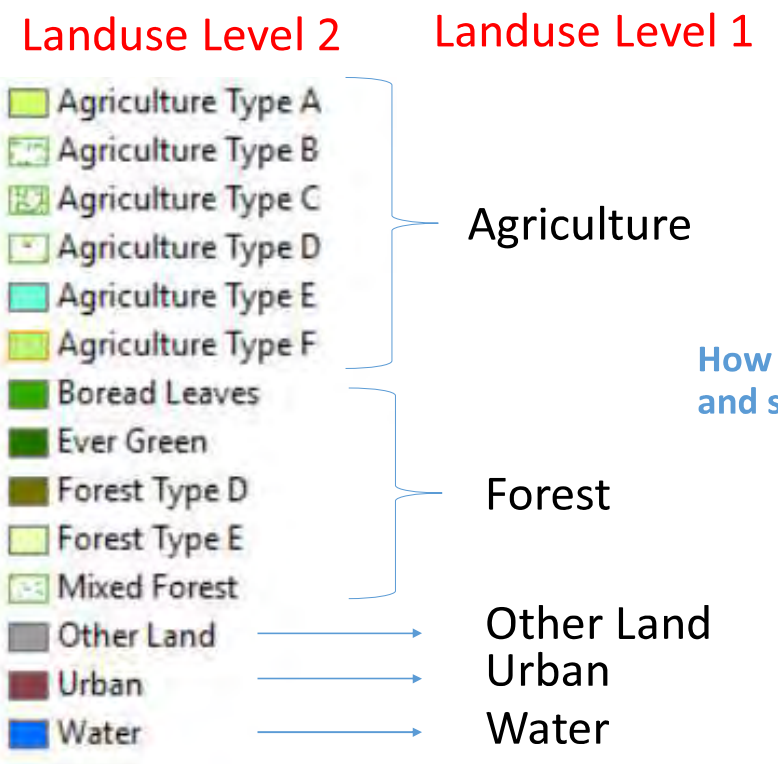




How to make Level 1 Landuse level and symbolize

- Make level one field landuse



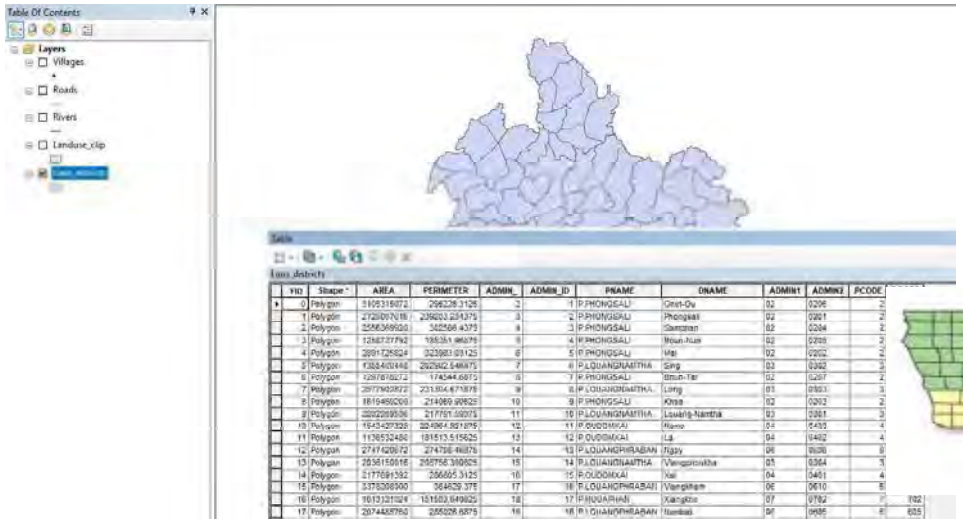
How to make Level 1 Landuse level and symbolize

[Field Name] = “Category Name” {operator} [Field Name] = “Category Name”

Create Province Layer

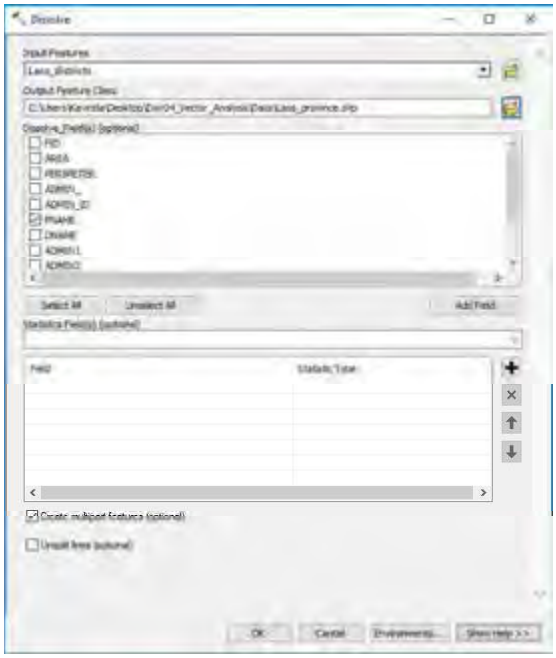
Use Dissolve tool

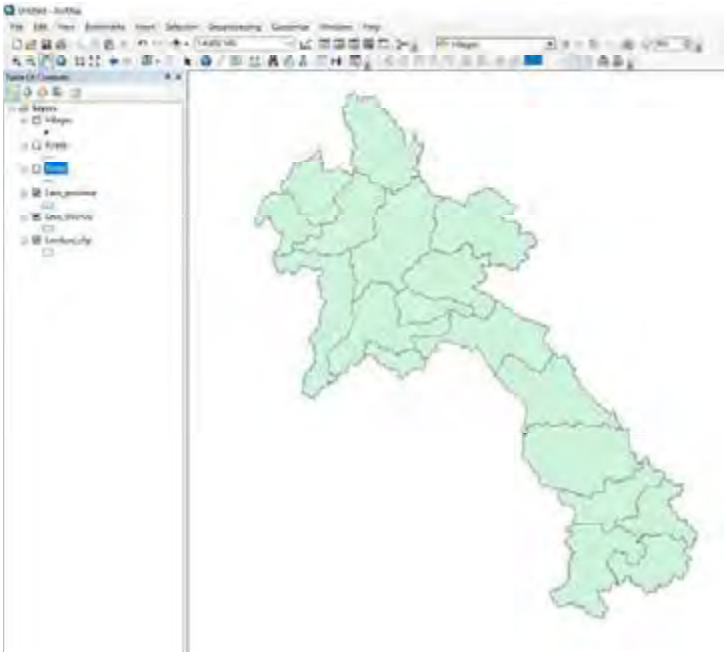
1. Open ArcTool Box
2. Data management Tools ➔ Generalization ➔ Dissolve



Create Province Layer

Use Dissolve tool



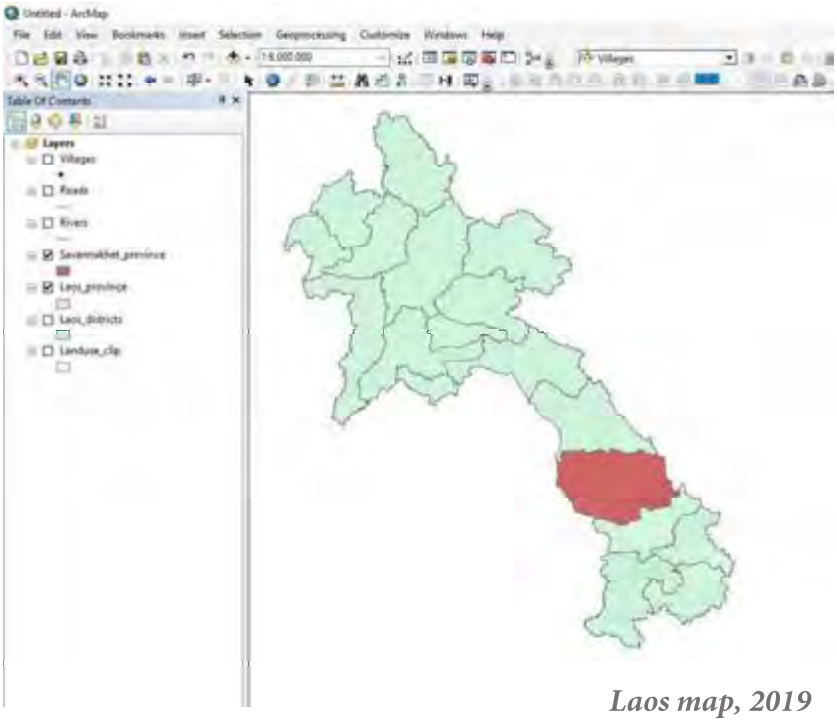


Laos map, 2019

Create Savannakhet Province Layer

Export data into separate later

1. Select Savannakhet province
2. [R] click and Data ➔ Export Data

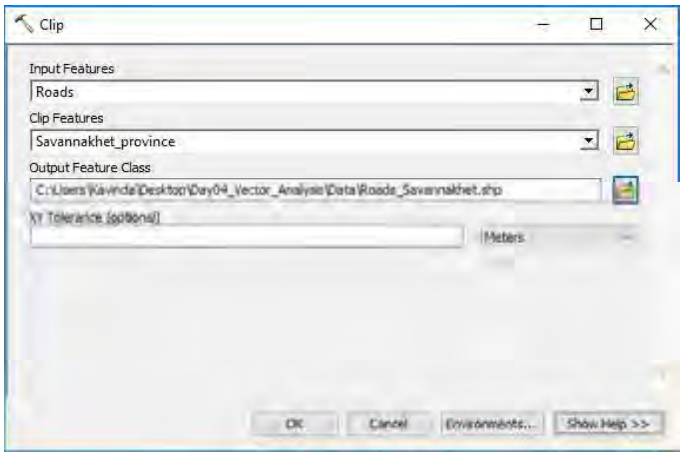


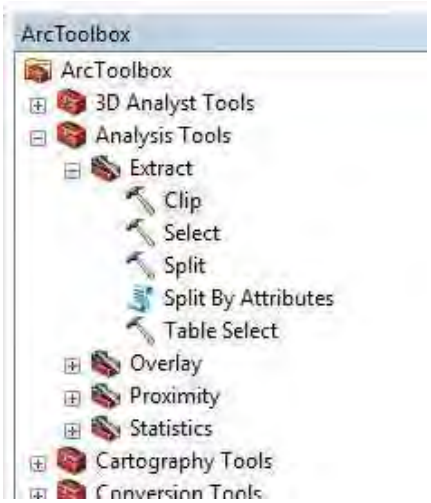
Laos map, 2019

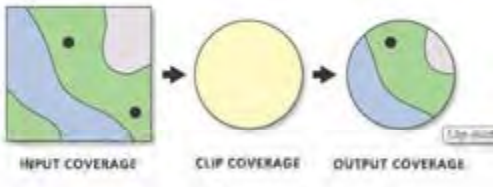
Data preparation for Savannakhet Province

Use Clip Tool

1. Analysis Tools ➔ Extract ➔ Clip
2. Clip all the layers by Savannakhet province layer



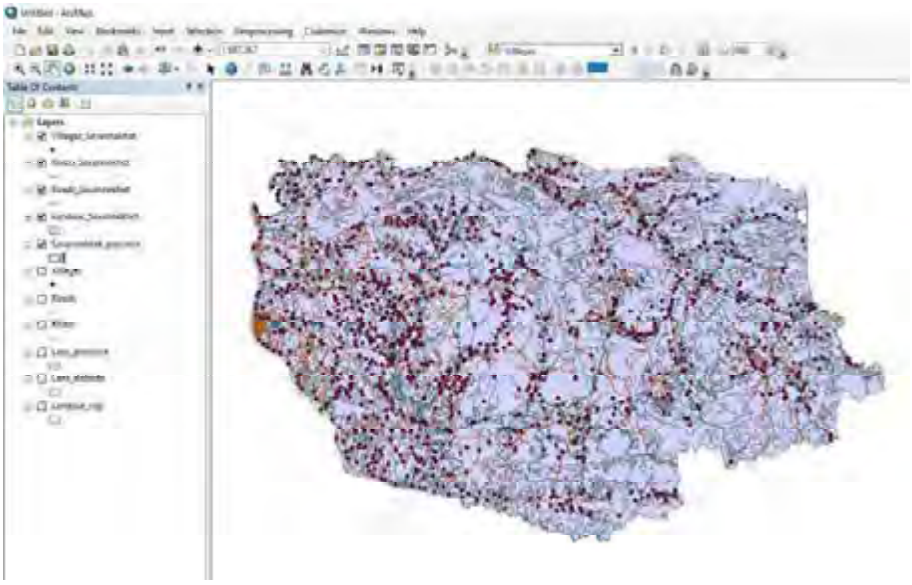




Data preparation for Savannakhet Province

Use Clip Tool

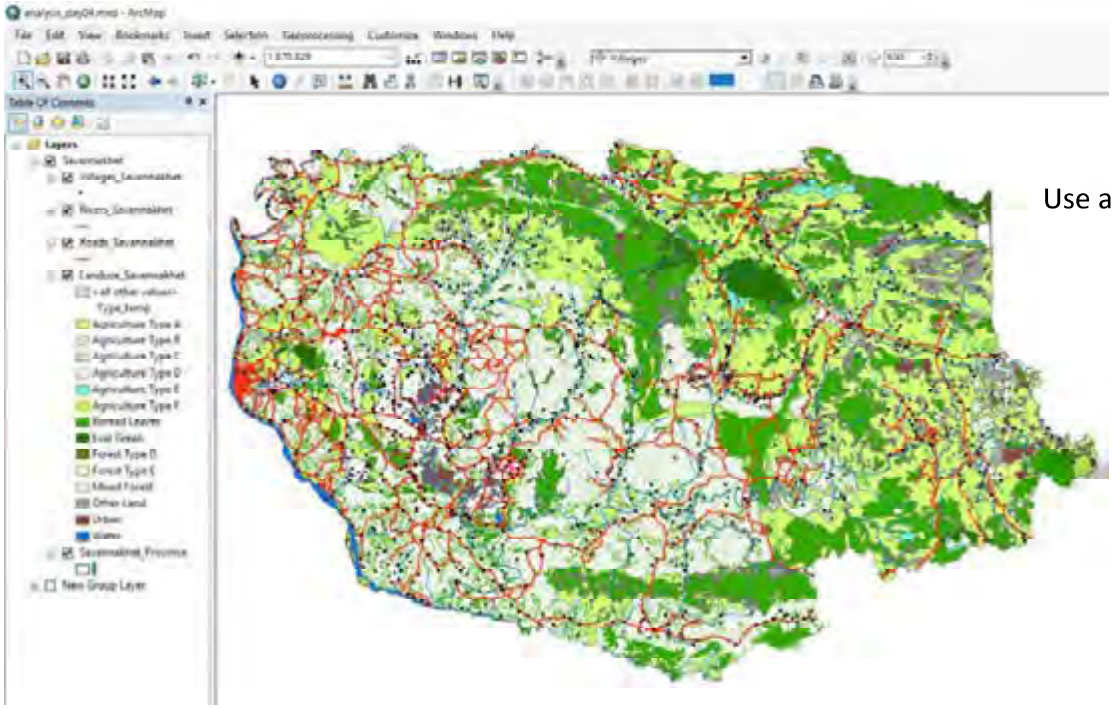
3. Clip landuse layer as well
4. Explore the dataset



Savannakhet, Laos map, 2019

Data preparation for Savannakhet Province

Use Clip Tool



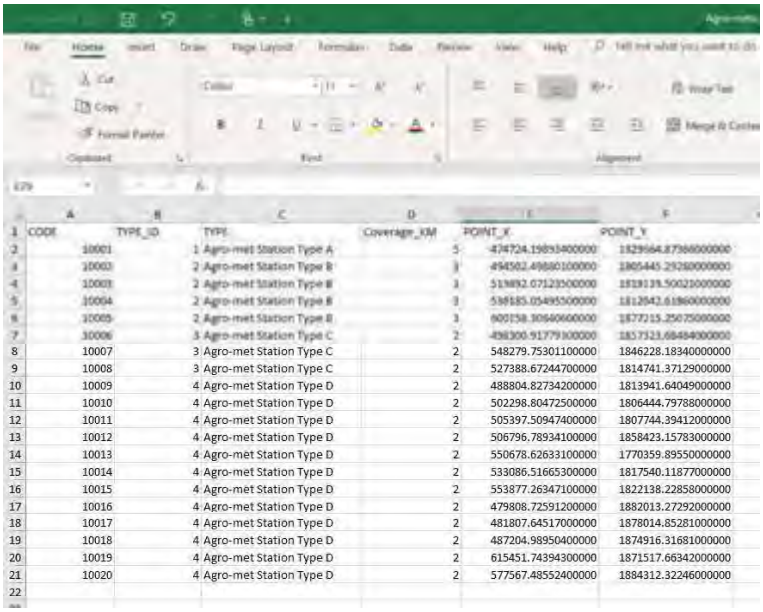
Use appropriate symbology

Savannakhet province, Laos map, 2019

Adding GPS data and creating layer

Data preparation

1. Open “Agro-meto_stations.xls” and explore the table

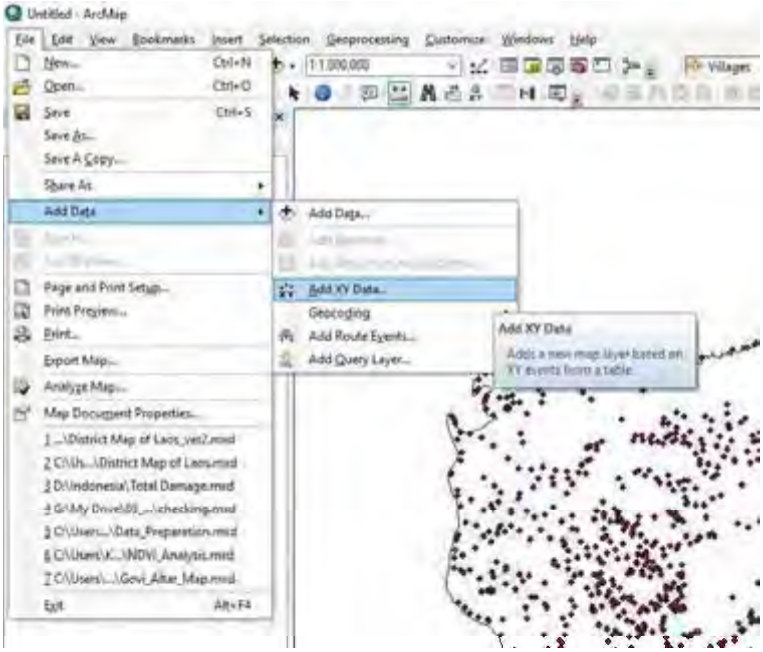


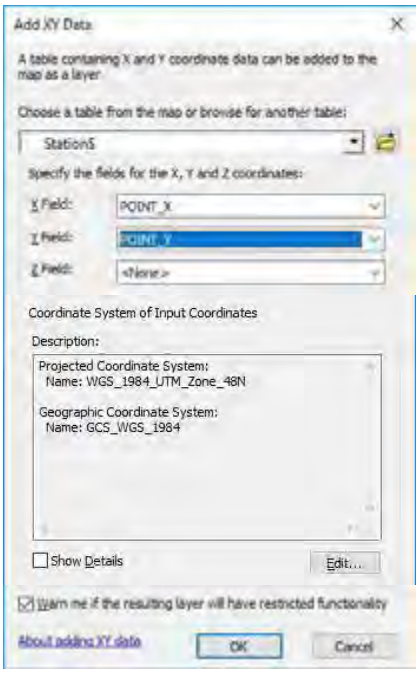
	A	B	C	D	E	F
1	CODE	TYPE_ID	TYPE	Coverage_KM	POINT_X	POINT_Y
2	10001	1	Agro-met Station Type A	5	474724.19893400000	1829664.87366000000
3	10002	2	Agro-met Station Type B	3	494502.49880100000	1805445.29260000000
4	10003	2	Agro-met Station Type B	3	513492.07123500000	1819139.50021000000
5	10004	2	Agro-met Station Type B	3	536185.05495500000	1812642.61860000000
6	10005	2	Agro-met Station Type B	3	500158.30660600000	1877215.25075000000
7	10006	3	Agro-met Station Type C	2	496300.91779300000	1857323.68484000000
8	10007	3	Agro-met Station Type C	2	548279.75301100000	1846228.18340000000
9	10008	3	Agro-met Station Type C	2	527388.67244700000	1814741.37129000000
10	10009	4	Agro-met Station Type D	2	488804.82734200000	1813941.64049000000
11	10010	4	Agro-met Station Type D	2	502298.80472500000	1806444.79788000000
12	10011	4	Agro-met Station Type D	2	505397.50947400000	1807744.39412000000
13	10012	4	Agro-met Station Type D	2	506796.78934100000	1858423.15783000000
14	10013	4	Agro-met Station Type D	2	550678.62633100000	1770359.89550000000
15	10014	4	Agro-met Station Type D	2	533086.51665300000	1817540.11877000000
16	10015	4	Agro-met Station Type D	2	553877.26347100000	1822138.22858000000
17	10016	4	Agro-met Station Type D	2	479808.72591200000	1882013.27292000000
18	10017	4	Agro-met Station Type D	2	481807.64517000000	1878014.85281000000
19	10018	4	Agro-met Station Type D	2	487204.98950400000	1874916.31681000000
20	10019	4	Agro-met Station Type D	2	615451.74394300000	1871517.66342000000
21	10020	4	Agro-met Station Type D	2	577567.48552400000	1884312.32246000000
22						

Adding GPS data and creating layer

Data preparation

2. Go to File ➔ Add Data ➔ Add XY Data



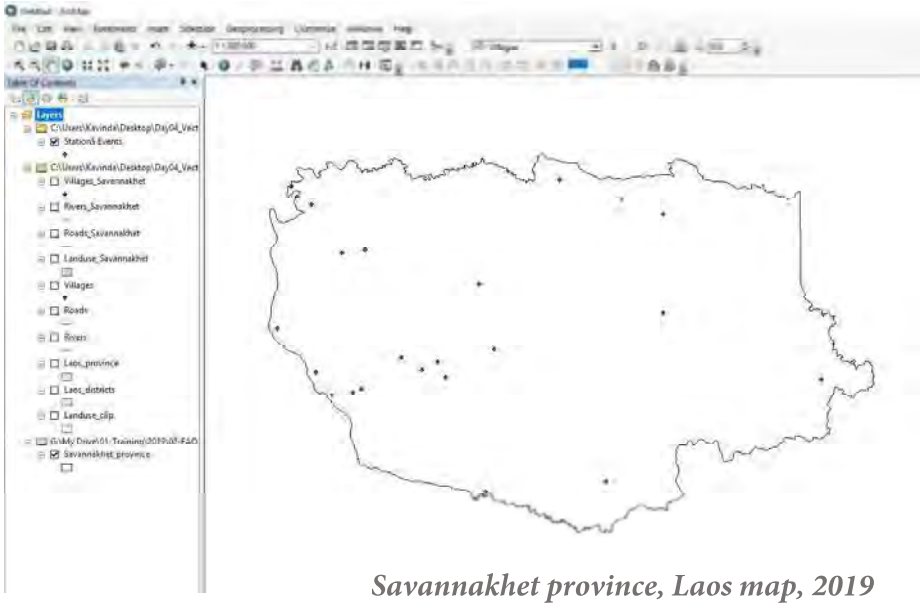


Adding GPS data and creating layer

Data preparation

2. Explore the data, this is temporary file

3. To make it permanent file; [R] click ➔ Data ➔ Export Data

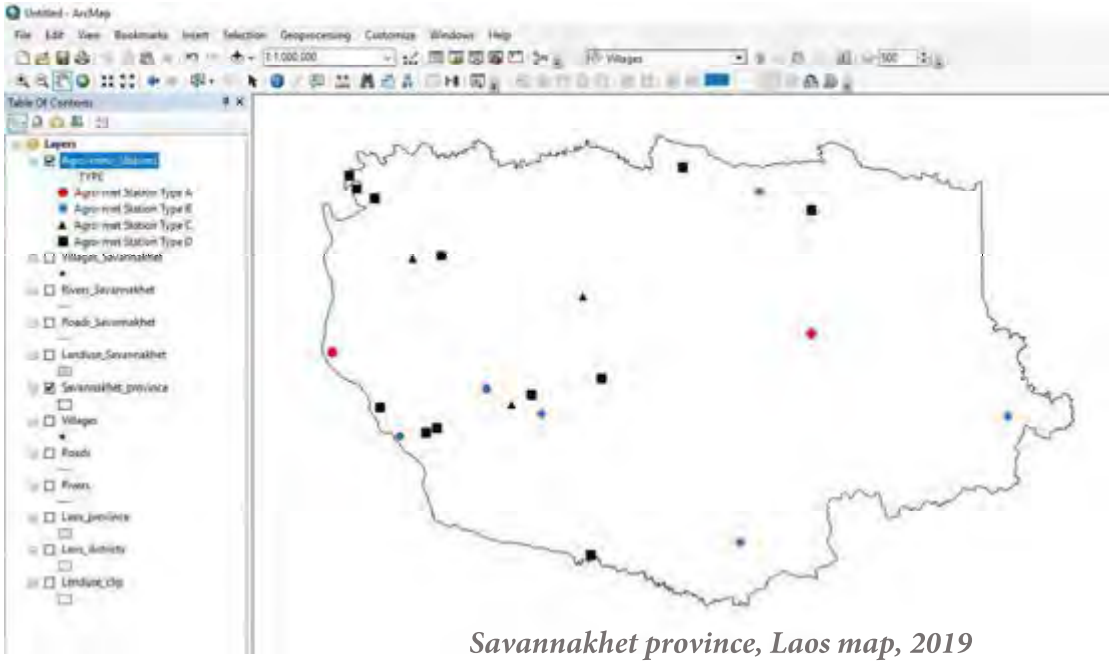


Savannakhet province, Laos map, 2019

Adding GPS data and creating layer

Data preparation

4. Symbolize the created later

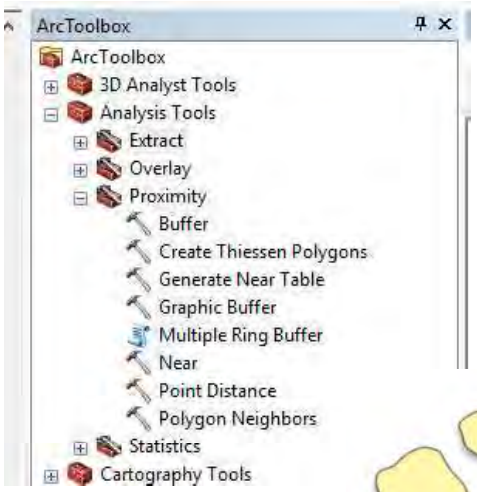


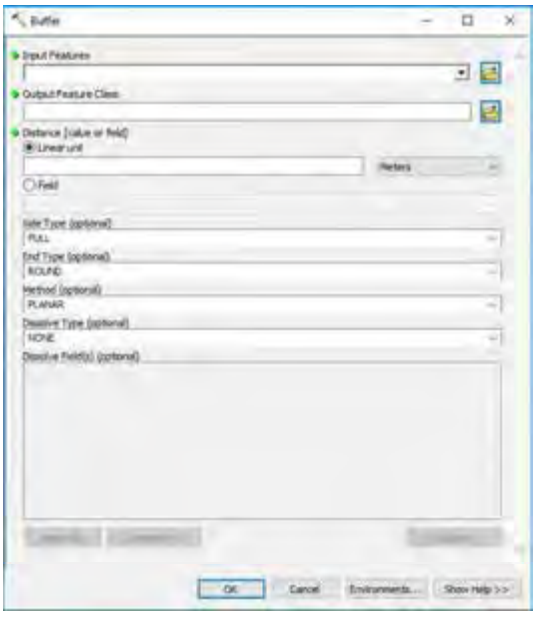
Savannakhet province, Laos map, 2019

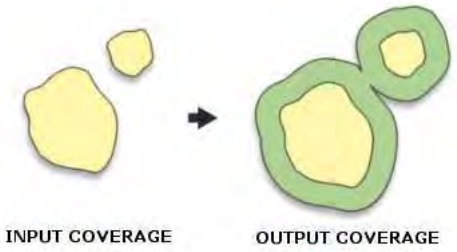
Proximity Tools

Use Buffer Tool

1. Analysis Tools ➔ Proximity ➔ Buffer



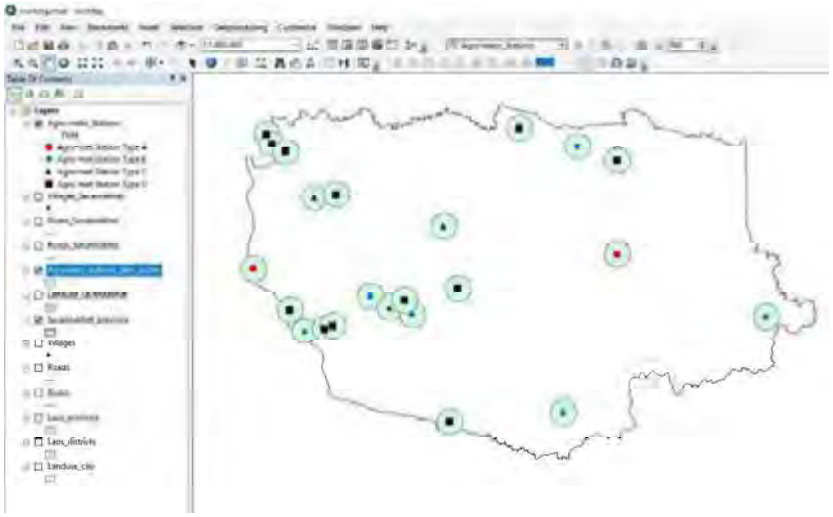




Proximity Tools

Use Buffer Tool

2. Create 5km buffer for Agromet stations

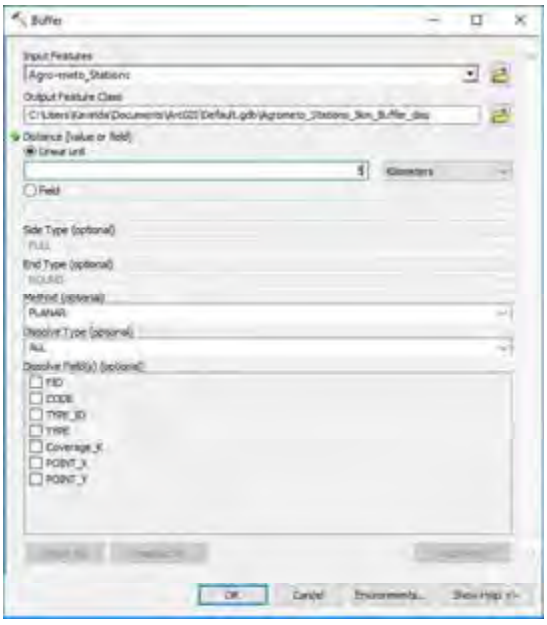


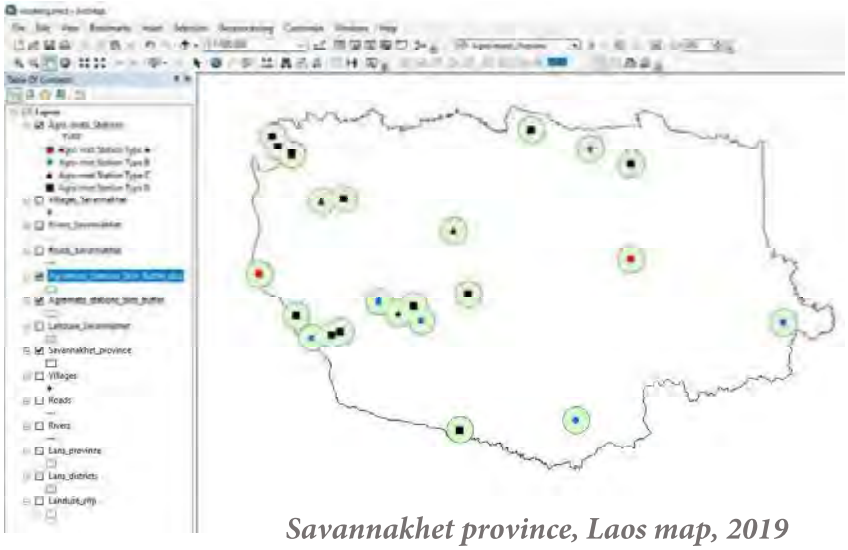
Savannakhet province, Laos map, 2019

Proximity Tools

Use Buffer Tool: Try with Dissolve Type: All

3. Create 5km buffer for Agromet stations with dissolve polygons



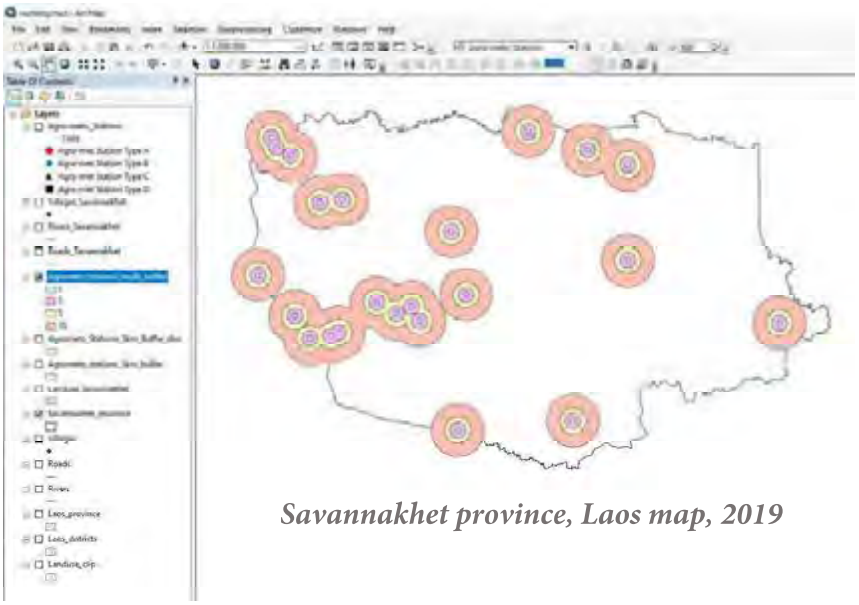


Savannakhet province, Laos map, 2019

Proximity Tools

Use Buffer Tool: Try with Multiple Ring Buffer

4. Create 1, 3, 5, 10 km buffer for Agromet stations with dissolve polygons

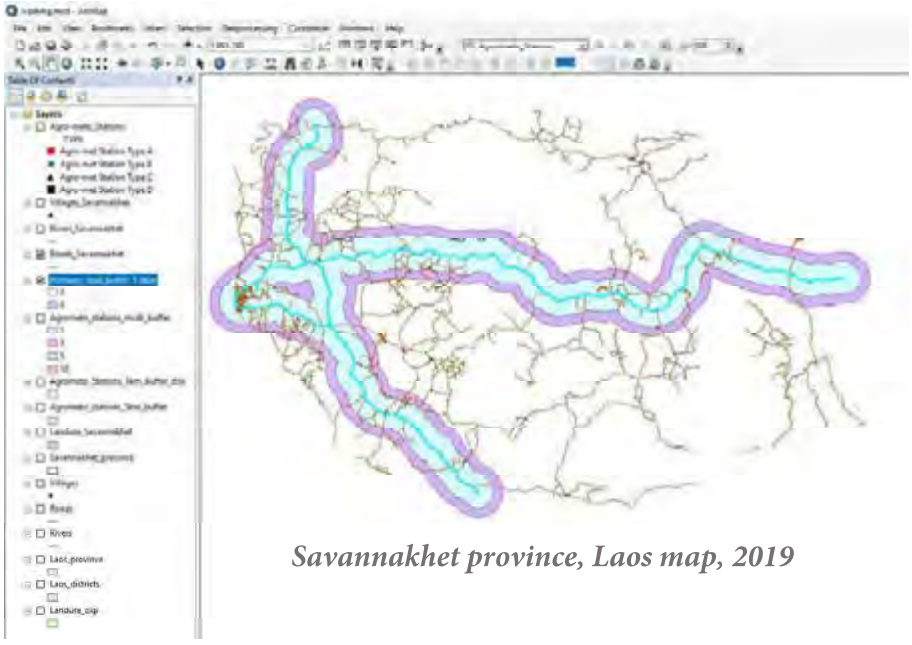


Savannakhet province, Laos map, 2019

Proximity Tools: Self-task I

Use Buffer Tool: buffer for line feature

1. Create 5km and 8 km buffer zones for “primary” road in Savannakhet province



Savannakhet province, Laos map, 2019

How many villages within 10km distance to all agromet stations in Savannakhet Province?

Answers by Participants:
1st place: 393 villages by Natnakhone SAENGCHAN
2nd place: 393 villages by Sengduangduan
3rd place: 393 villages by Phousavanh
4th place: 393 villages by Phapasit
5th place: 393 villages by Kaemery CHAO
6TH place:

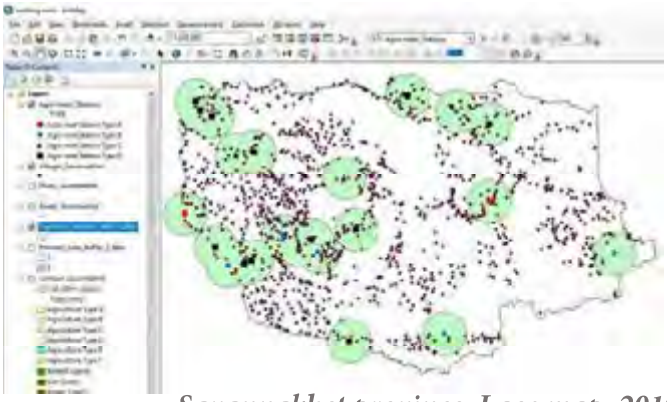
Proximity Tools: Self-task II

Hint: You can do this several ways; buffer tools and clip or select by location tool

Identify the villages within 10km distance to agromet stations

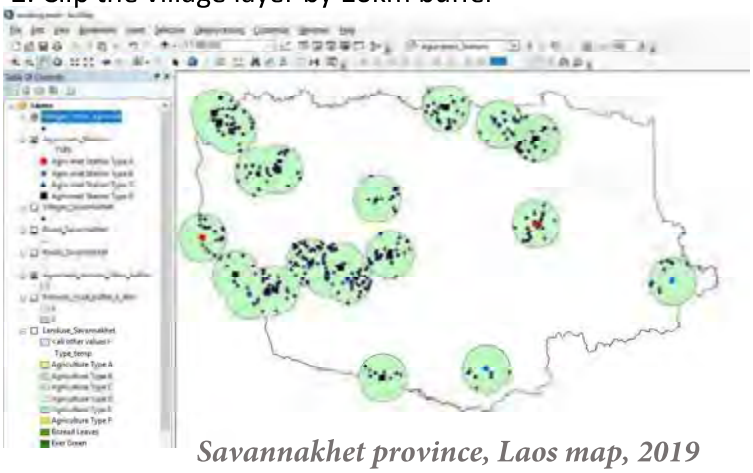
Answer: using buffer and clip tools

1. 10km buffer for Agromet Stations



Savannakhet province, Laos map, 2019

2. Clip the village layer by 10km buffer

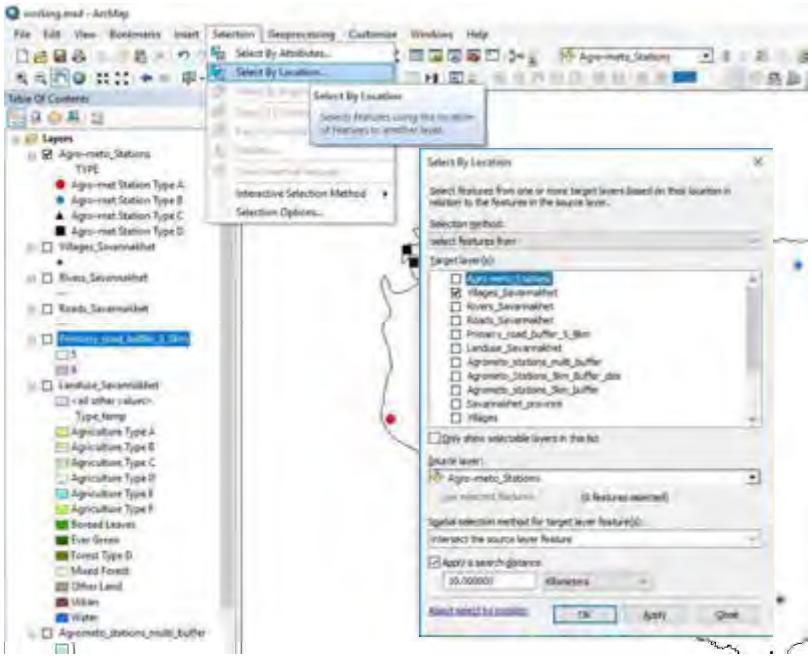


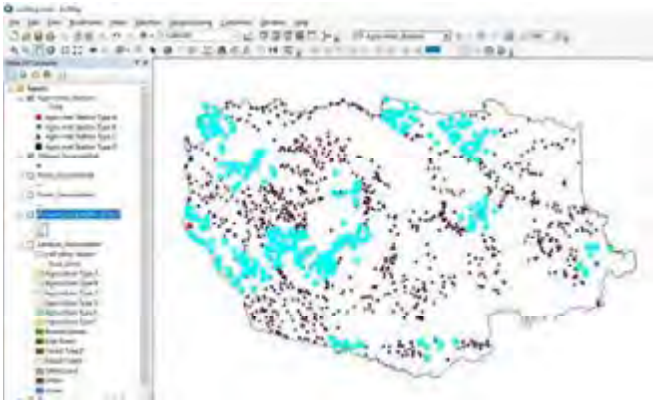
Savannakhet province, Laos map, 2019

Answer: using Select By Location tool

Hint: you have to do two types of operations

1. Identify the villages within 10km distance to agromet stations





Savannakhet province, Laos map, 2019

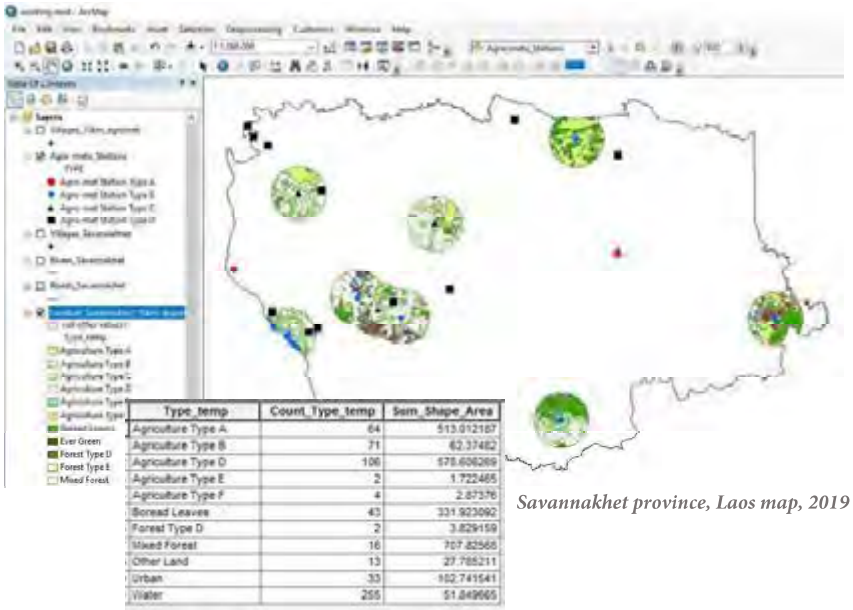
Overlay operations: Self-task III

Hint: you have learnt all the tools to do this operation

Create a separate landuse layer within the distance of 10km from Agromet stations Type B and C. Then generate area (sqkm) vs landuse type table and area percentage

Steps:

1. Select Agromet Stations Type B and C
2. Create a new layer of Agromet stations Type B and C
3. Create a 10km buffer for above layer
4. Clip landuse layer by 10km buffer
5. Calculate area
6. Use Summarize tool



Type_temp	Count_Type_temp	Sum_Shape_Area
Agriculture Type A	64	513.012187
Agriculture Type B	71	62.37482
Agriculture Type D	106	978.606289
Agriculture Type E	2	1.722465
Agriculture Type F	4	2.87376
Boread Leaves	43	331.923092
Forest Type D	2	3.829159
Mixed Forest	16	707.82566
Other Land	13	27.785211
Urban	33	102.741541
Water	255	51.849665

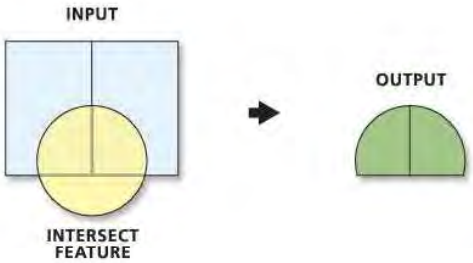
Savannakhet province, Laos map, 2019

Use of Intersect and Union tool

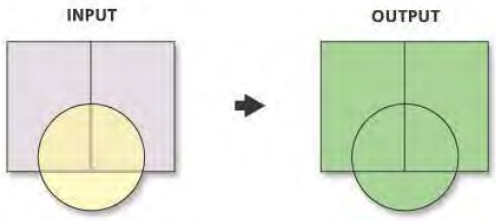
Understand the concept of these vector operations

1. Two layers use for demonstrate of these tool (Landuse and Agromet stations)
2. Make a 5km and 10km multiple ring buffer for agromet stations
3. Carefully check the attribute table of both layers before preforming analysis
4. Perform Intersect operation
5. Check and understand the generated attribute table
6. Perform Union operation
7. Check and understand the generated attribute table

Intersect

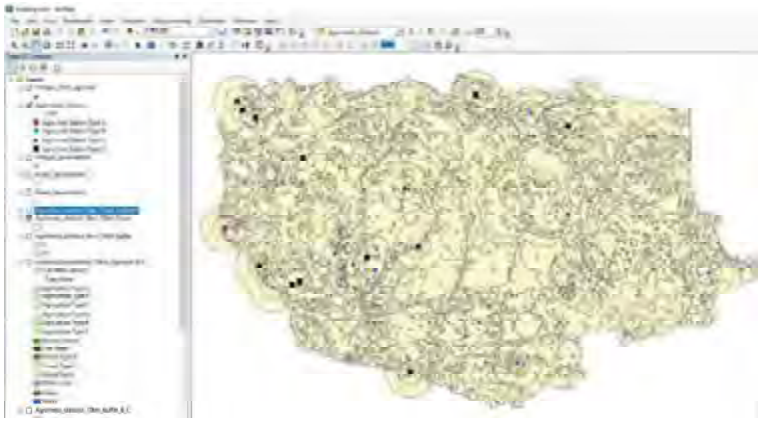


Union



Use of Intersect and Union tool

Understand the concept of these vector operations



Union results

Intersect results

Merge and Append tools

How to add newly established Agromet stations

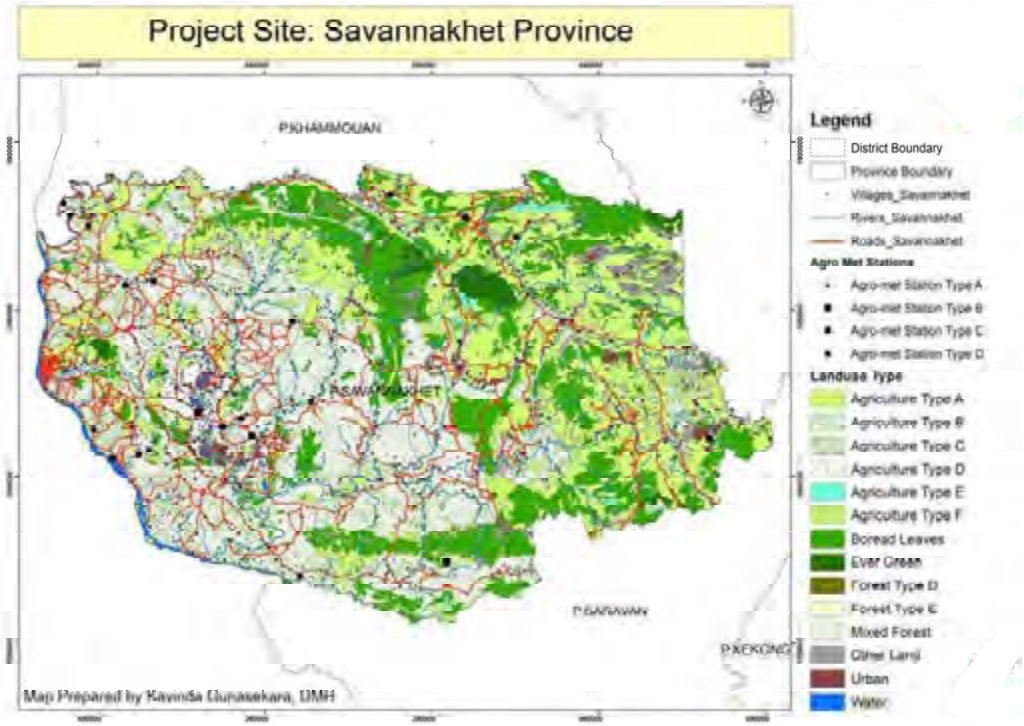
How to add newly established Agro Meteorological Stations to the existing Agromet station dataset?

