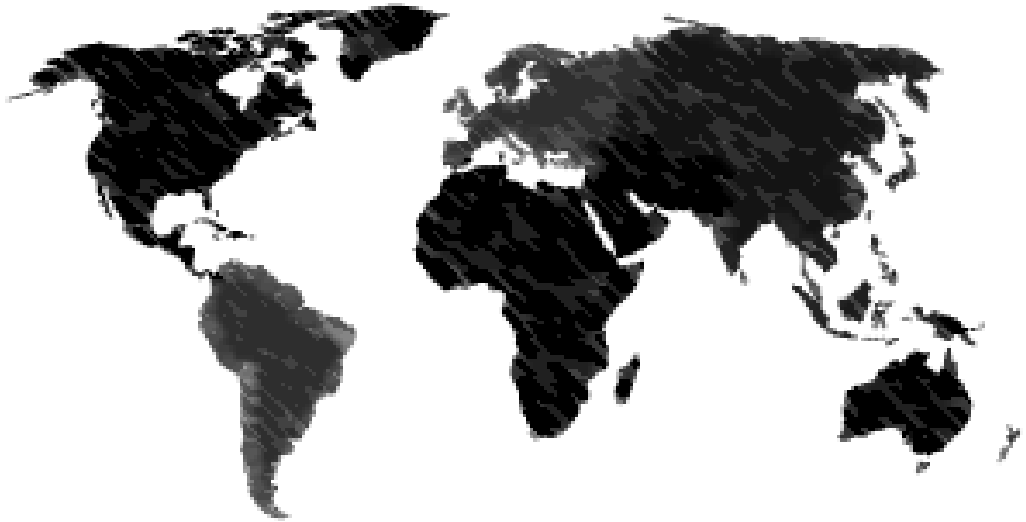
INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND MAPPING AGRICULTURAL SYSTEM

Hands-On Workshop



Department of Agriculture and Livestock

Port Moresby, PNG

2023

Agenda for workshop

- Principles of GIS
- Data formats and GIS
- Projections and GPS data
- Spatial data integration
  - Population
  - Agricultural system

The Principles of Geographic Information Systems (GIS)

Definition and importance of GIS

- GIS stands for Geographic Information System
- GIS is a computer-based system that captures, stores, manages, analyzes, and visualizes spatial data, including maps, satellite imagery, and other geospatial information
- GIS allows for the integration and analysis of data from multiple sources, helping to understand patterns, relationships, and trends in geographic data

Components of GIS

- Data: The foundation of GIS is data, including
  - spatial data (e.g., geographic features, locations) and
  - attribute data (e.g., characteristics, and attributes associated with spatial data)

- Software: GIS software enables the creation, management, analysis, and visualization of spatial data. e.g., ArcGIS, QGIS, and Google Earth

- Hardware: GIS requires hardware, such as computers, servers, and GPS devices, to process and store data

- People: Skilled GIS professionals are needed to operate and analyze GIS data, interpret results, and make informed decisions

What kind of questions can GIS address?

- Location
- Quantity (Measurement)
- Patterns
- Trends (Temporal Aspect)
- Surrounding Conditions & Relationships
- Implications (Planning for the future)

Importance of GIS

- Improved Decision Making:
  - by providing visualizations, analysis, and insights from spatial data.
- Spatial Analysis and Modeling:
  - overlay analysis, proximity analysis, and network analysis.
- Data Integration and Management:
  - satellite imagery, aerial photography, GPS data, and other spatial datasets.
- Visualization and Communication:
  - maps, charts, and other graphical representations of spatial data.
- Cost and Time Savings:
  - GIS helps in optimizing resources, reducing costs
- Environmental and Social Impact Assessment:
  - infrastructure development, land use planning, and natural resource management.