1. Right hand table shows the coordinates of new Agro Meteoritical stations (coordinates in UTM 48N WGS84)
2. Make a new layer of newly established stations
3. Merge newly created stations with existing stations
4. Try append tool as well, as the second option

X Coordinate	Y Coordinate	Code
582722.43	1842666.56	10024
588543.56	1808271.36	10025
649397.34	1850869.08	10026

Home work

Home work - make a map similar to this

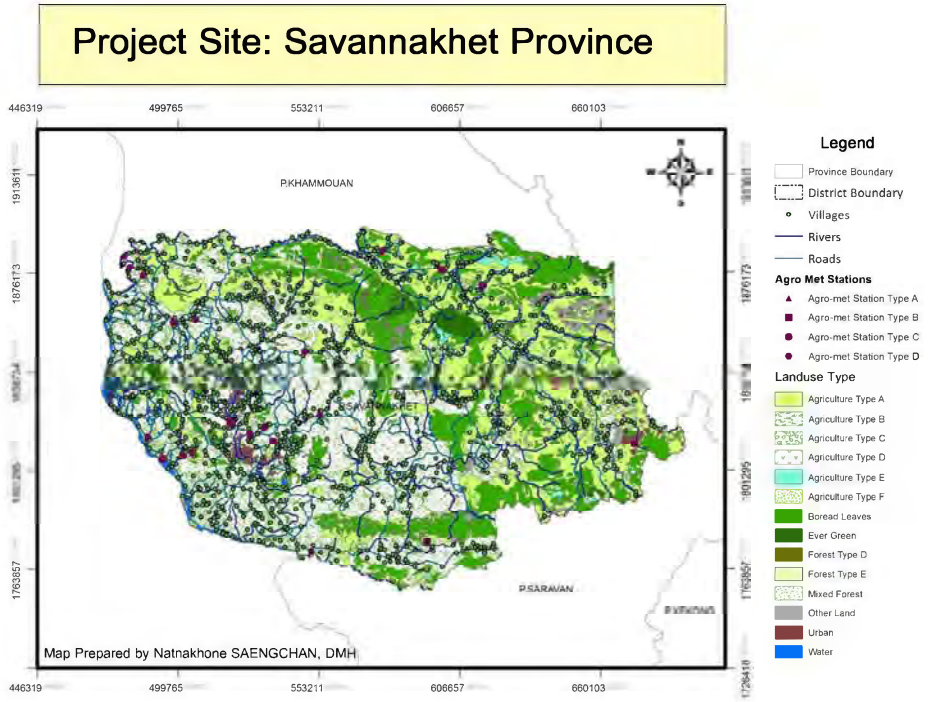


Savannakhet, Laos map, 2019

DMH MONRE

Participants Answers

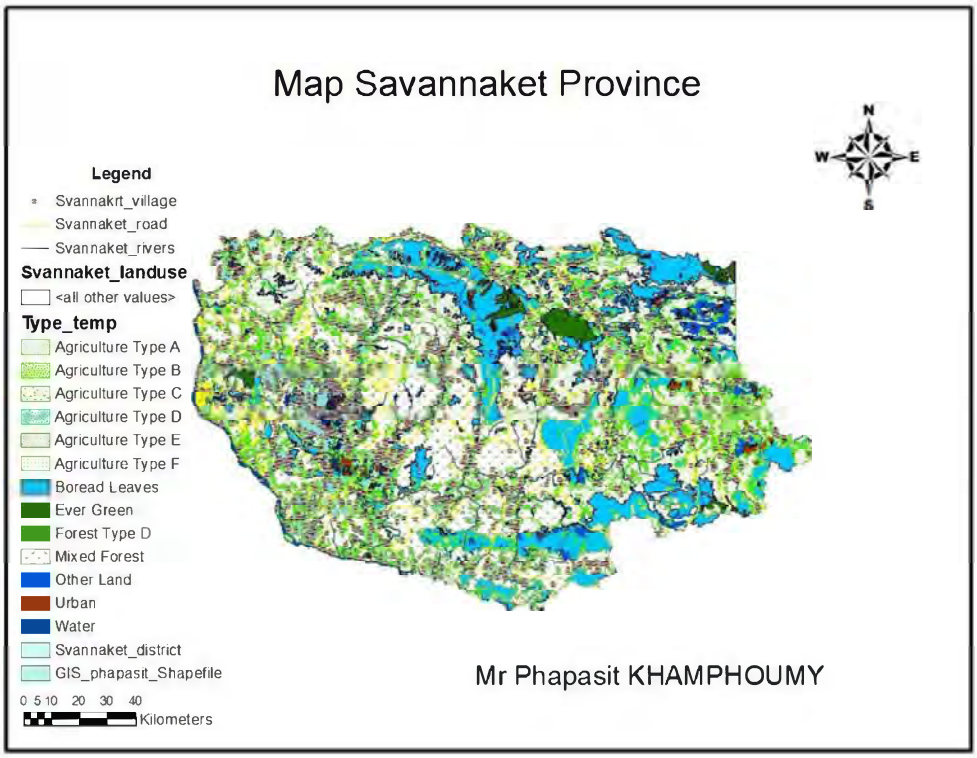
Home work - Map prepared by Natnakhone



Savannakhet, Laos map, 2019

DMH MONRE

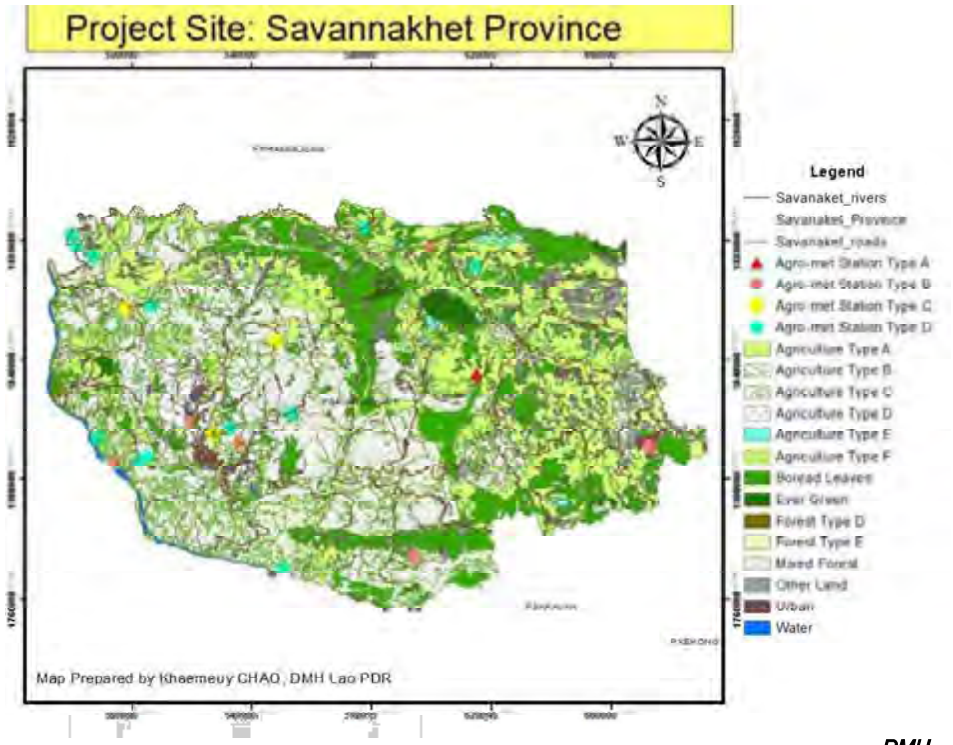
Home work - Map prepared by Phapasit



Savannakhet, Laos map, 2019

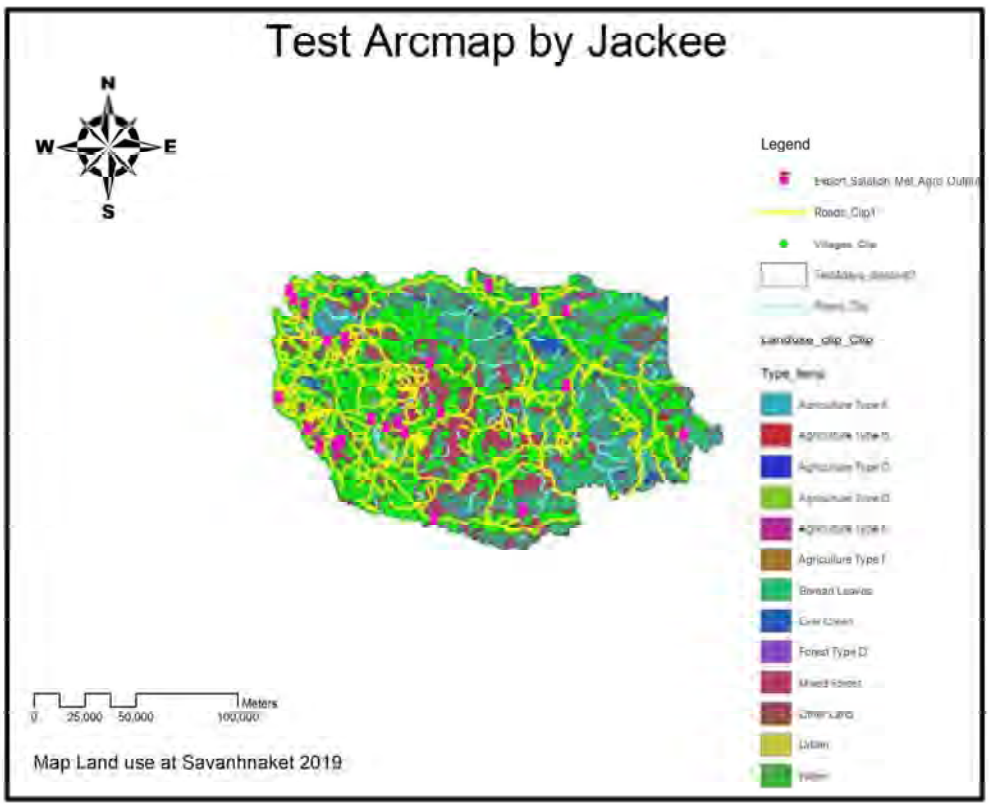
DMH MONRE

Home work – Map prepared by Phapasit



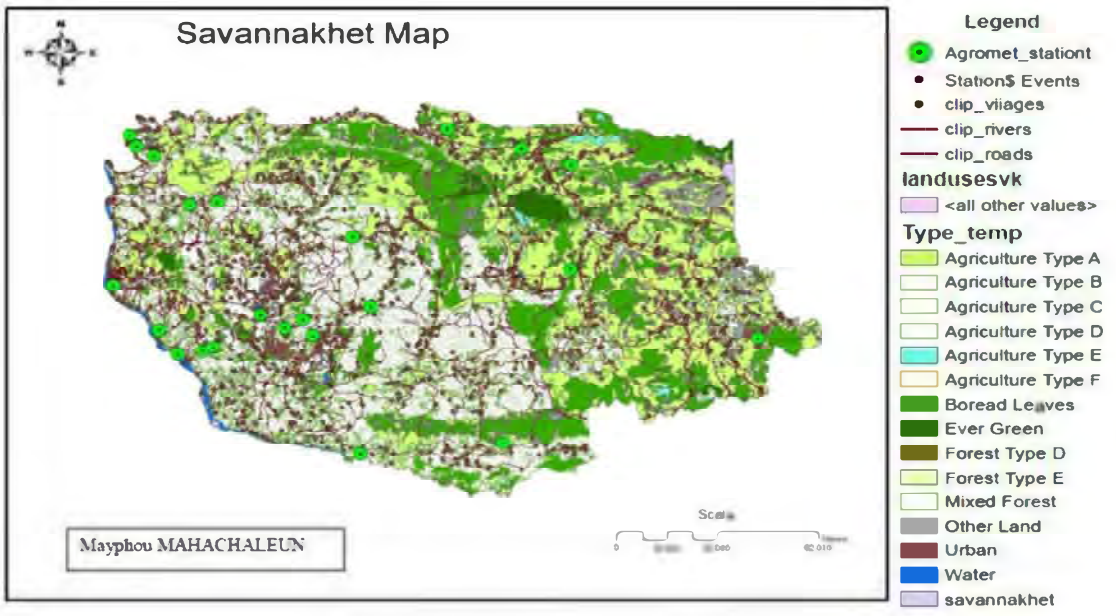
Savannakhet, Laos map, 2019

DMH MONRE



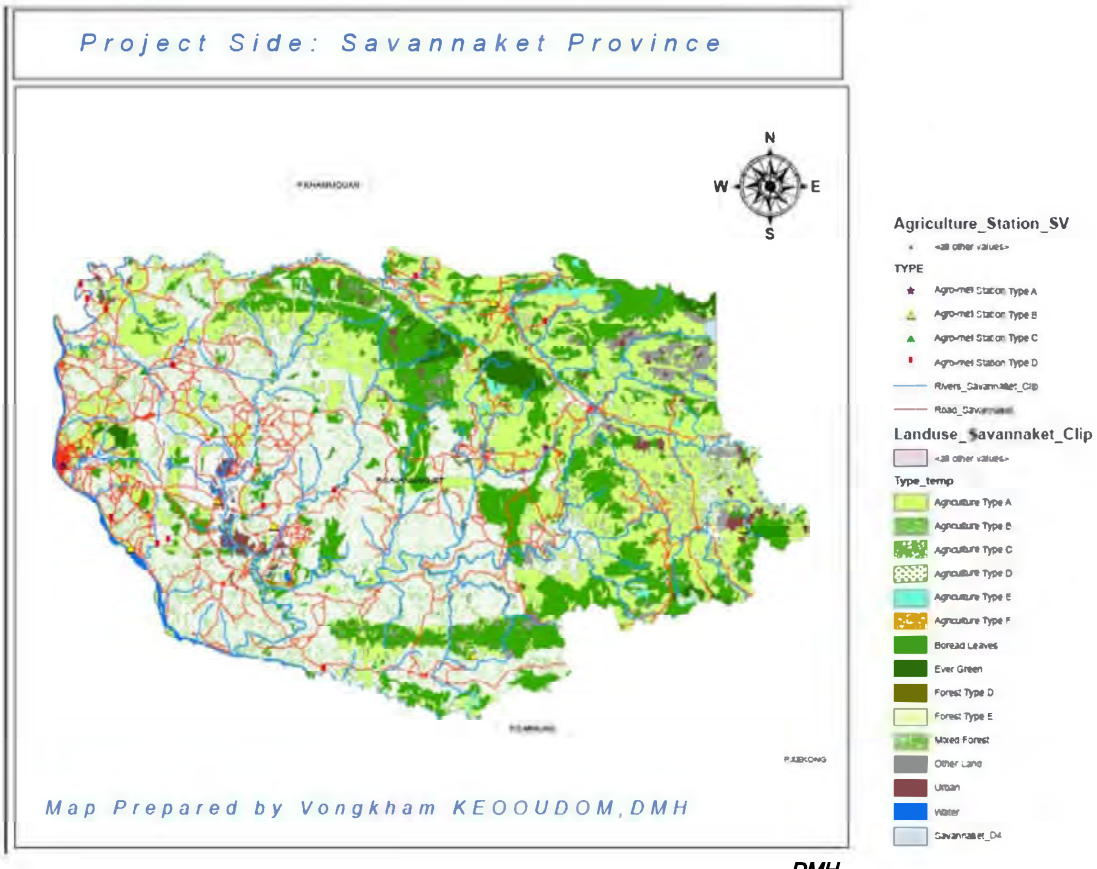
Savannakhet, Laos map, 2019

DMH MONRE



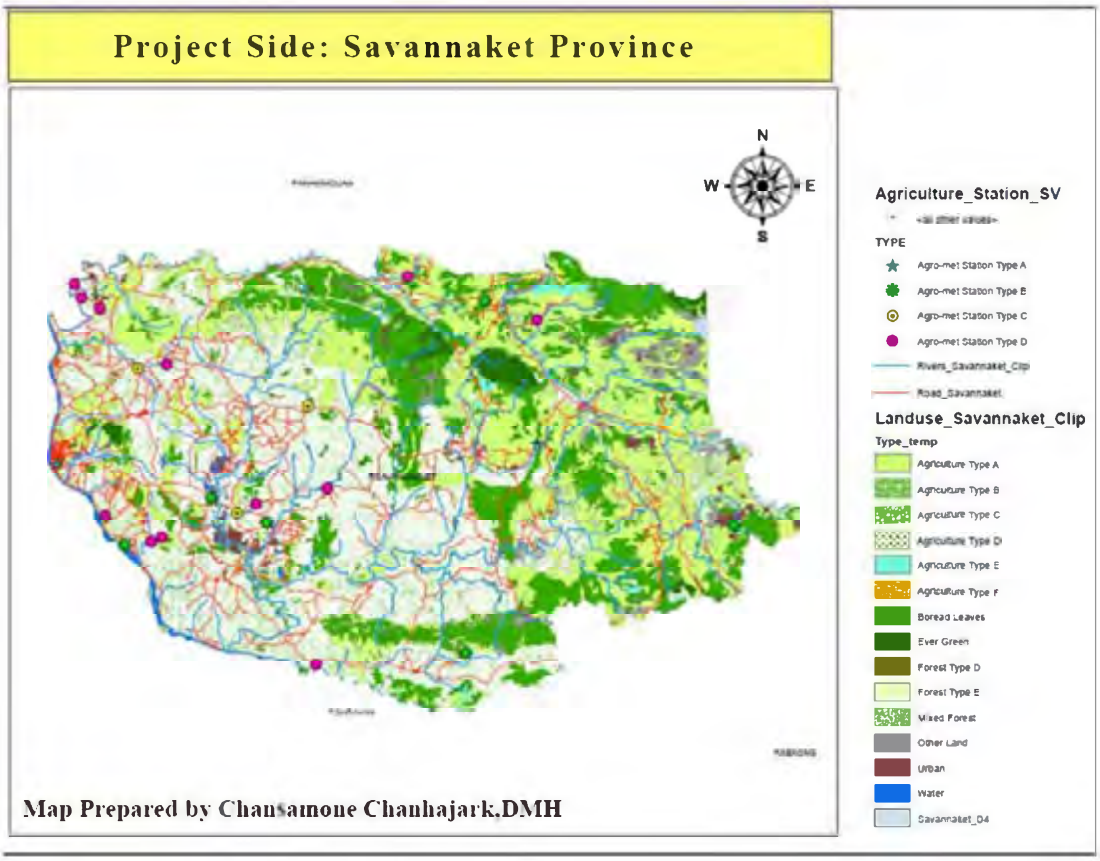
Savannakhet, Laos map, 2019

DMH MONRE



Savannakhet, Laos map, 2019

DMH MONRE

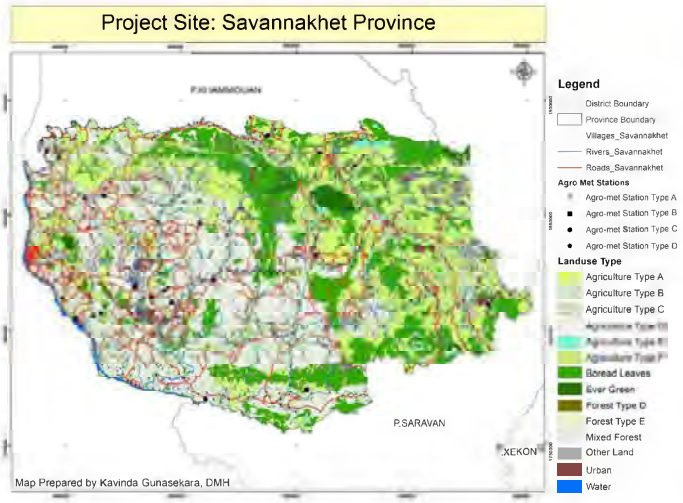


Savannakhet, Laos map, 2019

DMH MONRE

Home wrok: teacher vs student

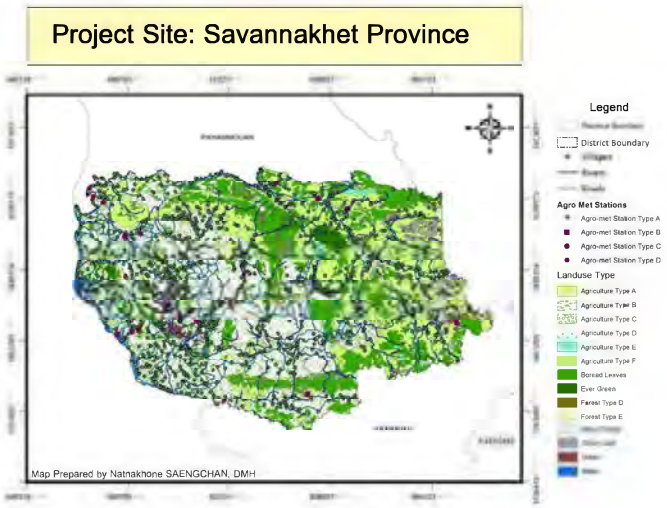
Teachers' map



Savannakhet, Laos map, 2019

DMH MONRE

Mr. Natnakhone's Map



Savannakhet, Laos map, 2019

DMH MONRE

Vector & Raster Analysis Part II

Basic useful tools in vector & rater operations

(data use in this exercise is only for demonstration purpose only)

Dr. Kavinda Gunasekara

Frank Yrle

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security in Lao PDR

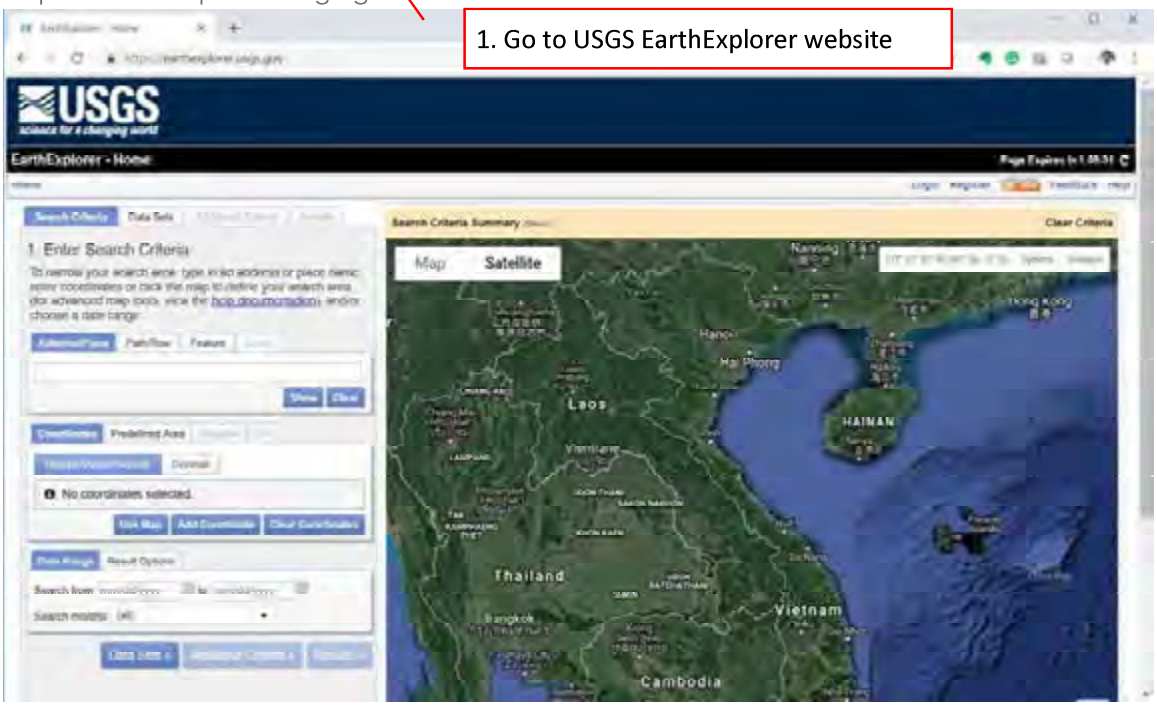
Learning topics

Overview o the exercise

1. Adding raster data: freely downloaded SRTM30 tiles
2. Explore raster data
3. How to make mosaic raster
4. How to clip raster data by a polygon
5. How to make Slope layer
6. How to make Aspect/hillshade layer
7. How to reclassify raster data
8. How to convert in between Raster and vector
9. Final vector overlay operation: finding best locations for new Agro Meteorological stations

How you can download free elevation data?

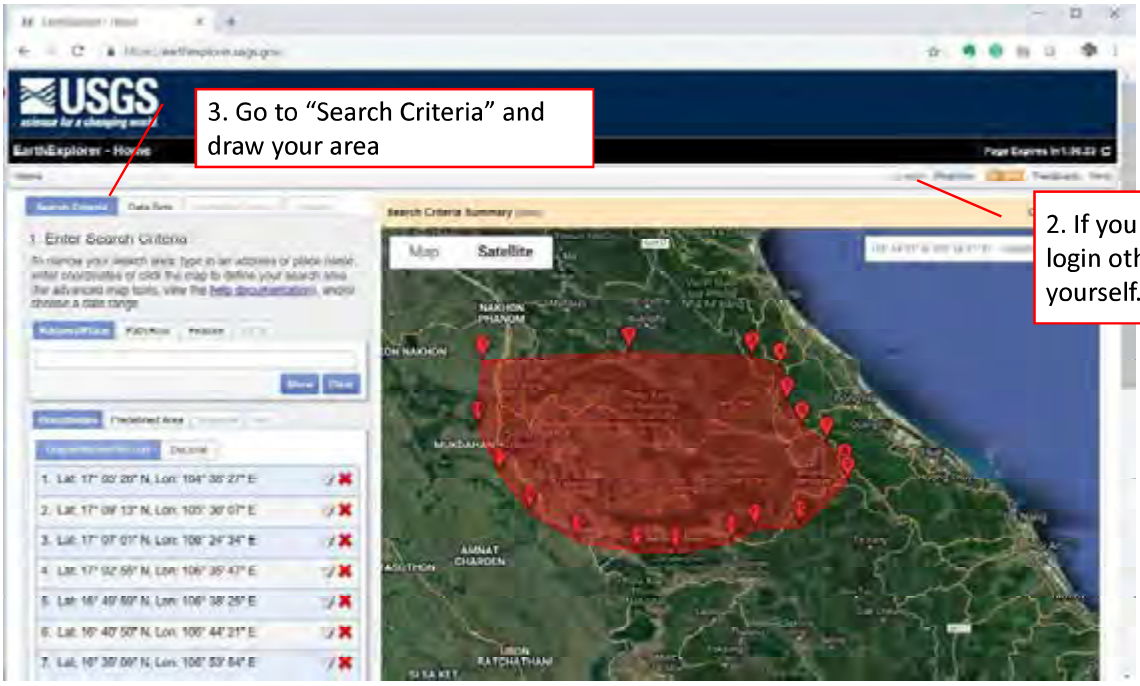
https://earthexplorer.usgs.gov/



Laos map, 2019

How you can download free elevation data?

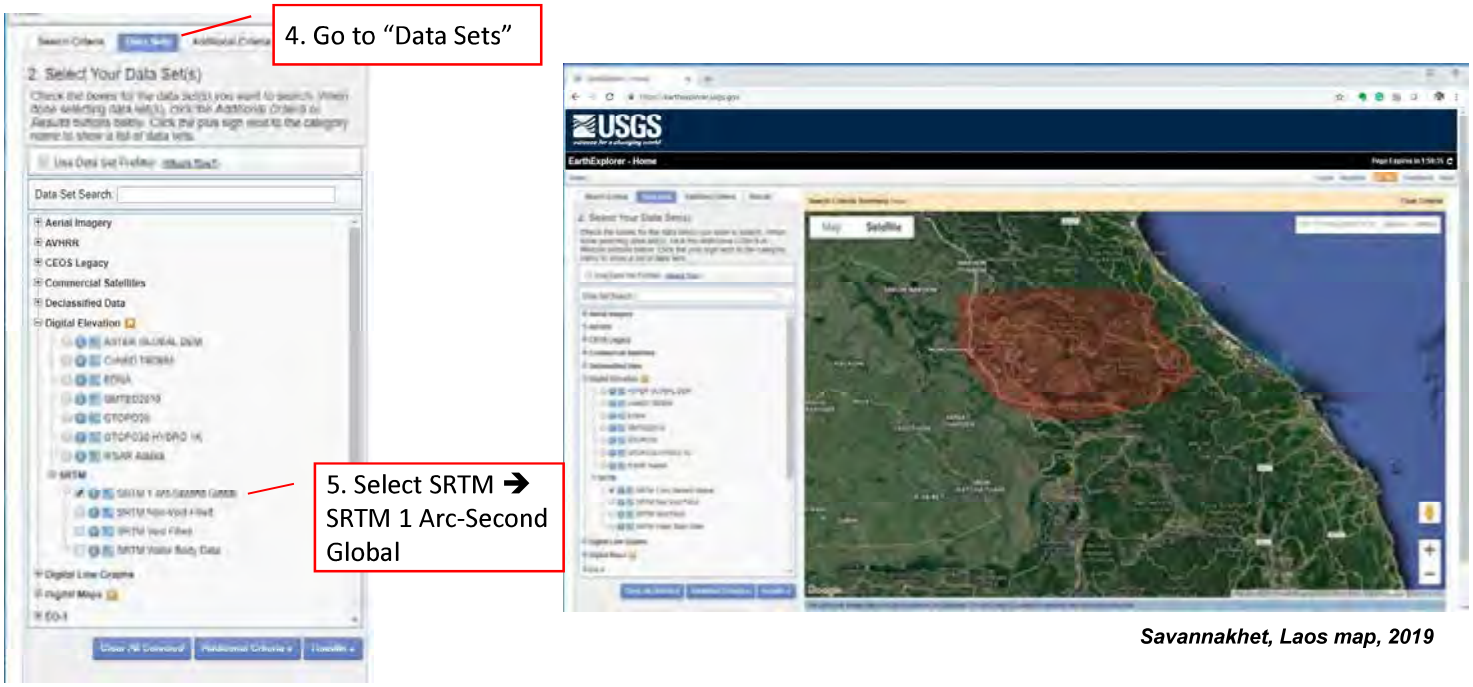
https://earthexplorer.usgs.gov/



Savannakhet, Laos map, 2019

How you can download free elevation data?

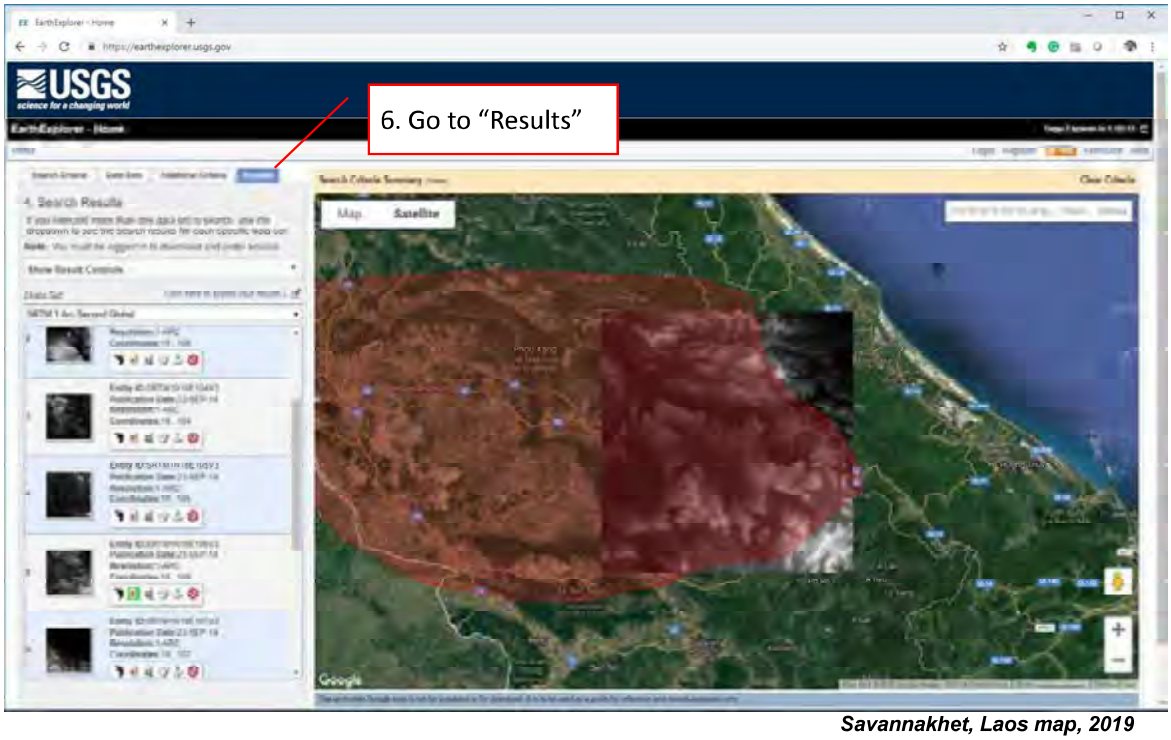
https://earthexplorer.usgs.gov/



Savannakhet, Laos map, 2019

How you can download free elevation data?

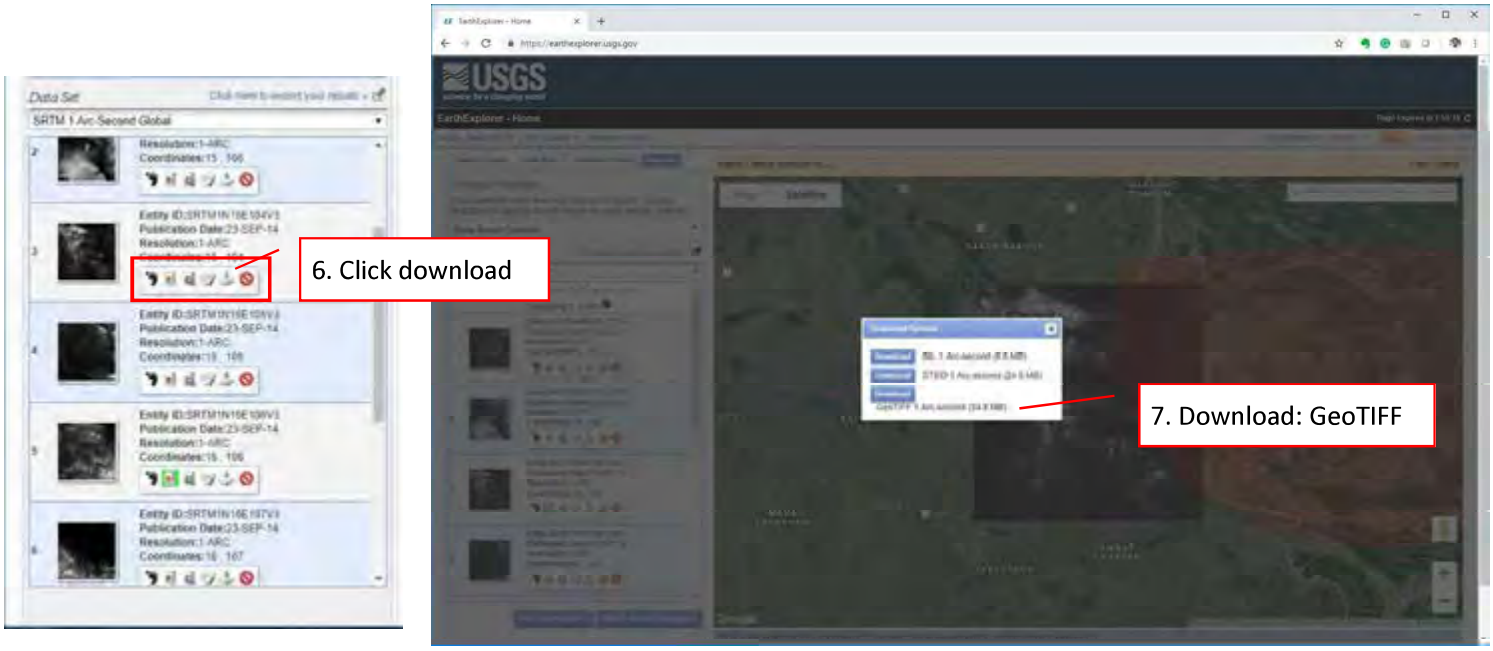
https://earthexplorer.usgs.gov/



Savannakhet, Laos map, 2019

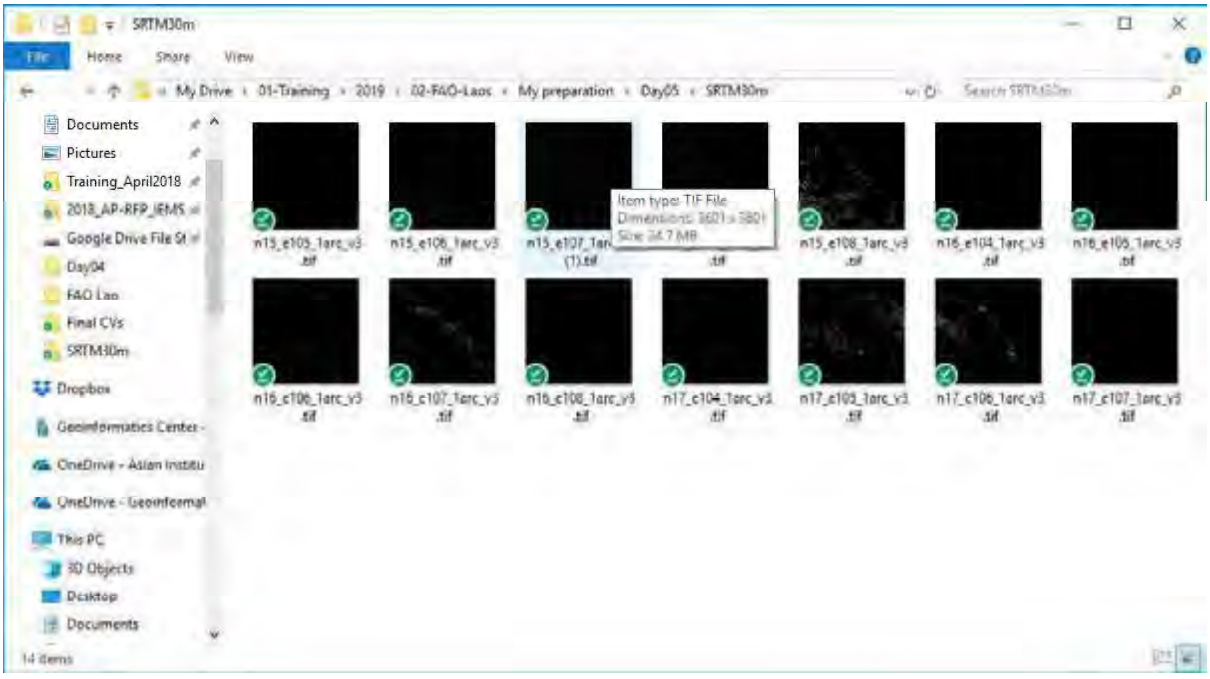
How you can download free elevation data?

https://earthexplorer.usgs.gov/



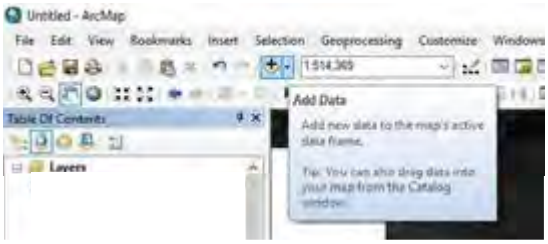
Downloaded SRTM 30m Elevation Data

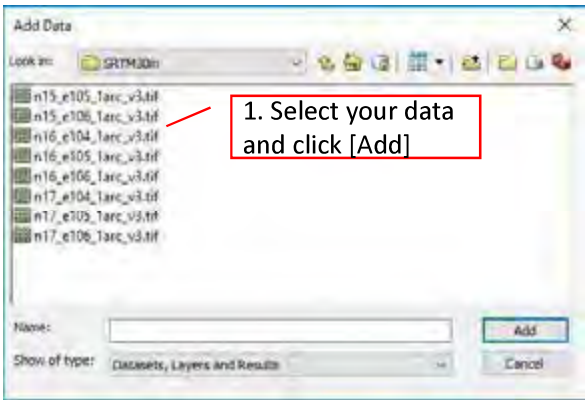
Browse the downloaded using windows explorer



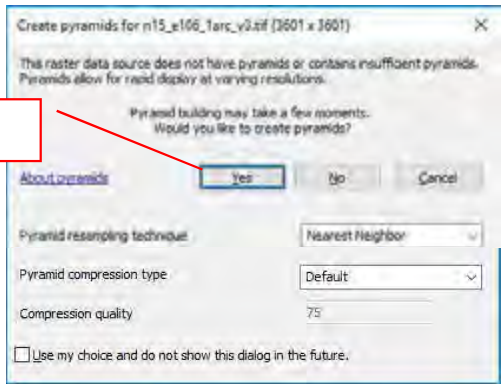
How to open Raster data in ArcMap

Go to Add Data ➔ browse your data folder



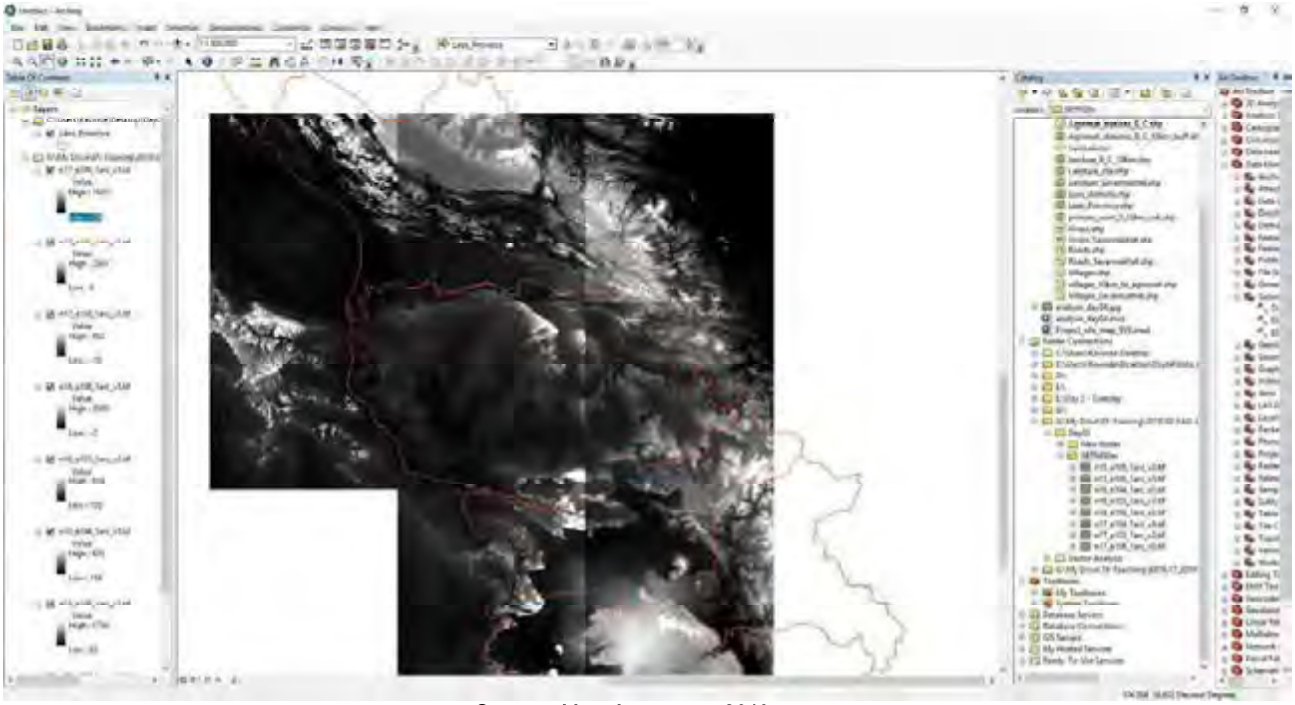


2. Click [Yes]



How to open Raster data in ArcMap

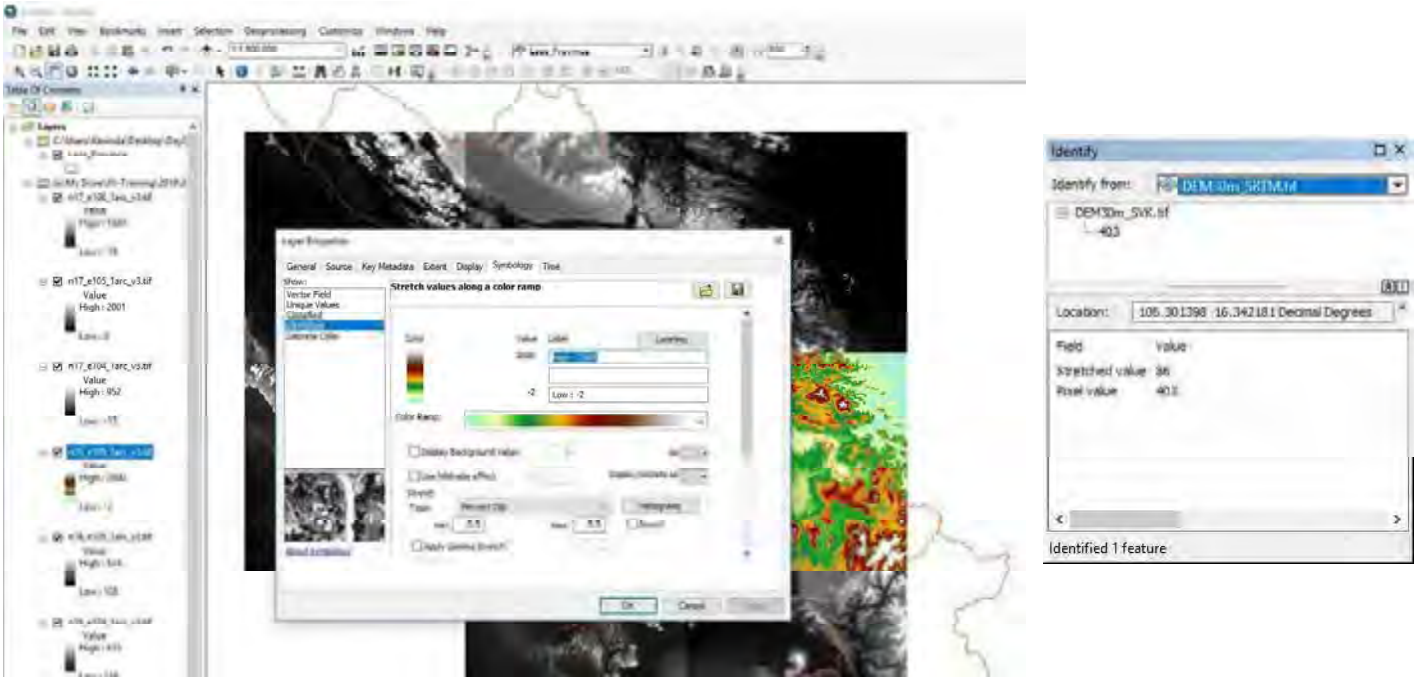
Elevation data



Savannakhet, Laos map, 2019

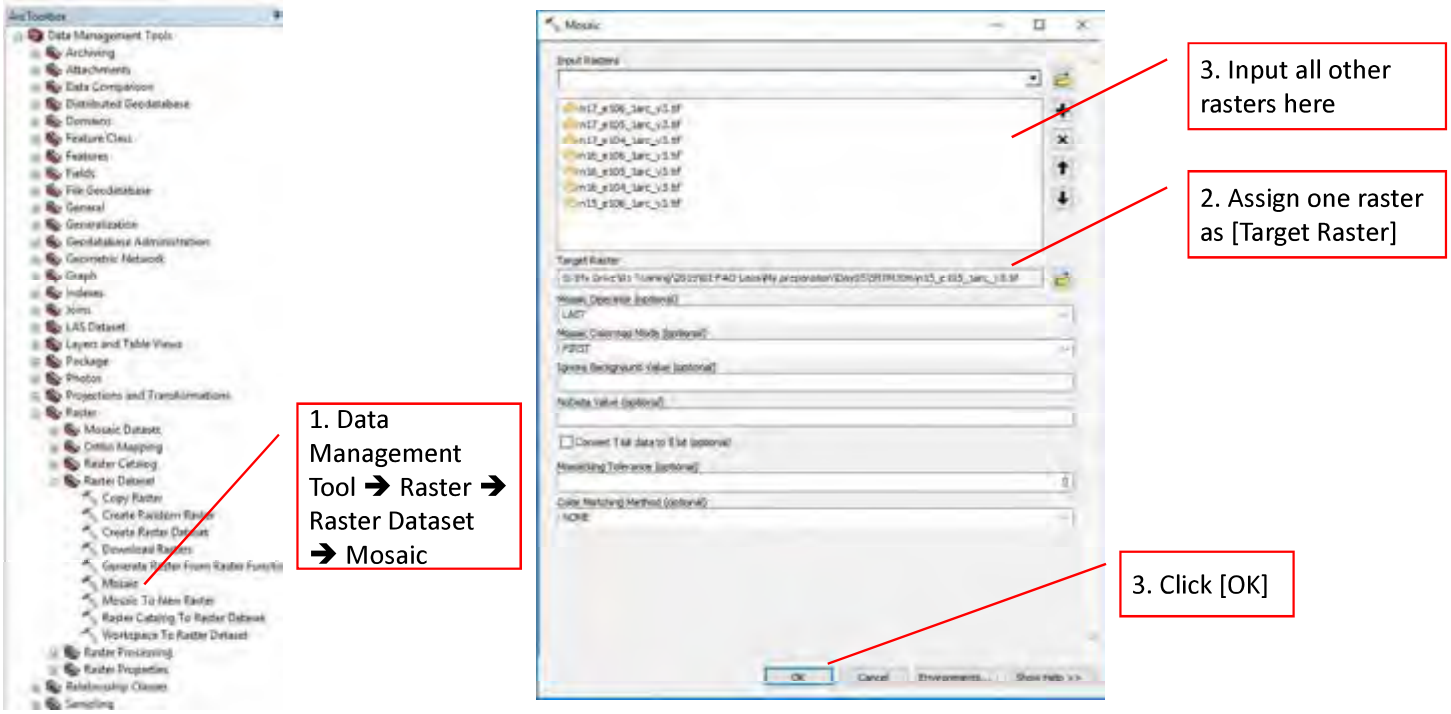
Explore the added raster data

Use identity tool and try to change symbology



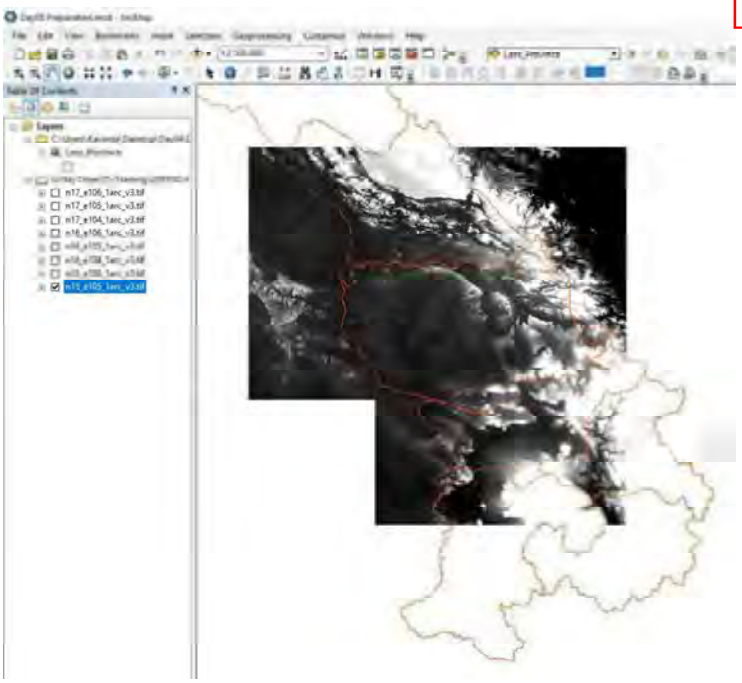
How to mosaic raster data

Making single raster for whole Savannakhet province

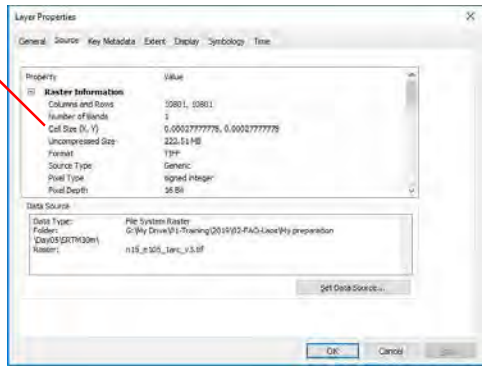


Explore generated raster data

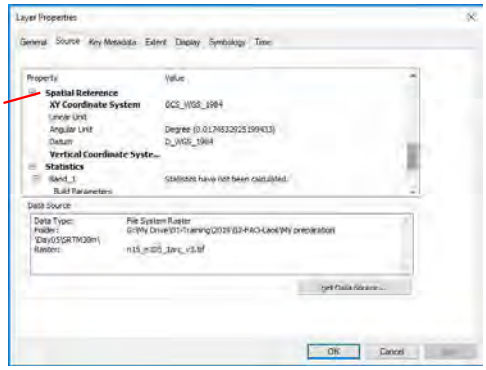
Check layer properties



Check cell size



Check coordinate system

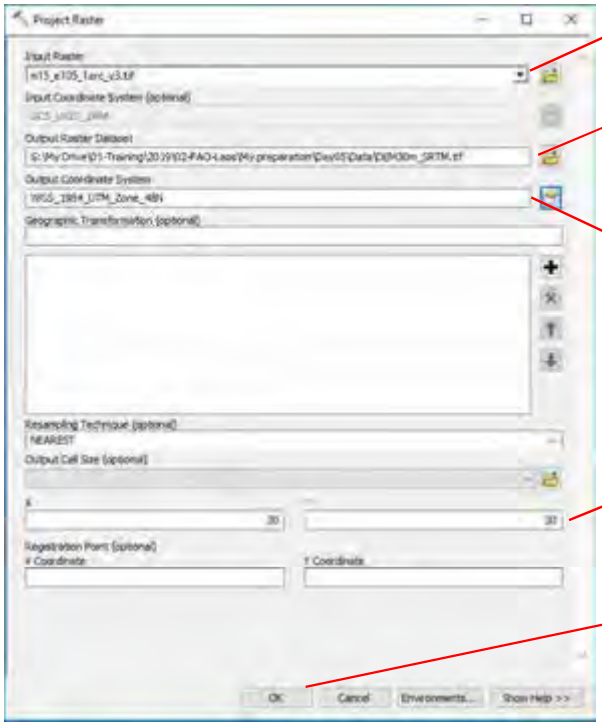


Savannakhet, Laos map, 2019

How to reproject raster to a new coordinate system

WGS84 Lat Lon to UTM48N WGS84

1. Data Management Tool ➔ Projections and Transformations ➔ Project Raster



2. Input Raster

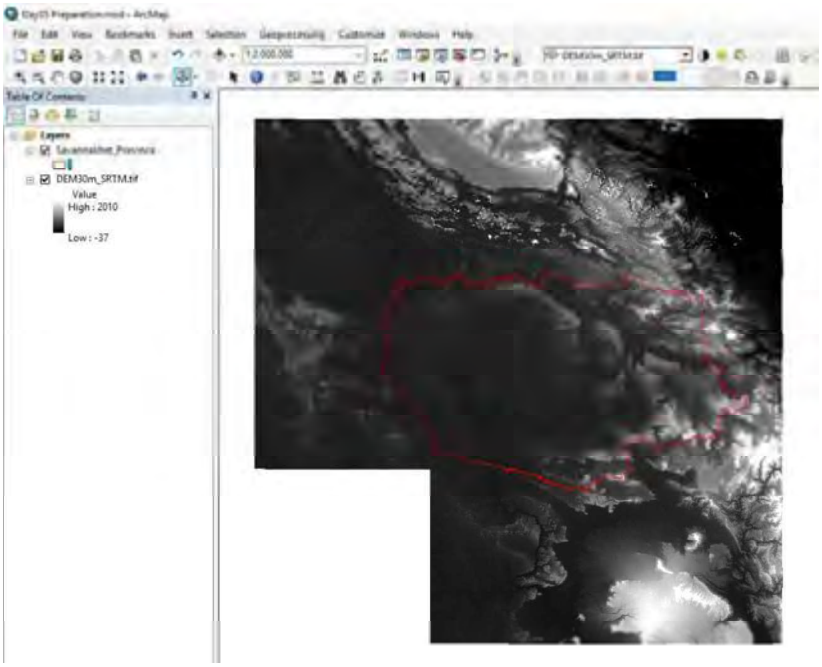
3. Output Raster name

4. Output Coordinate System: WGS_1984_UTM_Zone_48N

5. Output Cell Size: 30m

6. Click [OK]

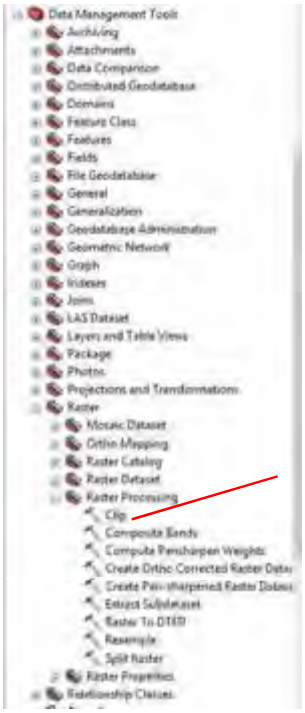
Reprojected Elevation Raster



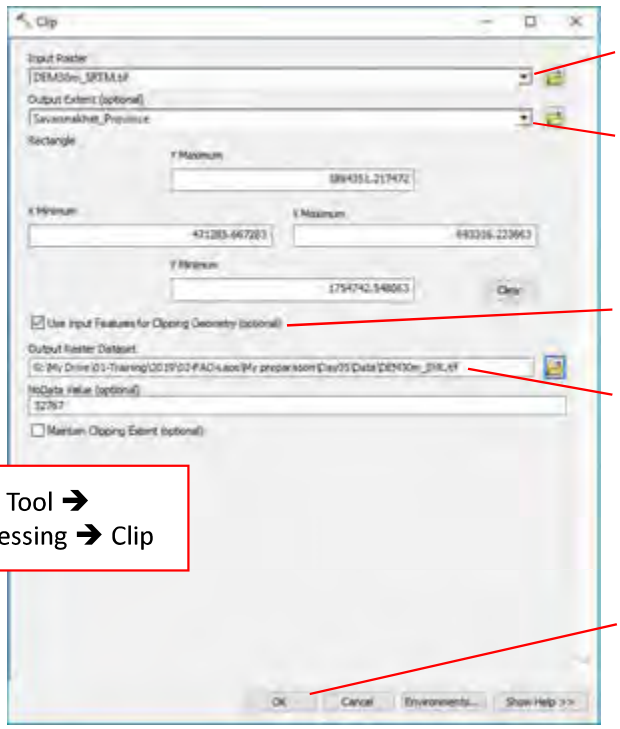
Savannakhet, Laos map, 2019

How to clip Raster data

Clip your elevation Raster to Savannakhet Province



1. Data Management Tool ➔ Raster➔ Raster Processing ➔ Clip



2. Input DEM

3. Savannakhet province boundary

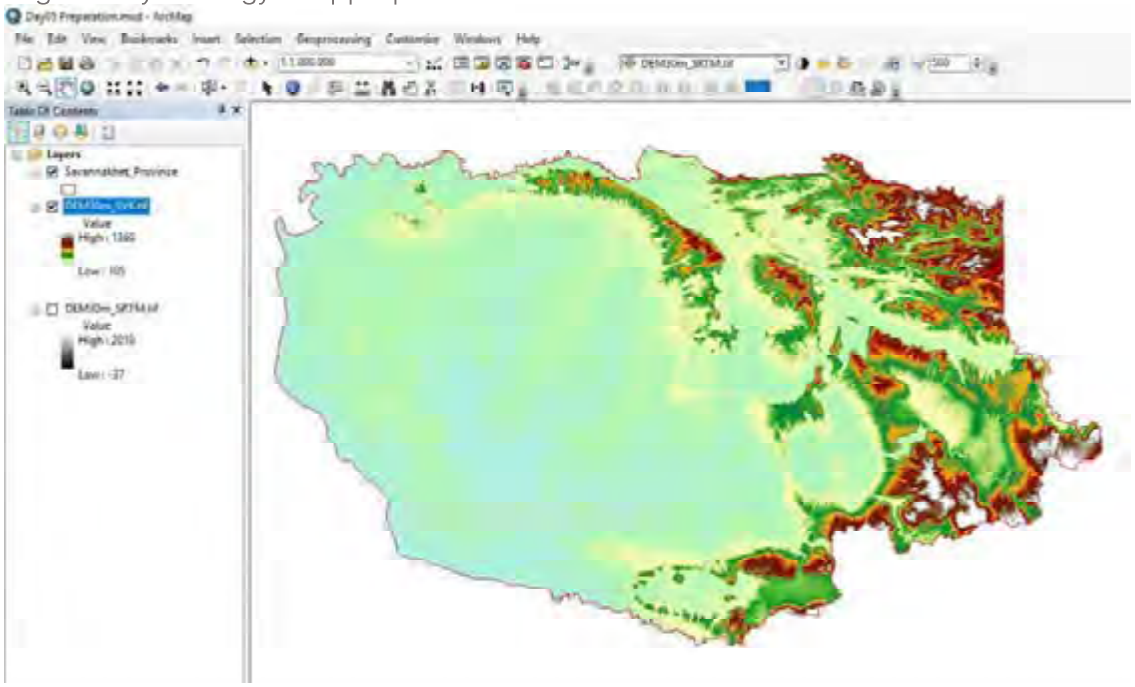
4. Click this option

5. Output name: DEM30m_SVK.tif

6. Click [OK]

Elevation data – Savannakhet province

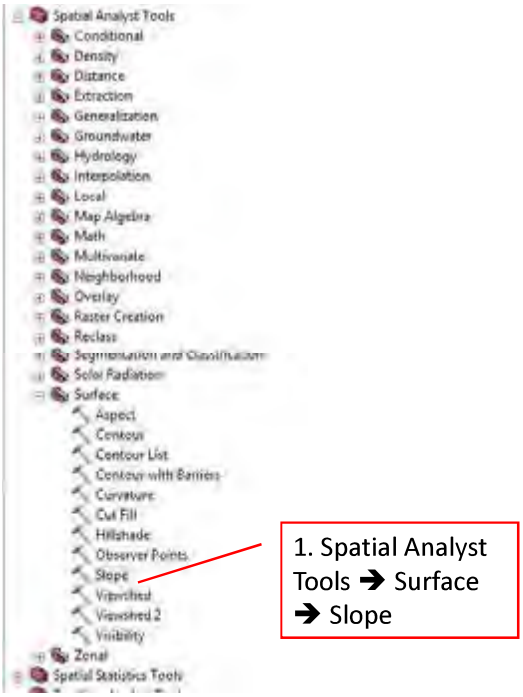
Change the symbology to appropriate colors



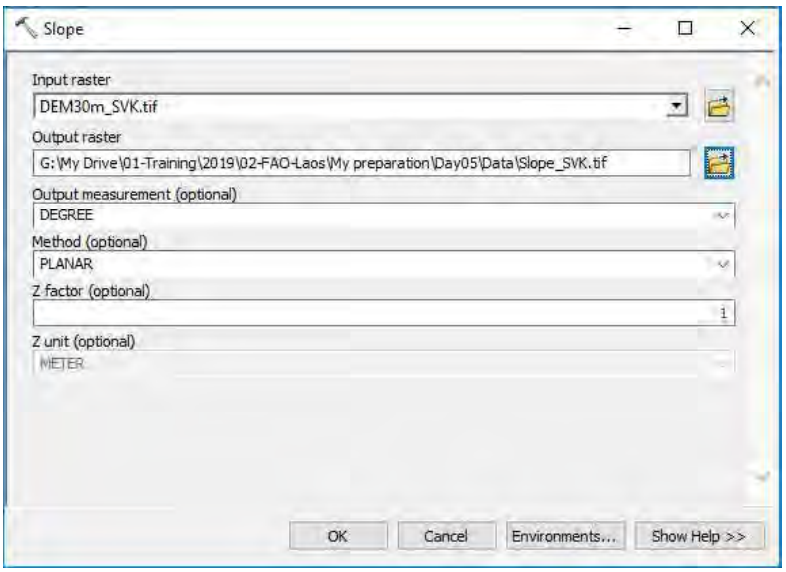
Savannakhet, Laos map, 2019

How to create Slope

Slope layer of Savannakhet province

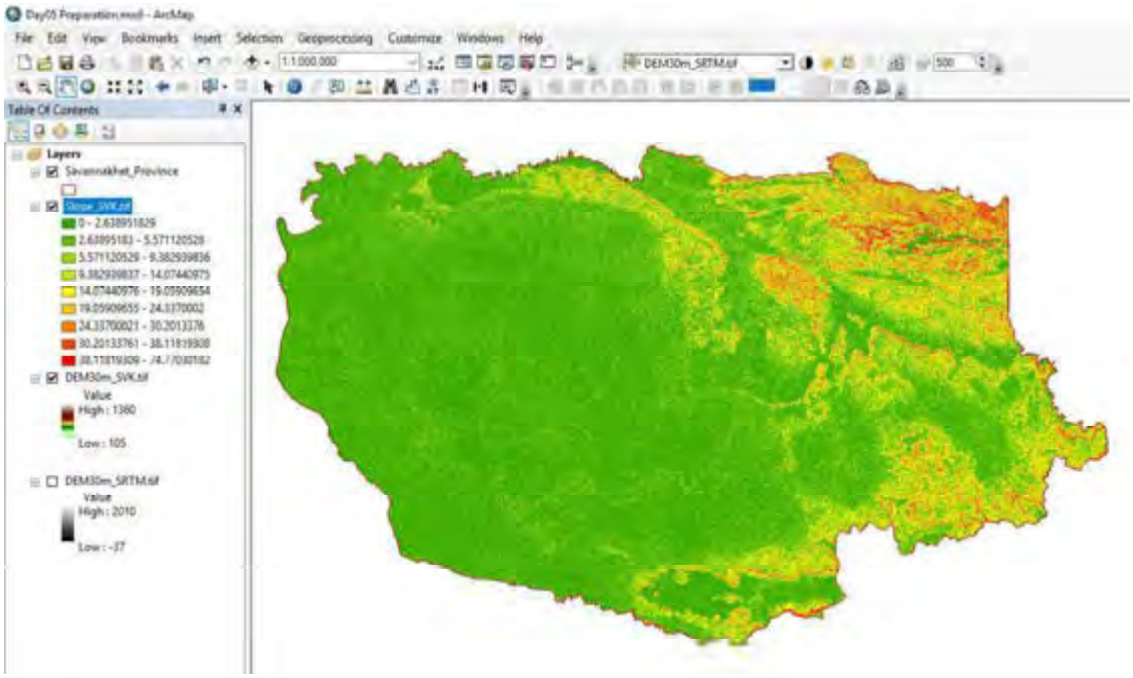


1. Spatial Analyst Tools ➔ Surface ➔ Slope



Slope Map – Savannakhet province

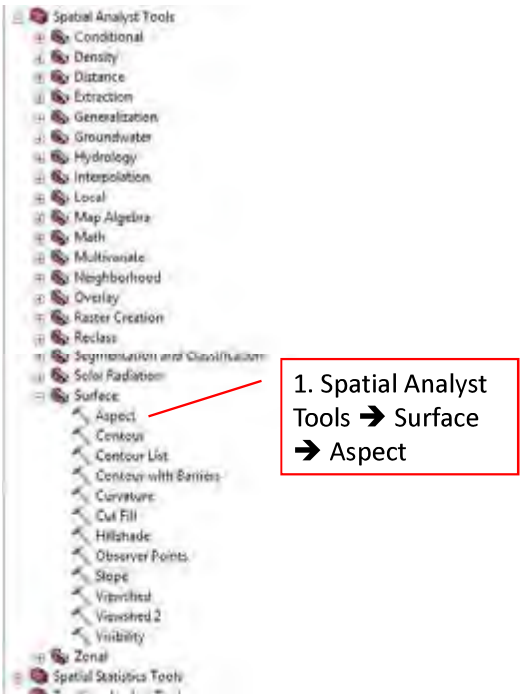
Slope classes in degrees



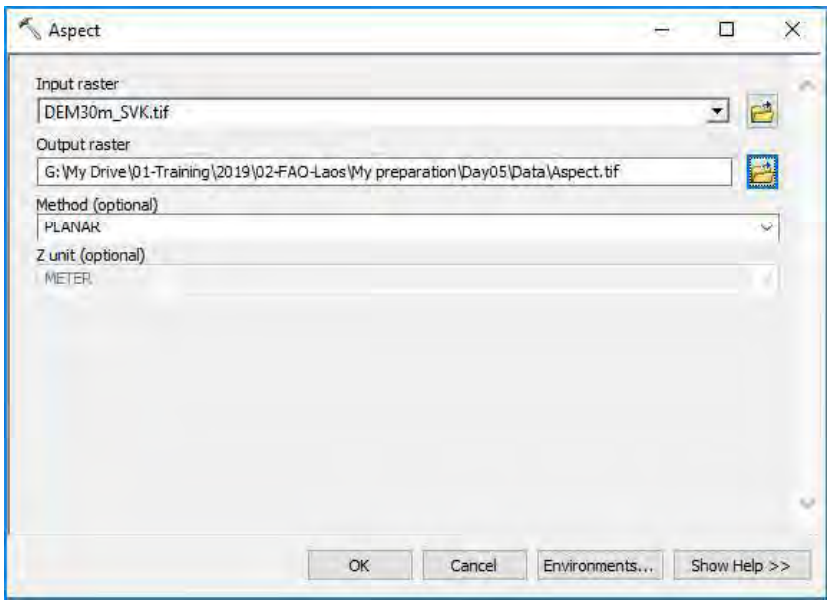
Savannakhet, Laos map, 2019

How to create Aspect

Aspect layer of Savannakhet province

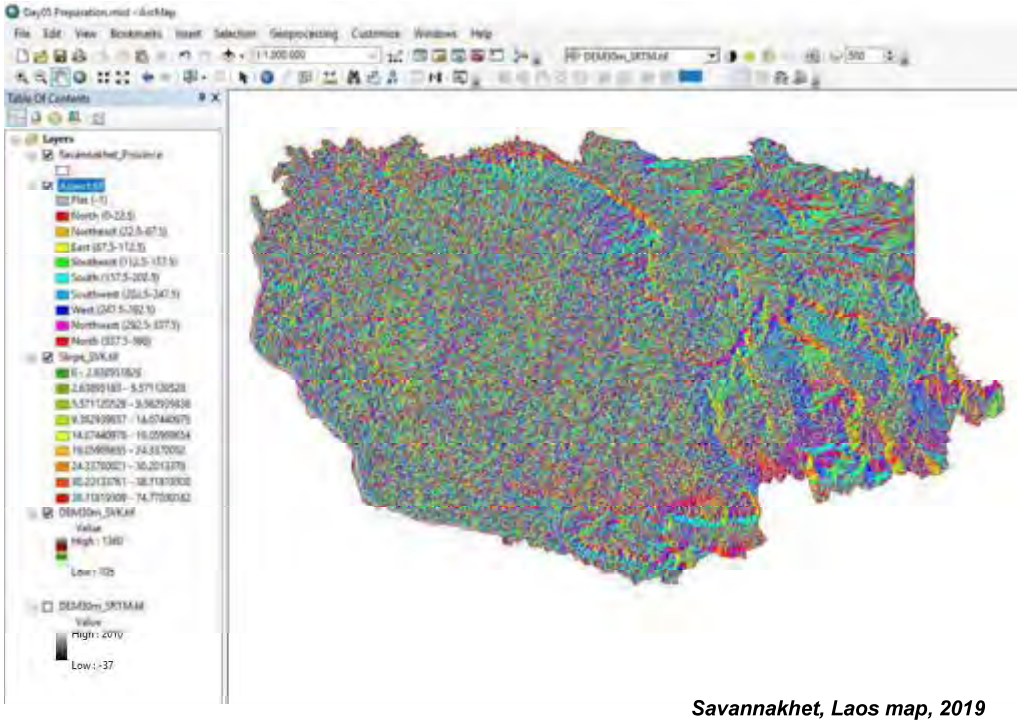


1. Spatial Analyst Tools ➔ Surface ➔ Aspect



Aspect Map – Savannakhet province

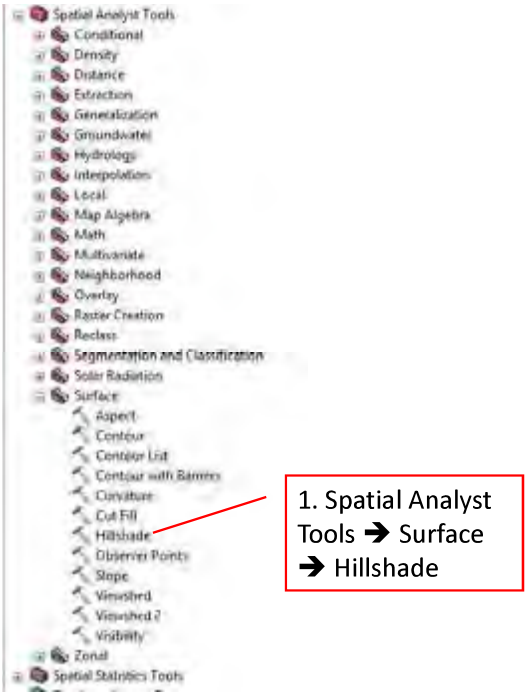
See the Aspect classes



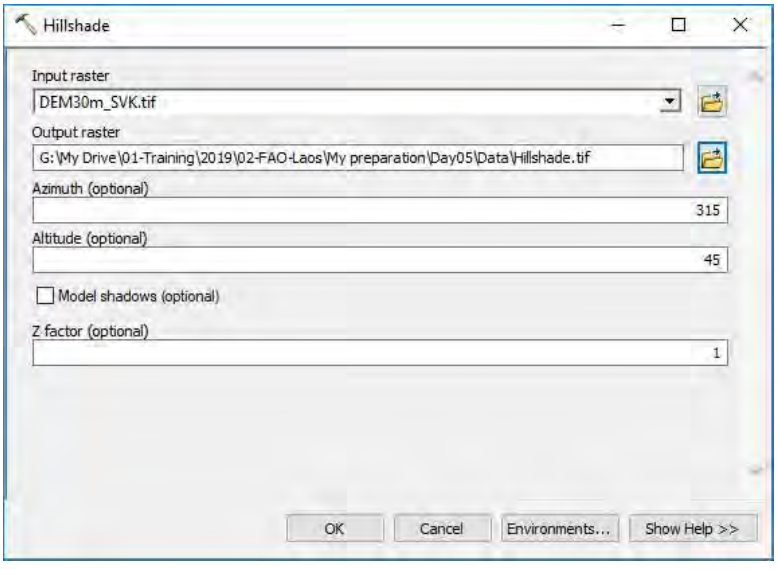
Savannakhet, Laos map, 2019

How to create Hillshade

Hillshade layer of Savannakhet province

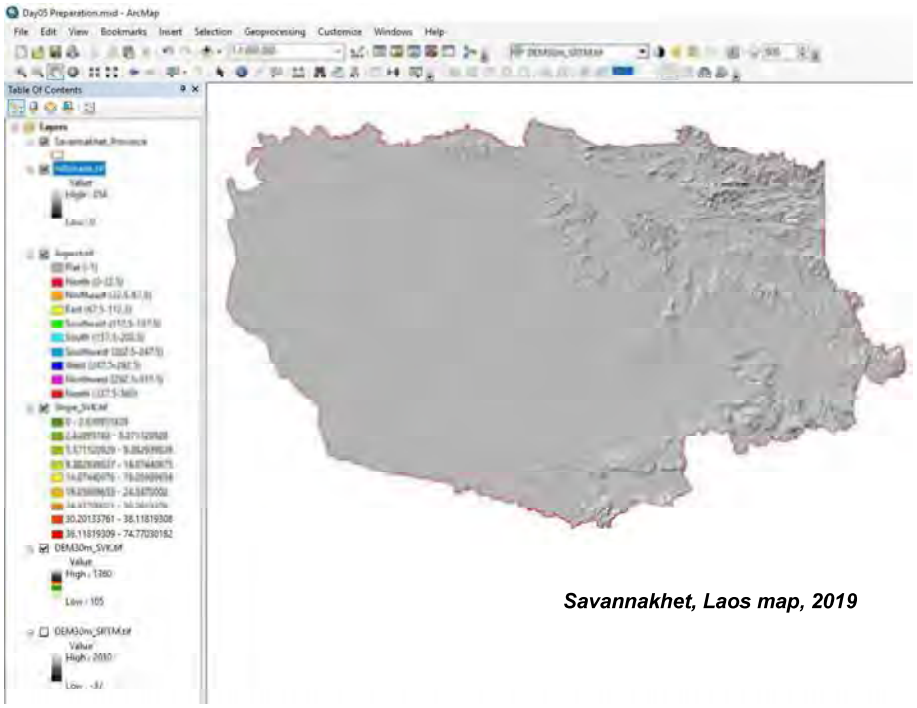


1. Spatial Analyst Tools ➔ Surface ➔ Hillshade



How you can download free elevation data?