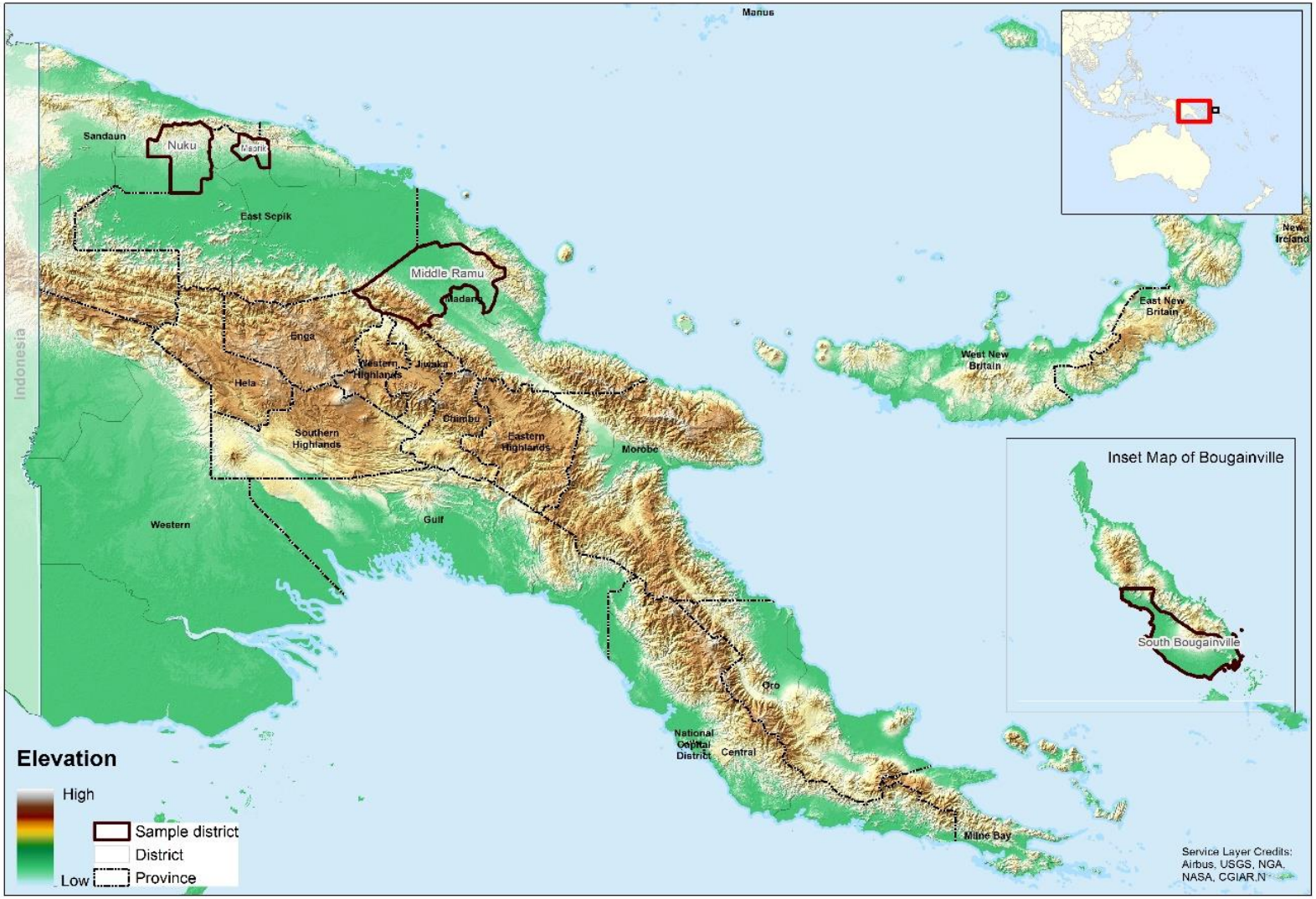
Geospatial Analysis

- It involves using GIS tools and techniques to analyze and interpret spatial data
- Include tasks such as overlay analysis, buffer analysis, spatial query, spatial statistics, and network analysis
- Helps in understanding spatial patterns, relationships, and trends, and supports decision-making in various fields

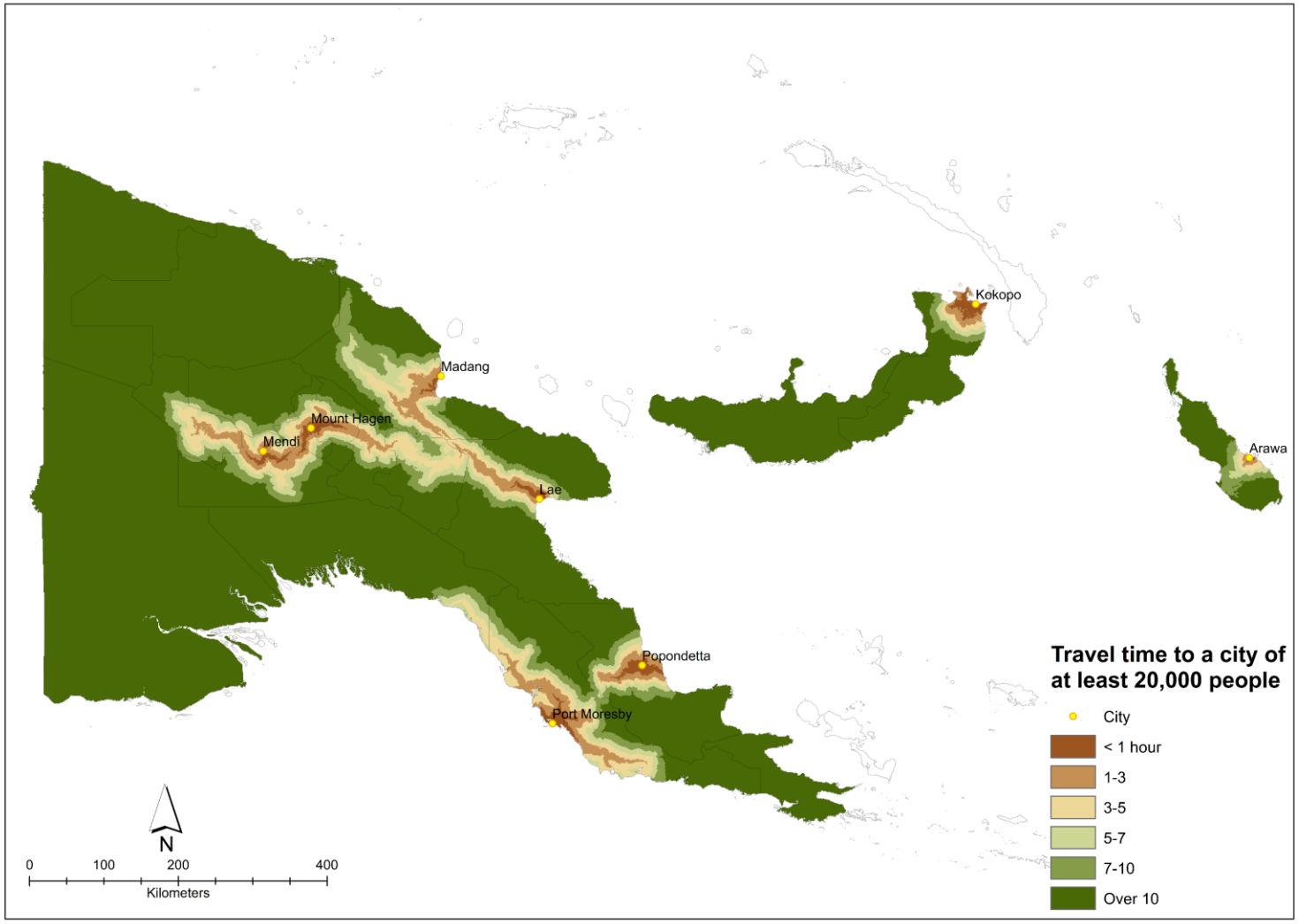
Cartography

- Cartography is the science and art of creating maps using GIS
  - designing and creating visually appealing maps that convey spatial information effectively
  - includes elements such as map layout, symbology, scale, projection, and map design principles

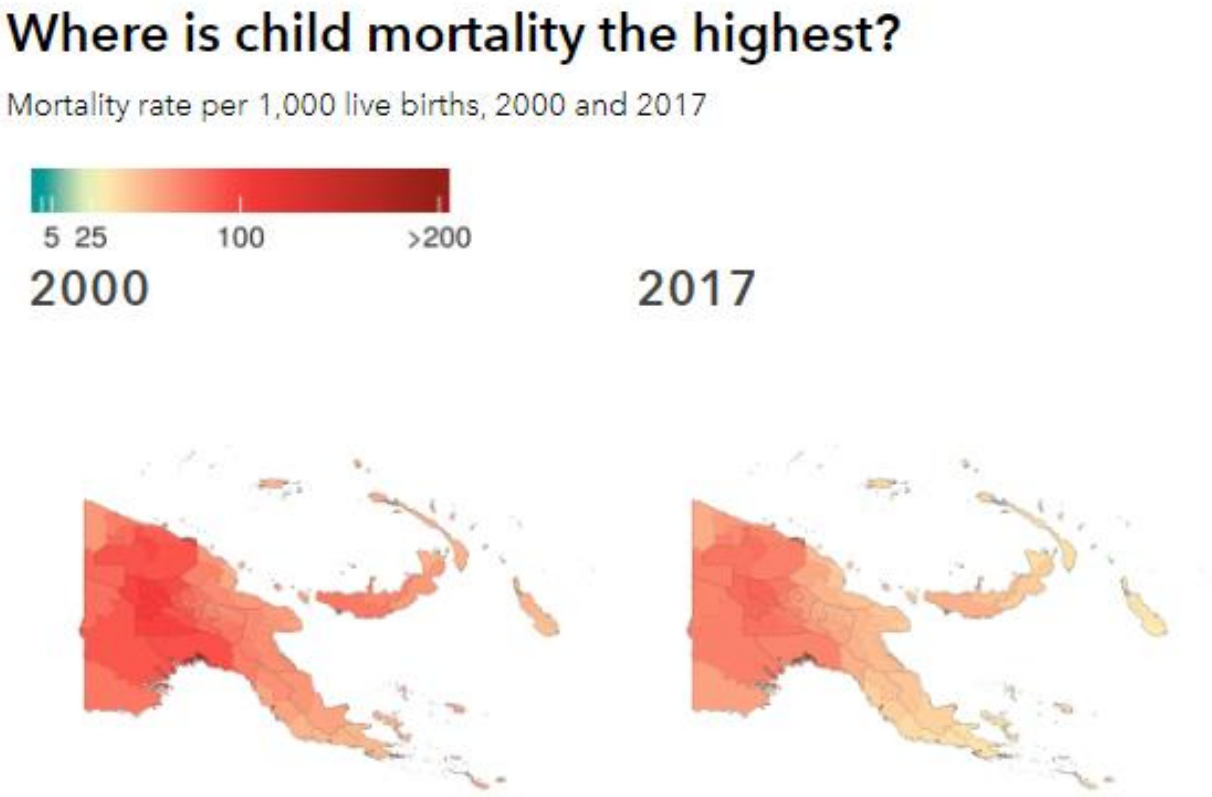
Location


Manus
Sandaun
Nuku
Wasnik
East Sepik
Middle Ramu
Madang
Indonesia
Enga
Western Highlands
Jiwaka
Hela
Chimbu
Southern Highlands
Eastern Highlands
Morobe
Western
Gulf
Oro
National Capital District
Central
Milne Bay
New Ireland
East New Britain
West New Britain
Inset Map of Bougainville
South Bougainville
Elevation
High
Low
Sample district
District
Province
Service Layer Credits: Airbus, USGS, NGA, NASA, CGIAR,N