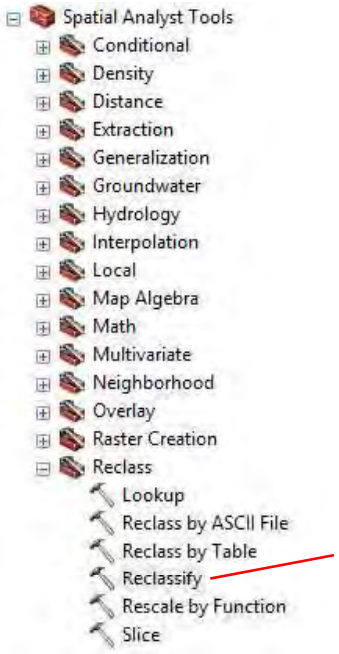
https://earthexplorer.usgs.gov/



Savannakhet, Laos map, 2019

How to re-class raster data

Necessary step if you want convert continuous raster data to vector



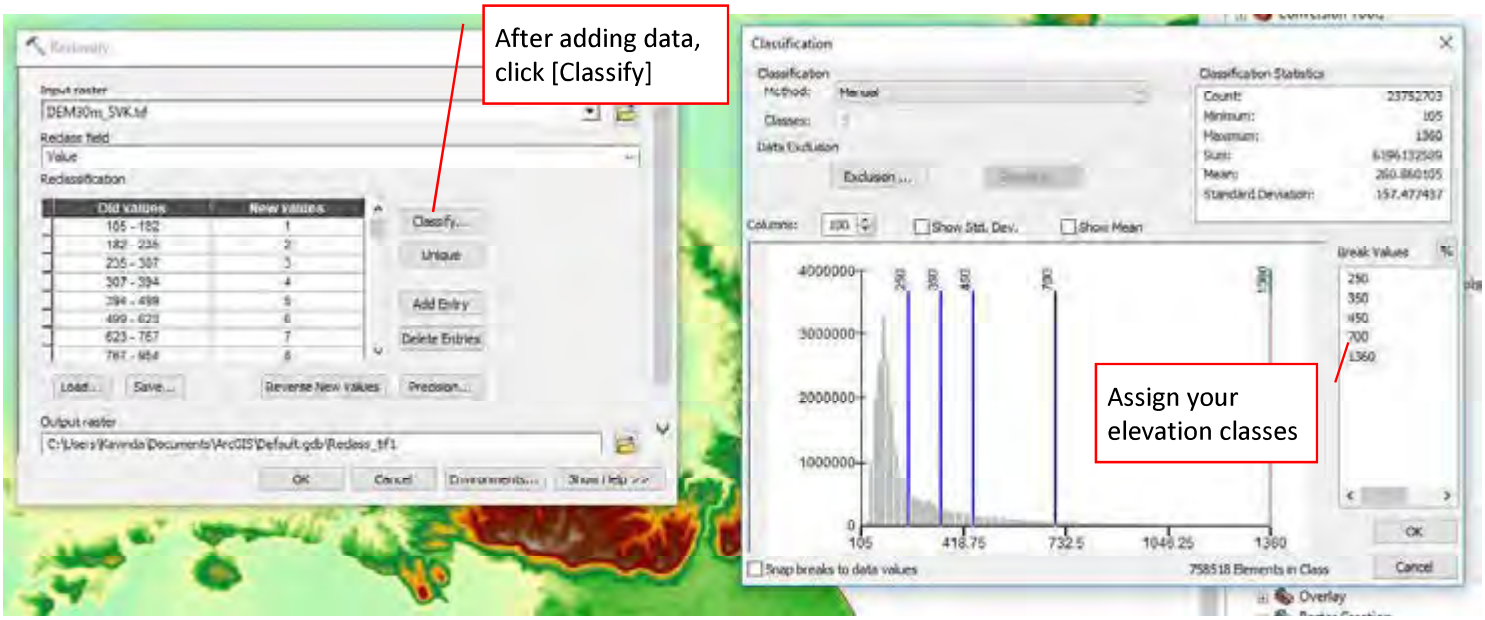
1. Spatial Analyst Tools ➔ Reclass ➔ Reclassify

Try to reclassify your elevation to

- Min – 250m
- 250m – 350m
- 350m – 450m
- 450m – 700m
- More than 700m

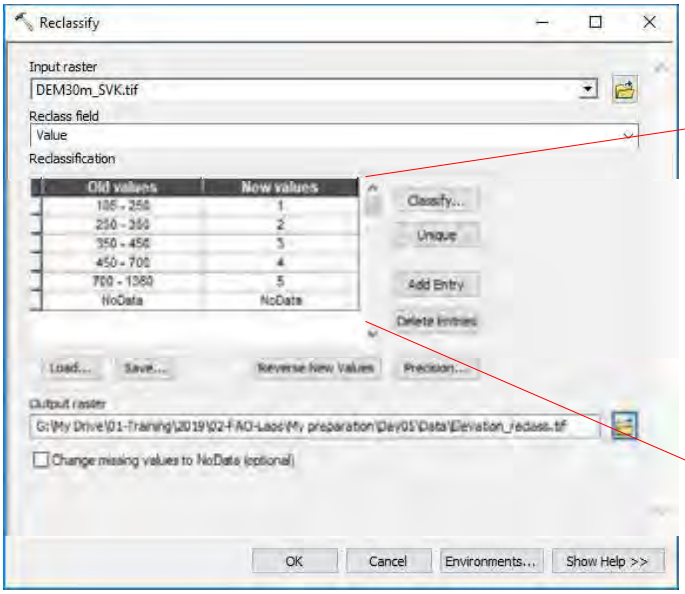
How to re-class raster data

Raster reclassification steps



How to re-class raster data

Raster reclassification steps



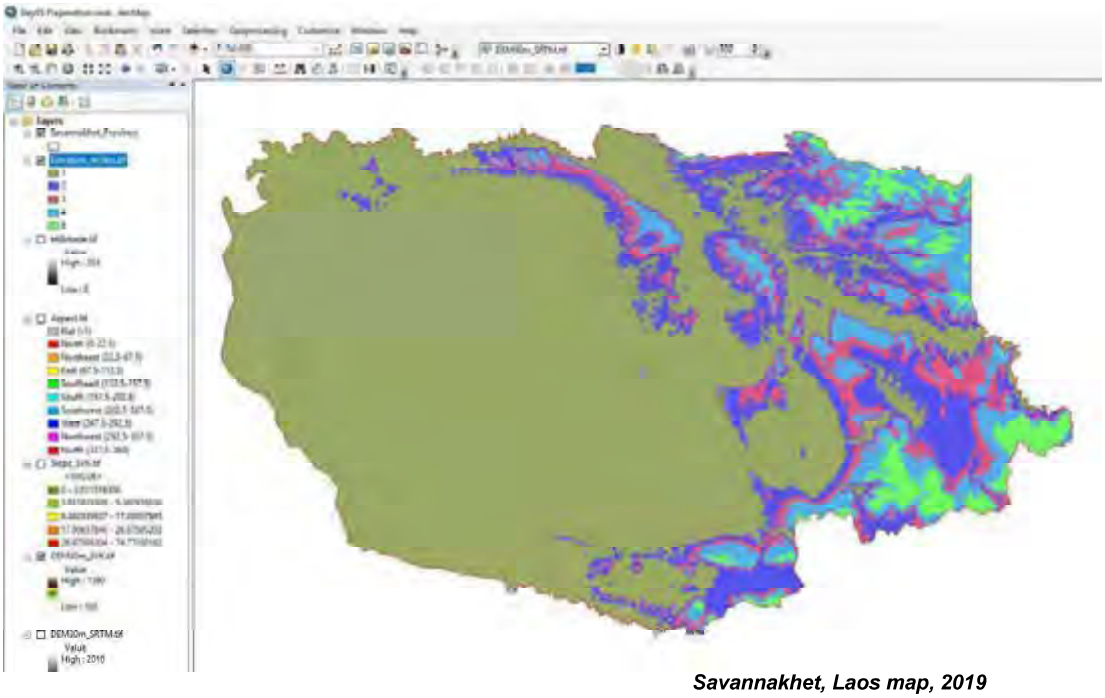
Note down the old values and new values

Reclassification

Old values	New values
105 - 250	1
250 - 350	2
350 - 450	3
450 - 700	4
700 - 1360	5
NoData	NoData

How to re-class raster data

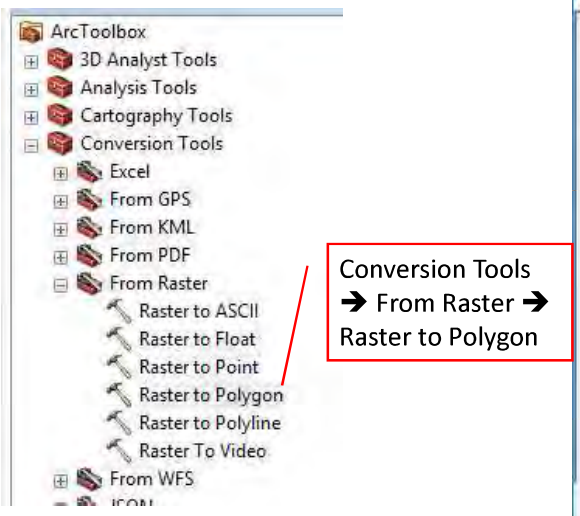
Display reclassified data



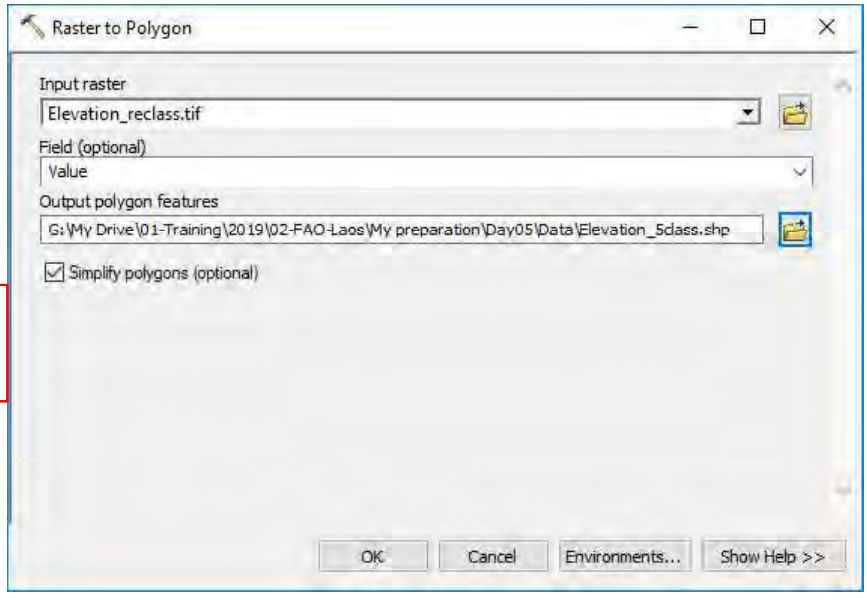
Savannakhet, Laos map, 2019

How to covert Raster to Vector data

Data convertion

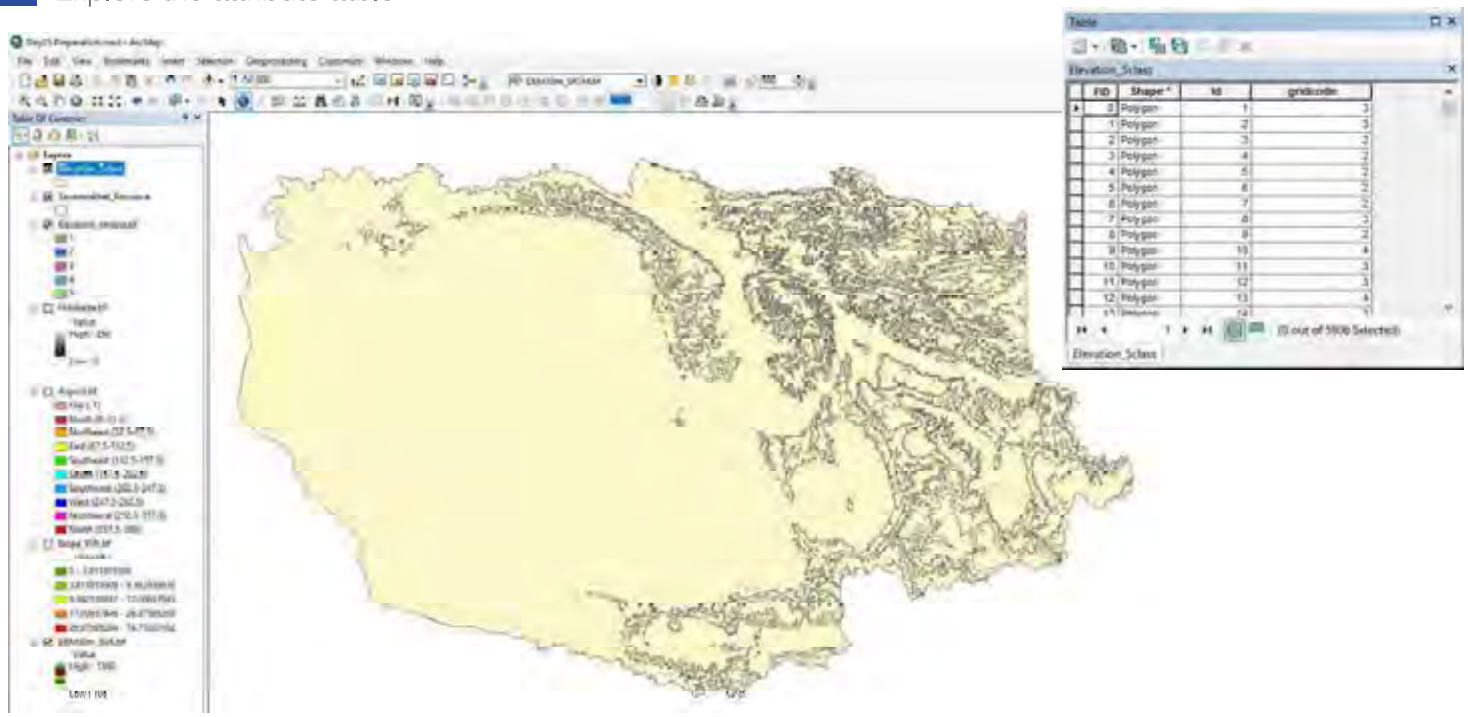


Conversion Tools ➔ From Raster ➔ Raster to Polygon



Elevation classes in vector format

Explore the attribute table



Savannakhet, Laos map, 2019

Overlay operations: Self-task V

Hint: you have learnt all the tools to do this operation

Can you find the area (in sqkm) of

I. 0 – 20 degree slope

II. more than 20degree slope

III. Optional: how many percentage of villages in 0-20 degree slope zone

Overlay operations: Self-task V

Hint: you have learnt all the tools to do this operation

Find the best locations for a new Agro Meteorological Stations

Criteria:

1. 10km away from “primary” roads
2. 20km away from existing Agro Meterological Stations
3. Elevation more than 450m

Contact Us

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www.ait.ac.th
www.geoinfo.ait.ac.th (our center)
www.Facebook.com/gicait

Strengthening Agro-climatic Monitoring and Information Systems (SAMIS)
to improve adaptation to climate change and food security in Lao PDR

Coordinate Systems & Projections

A first look into the concepts that comprise
a Geographic Information System

Dr. Kavinda Gunasekara

Frank Yrle

Overview
Coordinate Systems & Projections

1. Explore coordinate systems
2. Projecting Data in ArcGIS
3. Files without coordinate systems
4. Georeference a paper map

Coordinate Systems
Coordinate Systems & Projections

GIS are different than other data systems because they contain spatial data

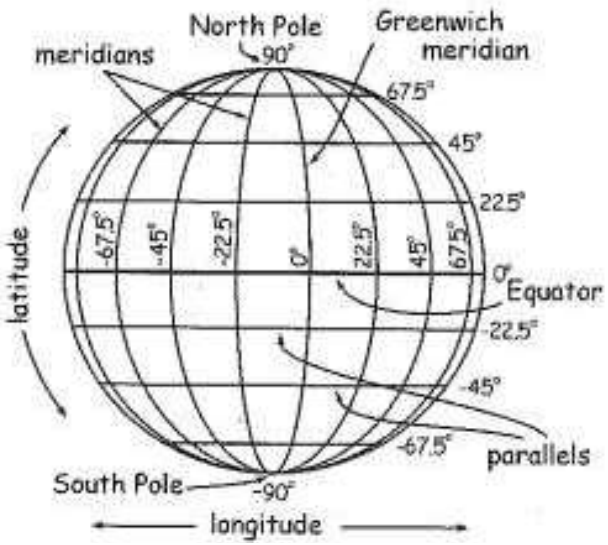
Coordinates
- Location
- Shape
- Extent

Two types of coordinate systems

Geographic Coordinate Systems
Coordinate Systems & Projections

Curved surface

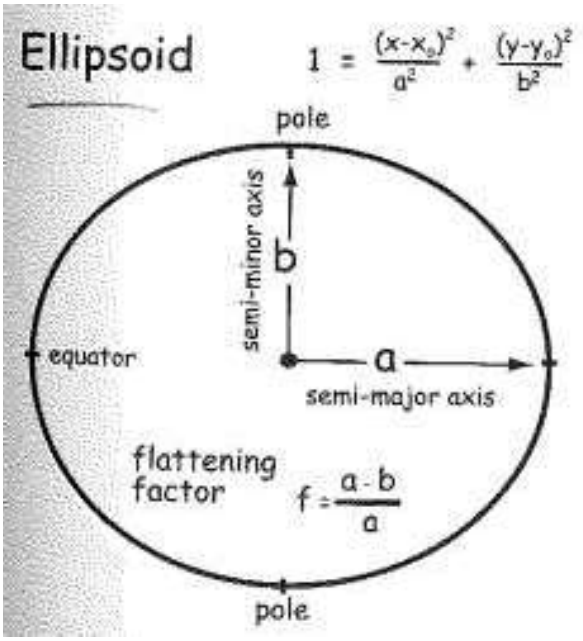
Geographic coordinates systems use a 3D spherical surface to define locations on the Earth



ESRI
Bolstad 2012

What makes up a geographic coordinate system?
Ellipsoid

Ellipsoid
- Originally measured with astronomical observations
- Measured at continental level – led to discrepancies in position
- More recently – GNSS and laser observation

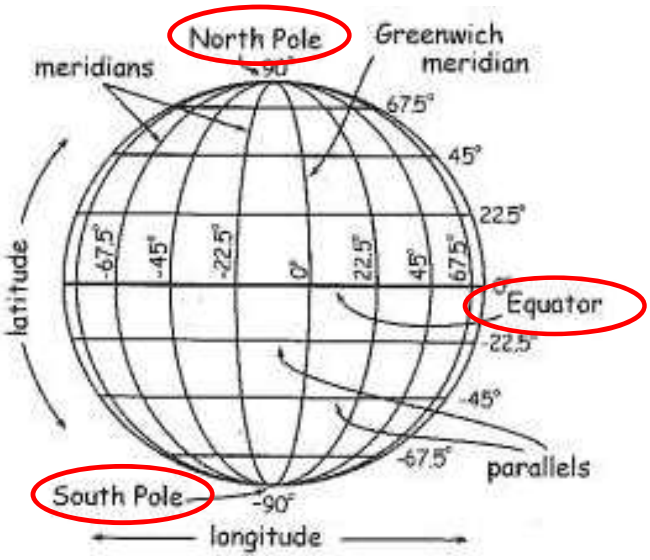


What makes up a geographic coordinate system?
Poles & Equator

- Poles – defined by the axis of revolution of the ellipsoid
- Equator – the circle mid-way between two poles, at a right angle to the polar axis, and spanning the widest dimension of the ellipsoid

⬇

Coordinates can be defined

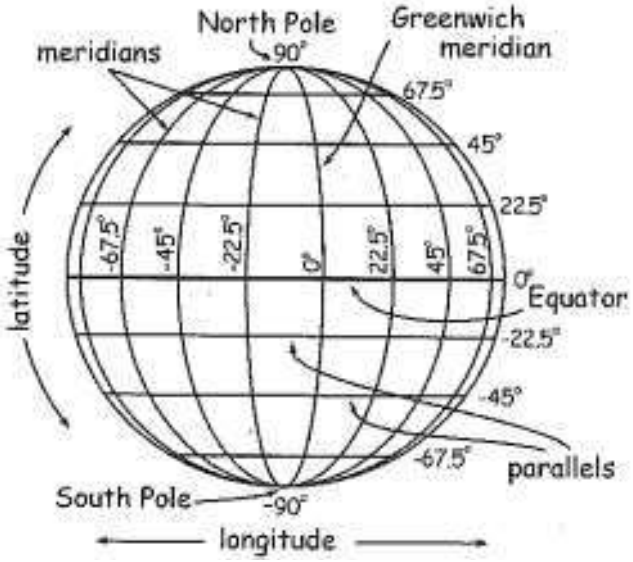


Bolstad 2012
Fundamentals of GIS

Geographic Coordinate Systems
Terms

Latitude – varies from N to S
Parallel = lines of constant latitude, runs E to W
Equator is 0° latitude

Longitude – varies from E to W
Meridian = lines of constant longitude, runs N to S
Meridians converge at the poles
Prime Meridian is 0 ° longitude



Bolstad 2012
Fundamentals of GIS

An additional component of a coordinate system
Datum

Geographic coordinate system with ellipsoid, poles, and equator specify only the position at the prime meridian

In order to know the other points on earth we must perform survey based on that

Datum is a reference surface
Datum is made up of: ellipsoid with a coordinate system & origin; set of points and lines that have been surveyed

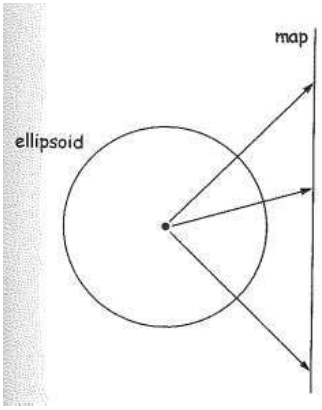
Governments typically have a surveying department to measure & maintain these points
The datum tells us the latitudes and longitudes of a set of points on an ellipsoid

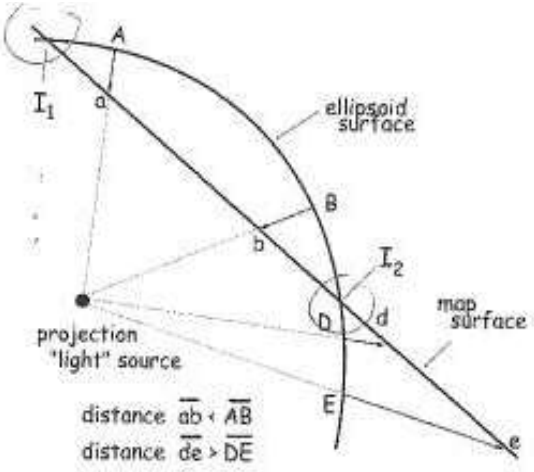
Bolstad 2012
Fundamentals of GIS

Map Projections

Coordinate Systems & Projections

Map projections are necessary to transfer the measurements made on an ellipsoid onto a flat map
Those measurements, or points, are projected from the Earth surface onto a flat map

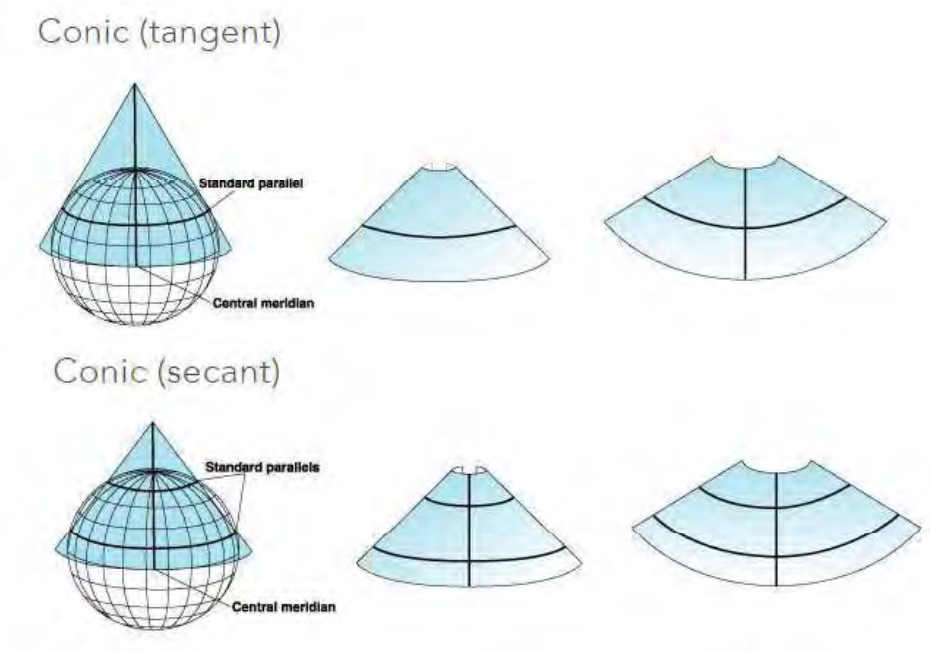




Bolstad 2012
Fundamentals of GIS

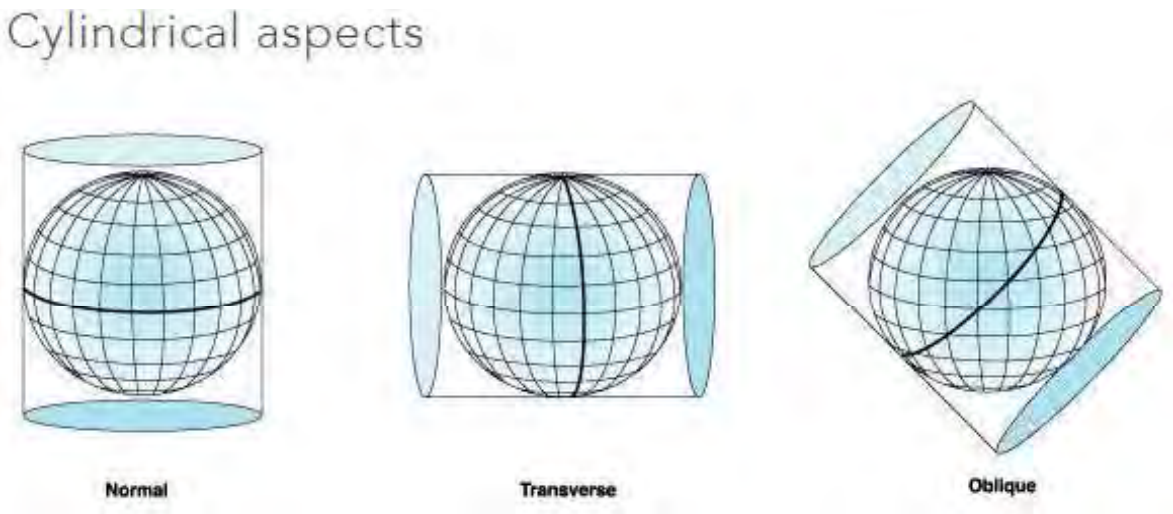
Projected Coordinate Systems

Shapes for projection



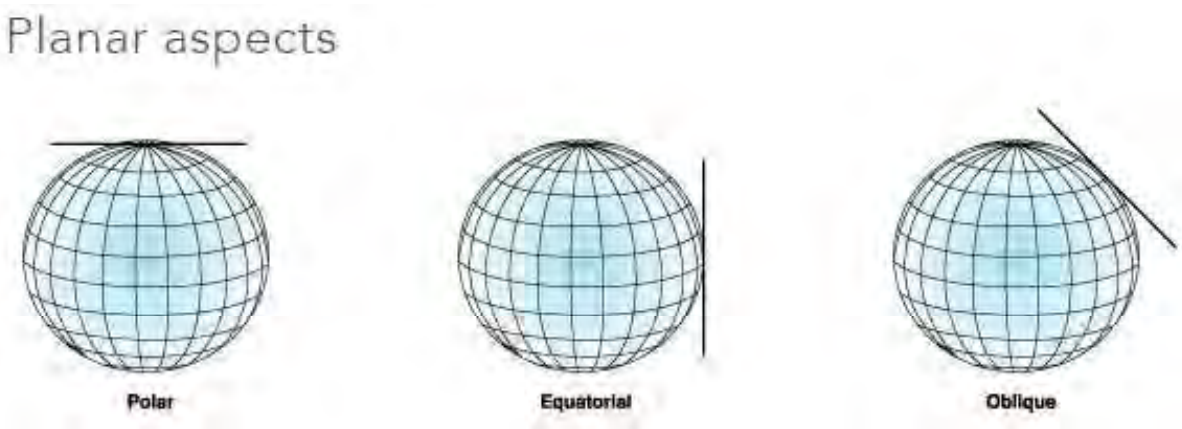
ESRI

Projected Coordinate Systems
Shapes for projection



ESRI

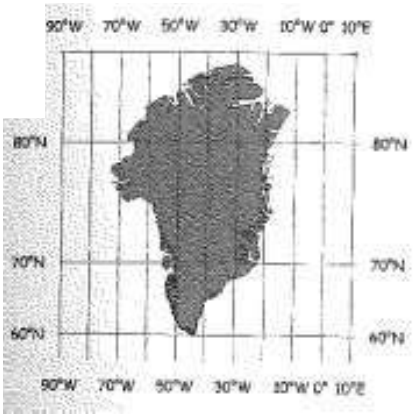
Projected Coordinate Systems
Shapes for projection

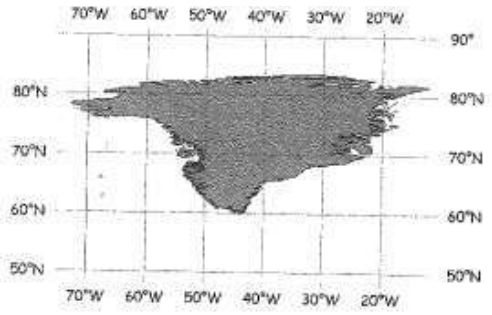


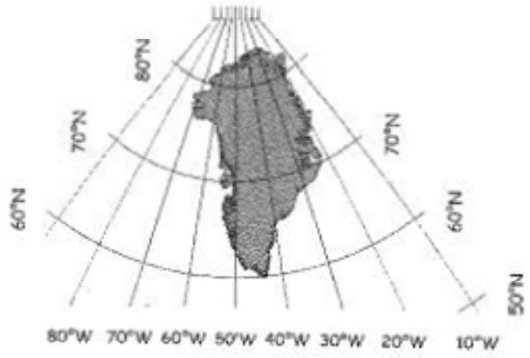
ESRI

Distortion in Maps
Coordinate Systems & Projectio

Distortion is inherent in all maps for distance, direction, shape, & area







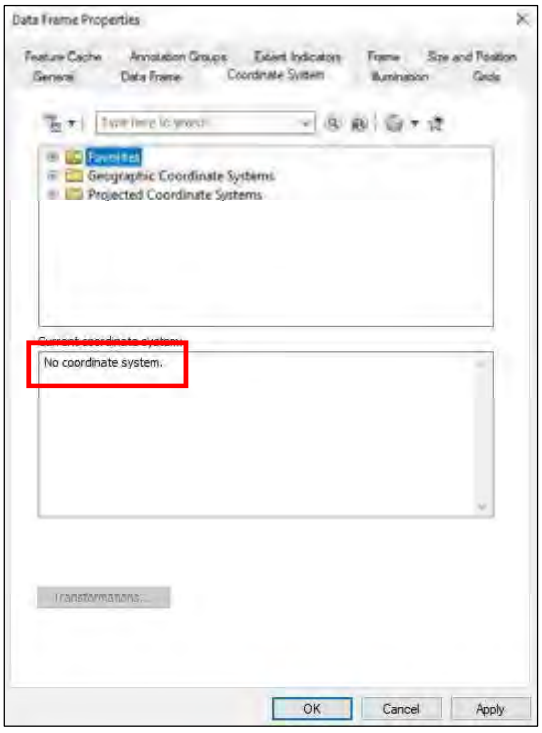
Bolstad 2012
Fundamentals of GIS

Overview
Coordinate Systems & Projections

1. Explore coordinate systems
2. Projecting Data in ArcGIS
3. Files without coordinate systems
4. Georeference a paper map

Start an ArcMap session
Blank map

Open ArcMap
At Table of Contents right-click Layers
Properties



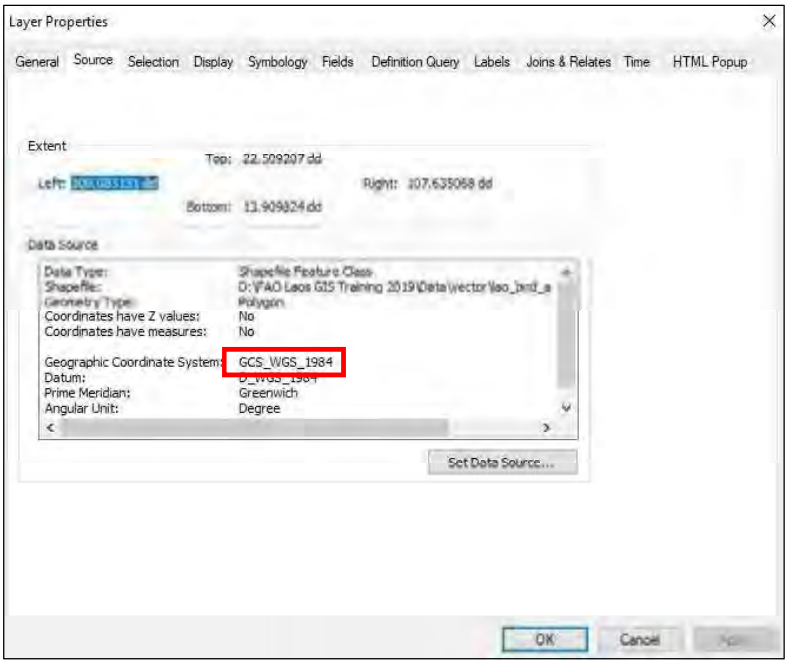
Also notice the units

994.062 202.494 Unknown Units

Adding Data & Coordinate Systems
Observe coordinate system

From ArcCatalog window add data:
Lao_bnd_admin0_ngd2018.shp
Right-click | Properties | Source tab

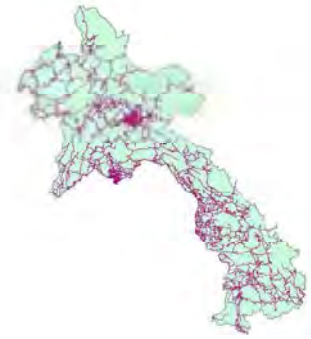
108.136 19.12 Decimal Degrees



The data frame takes on the coordinates of the first file added to it

Adding Data & Coordinate Systems

Observe coordinate system

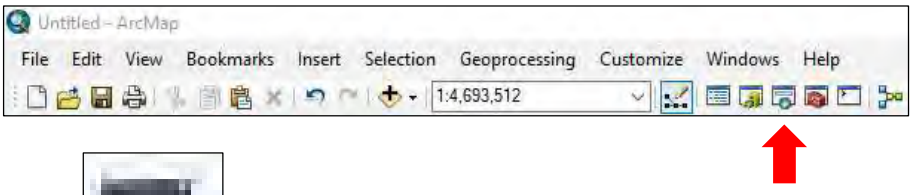


From ArcCatalog window add data:
Roads_utm.shp
Right-click | Properties | Source tab

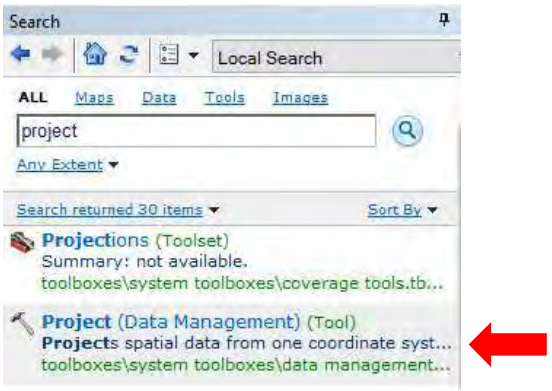
These two layers have different coordinate systems, but the data can be visualized because ArcMap is able to project on the fly

Projecting data

Observe coordinate system



Select the Search tool from the toolbar



Search for project

Click Project (Data Management)

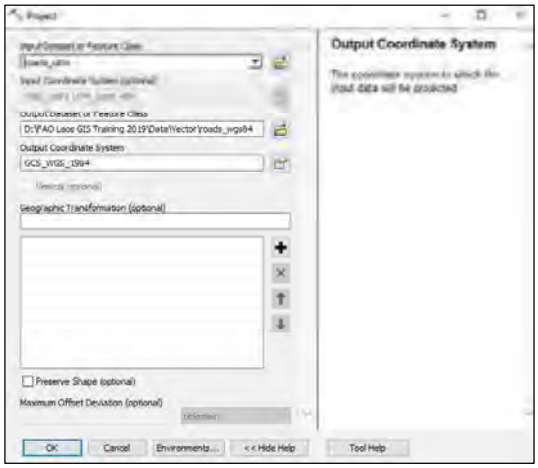
Adding Data & Coordinate Systems

Observe coordinate system

At the Project tool enter roads_utm.shp for the input dataset

Specify a file name and output folder

Finally select geographic coordinate system: WGS84 for the output coordinate system
OK



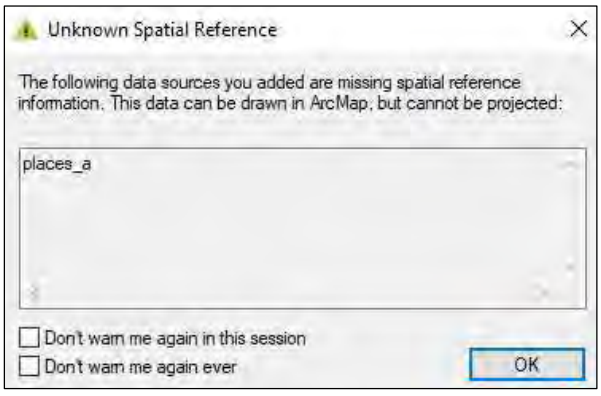
Defining a projection

Observe coordinate system

From ArcCatalog window add data: places_a.shp

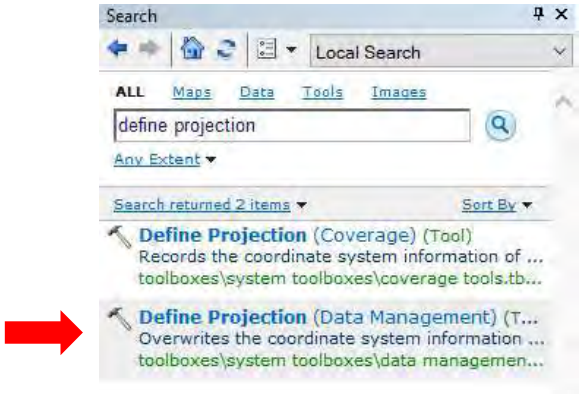
You should see a warning message titled Unknown Spatial Reference. This means the places_a shapefile doesn't have projection information associated with it.

We can add a projection to a file that doesn't have one by using the Define Projection tool; However, we should have some idea of what the projection is beforehand

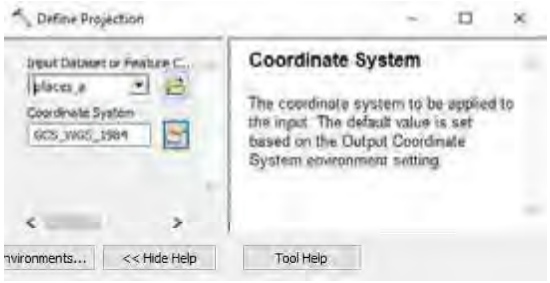


Defining a projection
Observe coordinate system

Use the Search tool to find Define Projection



In this case it turns out that the projection is WGS84, so select that at the Coordinate System box
OK



Overview
Coordinate Systems & Projections

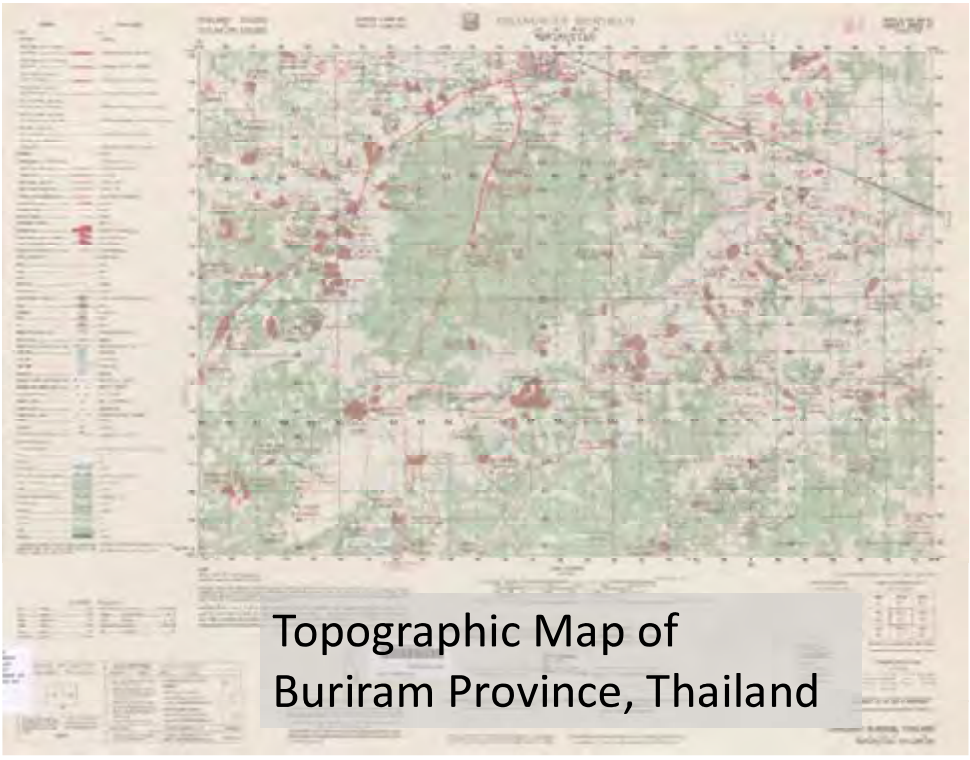
1. Explore coordinate systems
2. Projecting Data in ArcGIS
3. Files without coordinate systems
4. Georeference a paper map

Paper Maps

How can we integrate into a GIS?

Georeference

Performed on scanned paper maps to align them with a known coordinate system

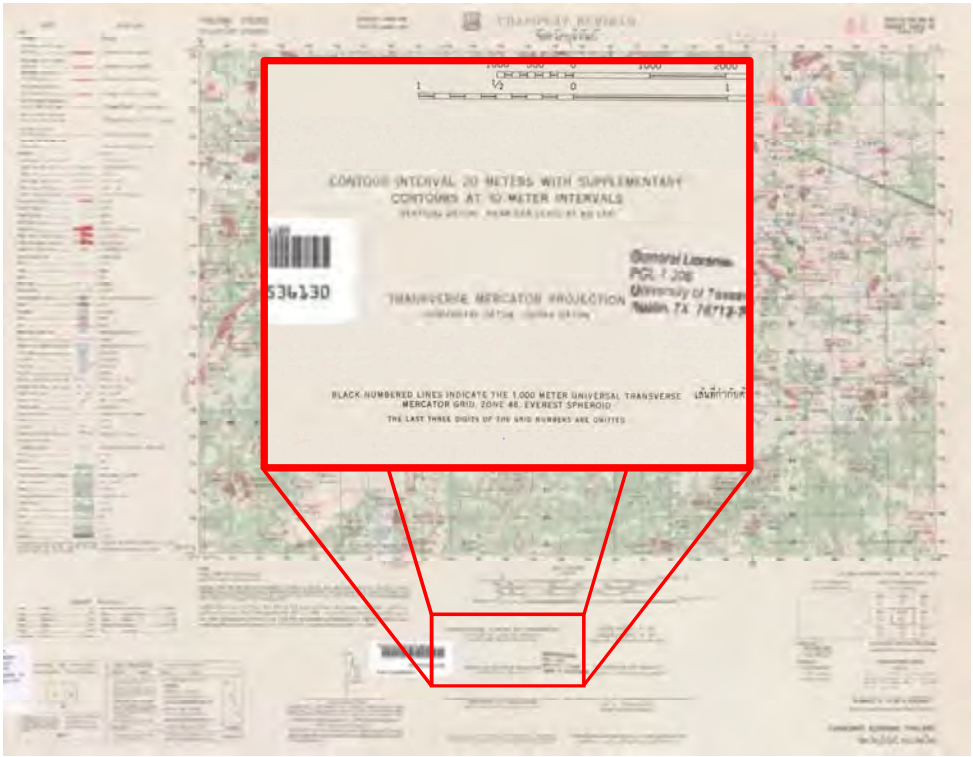


Topographic Map of Buriram Province, Thailand

Info needed to Georeference

Two Requirements

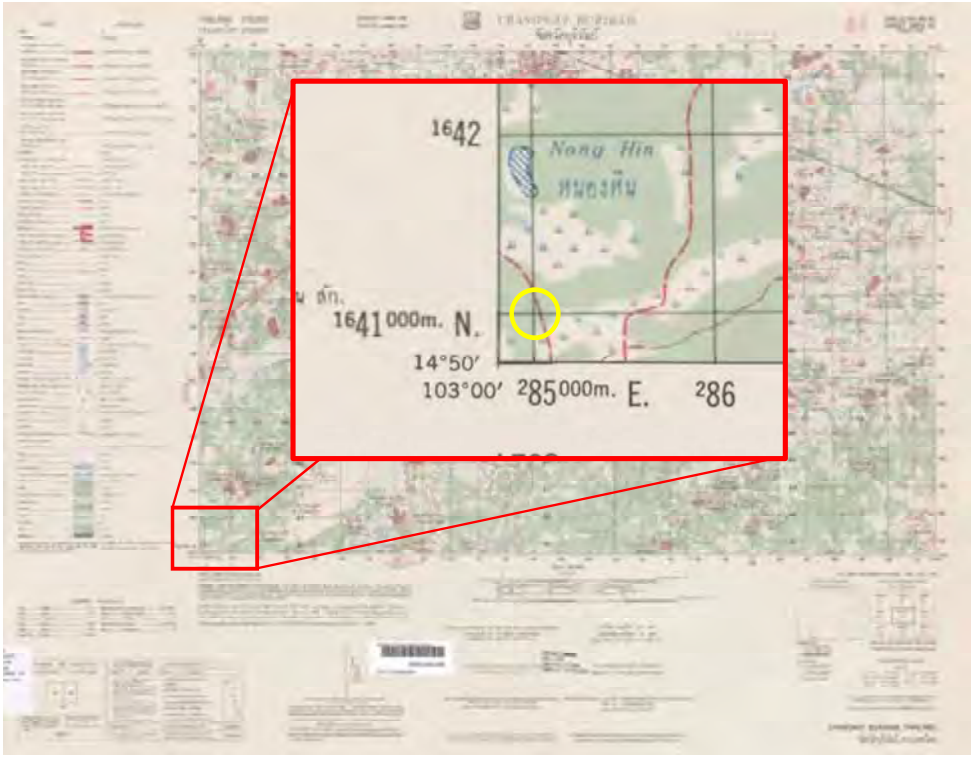
1. Metadata – Coordinate System, Projection
2. Ground Control Points (GCP)



Info needed to Perform Georeference

Two Requirements

1. Metadata – Coordinate System, Projection
2. Ground Control Points (GCP)

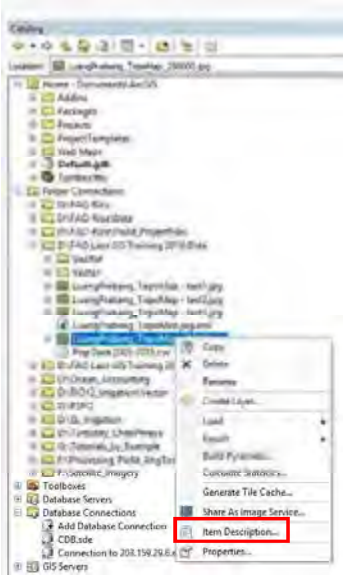


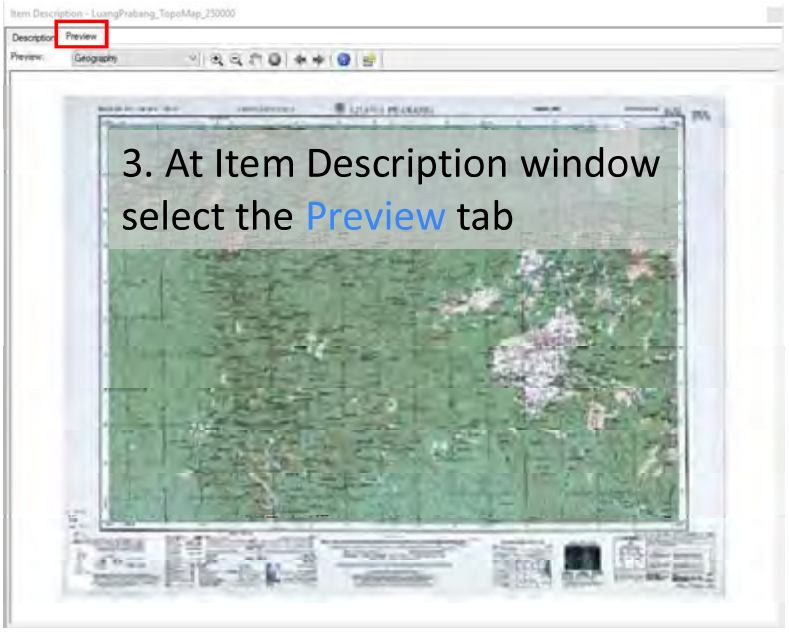
Coordinates for this GCP:
X = 285,000 m E
Y = 1,641,000 m N

Applications of GIS

Many disciplines use GIS

1. Open the ArcCatalog Window in ArcMap





2. Find the file LuangPrabang_TopoMap_250000.jpg
Right Click and select Item Description…

Applications of GIS

Many disciplines use GIS

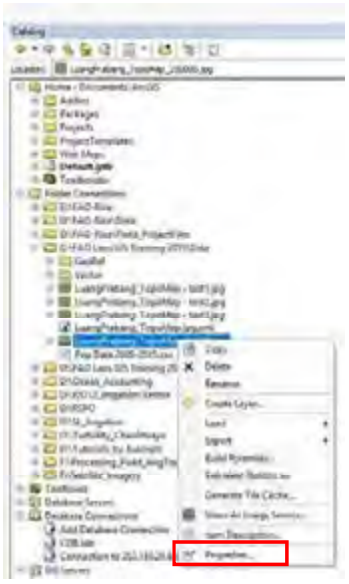
Some important info present on paper map:

- Scale
- Year
- Creator
- Projection
- Spheroid

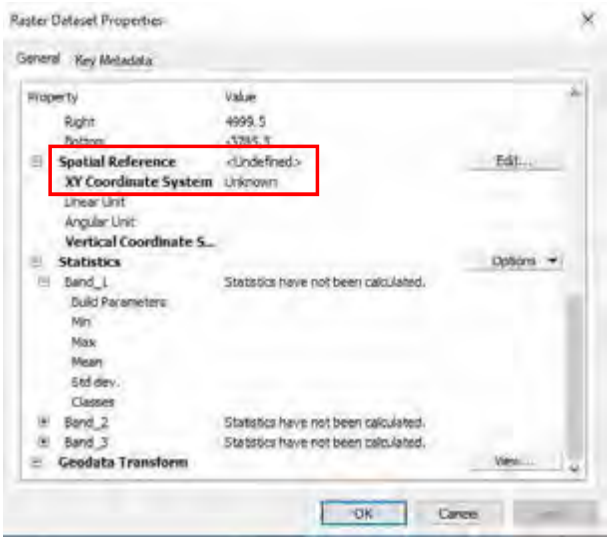
Activity:
Find each one on the map

Applications of GIS

Many disciplines use GIS



4. Open Properties for LuangPrabang_TopoMap_250000.jpg

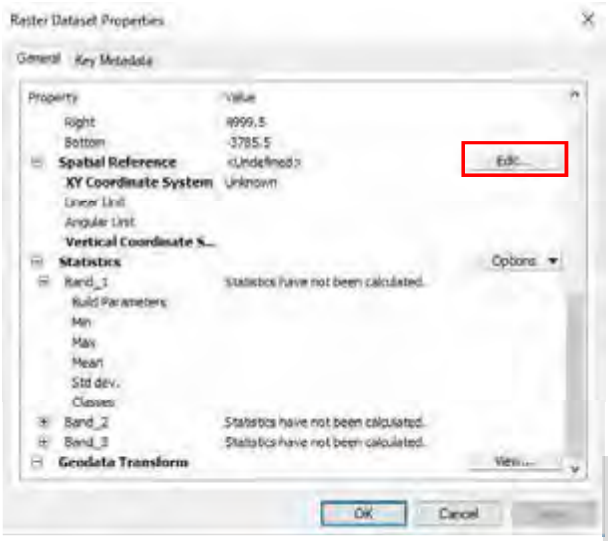


(Scroll down to find Spatial Reference Data)

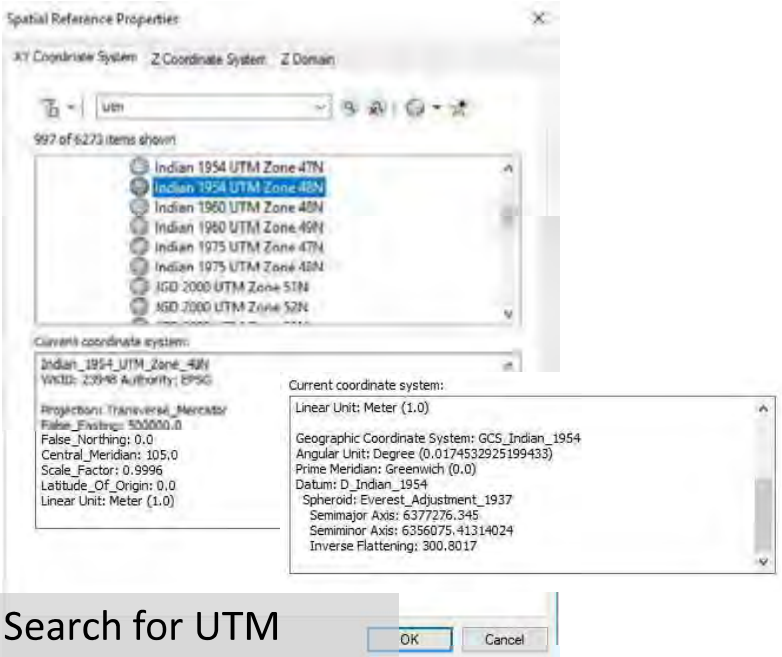
5. Notice that the spatial reference is unknown. We can find this information printed on the map.

Applications of GIS

Many disciplines use GIS



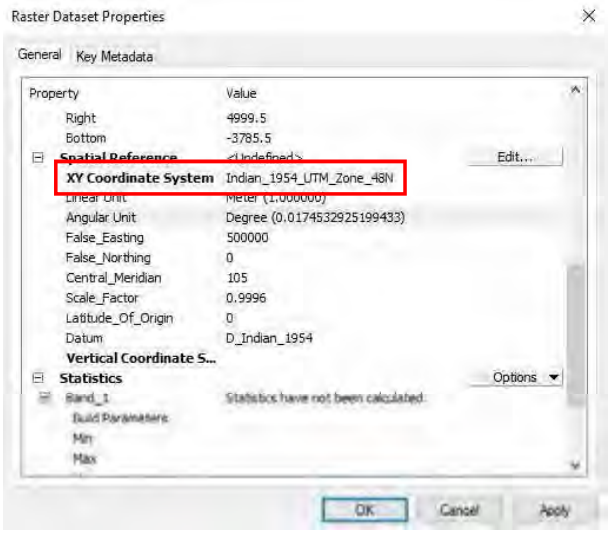
6. Click the Edit button



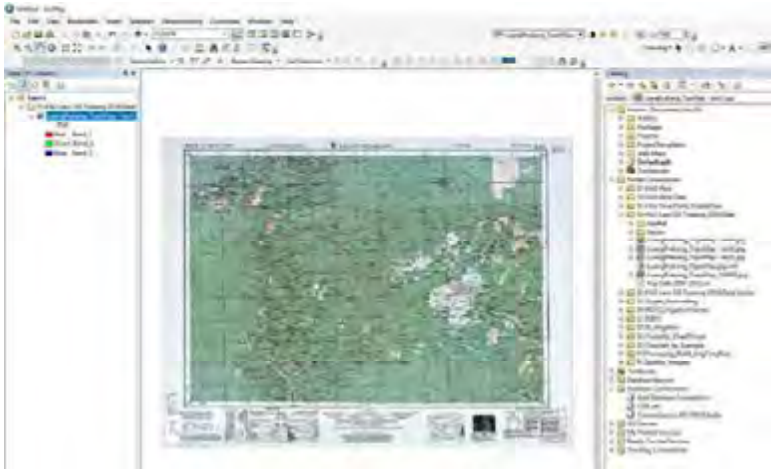
7. Search for UTM
- Navigate to Asia folder
- Find Indian 1954 UTM Zone 48

Applications of GIS

Many disciplines use GIS



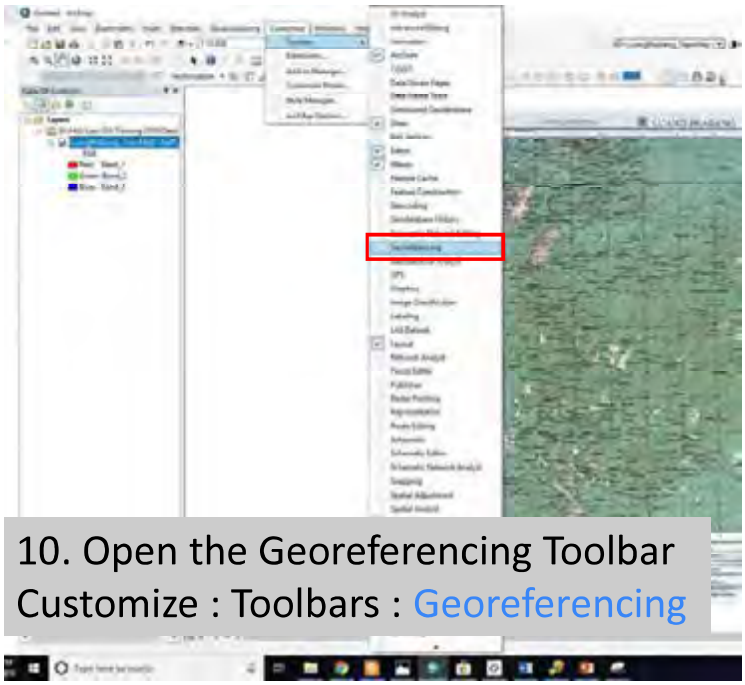
8. Click Apply.
The coordinate system will be updated with your selection



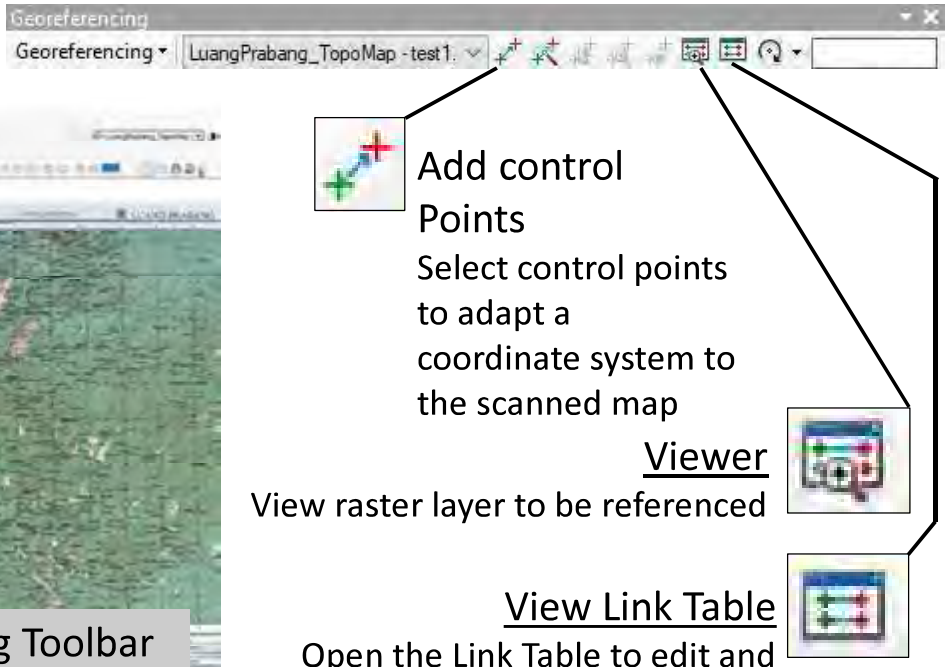
9. Drag & drop LuangPrabang_TopoMap_250000.jpg from ArcCatalog window into the ArcMap data view on the left.
Your Topo map will appear.

Applications of GIS

Many disciplines use GIS



10. Open the Georeferencing Toolbar
Customize : Toolbars : Georeferencing



Add control Points
Select control points to adapt a coordinate system to the scanned map

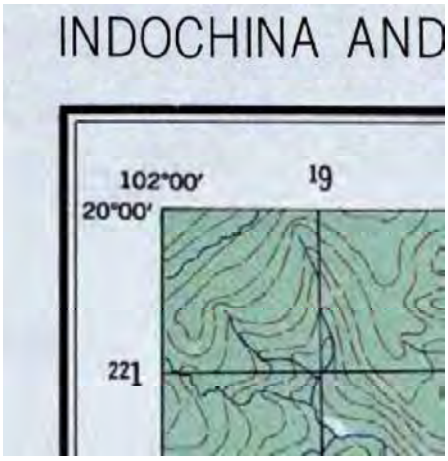
Viewer
View raster layer to be referenced

View Link Table
Open the Link Table to edit and examine the links

Applications of GIS

Many disciplines use GIS

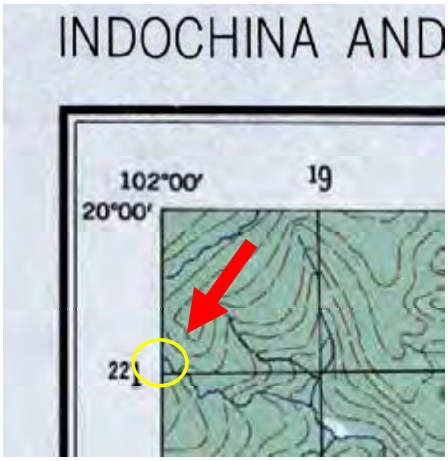
11. Click the Viewer button. The map will appear in the viewer window.



12. Zoom to the top left corner of the map

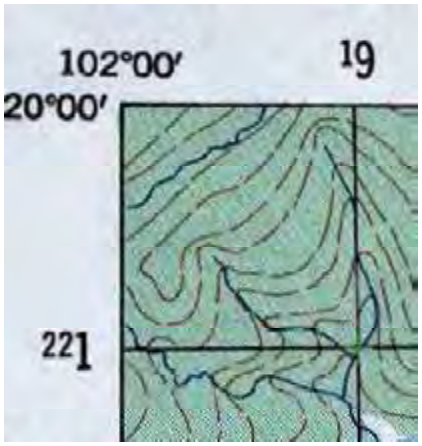
Applications of GIS

Many disciplines use GIS



13. Press the  Add Control Points button. Use the cursor to select the cross where the arrow is pointing. Click 2x

Upper Left



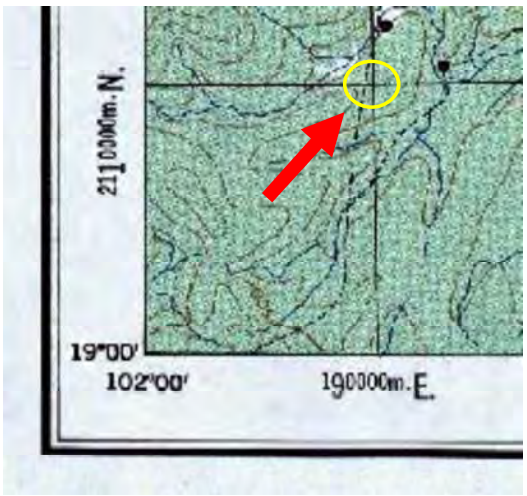
14. A green cross will appear where you clicked 2x

Applications of GIS

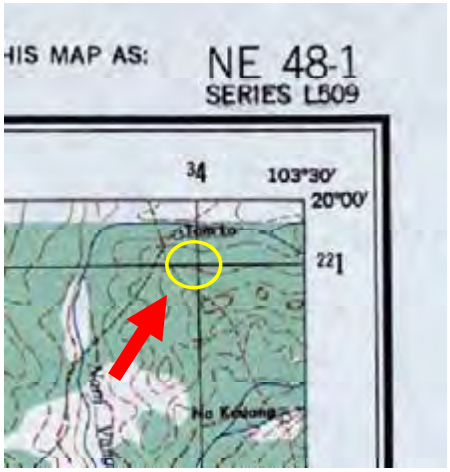
Many disciplines use GIS

15. Repeat for the other 3 corners of the image

Lower Left



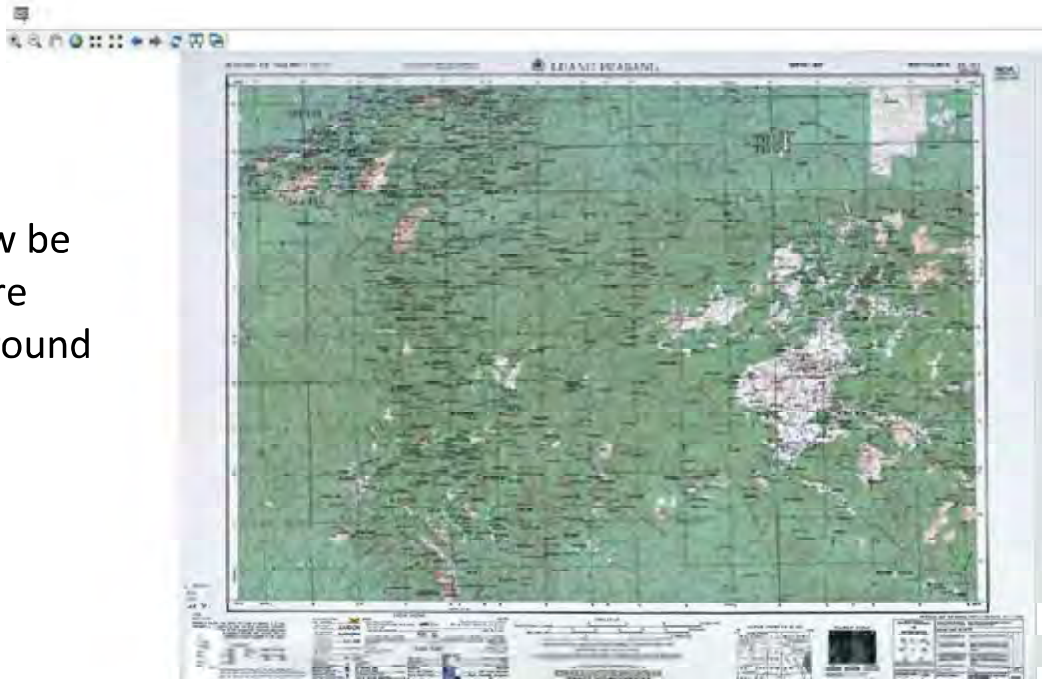
Upper Right



Lower Right

Applications of GIS

Many disciplines use GIS

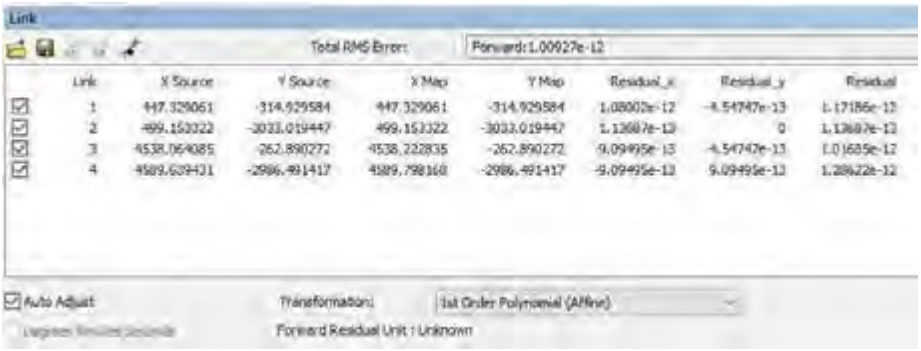


16. There should now be 4 green crosses where you 2x clicked the Ground Control Points

Applications of GIS

Many disciplines use GIS

17. Click the View Link Table button.



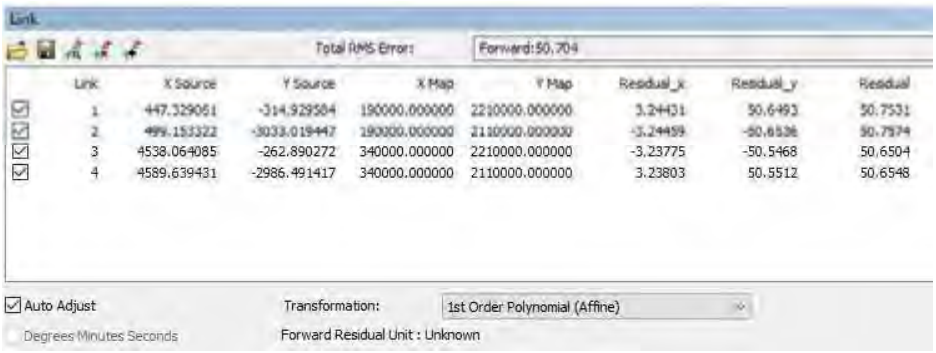
Enter the coordinates from the map into X Map & Y Map.

If you followed the same order as the powerpoint, Link 1 = Upper Left
Link 2 = Lower Left
Link 3 = Upper Right
Link 4 = Lower Right

Applications of GIS

Many disciplines use GIS

Press the  Full Extent button to if viewer loses track of the map.



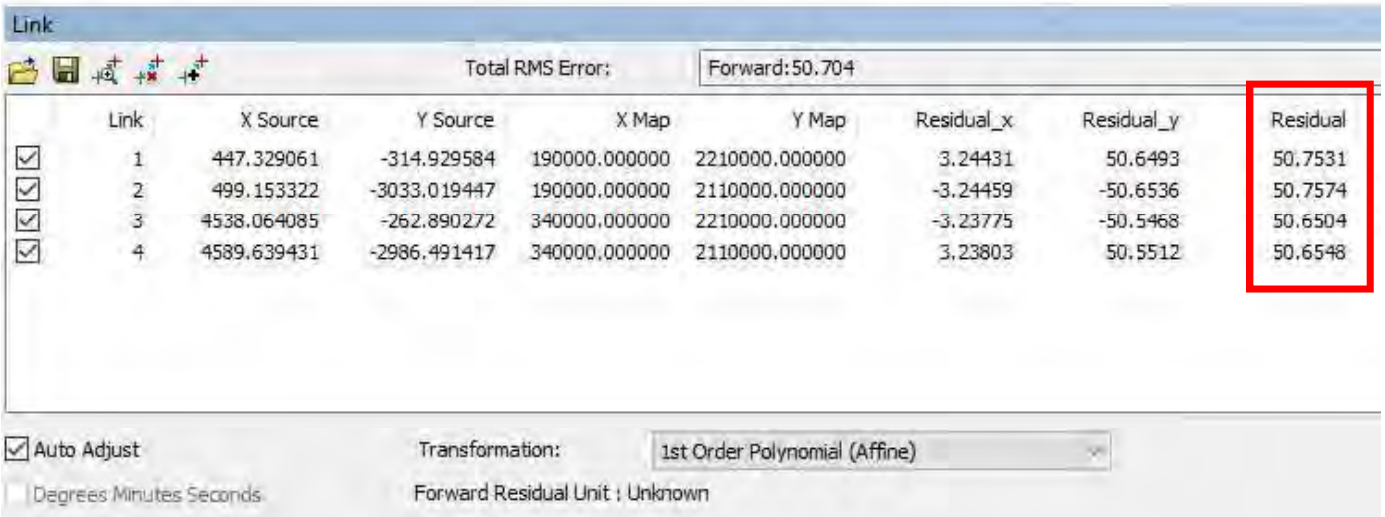
18. Enter the following coordinates:

Link	Location	X Map	Y Map
1	Upper Left	190000	2210000
2	Lower Left	190000	2110000
3	Upper Right	340000	2210000
4	Lower Right	340000	2110000

Residuals

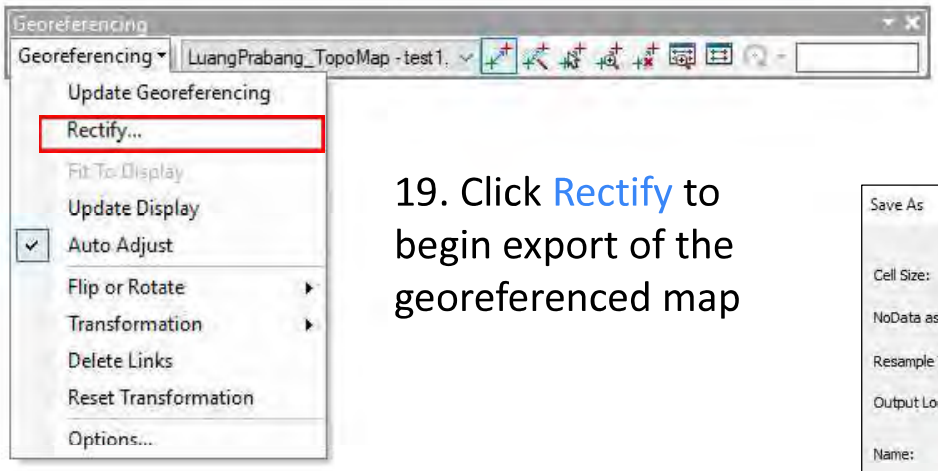
Many disciplines use GIS

Residual is very high



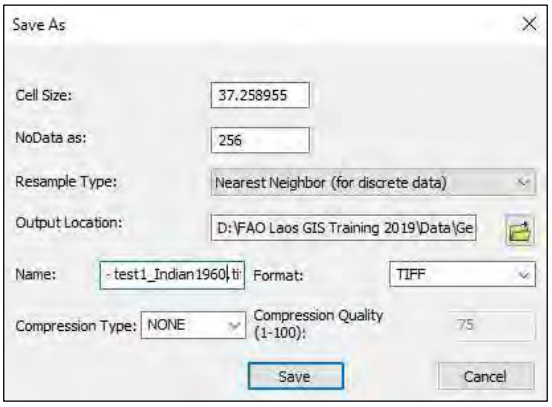
Rectify

Export your map



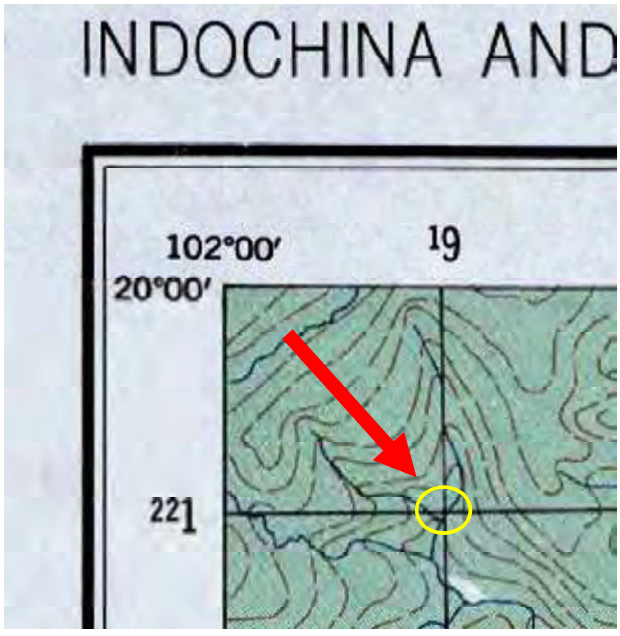
19. Click Rectify to begin export of the georeferenced map

20. Select a location and file name, then click Save



Results of georeferencing

Many disciplines use GIS

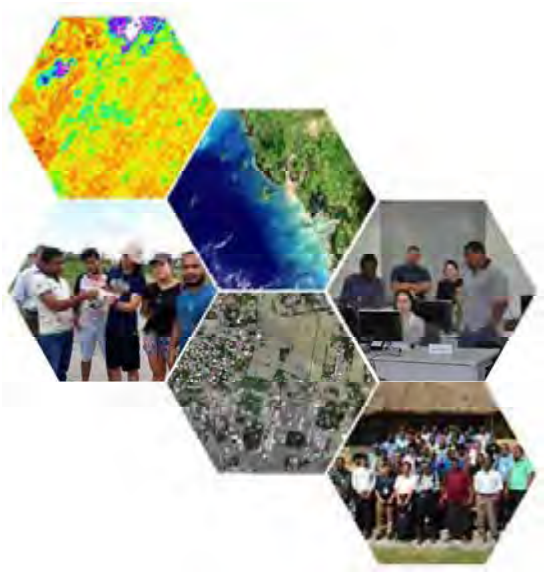


Before georeferencing

After georeferencing

Georeference the following image:

LuangPrabang_50000.jpg



Map Composition in ArcGIS

A first look into the concepts that comprise
a Geographic Information System

Dr. Kavinda Gunasekara
Frank Yrle

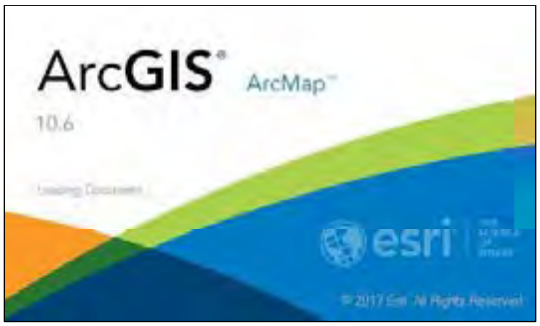
Topics covered in this section

Overview

1. Create new map
2. Exploring a map
3. Changing the symbol of features
4. Adding labels to a map
5. Laying out map
6. Saving map
7. Exporting map

Opening ArcMap 10.6

New empty map



❖Type Arcmap into the Windows search bar

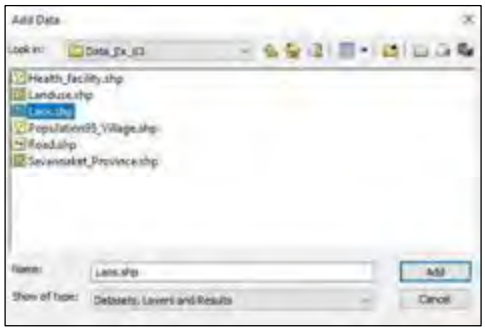
❖Select ArcMap 10.6

❖Click Cancel to open a new, empty map.

Adding a layer to a map

Assessment of skills – Begin at conclusion of lesson

- Adding a layer to a map, click the Add Data button 

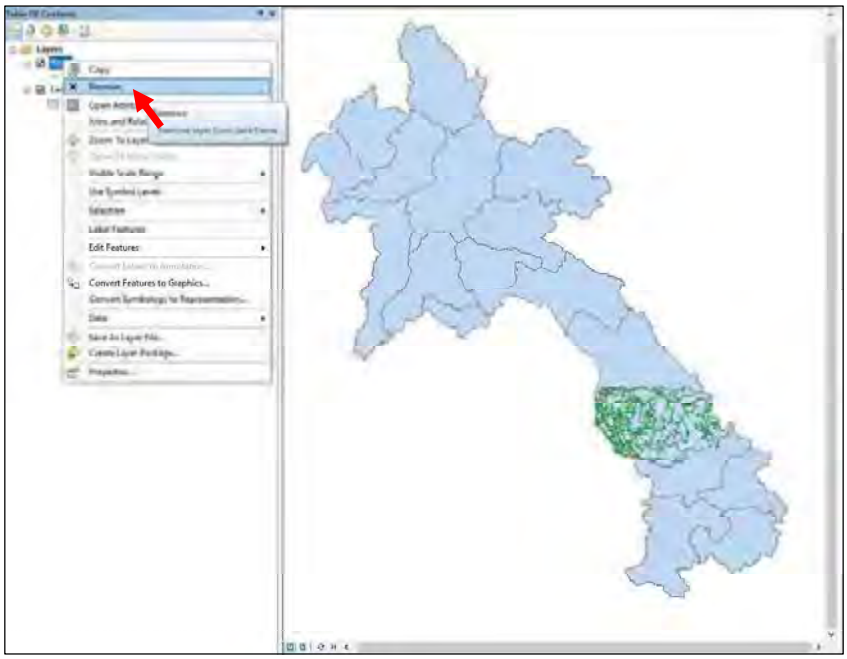


- Select a layer's name which you want to add to the map.
- Many layers could be selected as the same time (hold SHIFT on key broad and click to select)
- Then click Add button

Removing a layer from a map

Table of Contents

- To remove a layer, Right-click at the layer's name in the Tableof Contents then select Remove.



Laos map, 2019

Review of map navigation tools

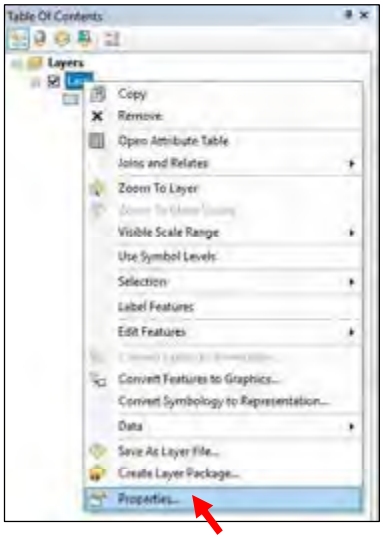
Located at toolbar

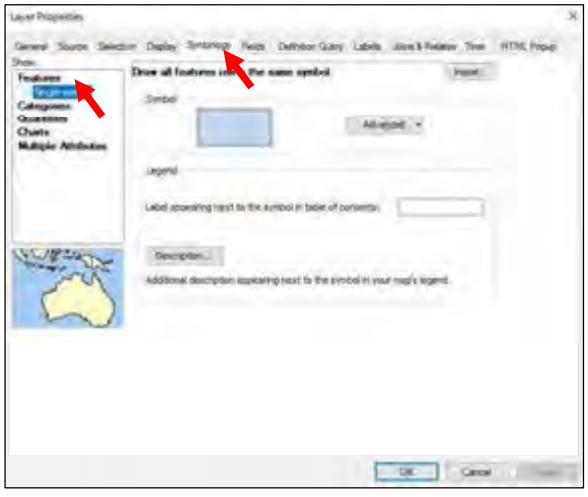
- To Zoom In click the  button and Zoom Out click the  then drag a box around the portion to Zoom.
- For Fixed Zoom In click  button and Fixed Zoom Out click at  button, the current display map will be zoomed.
- Click  button to Pan the map.
- Click  button to do quickly zoom out to the map's full extent.

Changing the symbol of features

Changing polygon features

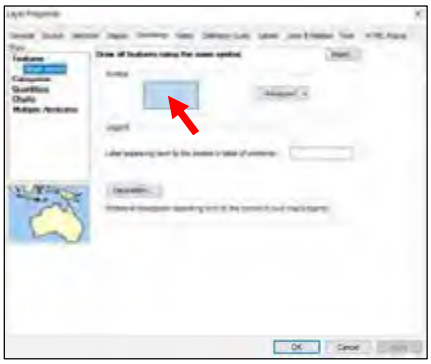
- Right-click the layer's name in the Table of Contents and click Properties
- Click the Symbology tab on the Properties dialog box, Click Features

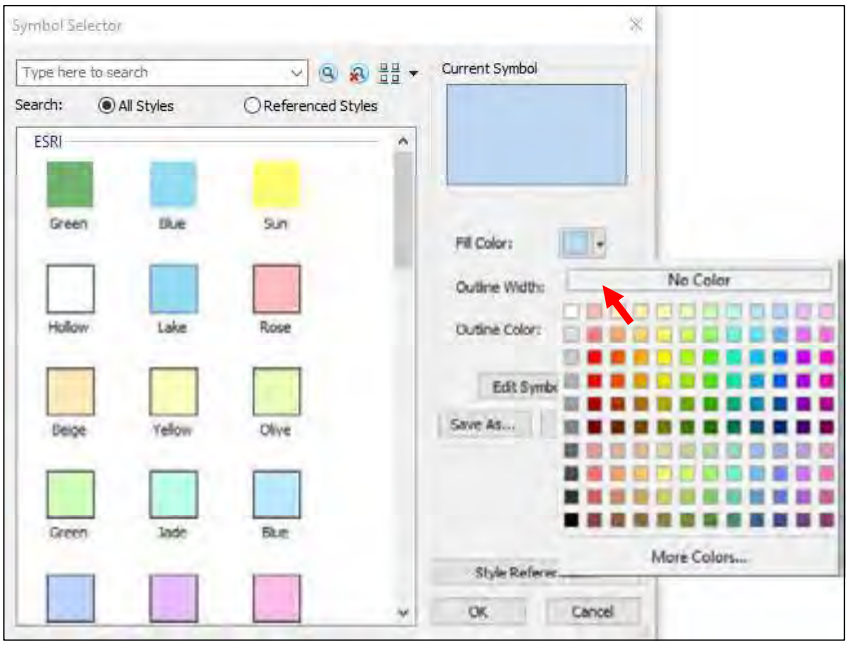




Changing symbology

Properties menu





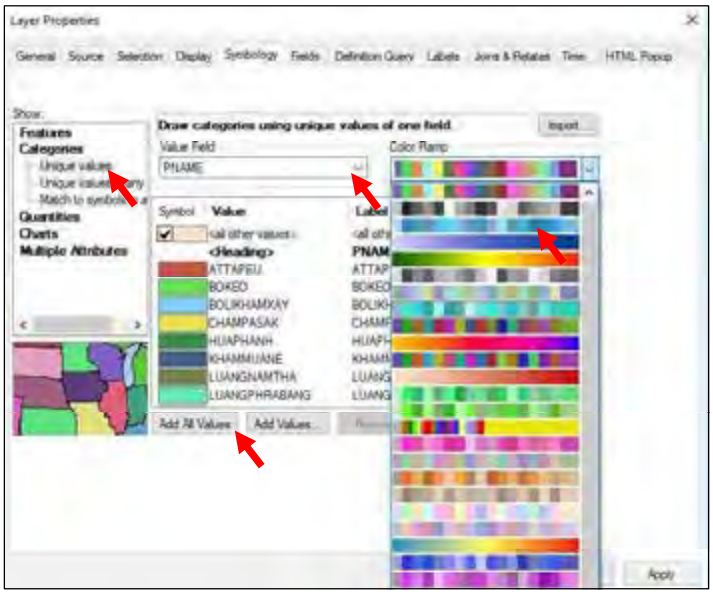
- Click the Symbol button to change the symbol.

- In the Symbol Selector dialog box, click a new symbol or change specific properties of symbol. Then click OK.

Exercises to be completed on your own

Assessment of skills – Begin at conclusion of lesson

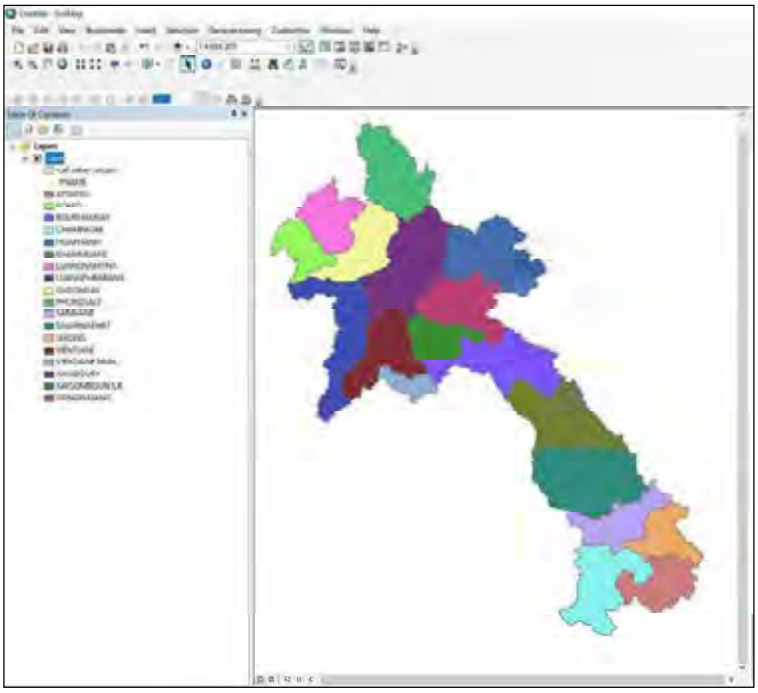
- At Layer Properties. Click the Symbology tab, then click Categories
- Click the Value Field, dropdown arrow and click the field that contains the values we want to map.
- Click the Color Scheme dropdown arrow and click a color scheme
- Click Add All Values, Click Apply.