Implications- Network analysis

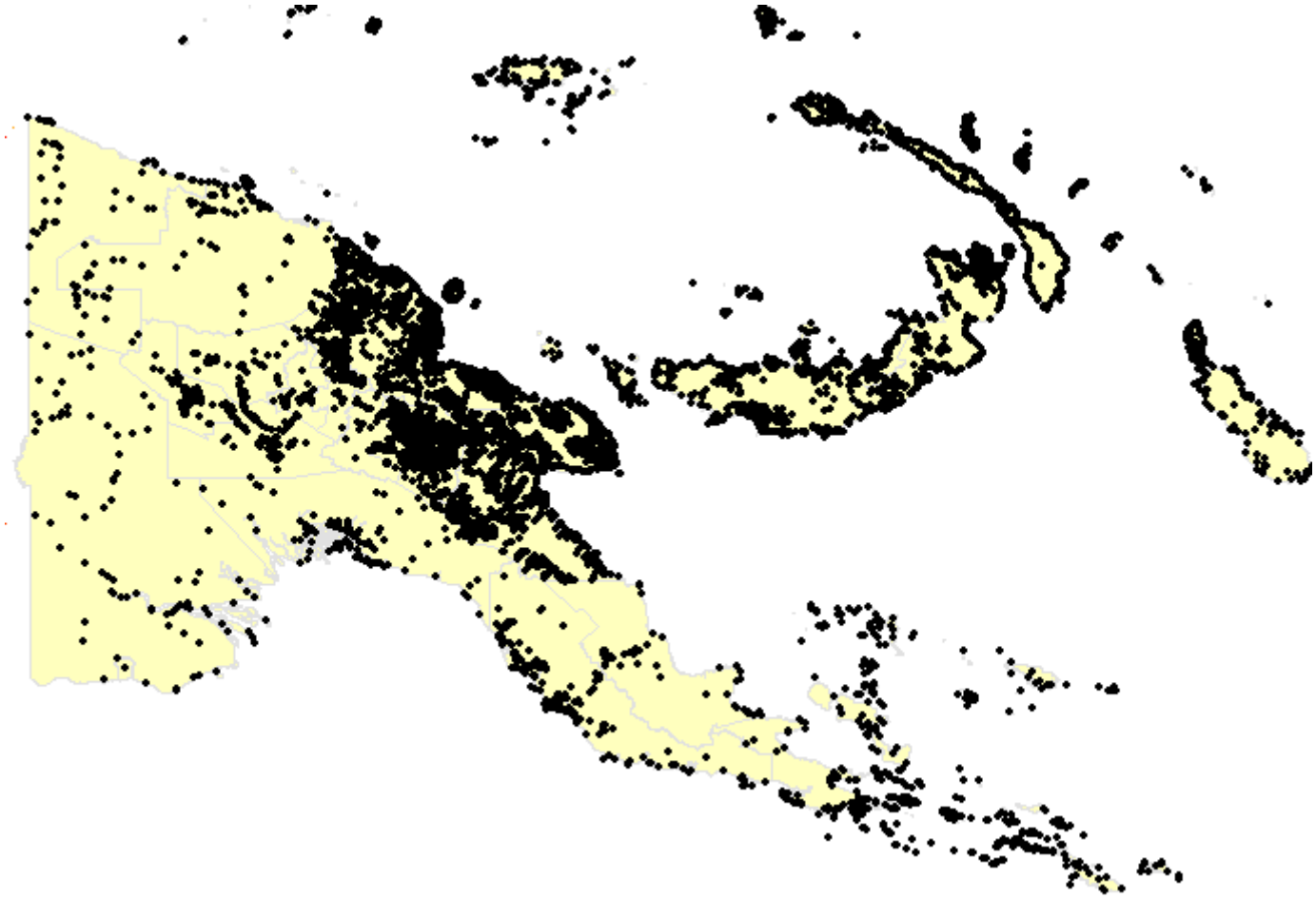


Quality - Trends

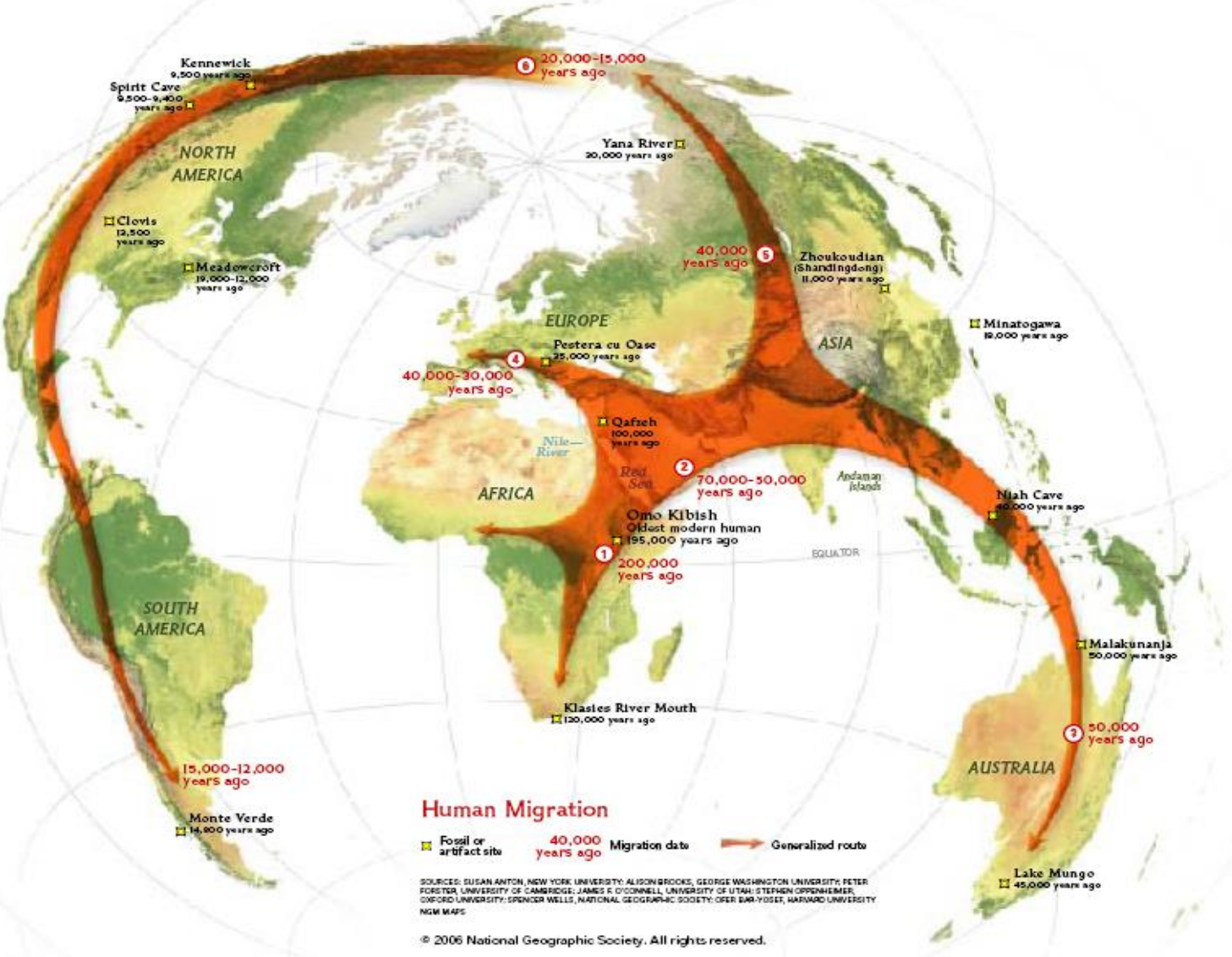


https://www.healthdata.org/papua-new-guinea

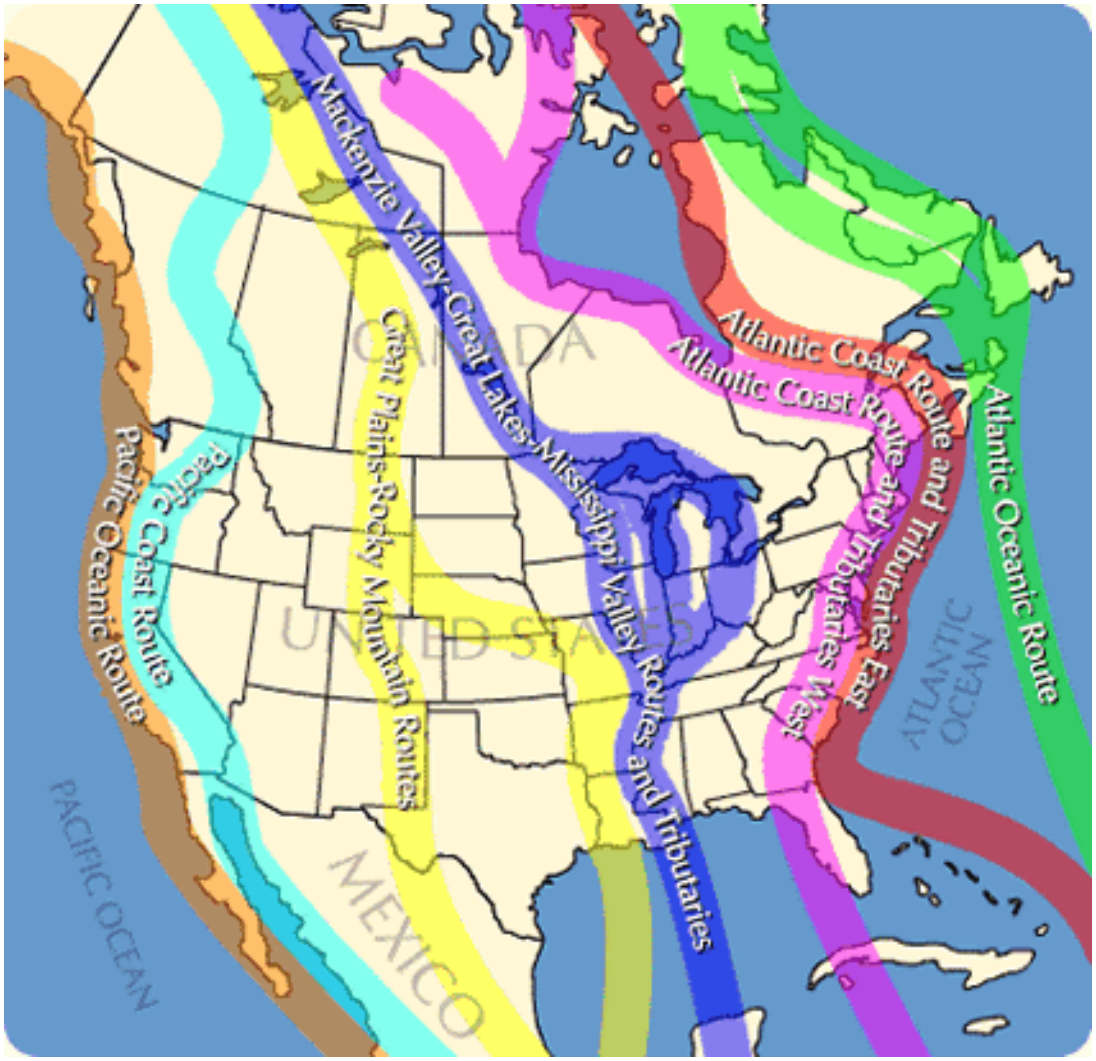
Patterns - Density



Trends - Spread



Implications- West Nile



Basic concepts: Spatial data

- Spatial data refers to data that has a geographic or spatial component, such as **location**, **shape**, and **attributes** associated with geographic features