Symbolizing Features
Unique Values

- Examine map colors

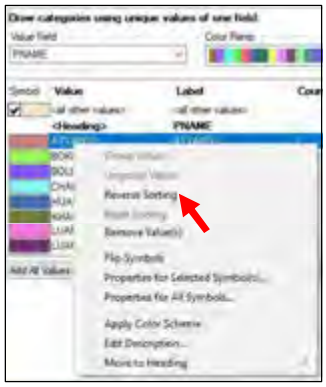
and Click OK button

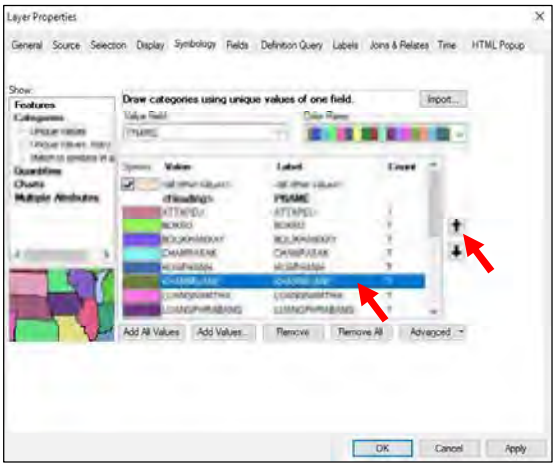


Laos map, 2019

Symbolizing Features
Sorting values

- To **Sort unique value**, in Layer Properties, Click the Symbology tab.
- Click the Value column
- Click Reversed Sorting. Click OK



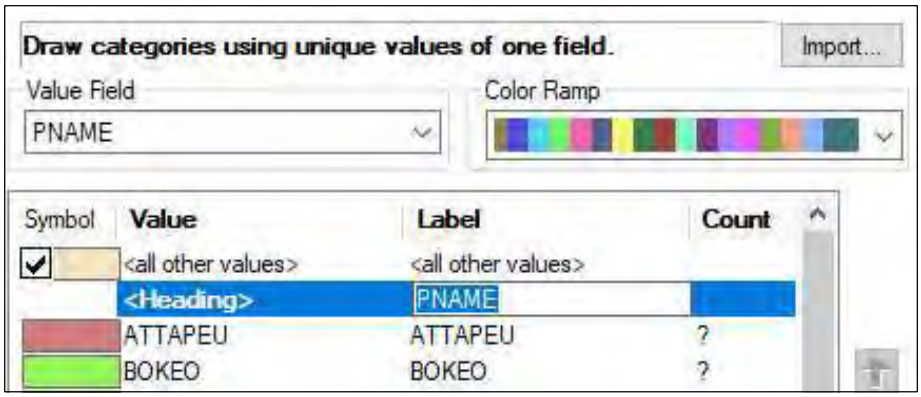


- To **Order unique values**, Click the Symbology tab.
- Click the value you want to move up or down in the list.
- Use the up and down arrows to either promote or demote the value in the list.
- Click OK.

Assigning new Label Heading

Accessed in Layer Properties Menu

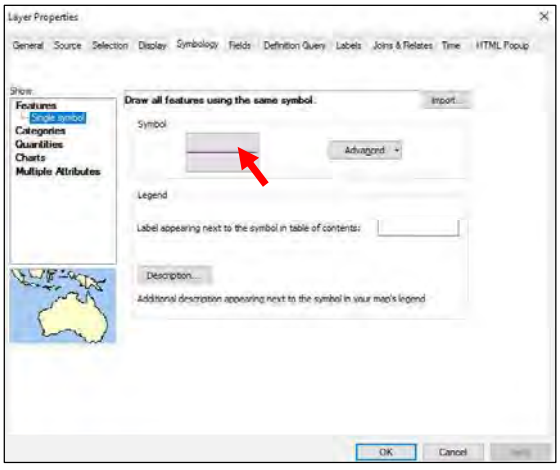
- To give a **new name for heading** of a group value
  Click the Symbology tab.
- Click at the heading in Label, and type a new heading.
- Then Click OK.



Changing the line features symbols

Assessment of skills – Begin at conclusion of lesson

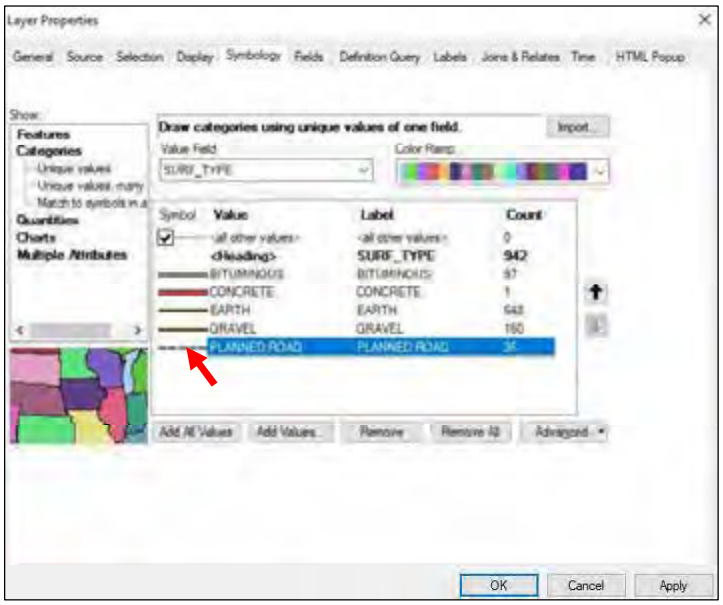
- Right-click at the layer's name of line layer in the table of contents, And click Properties.
- Click the Symbology tab on the Properties dialog box, Click Features
- Click the Symbol button to change the symbol.



Draw a line layer showing unique values

Layer Properties Menu

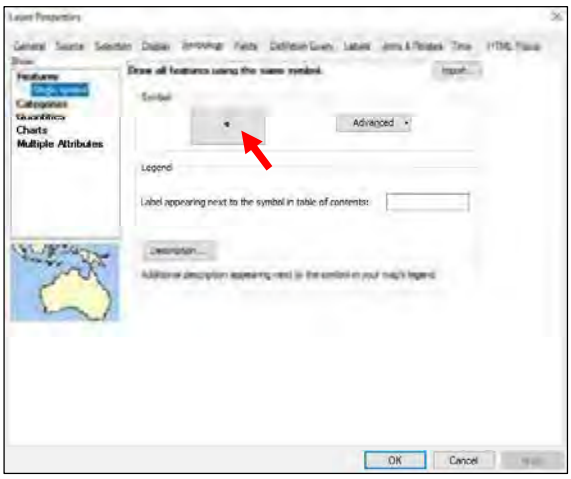
- Right-click the line layer and click Properties.
- Click the Symbology tab, then click Categories
- Click the Value Field, select the field that contains the values we want to map.
- Double-Click in each line feature value to change the line style, size and color.
- Click OK.



Changing point features symbols

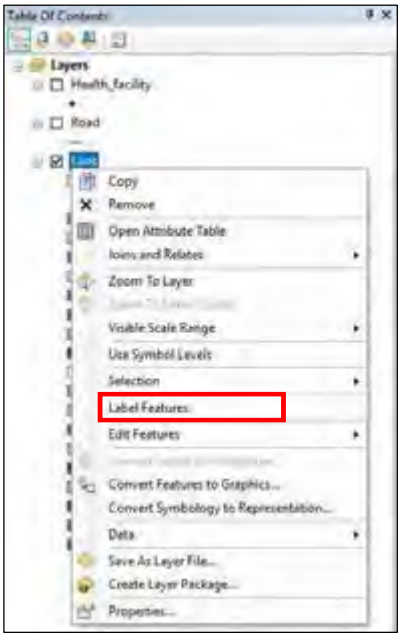
Assessment of skills – Begin at conclusion of lesson

- Right-click at the layer's name of point layer click Properties.
- Click the Symbology tab on the Properties dialog box, Click Features
- Click the Symbol button to change the symbol.



Adding Labels to a map

At Table of Contents

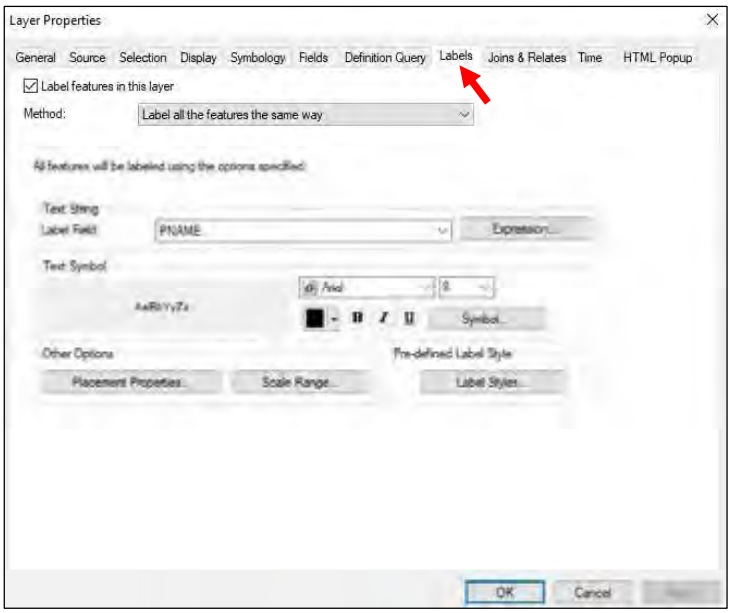


Laos map, 2019

Exercises to be completed on your own

Assessment of skills – Begin at conclusion of lesson

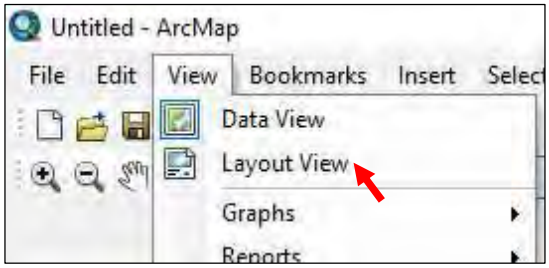
- To change the label properties, right-click at the layer's name. Select Properties, click Label tab.
- Then change the Method, Label Field, Text Style, Text Symbol and other properties. Click OK.



5. Laying out a map

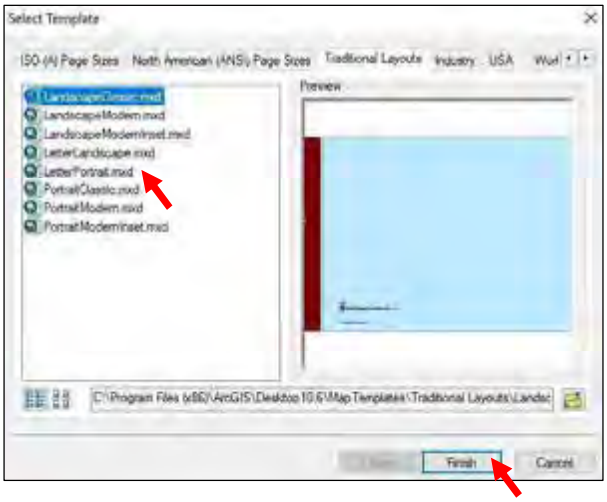
5.1 Using an Existing template

- Click View and click Layout View



- After entering Layout View the Layout toolbar will appear

- Click the Change Layout button to change layout and select template



- Select Template catalog tab and click a template style.
- Click Finish

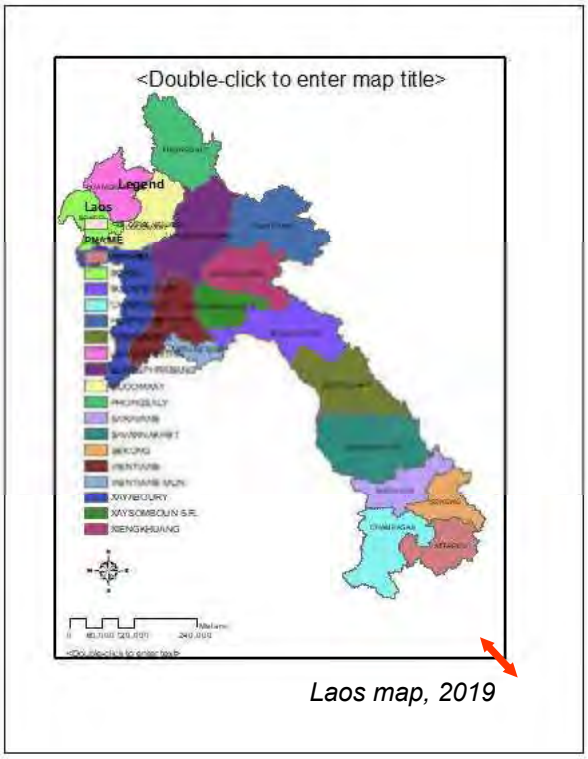
Making a map with a template

Adjust data frame

- Click the Select Elements button

Click the data frame to select it.

- The data frame is now outlined with dashed line and has selection handles at its corners and edges.
- Click the resize cursor.
- Click the corner, drag it up and to the left.



Making a map with a template

Adjust map elements

- Move other elements;

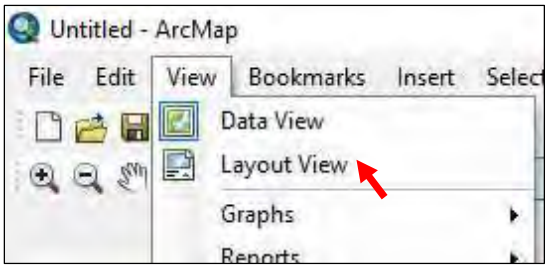
North Arrow, Legend frame, Scale Bar and Title out of the Data frame by clicking and dragging each element.

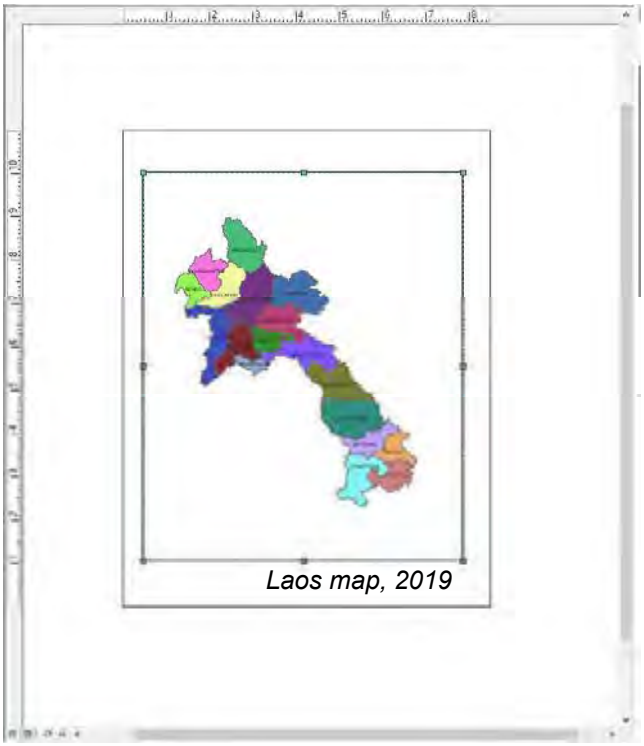
Laos map, 2019

5.2 Creating your own map

No template used

- Click View > Layout View

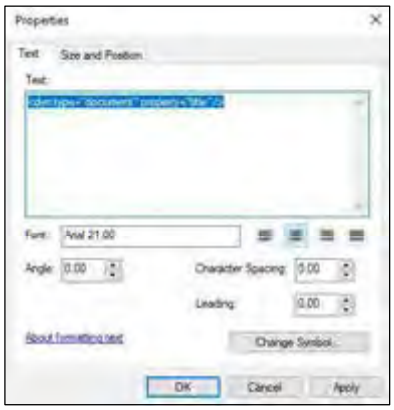


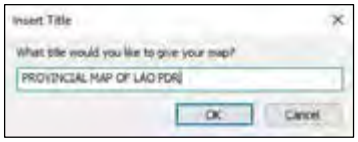


Creating your own map
Insert a title

- Select the Insert menu, then select the Title
- Title appears on the page. Type in a logical title such as “PROVINCIAL MAP OF LAO PDR”

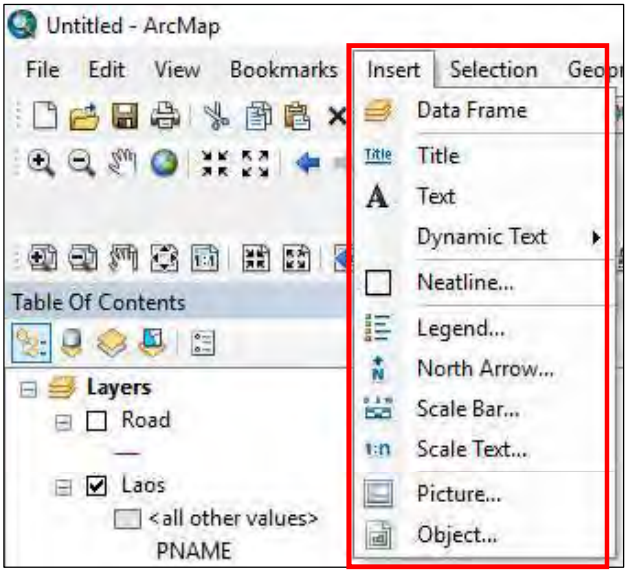
- After the title is entered move your cursor to the title and left click to select the title then right click to bring up the “Properties of the Title” window. Here you can make other changes; for example Change symbol is the button to use for increasing the text size or changing fonts.





Creating your own map
Adding other map elements

- Select the Insert menu, then select the North Arrow. Pick one you like then select OK.
- The North arrow is put on the page with a box around it. Dragging it to where you want it or resize it by dragging with corner.
- Add a Scale bar, Legend, Text, etc… as you did above.



Note: When adding the Legend accept default, select next and then finished.
Change the properties of the Legend matching with the layout later.

Creating your own map

Adding other map elements

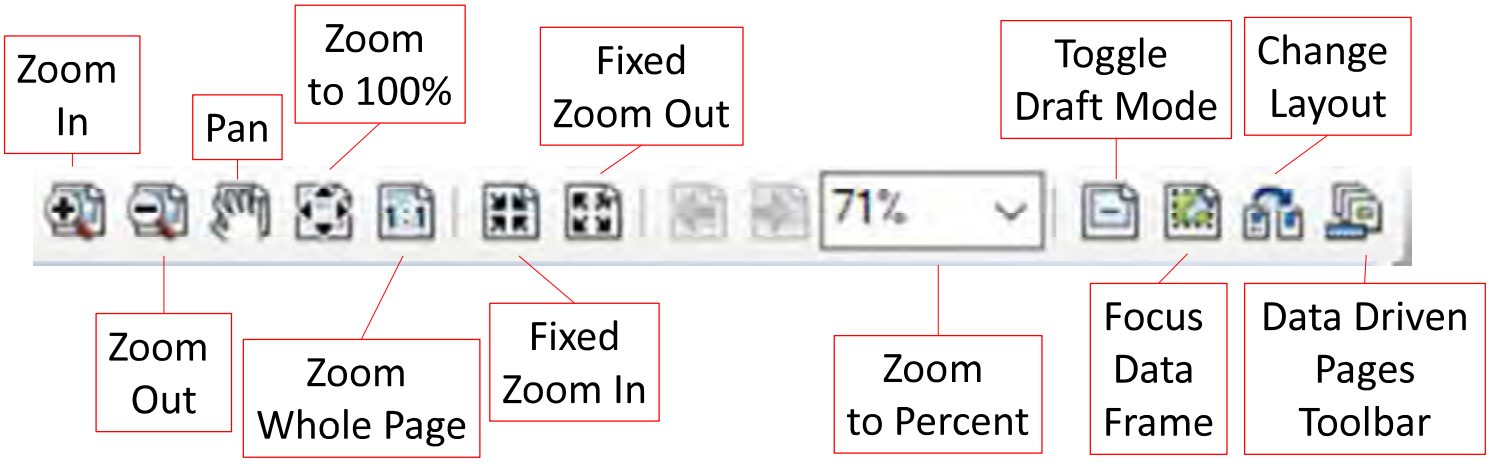
- Try laying out and styling the map on your own. Are there any areas you would improve upon?

Laos map, 2019

A closer look at the Layout toolbar

Assessment of skills – Begin at conclusion of lesson

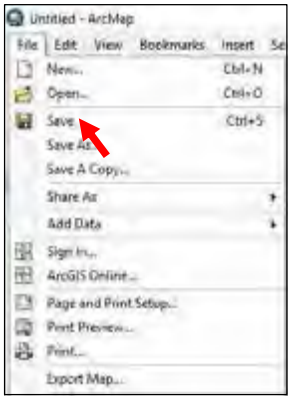
- Zooming for layout map can be used zoom tools set
- This Zoom set use for Layout View, these will not Change composition in Data View

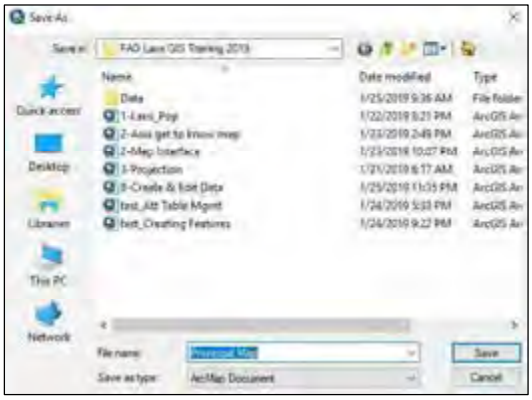


Saving a Map

Enter file name

- To keep the new map that you have created and also keep the old template map, use Save As to save this map under a new name.



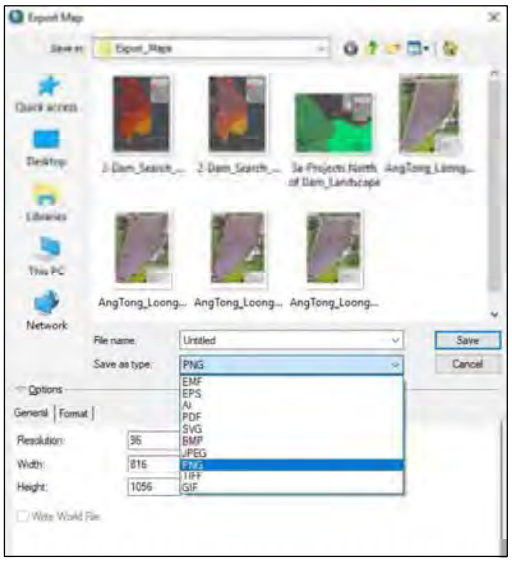


- Navigate to your directory and folder
- Type the map of map, Click Save.

Export map

Conversion to a common file format

Exporting map to another image format files to present into another software; PowerPoint or add your map into the report such as MS word.



- Click File and select Export Map. Navigate to your folder, type new file's name.
- Select format type of file such as: .BMP, .JPG, .TIFF
- Options menu allows modification of exported file such as resolution and quality.
- Then click Save.

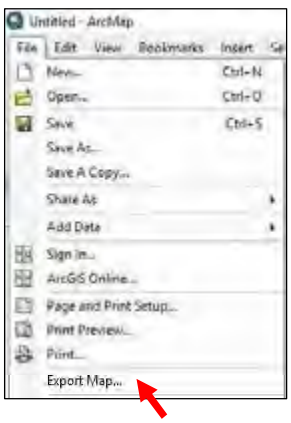


Table Management Using ArcGIS

A first look into the concepts that comprise
a Geographic Information System

I. Database File Handling

Overview

1. Start ArcGIS
2. Adding data
3. Field Data Management
   a. Sort data based on attributes
   b. Obtaining statistics of attributes
   c. Summarizing attributes based on a key attribute
4. Joining tabular data to spatial data and create new layer with tabular data
5. Relate tabular data to spatial data (understanding different between Join & Relate)
6. Table Management (select by attributes, graph, find & replace, etc.)
7. Adding and calculation in fields
   a. Adding new field/ Data types
   b. Calculate geometry (area, length, perimeter, etc.)
   c. Field calculator (assign new values, recode data)
   d. Deleting fields

II. Selection

Overview

1. Identify features
   a. Identifying features by pointing to them
   b. Change the filed on/off
   c. Hyperlinks
2. Select features
   a. Select by attributes
   b. Select by locations using several layers
3. Select records
   a. Interactively selecting records in a table
   b. Selecting record in a table by attributes
   c. Selecting all records
   d. Clearing the selection
   e. Switching the selection

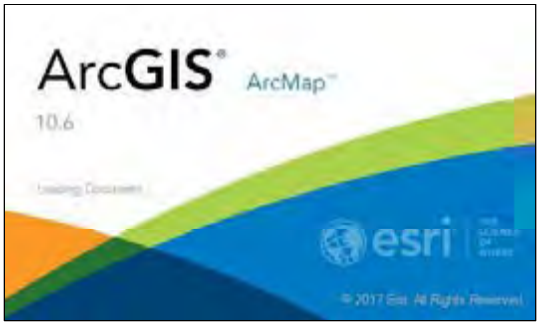
Exercises to be completed on your own

Assessment of skills – Begin at conclusion of lesson

1. Calculate population density in Savannaket province
2. Recode the population density as Low, Medium, High using your own class values
3. Symbolize using above three classes
4. Find and create a village layer - which are within a distance of 800m to road layer

Opening ArcMap 10.6

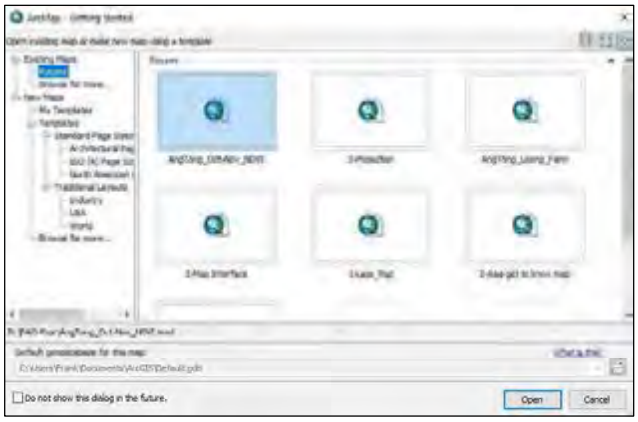
New empty map



❖Type Arcmap into the Windows search bar

❖Click ArcMap 10.6

❖Click Cancel to open a new, empty map.

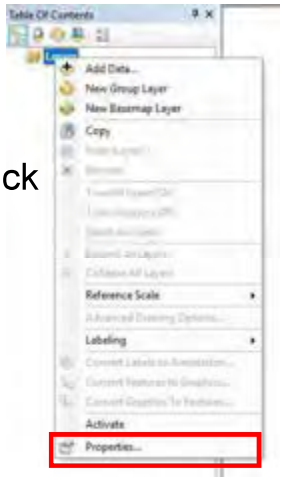


Set up at beginnning

Layer properties

Set Up Layer Properties

❖ At Table of Contents: Right Click "Layers" & select Properties



❖ Click "General Tab"

❖ Type "Savannaket" in the name Text box

❖ Set Map Unit "Meters"

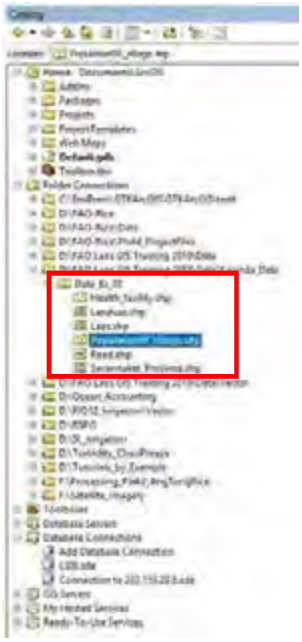
❖ Set Display Unit "Meters or Kilometers"

❖ Click OK

Adding Data from ArcCatalog

ArcCatalog window

❖ Start ArcCatalog by clicking the ArcCatalog button on the Standard toolbar 



❖ Navigate to:

D:\ArcGIS_Training\GIS_Data\Laos

❖ Hold down the Ctrl key to select several layers

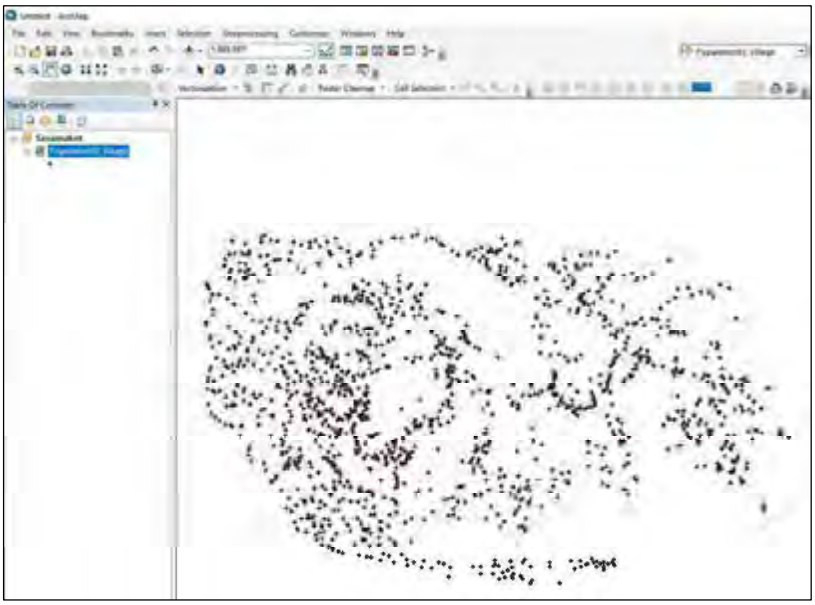
➢ Population95_Village.shp

Adding Data from ArcCatalog

ArcCatalog window

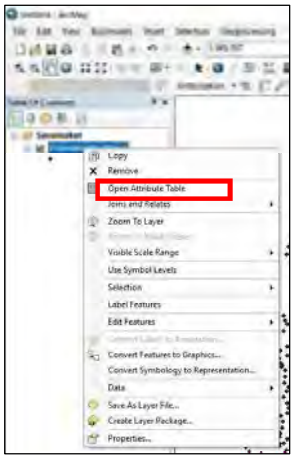
❖ Drag & Drop the file into ArcMap Data View

❖ The selected layer is added to the new data frame



Field Data Management

Interacting with Attribute Tables



a. Sort Data

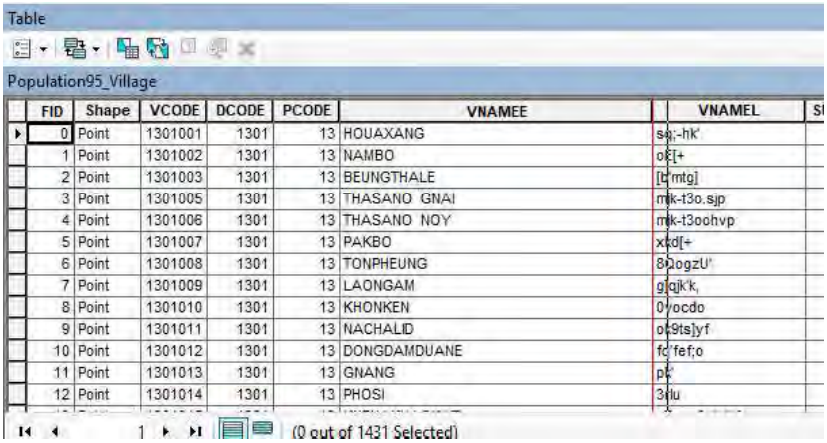
- Right click ‘Population95_Village’ layer
- Select >Open Attribute Table

Field Data Management

Adjusting field width

Columns are called fields in ArcMap

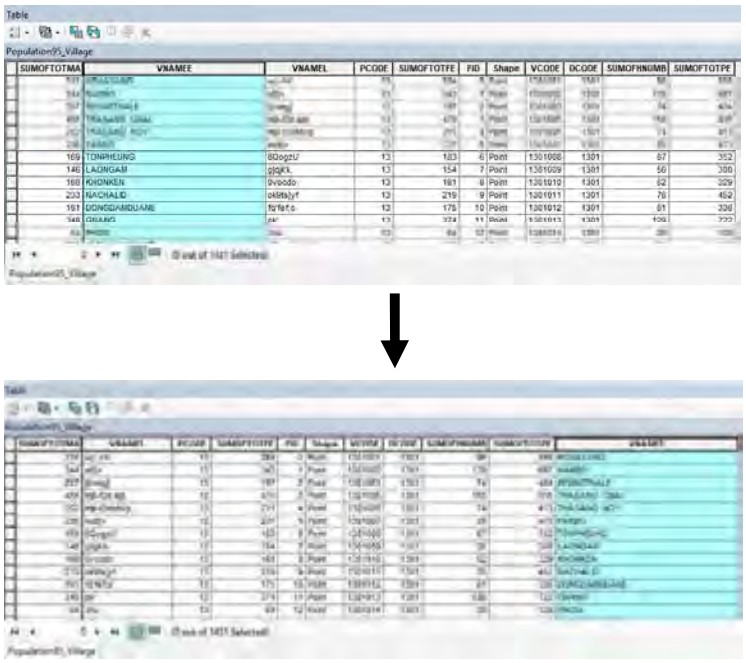
Widen fields by dragging the vertical line to the right of the field name



Field Data Management

Rearranging field position field width

2x click a field name and drag it to the position you like. This is helpful for organizing data

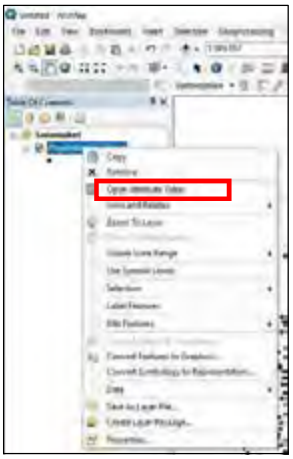


Field Data Management

Interacting with Attribute Tables

a. Sort Data

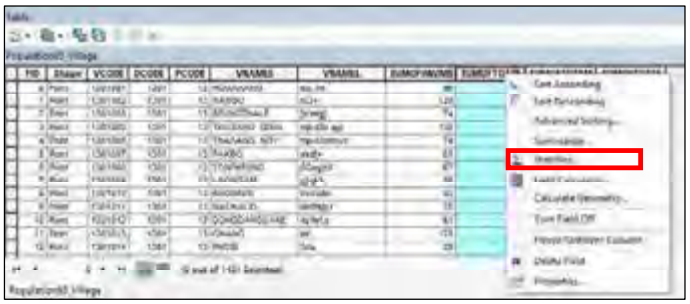
- Right click ‘Population95_Village’ layer
- Select >Open Attribute Table



- Right click ‘DCODE’ field
- Select ‘Sort Ascending’ or ‘Sort Descending’

b. Statistics

For a given field

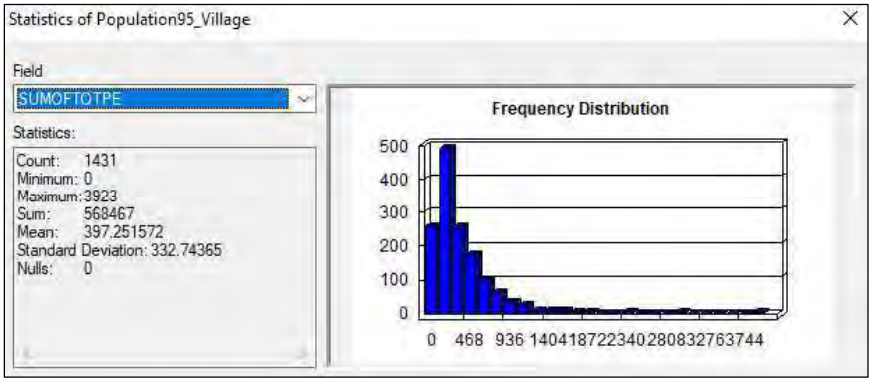


❖In ‘Population95_Village’ Attribute table, right click ‘SUMOFTOTPE’ field

❖ Select Statistics

❖ Table shows selected Field and statistics

- ➢ Count -- Total record
- ➢ Maximum
- ➢ Minimum
- ➢ Summary
- ➢ Mean
- ➢ Standard Deviation



c. Summarize Data

Creates new table

❖ In ‘pop95_vill’ Attribute table, right click ‘SUMOFTOTPE’ field

❖ Select Summarize

❖ Select a field to Summarize: DCODE

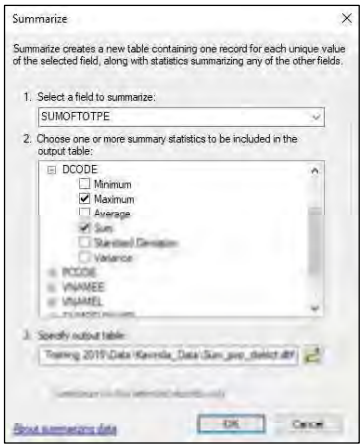
❖ Choose one or more summary statistics

To be included in the output table:

- ➢ Click PCODE, check ‘Maximum’
- ➢ Click SUMOFTOTPE, check ‘Sum’

❖ Specify Output table, Click browse

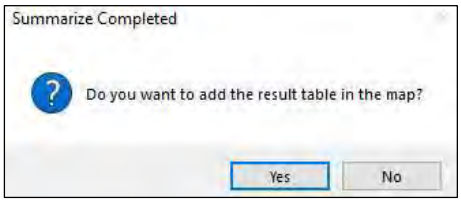
D:\ArcGIS_Training\GIS_data\Laos\Sum_pop_disrict.dbf, click OK

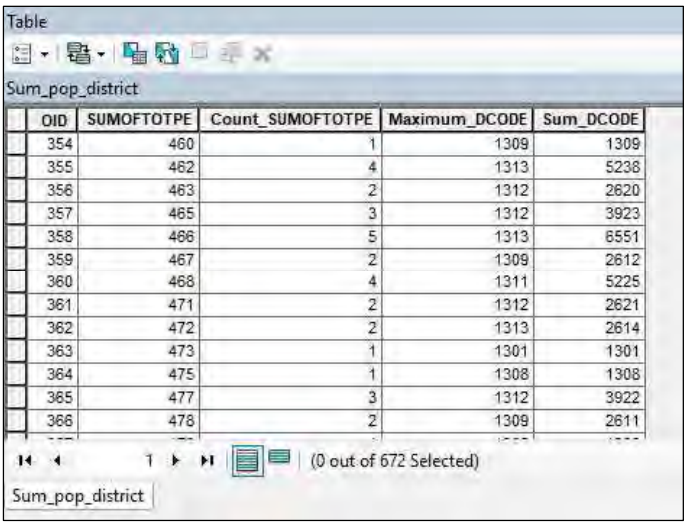


c. Summarize Data

Creates new table

❖ Click Yes to add result in the map





OID	SUMOFTOTPE	Count_SUMOFTOTPE	Maximum_DCODE	Sum_DCODE
354	460	1	1309	1309
355	462	4	1313	5238
356	463	2	1312	2620
357	465	3	1312	3923
358	466	5	1313	6551
359	467	2	1309	2612
360	468	4	1311	5225
361	471	2	1312	2621
362	472	2	1313	2614
363	473	1	1301	1301
364	475	1	1308	1308
365	477	3	1312	3922
366	478	2	1309	2611

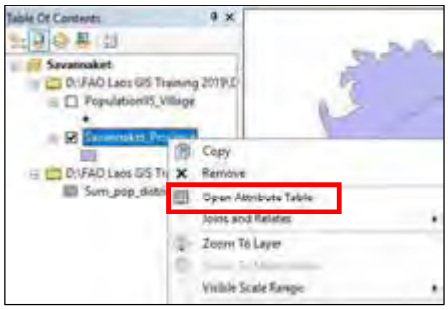
❖ Right Click “Sum_pop_disrict.dbf”

❖ Open

❖ Table show summarizing population in 1995 each district

Join Table to Feature

Bring attributes together

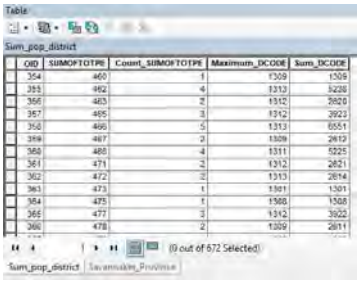


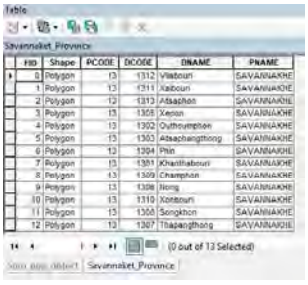
Establishes a one-to-one or many-to-one relationship

Join the table containing the ‘Sum_pop_district’ tabular data to the ‘Savannaket_Province’ attribute table, using “DCODE” as the common field.

❖ Add ‘*Savannaket_Province*’ from ArcCatalog window

❖Right click in the table of contents and click Open Attribute Table to see the existing attributes

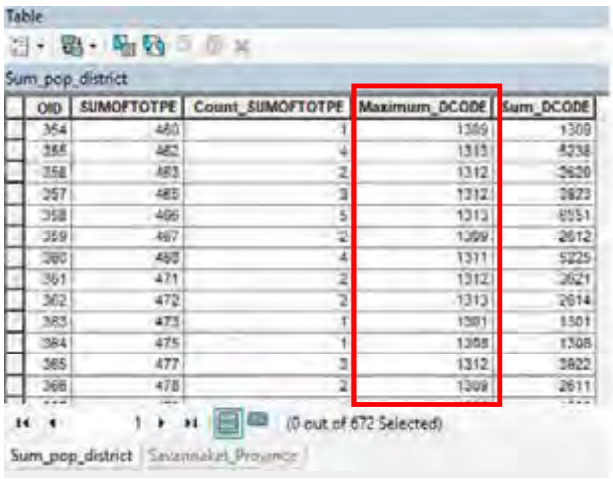




Join Table to Feature

Bring attributes together

Be able to join demography information via ‘DCODE’



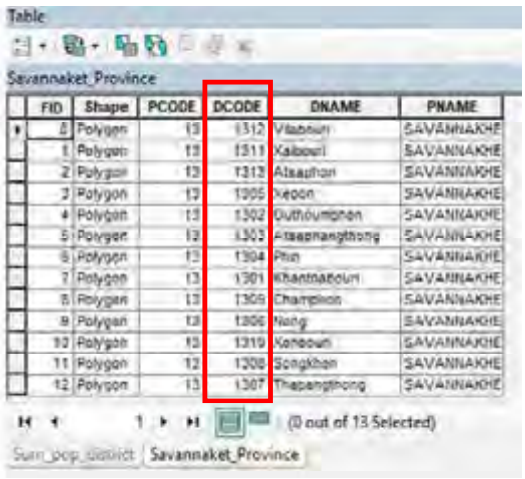
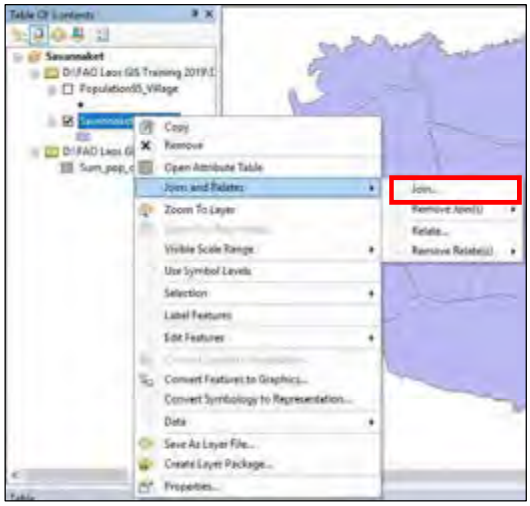


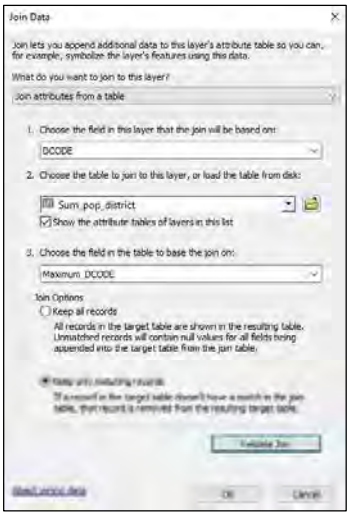
Table ➡ Attribute Table of Feature

Join Table to Feature

Bring attributes together

❖ Right-click ‘Savannaket_Province’ (Destination Table) in the Table of Contents, point to *Joins and Relates*, and click Join.