- Spatial data can be represented as **points**, **lines**, **polygons**, or **raster images**, and can be stored in various formats, such as vector and raster

- Spatial data is the foundation of GIS, and it can be collected, created, and analyzed using GIS tools and techniques

GIS Data Types and Sources

- GIS data can be categorized into two main types:
  - vector data
  - raster data
- **Vector data** represents geographic features as points, lines, or polygons, and is used to represent discrete and well-defined features such as roads, buildings, and land parcels

- **Raster data** represents geographic features as a grid of cells, where each cell contains a value that represents an attribute or characteristic and is used to represent continuous data such as elevation, temperature, and precipitation

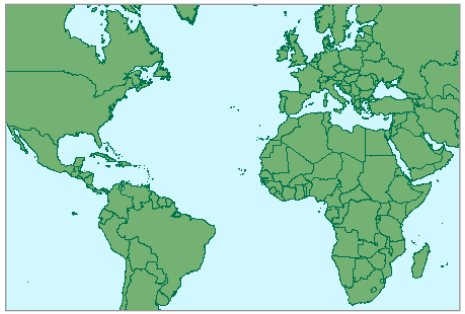
Vector Data

- **Points** represent a single location, such as a well or a city center

- **Lines** represent linear features, such as roads, rivers, or pipelines

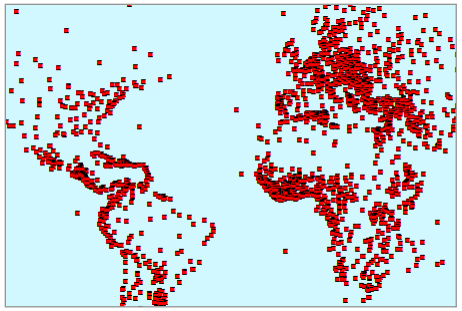
- **Polygons** represent enclosed areas, such as land parcels, administrative boundaries, or vegetation cover