❖ Setting Field of ‘Based on’ table, ‘Table to join‘ and ‘Field in the Table’ to join on

❖Click OK

Join Table to Feature

Bring attributes together

Then open '*Savannaket_Province'* Check the joined field

Table

Savannaket_Province

FID	Shape	PCODE	DCODE	DNAME	PNAME	OID	SUMOFTOTPE	Count_SUMOFTOTPE	Maximum_DCODE *	Sum_DCODE
0	Polygon	13	1312	Vilabouri	SAVANNAKHE	5	40	1	1312	1312
1	Polygon	13	1311	Xaibouri	SAVANNAKHE	29	83	1	1311	1311
2	Polygon	13	1313	Atsaphon	SAVANNAKHE	0	0	22	1313	28715
3	Polygon	13	1305	Xepon	SAVANNAKHE	27	81	1	1305	1305
4	Polygon	13	1302	Outhoumphon	SAVANNAKHE	179	240	1	1302	1302
5	Polygon	13	1303	Atsaphangthong	SAVANNAKHE	165	224	1	1303	1303
6	Polygon	13	1304	Phin	SAVANNAKHE	2	34	1	1304	1304
7	Polygon	13	1301	Khanthabouri	SAVANNAKHE	75	133	1	1301	1301
8	Polygon	13	1309	Champhon	SAVANNAKHE	70	128	3	1309	3915
9	Polygon	13	1306	Nong	SAVANNAKHE	1	21	1	1306	1306
10	Polygon	13	1310	Xonbouri	SAVANNAKHE	42	98	2	1310	2616
11	Polygon	13	1308	Songkhon	SAVANNAKHE	13	62	1	1308	1308
12	Polygon	13	1307	Thapangthong	SAVANNAKHE	18	70	1	1307	1307

1 (0 out of 13 Selected)

Sum_pop_district | Savannaket_Province

Join Table to Feature

Create new layer from joined data

- Create a new layer with joined tabular data
  - Right click on '*Savannaket_Province' > Data > Export data,* give the new layer name as '*Savannaket_Province_pop'*
- Add new '*Savannaket_Province_pop' layer to ArcMap and see the attributes*.

Relate

Relate data from two different layers

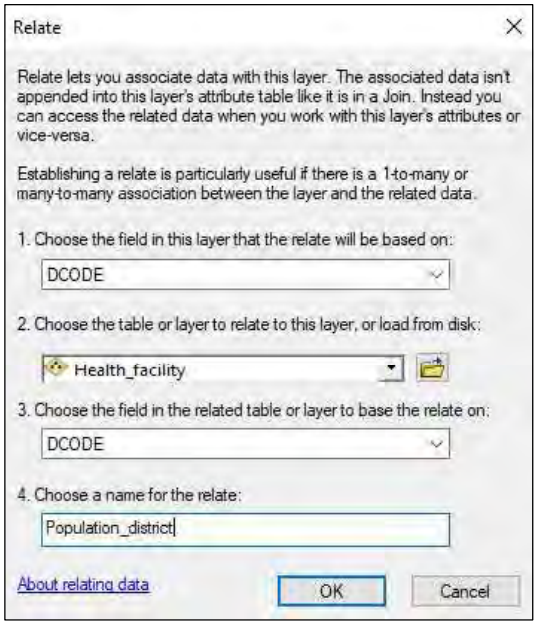
- Drag & Drop 'Health_Facility' from ArcCatalog window

- Right-click the layer you want to relate "*Savannaket_Province*", point to Joins and Relates, and click Relate.
- Click the first dropdown arrow and click the field in the layer on which the relate will be based "DCODE".
- Click the second dropdown arrow and click the table or layer to relate to, "*Health_facility*", or load the table from disk.

Relate

Relate data from two different layers

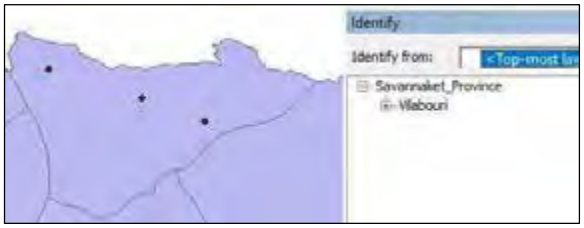
- Click the third dropdown arrow and click the field in the related table on which to base the relate "DCODE".
- Type a name for the relate "Population_District".
- You'll use this name to access the related data.
- Click OK



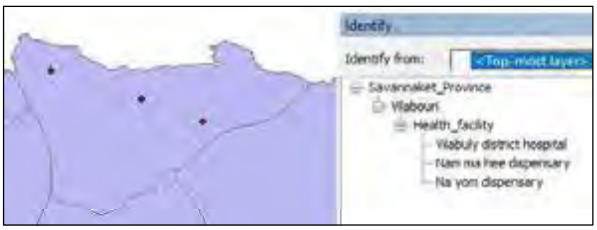
Relate

Relate data from two different layers

Related information appears when you use the Identify Tool



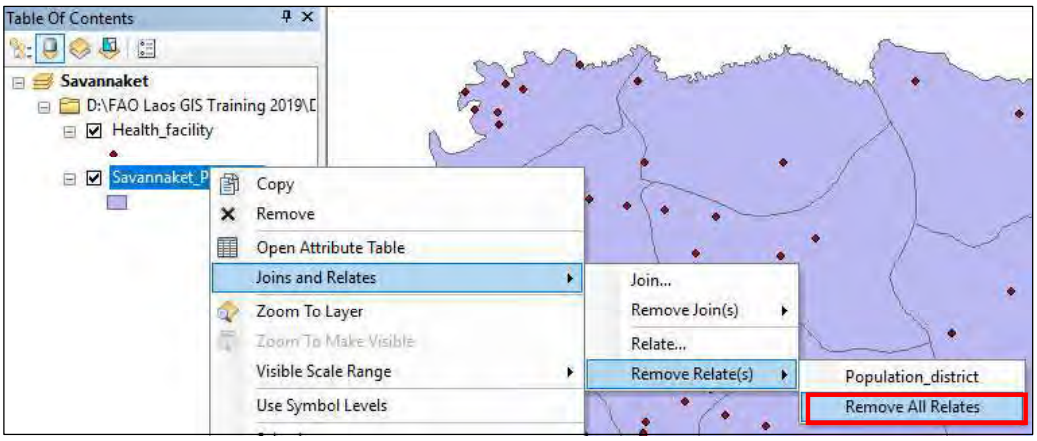
- Click Identify Tool
- Select Vilabouri district
- Click the + symbol next to Vilabouri to reveal the related Health_facility sub-menu



Opening the sub-menu reveals the names of 3 health facilities in Vilabouri district

Remove Relate

Return to previous condition before relate



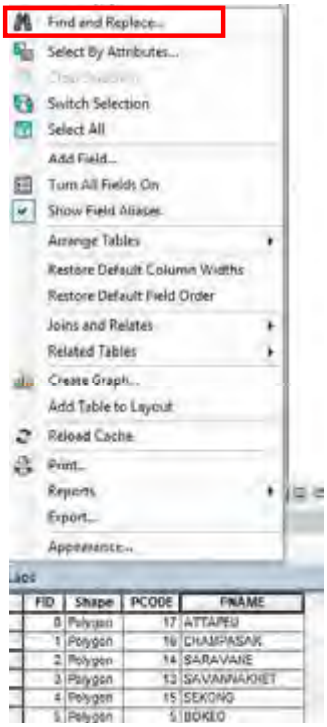
- Right-click the layer containing a relate you want to remove and point to Joins and Relates.
- Point to Remove Relate(s) and click the relate you want to remove.

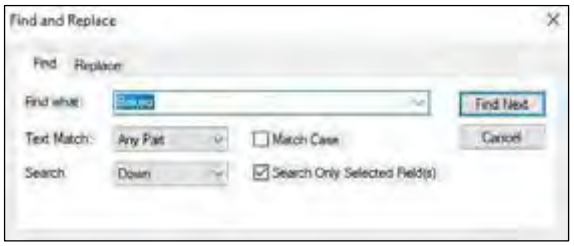
Find & Replace - Attribute Table

Works like similar tools in MS Word or Excel

- Drag & drop Add Data 'Laos.shp' from ArcCatalog window
- Open Attribute Table
- Go to Options, Right Click
- Select Find & Replace
- Type 'Bokeo'
- Click Find Next

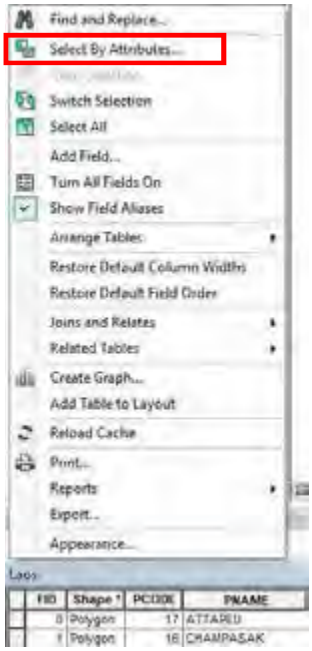
In order to replace text in a field you must enter editing mode





Selecting by Attributes in Attribute Table

Completed within attribute table



- Open Attribute Table
- Go to Options, Select By Attributes, select "PNAME" and click the = sign
- Click Get Unique Values to reveal a list of province names
- Double-click Bokeo
- Click Apply

- Borkeo is now selected on the map & in the Attribute Table

Examine other commands

Commands available for attribute table

4.3 Select All

4.4 Clear Selection

4.5 Switch Selection

4.6 Create Graph

4.7 Add Table to Layout

4.8 Reload Cache -- a temporary file,

or cache, help to display and navigate

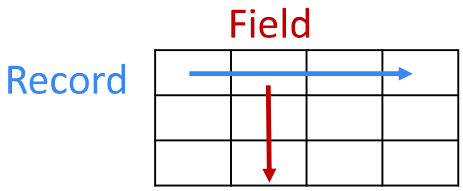
data efficiently

4.9 Export

4.10 Appearance

Adding data & deleting attributes

Create and remove attribute table data



a. Adding fields to a table

- Click Options in the table to which you want to add a field.
- Click Add Field.
- Type the name of the field.
- Click the Type dropdown arrow and click the field type.
- Set any other field properties as necessary.
- Click OK.

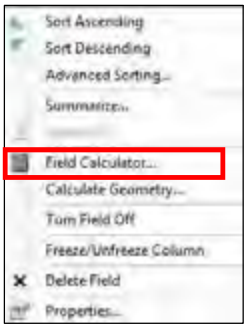
Data formats available

Attribute Table

Name	Specific range, length, or format	Size (Bytes)	Applications
Short integer	-32,768 to 32,767	2	numeric values without fractional values within specific range; coded values
Long integer	-2,147,483,648 to 2,147,483,647	4	numeric values without fractional values within specific range
Single precision floating point number (Float)	approximately -3.4E38 to 1.2E38	4	numeric values with fractional values within specific range
Double precision floating point number (Double)	approximately -2.2E308 to 1.8E308	8	numeric values with fractional values within specific range
Text	up to 64,000 characters	varies	names or other textual qualities
Date	mm/dd/yyyy hh:mm:ss A/PM	8	date and/or time
BLOB	varies	varies	images or other multimedia
GUID	36 characters enclosed in curly brackets	16 or 38	customized applications requiring global identifiers

Examine other commands

Field Calculator

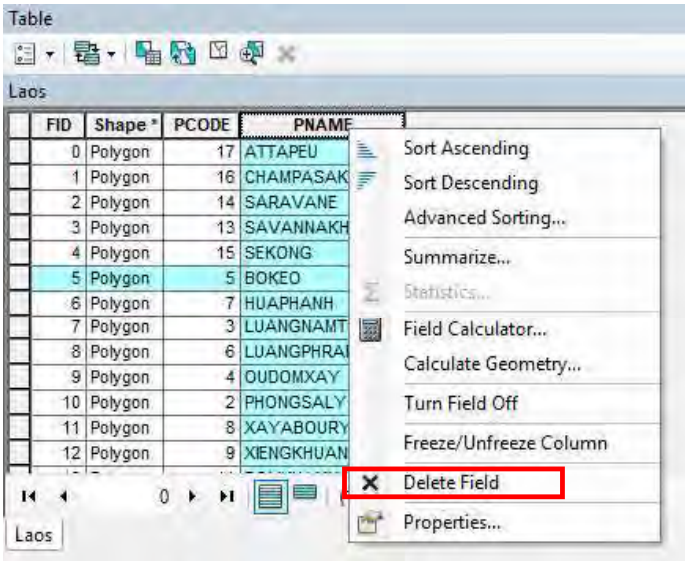


- Click Editor on the Editor toolbar and click Start Editing. You can make calculations without being in an editing session; however, in that case, there is no way to undo the results.
- Right-click the layer or table you want to edit and click Open Attribute Table
- Select the records you want to update
- If you don't select any, the calculation will be applied to all records.
- Right-click the field heading for which you want to make a calculation and click Field Calculator.
- Use the Fields list and Functions to build a calculation expression. You can also edit the expression in the text area
- Optionally, you can type a value to set to the field.
- Click OK.
- Click Editor on the Editor toolbar and click Stop Editing

d. Deleting fields from a table

Attribute Tables

- Right-click the field header in the table window of the field you want to delete.
- Click Delete Field.
- Click Yes to confirm the deletion.
- Deleting a field cannot be undone.



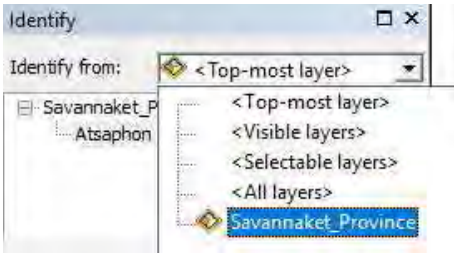
Selection

View feature's attribute data in Data View

The Identify tool allows you to see the attributes of your data.

a. Identifying features by pointing to them

Click the Identify tool on the Tools toolbar, the Identify Results dialog box opens.



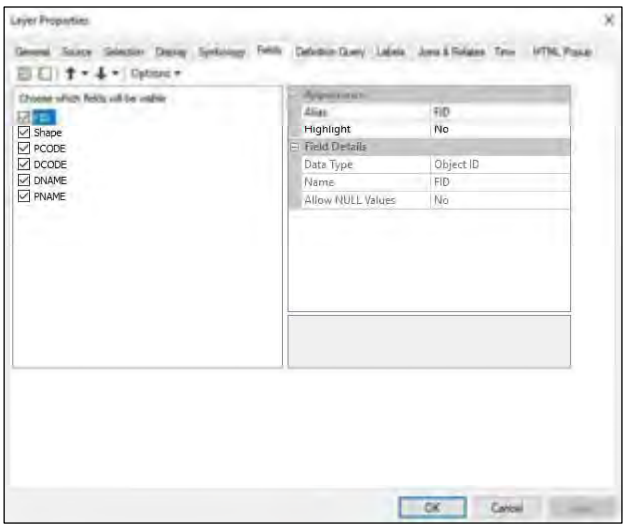
Click the mouse pointer over the map feature you want to identify, the features in the topmost layer under the pointer will be identified.

Hiding Fields

Alters visible attributes for identify tool

b. Format attribute data appearing in Identify dialog box

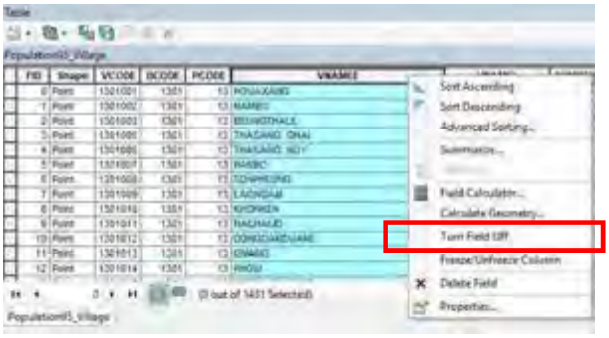
- Right-click the layer in the table of contents and click Properties.
- Click the Fields tab.
- Click the Primary Display Field dropdown arrow and click a field.
- Optionally, check the fields in the Name column which are relevant to your map and uncheck those that are not; or, click the button in the Number Format column to format your numbers.
- Click OK.

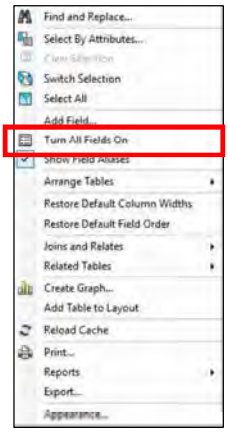


Another way to hide fields

Hide fields at attribute table

- Another way to hide Fields – Use Attribute Table
- a. Right click field name and select Turn Field Off



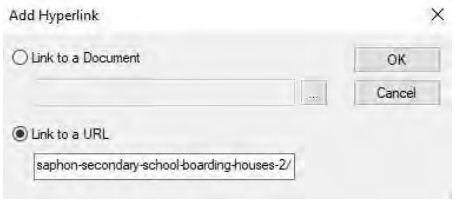


- To turn hidden fields back on: At attribute table click Table Options
- Select Turn All Fields On

Selection
Identify Features

c. Creating hyperlinks for the Identify Results dialog box

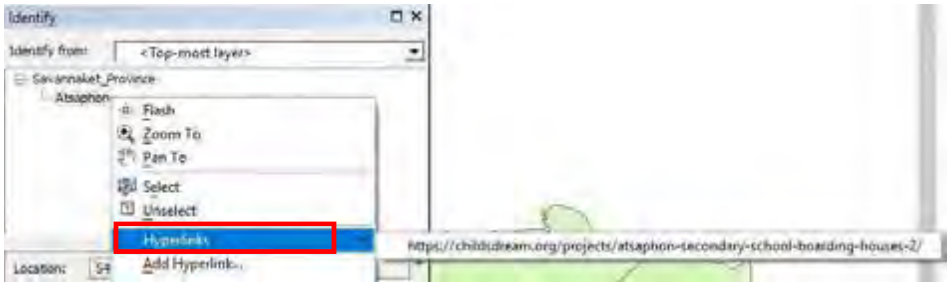
- Right-click on a feature's name in the left pane of the Identify Results dialog box, then click Add Hyperlink.



- Click Link to a Document or Link to a URL,
- Click the Browse button to select a document or type a URL, Then OK.
- To see the link, Right Click on Identify Results, Click Hyperlinks.

Access Hyperlink
Identify Features

- To see the link, Right Click on Identify Results, Click Hyperlinks.



Another way to access the hyperlink:

- Click Hyperlink button 
- Features with hyperlink will have blue outline
- Cursor will change to lightning bolt
- Click hyperlinked features to access website

2. Select Features

Select by Attributes

- Click Selection on the Main menu and click Select By Attributes.
- Click the Layer dropdown arrow and

  click the layer containing the features you want to select.
- Click the Method dropdown arrow and click a selection method.
- Double-click a field to add the field name to the expression box.
- Click an operator to add it to the expression.
- Click Get Unique Values to see the values for the selected field.
- Double-click a value to add it to the expression.

Select by Attributes

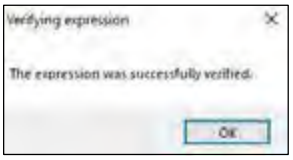
Use attribute data to select features

❖ Click the Verify button to see if you are using proper syntax or if the criteria you've entered will select any features .

❖ Click Apply.

❖ The status bar at the bottom of the ArcMap window tells

you how many features are selected.



❖ Use the Clear button to empty the expression box.

❖ Use the Save and Load buttons respectively

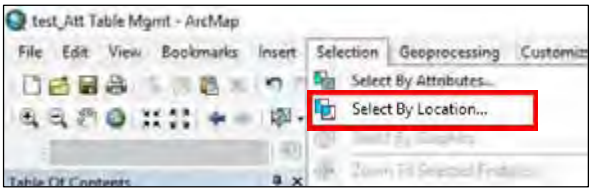
to save your current query as a file or load an existing one.

❖ The files used to save the queries have a .EXP extension but can be edited with any text editor. Only the content of the expression box is saved in the file, not the complete expression.

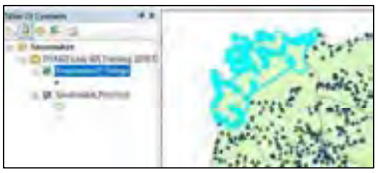
❖ Click Close when you are finished selecting features.

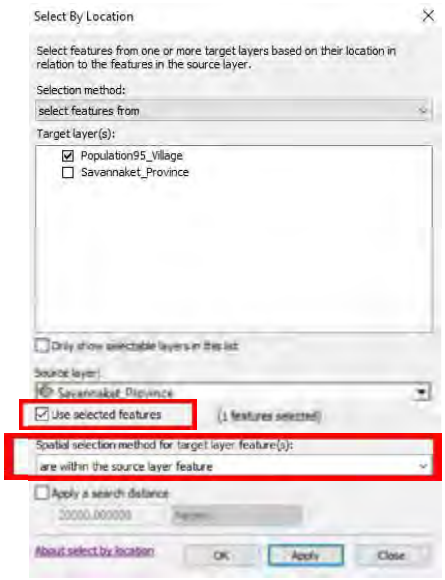
Select by Location

Use location to select features



- Click Selection and click Select By Location.
- Click the dropdown arrow and click a selection method.
- Check the layers whose features you would like to select.
- Click the dropdown arrow and click a selection method.
- Click the dropdown arrow and click the layer you want to use to search for the features.
- Check to use only the selected features.
- Check Apply a buffer to the features in <layer> and set the distance within which to search for features.
- Click Apply.

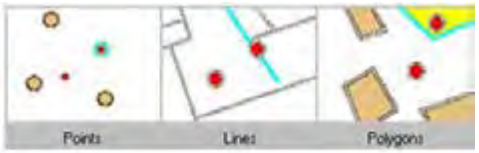




Select Features according to their location

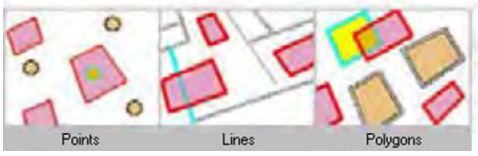
Select by Location – Spatial Selection Method

Intersect -- This method is similar to the Are crossed by the outline of method but also selects any features bordered by the reference features. For example, selecting wilderness areas intersected by roads will select any wilderness area with a road running within its boundaries or alongside it.



When finding features that intersect with point features

When finding features that intersect with line features



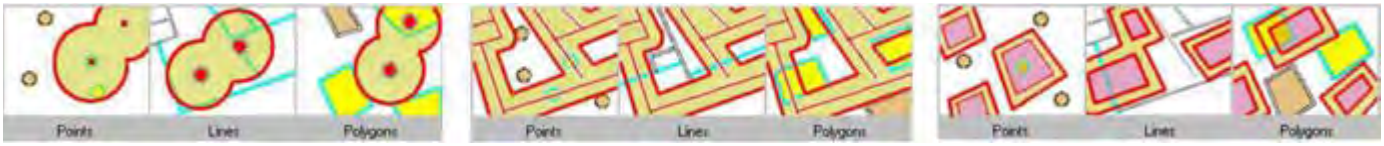
When finding features that intersect with polygon features

The highlighted cyan features are selected because they intersect the red features

Are within a distance of

Select by Location – Spatial Selection Method

When finding features that are within a given distance



point features *line features* *polygon features*

The highlighted cyan features are selected because they intersect the red features

Are within a distance of -- This method selects features near or adjacent to features in the same layer or in a different layer. For example, if you have a layer of clean and polluted wells, you can find all the clean wells within 500 meters of the polluted ones. Or, you could find the reservoirs and farms in other layers that are within this distance of the polluted wells. You can also use this option to find features adjacent to other features. For example, you may have already selected land parcels that your company might purchase, and now you want to get information about adjacent parcels. In this case, you would select the parcels within zero distance of the ones you've already selected.

Completely Contain

Select by Location – Spatial Selection Method

When finding point, line and polygon features completely contained by polygon features

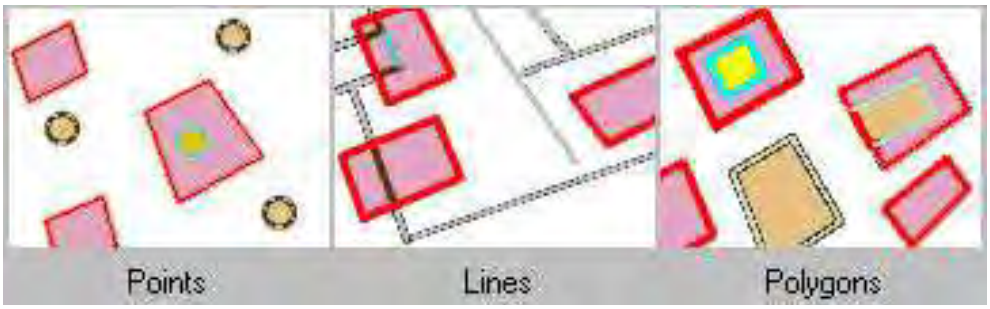
The highlighted cyan features are selected because they intersect the red features

Completely contain -- You can select polygons in one layer that completely contain the features in another layer. For example, you can select forested areas that have lakes completely within them. To select polygons that completely contain features a certain distance within them, specify a buffer distance. For example, you can select forested areas with lakes at least 500 meters within them by buffering the lakes.

Are Completely Within

Select by Location

When finding features that are completely within polygon features



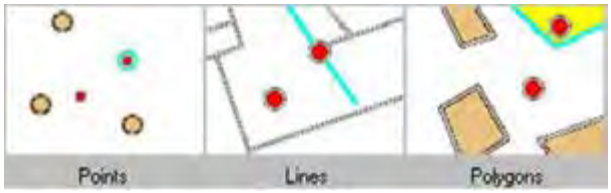
The highlighted cyan features are selected because they intersect the red features

Are completely within -- This method selects features in one layer that fall completely inside the polygons of another. For example, you can select lakes completely within a forested area. To select features that are a distance from the edges of the polygon they fall inside, specify a buffer distance. For example, you can select lakes that are at least 500 meters within a forested area.

Have Their Center In

Select by Location – Spatial Selection Method

Have their center in -- This method selects the features in one layer that have their center in the features of another layer.



When finding features that have their centers within a distance of point features

When finding features that have their centers within a distance of line features

When finding features that have their centers within a distance of polygon features

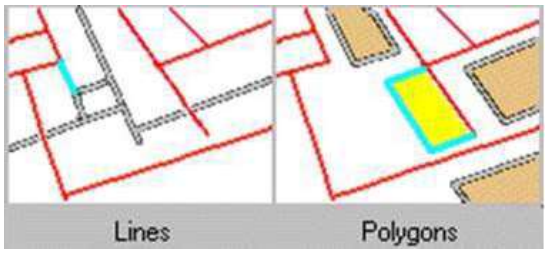
The highlighted cyan features are selected because they intersect the red features

Share a Line Segment With

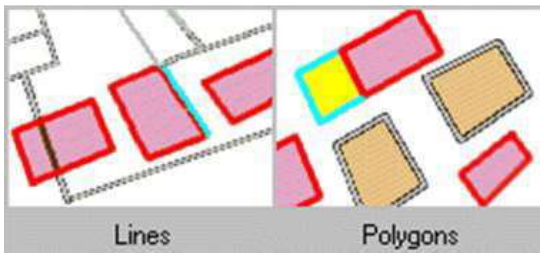
Select by Location – Spatial Selection Method

Share a line segment with -- This method selects features that share line segments, vertices, or nodes with other features

You can't use this method to select point features



When finding features that share a line segment with the line features



When finding features that share a line segment with the polygon features

The highlighted cyan features are selected because they intersect the red features

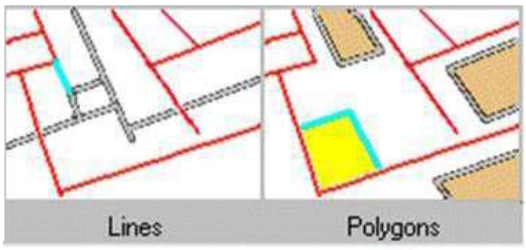
Touch the Boundary of

Select by Location – Spatial Selection Method

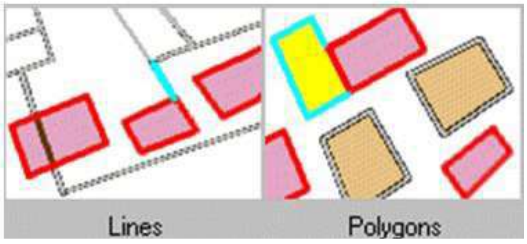
Touch the boundary of -- If you are selecting features using a layer containing lines, this method selects lines and polygons that share line segments, vertices or endpoints (nodes) with the lines in the layer. The lines and polygons will not be selected if they cross the lines in the layer.

If you are selecting features using a layer containing polygons, this method selects lines and polygons that share line segments or vertices with the polygon boundaries. The lines and polygons will not be selected if they cross the polygon boundaries.

When finding features that touch the boundary of line features



When finding features that touch the boundary of polygon features



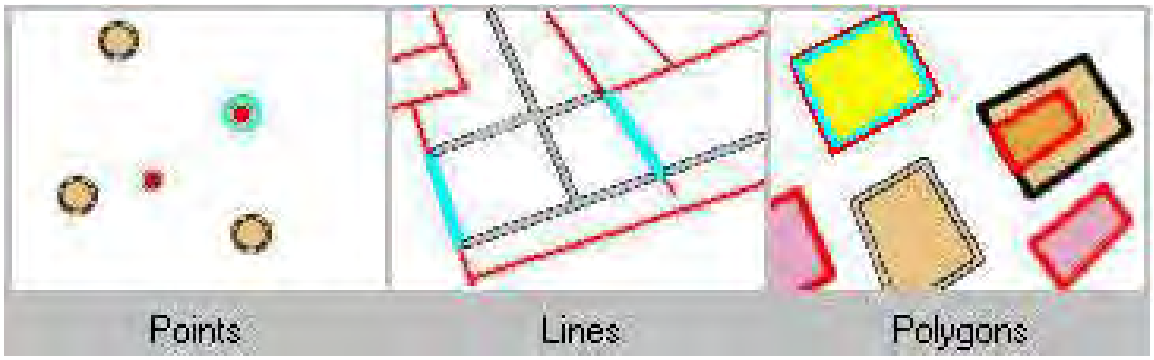
You can't use this method to select point features.

The highlighted cyan features are selected because they intersect the red features

Are Identical to

Select by Location – Spatial Selection Method

When finding features that are identical to other features



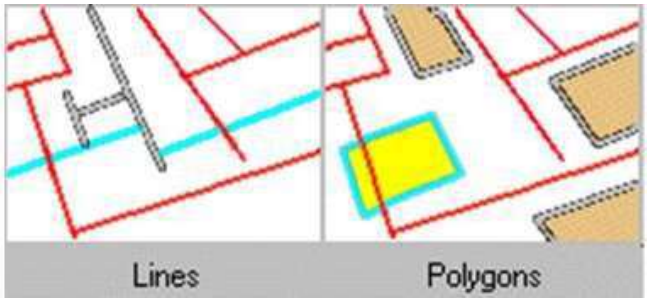
The highlighted cyan features are selected because they intersect the red features

Are identical to -- This method selects any feature having the same geometry as a feature of another layer. The feature types must be the same—for example, you use polygons to select polygons, lines to select lines, and points to select points.

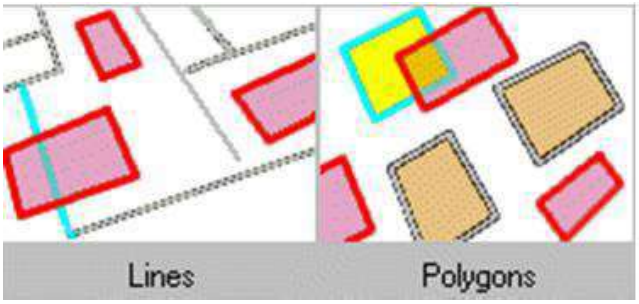
Are Crossed by the Outline of

Select by Location – Spatial Selection Method

Are crossed by the outline of -- This method selects any feature having the same geometry as a feature of another layer. The feature types must be the same—for example, you use polygons to select polygons, lines to select lines, and points to select points.



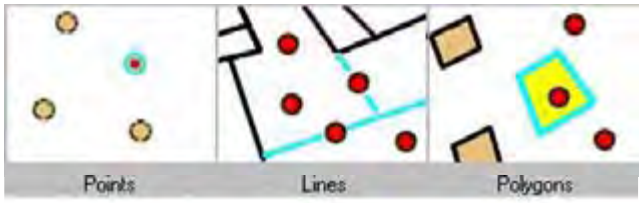
When finding features that are crossed by the outline of line features



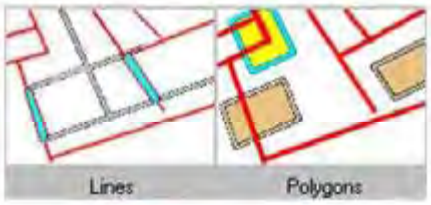
When finding features that are crossed by the outline of polygon features

Contain

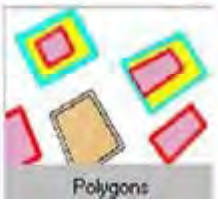
Select by Location – Spatial Selection Method



When finding features that contain point features



When finding features that contain line features



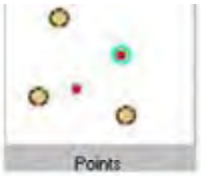
When finding features that contain polygon features

Contain -- This method selects features in one layer that contain the features of another. This method differs from the Completely Contain method in that the boundaries of the features can touch. For example, with the Contain method, a forest will contain a lake—and thus be selected—even if the border of the lake touches the border of the forest. The forest would not be selected using Completely Contain because the borders touch.

Are Contained by

Select by Location – Spatial Selection Method

Are contained by
This method selects features in one layer that are contained by the features in another. For example, you can select those cities that are contained by a county. This method differs from the Are completely within method in that the edges of the features can touch.



When finding features that contained by point features

When finding features that contained by line features

When finding features that contained by polygon features

The highlighted cyan features are selected because they intersect the red features

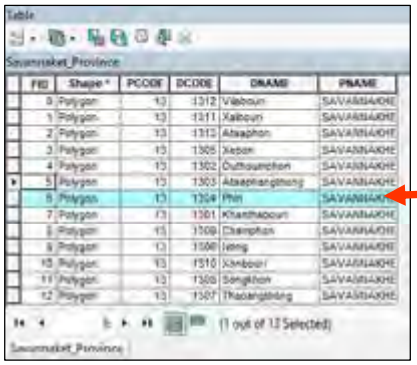
Select Records

Select records to select features

3.1 Interactively selecting records in a table

- Open the attribute table for a layer on your map.
- Click the leftmost column in the table adjacent to the record you want to select.

  To select consecutive records, you can click and drag the mouse.
- Press and hold the Ctrl key while clicking additional records.



Selecting Records in a table by attributes

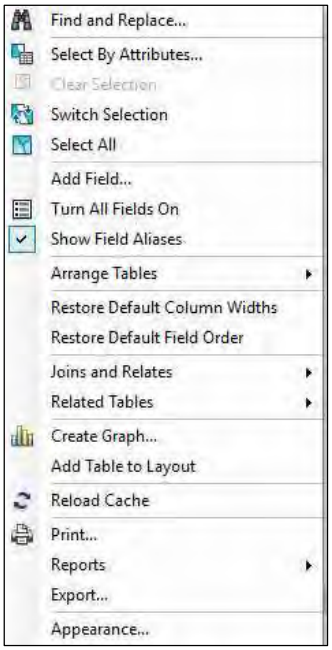
Select by Attributes

3.2 Selecting records in a table by attributes

- Click Options in the table you want to query and click Select By Attributes.
- Click the Method dropdown arrow and click the selection procedure you want to use.
- Double-click the field from which you want to select.
- Click the logical operator you wish to use.
- Click the Get Unique Values button, then scroll to and double-click the value in the Unique Values list you wish to select.
- Optionally, you can type a value directly into the text box.
- Click Verify to verify your selection.
- Click Close.
- Your selection is highlighted in the table.

Selecting & Unselecting Records

Attribute table options menu



3.3 Selecting all records

- Click Options in the table and click Select All

3.4 Clearing the selected set

- Click Options in the table and click Clear Selection

3.5 Switching the selected set

- Click Options in the table and click Switch Selection

III. Self Task

III. Self Task

Assessment of skills

1. Calculate population density in Savannaket province
2. Recode the population density as Low, Medium, High using your own class values
3. Symbolize using above three classes
4. Find and create a village layer - which are within a distance of 800m to road layer

Creating & Editing Data in ArcGIS

A first look into the concepts that comprise a Geographic Information System

Overview

Topics covered during this lesson

1. Create a geodatabase
2. Create a feature class
3. Digitizing
4. Edit features
5. Skills Test

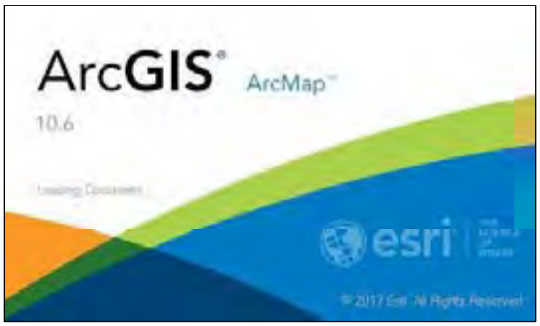
Exercises to be completed on your own - Digitizing

Assessment of skills – Begin at conclusion of lesson

1. Access Subdivision Bookmark. Extend streets into subdivision
2. Access Nam Ngum Reservoir. Add Nam Ngum Reservoir to the Inland_Water feature class
3. Access the Airport Bookmark. Make a feature class called Airport_Roadways; make a line feature class that has separate domains for taxiway and runway; make a feature class for apron

Opening ArcMap 10.6

New empty map



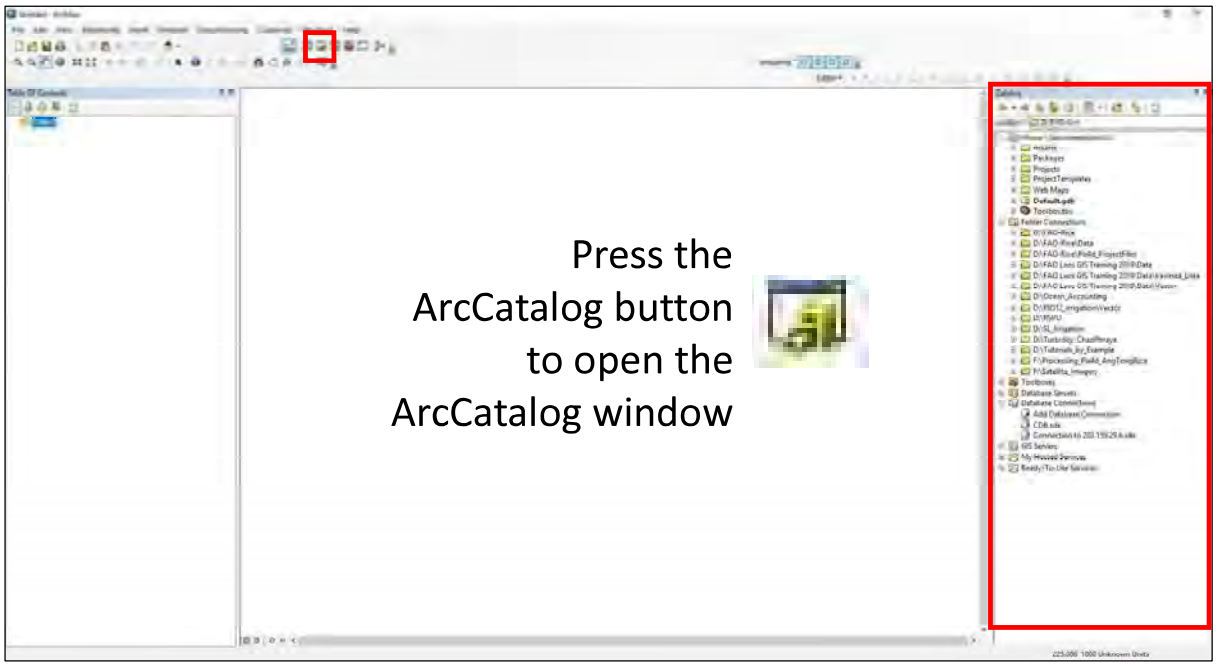
❖Type Arcmap into the Windows search bar

❖Click ArcMap 10.6

❖Click Cancel to open a new, empty map.