Vector data



Polygon

Line



Point

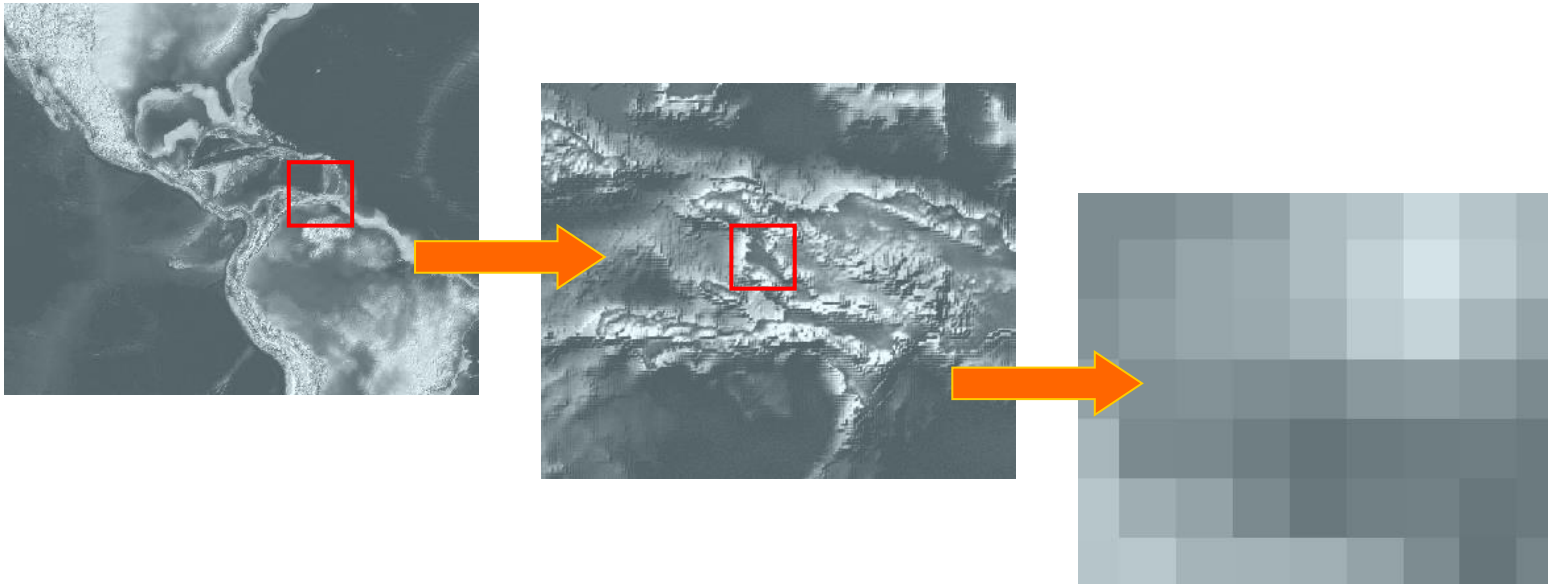
Vector data are also called Shapefiles

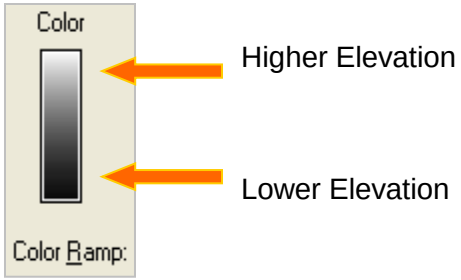
Raster Data

- Each cell in a raster represents a location and contains a value that represents a specific attribute, such as elevation, temperature, or land cover

- Raster data is used for continuous data analysis, modeling, and visualization

Raster data





Basic concepts: Layers

- Layers are the building blocks of GIS, and they represent different thematic information that can be stacked on top of each other to create a map

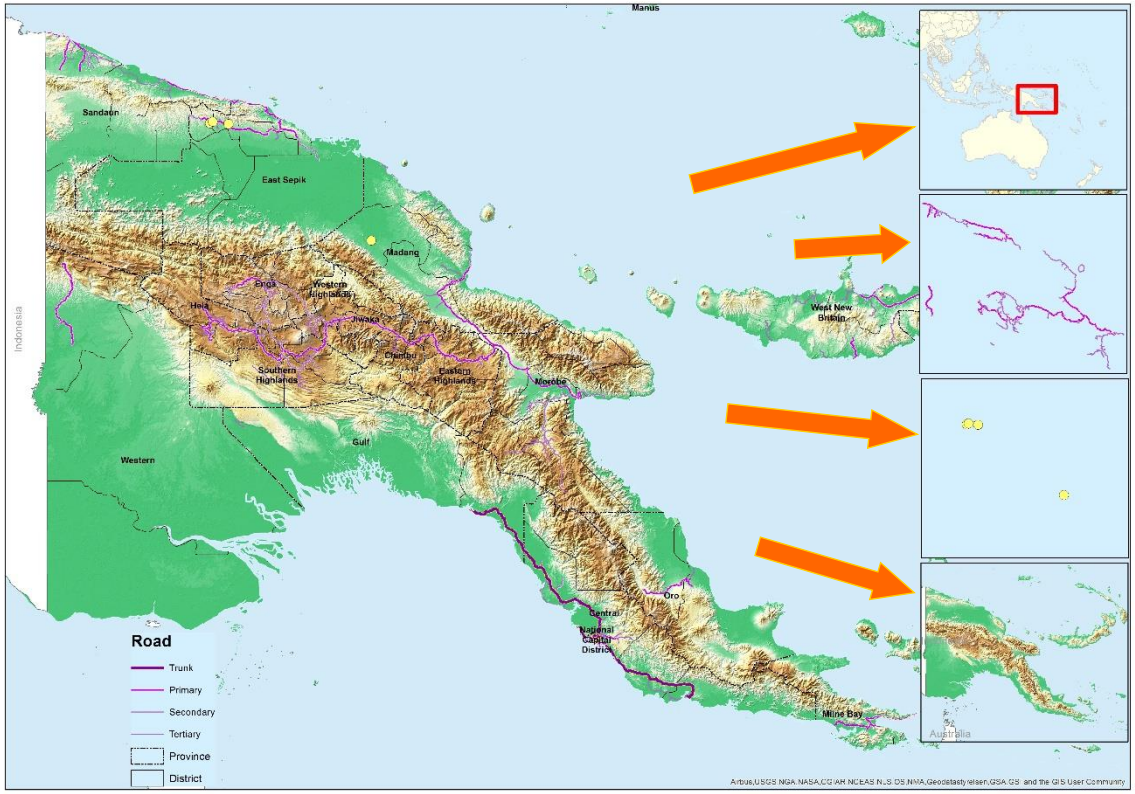
- Layers can include features such as roads, buildings, rivers, and land parcels, each represented as a separate layer with its own attributes and properties