Open the Arc Catalog Window

Getting started



Press the ArcCatalog button to open the ArcCatalog window

Create a File Geodatabase

At Arc Catalog Window

Navigate to your preferred folder for this project

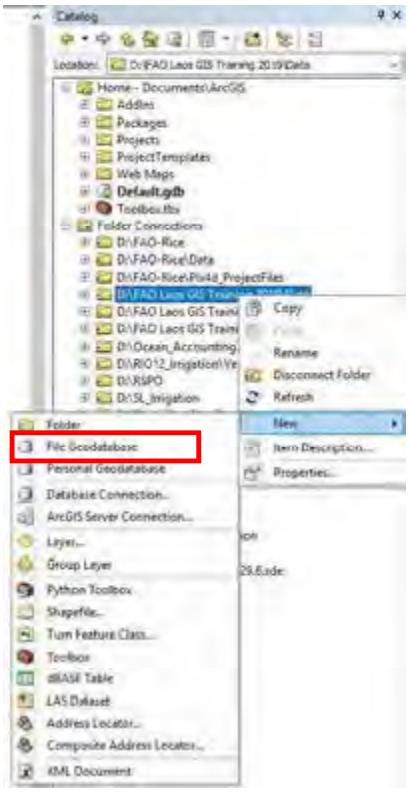
Right-click the folder and select New

We can see 2 types of geodatabases available:

File Geodatabase and Personal Geodatabase

Click File Geodatabase

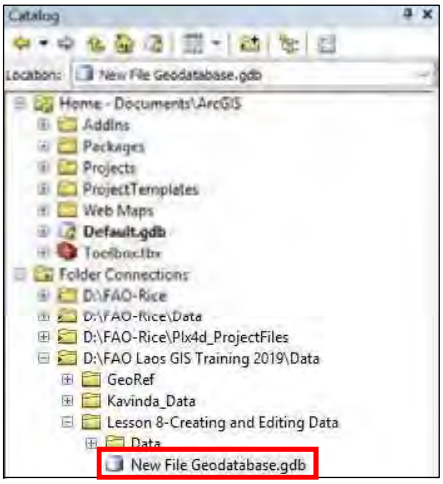
This will create a file geodatabase in your project folder



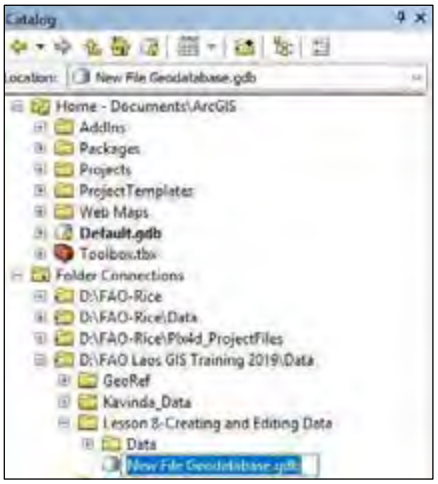
Rename File Geodatabase

ArcCatalog Window

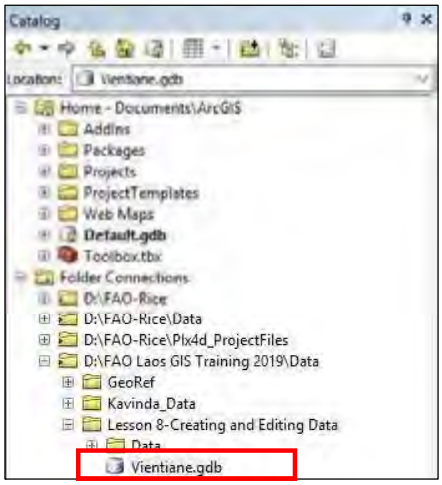
Rename the geodatabase Vientiane



The file geodatabase has been created and is visible in your project folder



2x Click New File Geodatabase.gdb to rename it



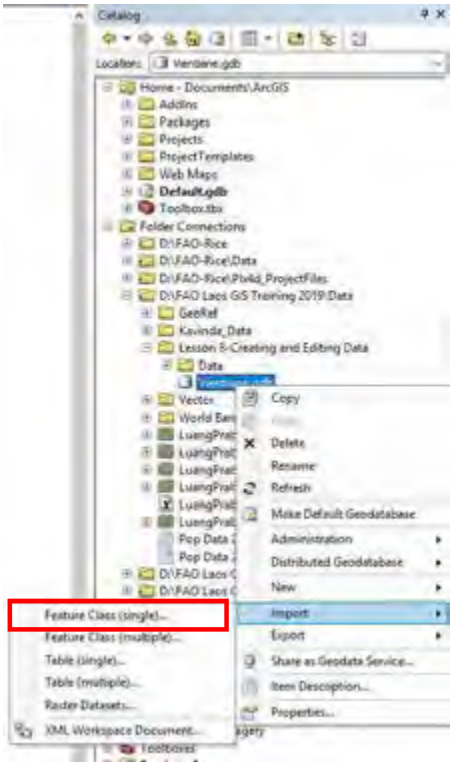
Add data to the geodatabase

Feature Class (single)

Feature classes, tables, and raster data can be added to a file geodatabase

There are options to add a single feature class or multiple

Select Feature Class (single)



Import feature class to file geodatabase

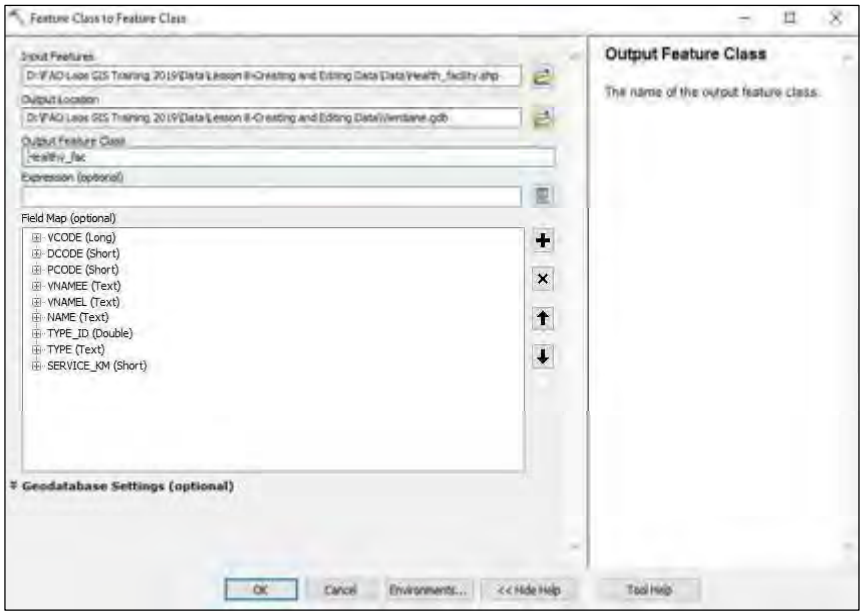
Single Feature class

Input Features:
Choose the Lesson 8 – Creating & Editing Data folder

Select file:
Health_facility.shp

Output Feature Class:
Healthy_fac

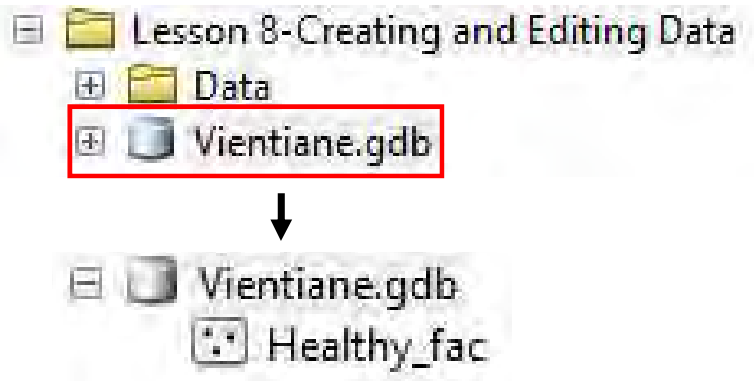
Click OK



Overview

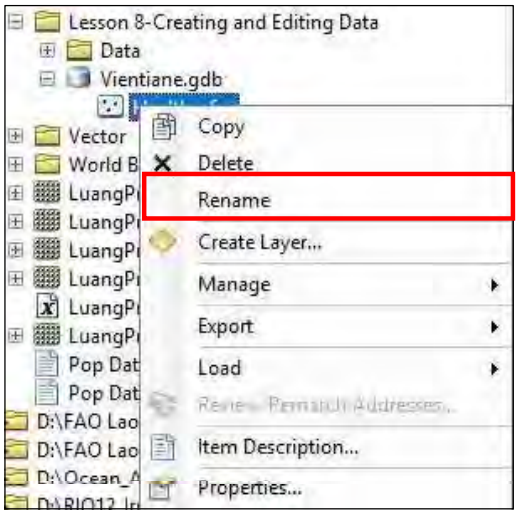
Overview

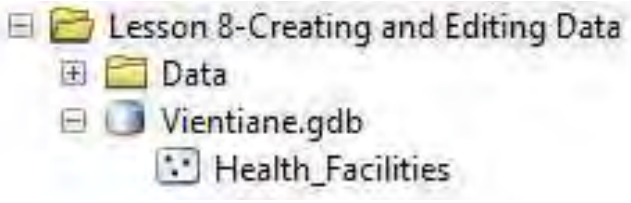
The Health_facilities layer is now in the Vientiane file geodatabase. It also has the name we assigned, healthy_fac



Renaming a feature class in a geodatabase

Overview

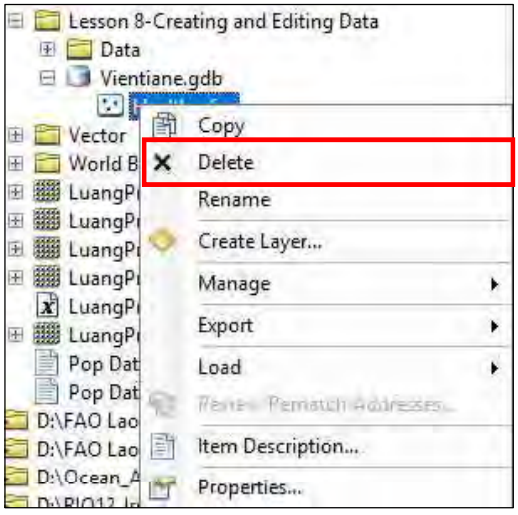




To rename: right-click a feature class and select Rename. Type new name and click outside of text box

Deleting a feature class from file geodatabase

Overview

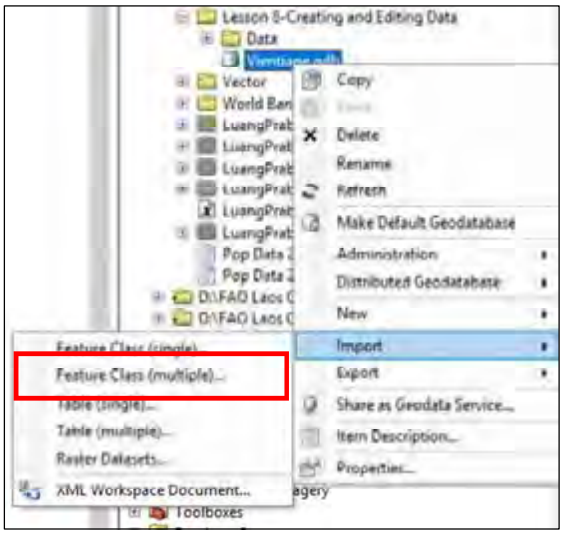


To delete: right-click a feature class and select Delete. Type new name and click outside of text box

Add data to the geodatabase
Feature Class (multiple)

Multiple feature classes can be added to a file geodatabase at once

Right-click Vientiane.gdb
Import | Feature Class (multiple)

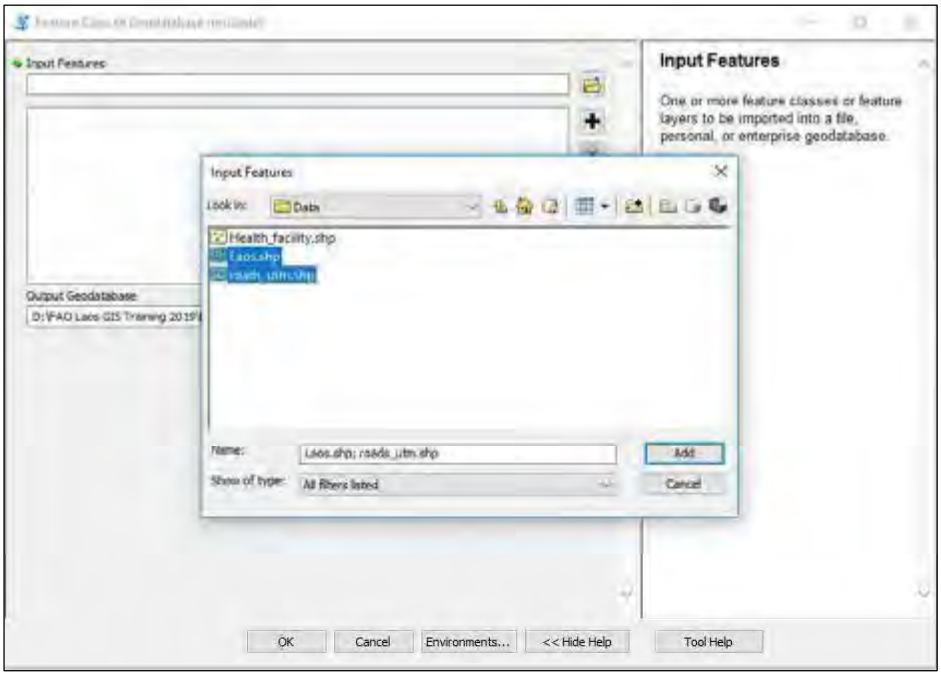


Add data to the geodatabase
Feature Class (multiple)

Click the folder icon for Input Features to access the Lesson 8 – Creating & Editing Data folder

Shift-click Laos.shp & roads_utm.shp, then press Add

Click OK to add both files to the file geodatabase

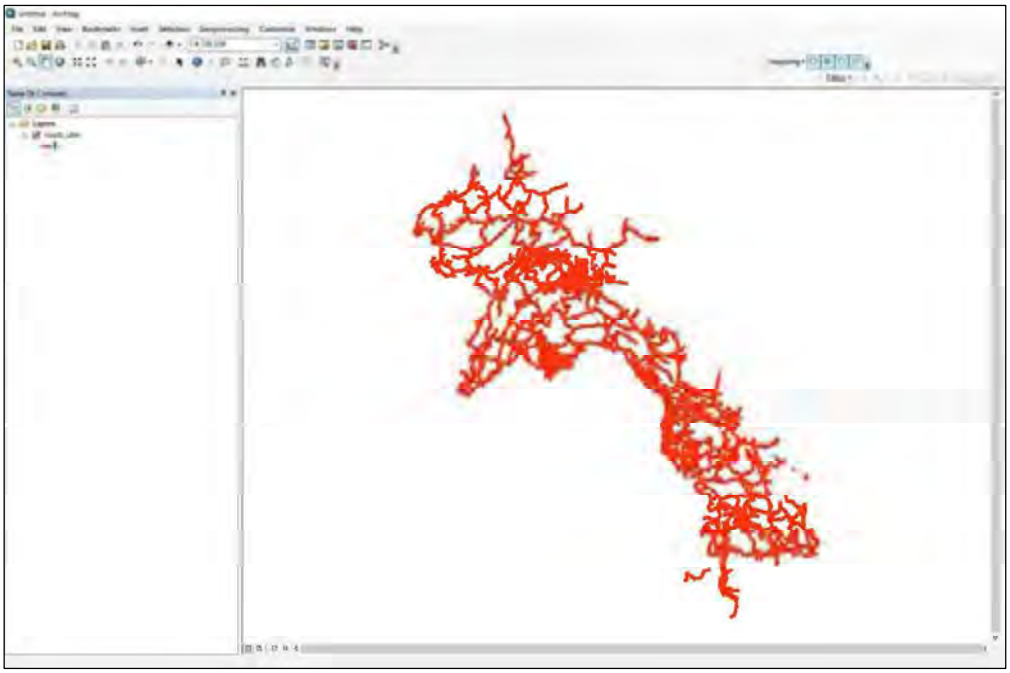


Add data to the geodatabase

Feature Class (multiple)

Drag & drop roads_utm from the Arc Catalog window to the Data View

Change the symbology to Highway



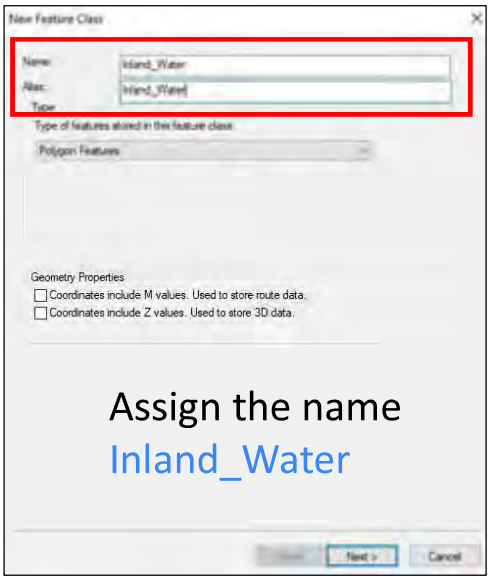
Overview

Topics covered during this lesson

1. Create a geodatabase
2. Create a feature class
3. Digitizing
4. Edit features
5. Skills Test

Creating a feature class in a file geodatabase
Overview

Right-click the file geodatabase ‘Vientiane.gdb’
New | Feature Class



Assign the name
Inland_Water

Creating a feature class in a file geodatabase
Selecting feature type

Here we define the type of features that will be in this new layer:
Point, line, polygon, etc.

Select polygon

Click Next to proceed

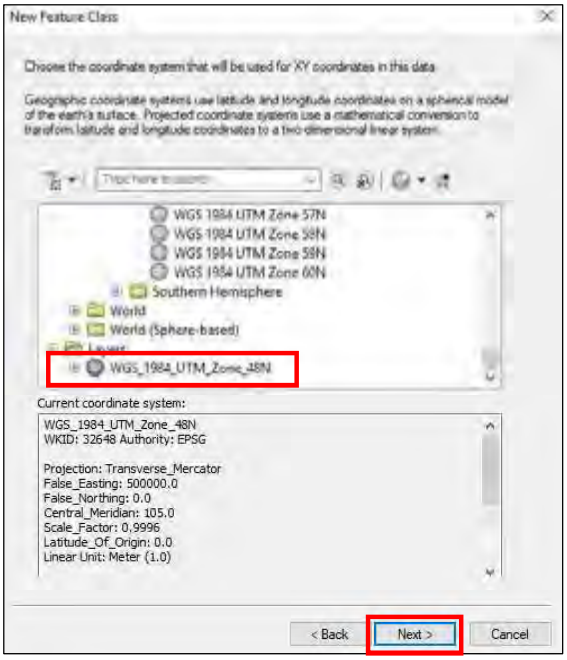
Creating a feature class in a file geodatabase

Overview

Assign a coordinate system to the new feature class.

Use the same coordinate system as the roads_utm and Laos layers

We are able to easily access that coordinate system if the layer has already been added to map view by accessing the layers folder



Creating a feature class in a file geodatabase

XY Tolerance & Database Storage Configuration

Accept defaults for XY Tolerance & database storage configuration

Creating a feature class in a file geodatabase

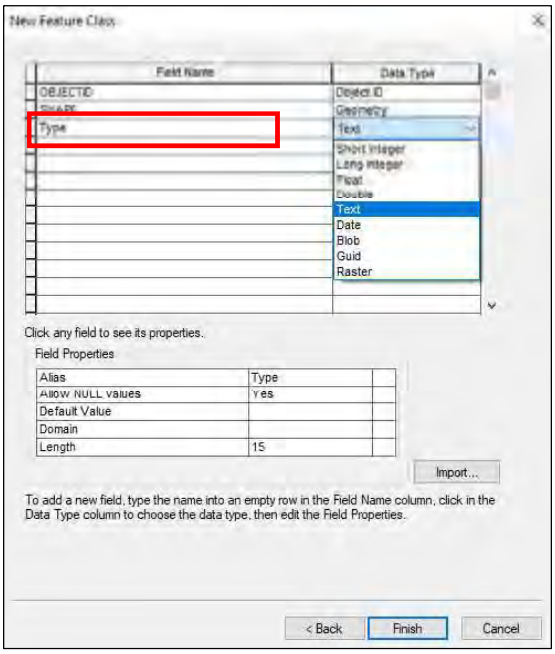
Adding a new field

Enter a new field name: Type

Data Type: Text

Limit the length to 15 characters for the Type field

Click Finish



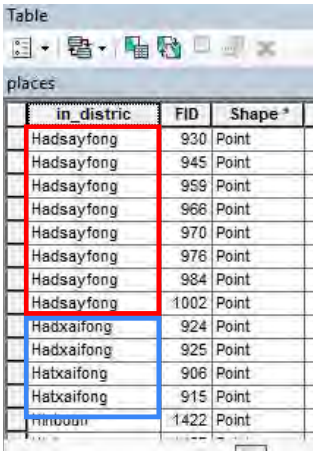
Setting Domain Values

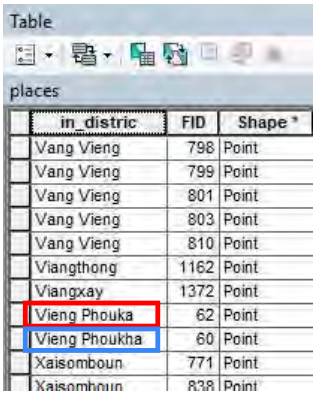
Helps prevent errors

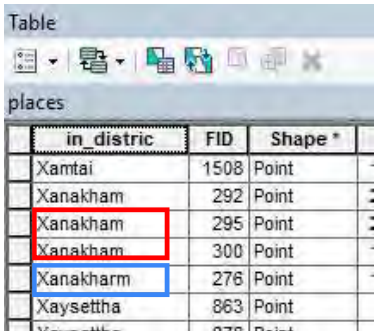
Why set Domain values?

Prevents clerical errors when entering attribute data

Misspelled attributes won't appear in a query; hinders usefulness of attribute data







Creating a Domain

Inland Water Bodies

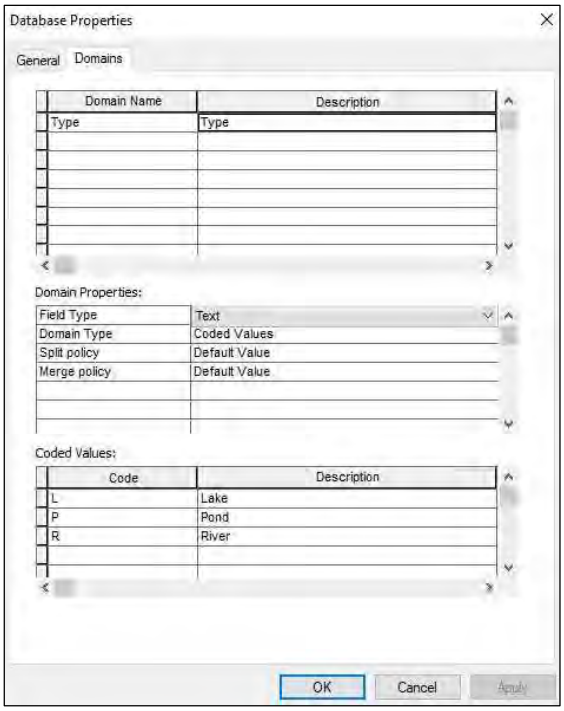
Right-click the Vientiane.gdb and select Properties

Enter the Domain tab

Domain Name: Type
Description: Type

Field Name: Text

Enter Code & Description values
Click OK



Assign Domain to 'Type' Field

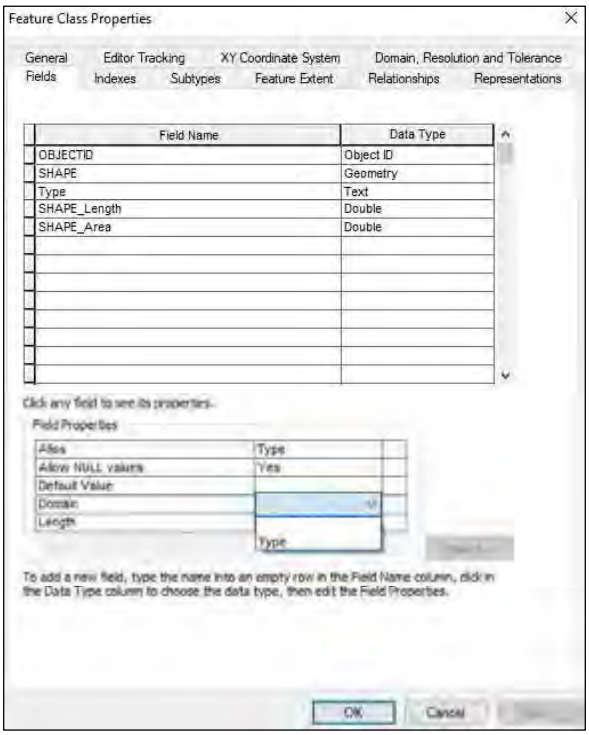
Setting domain values

Open Properties for 'Inland_Water ' feature class

Click on Type at the Field Name box

At the Field Properties box (bottom box) click the down arrow in the cell to the right of Domain
Select Type

Click OK



Overview
Topics covered during this lesson

1. Create a geodatabase
2. Create a feature class
3. Digitizing
4. Edit features
5. Skills Test

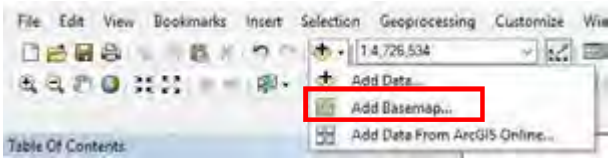
Overview
Topics covered during this lesson

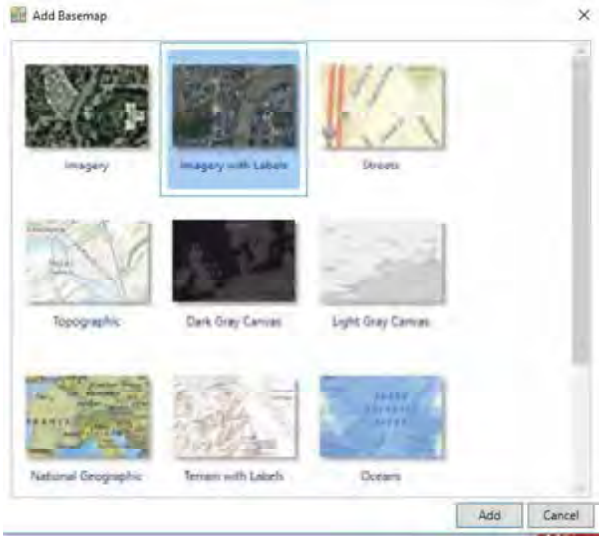
3. Digitizing

a. Roads

b. Lake

Adding a Basemap
Overview

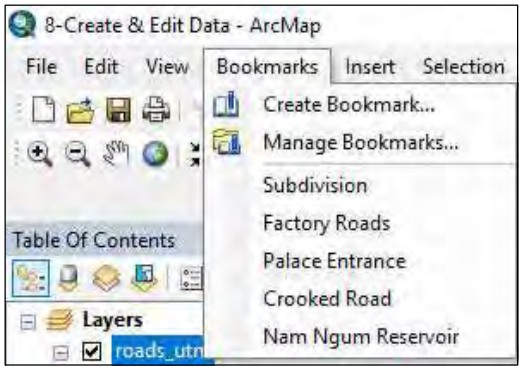




Basemaps can assist with digitizing

Add Basemap – Imagery with labels

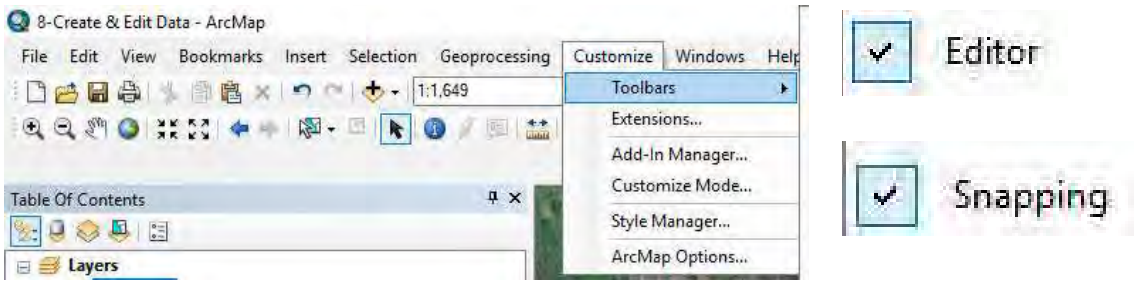
Bookmark
Factory Roads



Access the Factory location by selecting Bookmarks | Factory Roads

Activating Toolbars

Editor & Snapping Toolbars

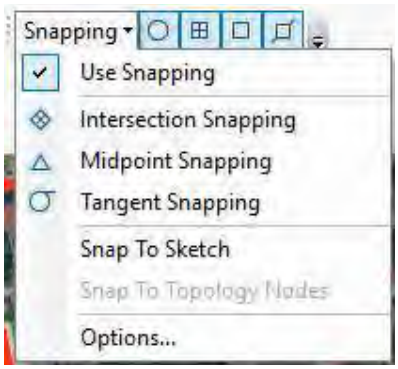


The Editor toolbar contains tools that make it convenient for creating and editing features

Setting Domain Values

Overview

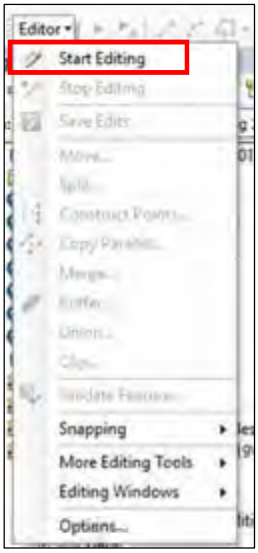
Turn on snapping at the snapping toolbar by clicking Snapping | Use Snapping



Don Chan riverside, Vientiane, Laos map, 2019

Start an Edit Session
Overview

Initially the Editor Toolbar is initially grey because it is inactive.
It can be activated by selecting Editor | Start Editing



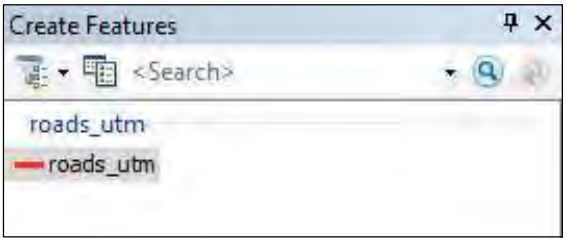
Inactive

Active

Create Features Window
Overview

The Create Features window allows you to add features a feature dataset

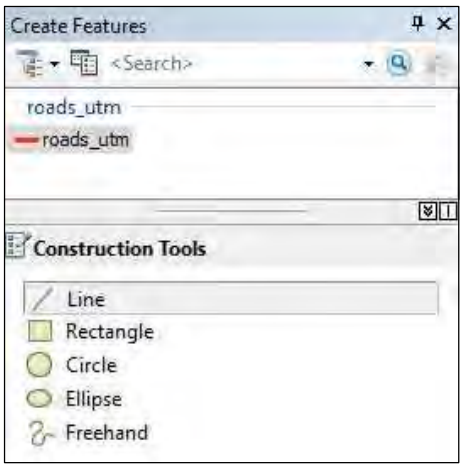
Click the Create Features button on the Editor toolbar to open it



Turn on the roads_utm layer

Create Features Window
Overview

Click roads_utm in the Create Features window to make the Construction Tools window appear. Select Line.

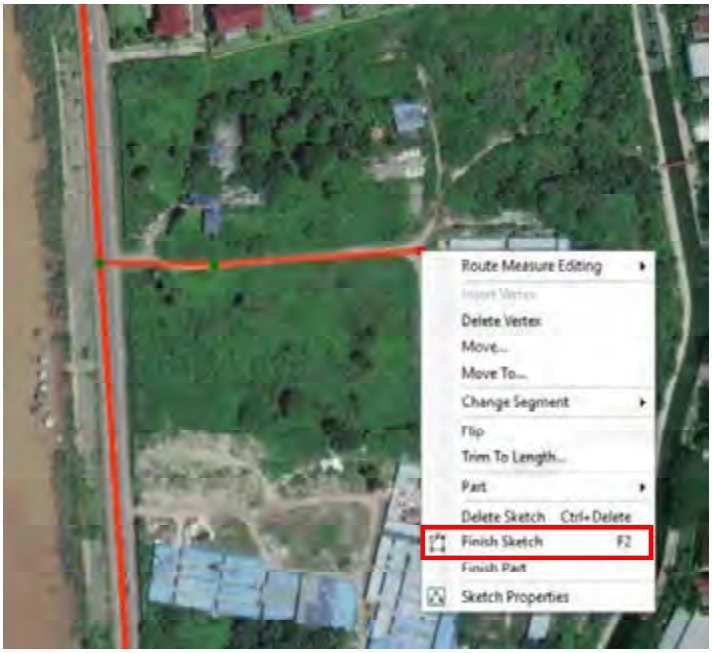


Setting Domain Values
Overview

Digitize a line from the perpendicular road to the factory

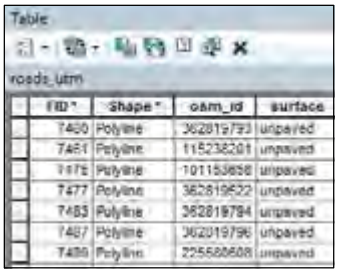
At your last vertex right-click and select Finish Sketch

Repeat the process for the nearby factory to the south.

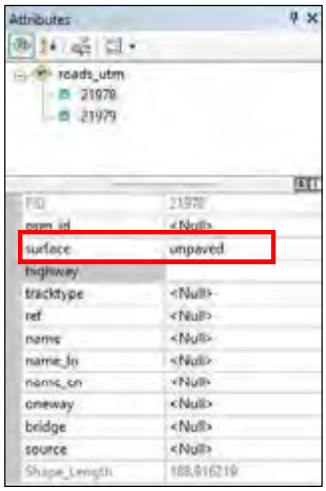


Don Chan riverside, Vientiane, Laos map, 2019

Setting Domain Values
Overview



The attribute table for roads_utm shows a field called surface. There is a class called unpaved. Next, add unpaved to the attributes for the roads you just digitized.



Use the Edit Tool  to select the two lines you just created. Then click the Attributes button  on the Edit toolbar. At the surface field enter unpaved for both lines.

Overview
Topics covered during this lesson

3. Digitizing

a. Roads

b. Lake

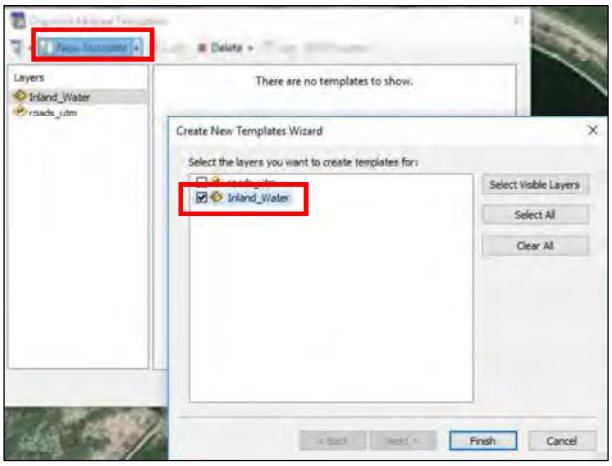
Thatluang lake, Vientiane , Laos map, 2019

Use the Bookmark to go to Thatluang Lake
Drag & drop 'Inland_Water' from ArcCatalog window to the Data View

Creating a Digitizing Template for Inland_Water

Overview

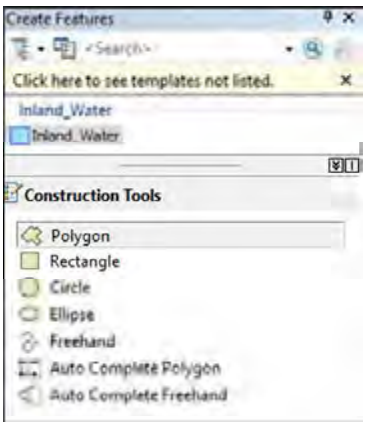
Select the Organize Templates button at the Create Feature window. This will let you create a template for Inland Water and digitize in that layer.



Click New Template
Select Inland_Water
Finish

Digitizing Template for Inland_Water

Overview



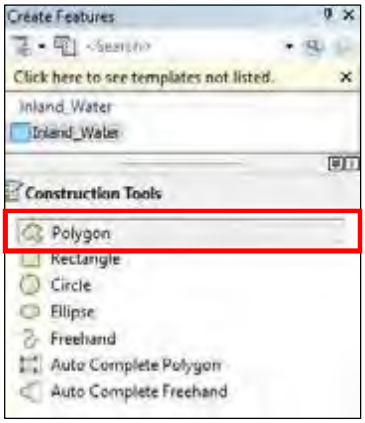
Thatluang lake, Vientiane , Laos map, 2019

A number of construction tools are available at the Construction Tools window. Experiment with different tools to understand how they work.

Digitizing Tools at the Editor Menu

Polygon + Straight Segment & End Point Arc Segment

Selecting the 'Inland_Water' template at the Create Features Menu, then selecting an option from the Construction Tools window makes more editing tools available



Straight Segment

Digitize straight segments

End Point Arc Segment

Create 2 vertices then move cursor to form a curve

Digitizing Thatluang Lake

Create a polygon feature

Use Straight Segment & End Point Arc Segment to digitize a polygon representing Thatluang Lake

Hint: It is possible to switch between tools while digitizing

The finished polygon should look similar to the image on the right

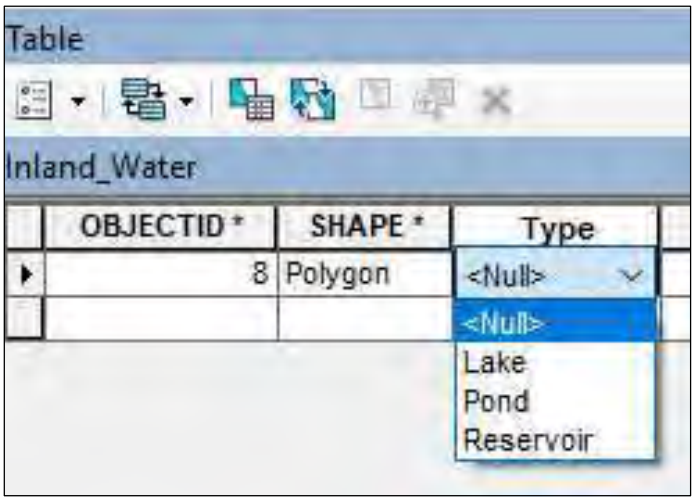
Thatluang lake, Vientiane , Laos map, 2019

Update Field Values for Inland_Water

Assign Type

Open the attribute Table for Inland_Water

Click in the Type field to select Lake



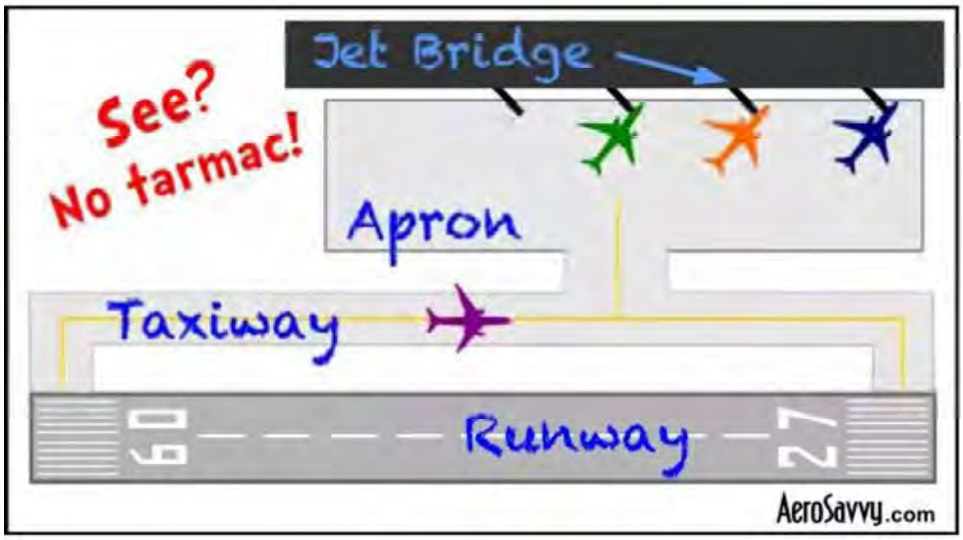
III. Self Task

Assessment of skills - Digitizing

1. Add a Name field (text) to 'Inland_Water'. Enter the name for Thatluang Lake
2. Extend streets into subdivision
3. Add Nam Ngum Reservoir to the Inland_Water feature class
4. Make a feature class called Airport_Roadways; make a line feature class that has separate domains for taxiway and runway and digitize; make a feature class for apron and digitize

Airport Terms

See image



Overview

Topics covered during this lesson

1. Create a geodatabase
2. Create a feature class
3. Digitizing
4. Edit features
5. Skills Test

Editing Features
Must be in Edit Mode

Bookmark | Palace Entrance

Don Chan Palace, Laos map 2019

Delete features

Enable the Edit Tool 

Click the segment that is to be deleted. The segment will be highlighted blue.

Press the delete key on the keyboard.

Editing Features
Must be in Edit Mode

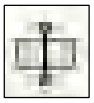
Bookmark | Crooked Road

Roads in Vientiane, Laos map, 2019

Move Vertices

- Adjust vertices if it appears that they are incorrectly placed.
- Double-click the feature.
- Vertices will appear
- Drag & drop the vertices until the feature achieves correct position

Editing Features
Must be in Edit Mode

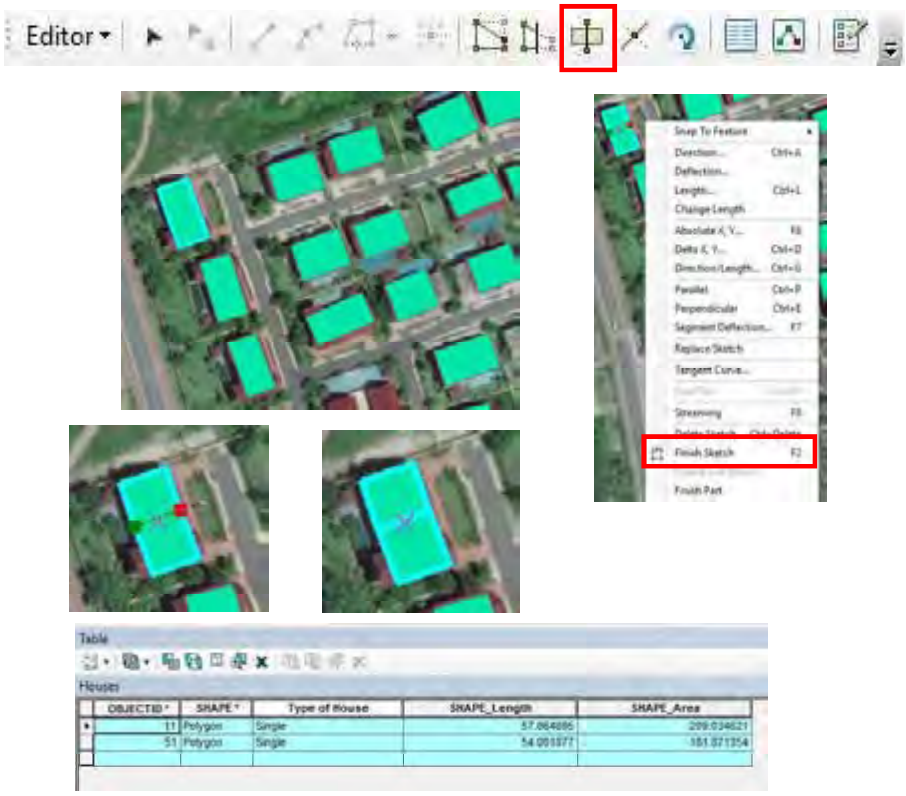
Cut Polygons Tool


Splits a polygon feature into 2 features

Make sure snapping is on
Select Cut Polygons Tool from Editor Toolbar

Click two opposite ends of polygon

Right-click and select Finish Sketch



Editing Features
Must be in Edit Mode

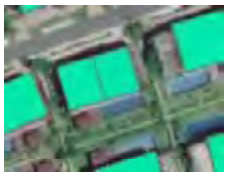
OBJECTID *	SHAPE *	Type of House	SHAPE_Length	SHAPE_Area
24	Polygon	Duplex	54.28808	182.43152
53	Polygon	Duplex	53.386071	175.710898

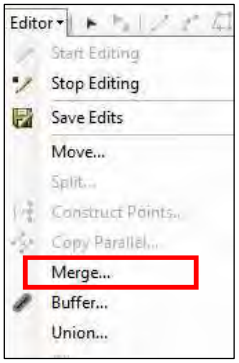
Merge Tool
Combines two separate features into one feature

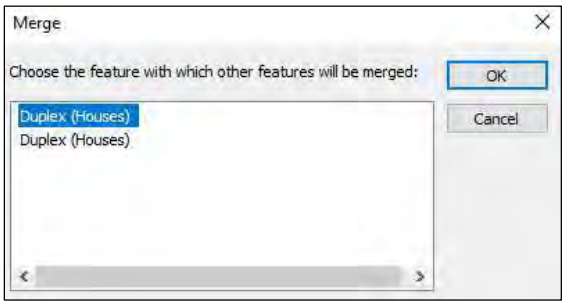
Select the two features to merge

Click Editor | Merge

Choose which feature to merge into
OK







Result is single feature with combined geometry of the two features merged

OBJECTID *	SHAPE *	Type of House	SHAPE_Length	SHAPE_Area
24	Polygon	Single	77.871019	358.142418

Overview

Topics covered during this lesson

1. Create a geodatabase
2. Create a feature class
3. Digitizing
4. Edit features
5. Skills Test

Self Task

Assessment of skills - Editing

1. Create a Feature class called ‘Land_Plots’ in Vientiane geodatabase
2. At Subdivision: Determine the size of one lot
3. Make one large polygon the size of 5 lots. Place onto the adjacent undeveloped land and split into 5 lots.
4. Prepare enough house lots to populate the entire empty plot of land
5. Extend roads from subdivision into the undeveloped land

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