- Layers can be added, removed, and manipulated in GIS software to create complex spatial analyses and visualizations

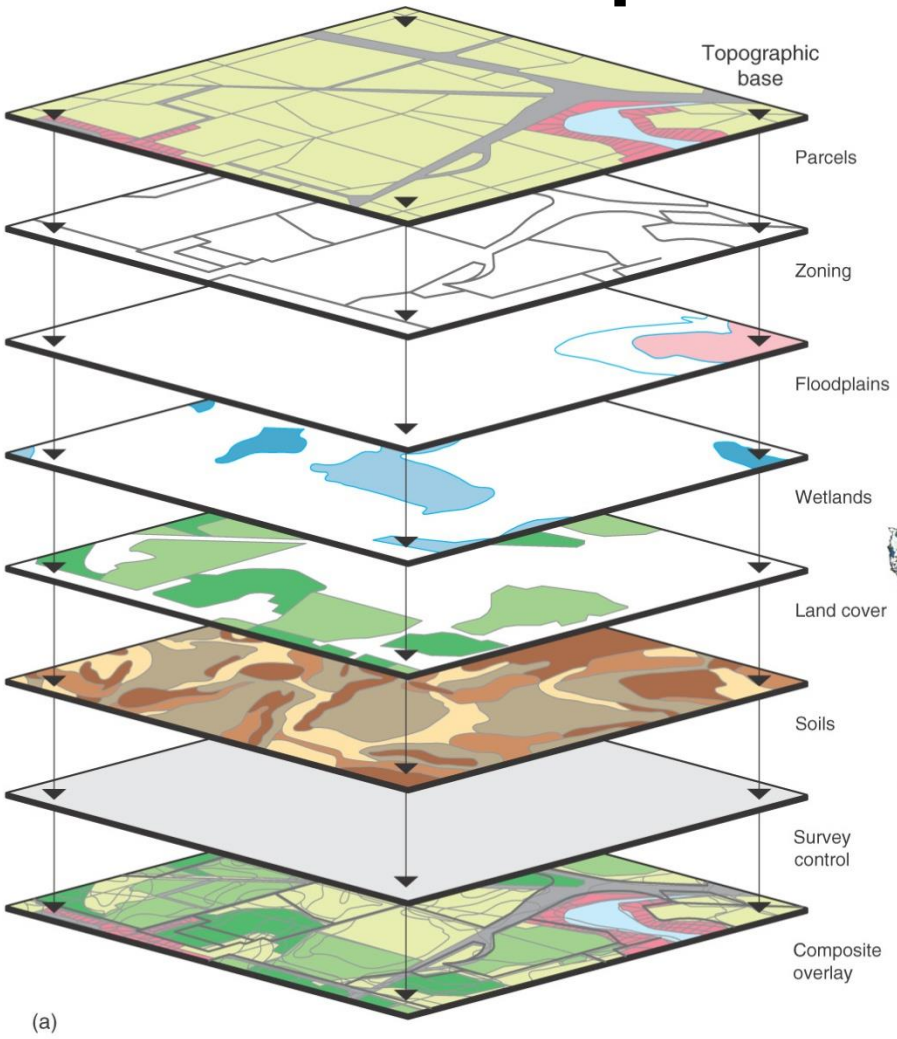
GIS map components

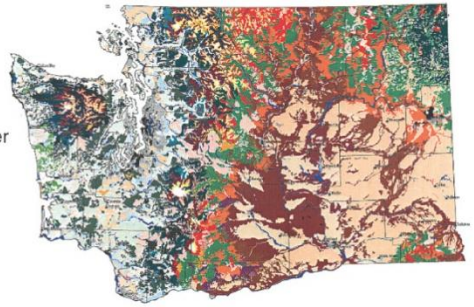
- A **Map** is made up of **Layers or Shapefiles**
- **Layers** contain **Features**
- **Features** can take the form of **Points, Lines and Polygons,** and are known collectively as **Vector Data**
- **Layers** contain **Features,** and each **Feature** is linked to a row of information in the **Attribute table**

Layers contain features



Each map is a system of layers





Each layer will have either Vector Data or Raster Data

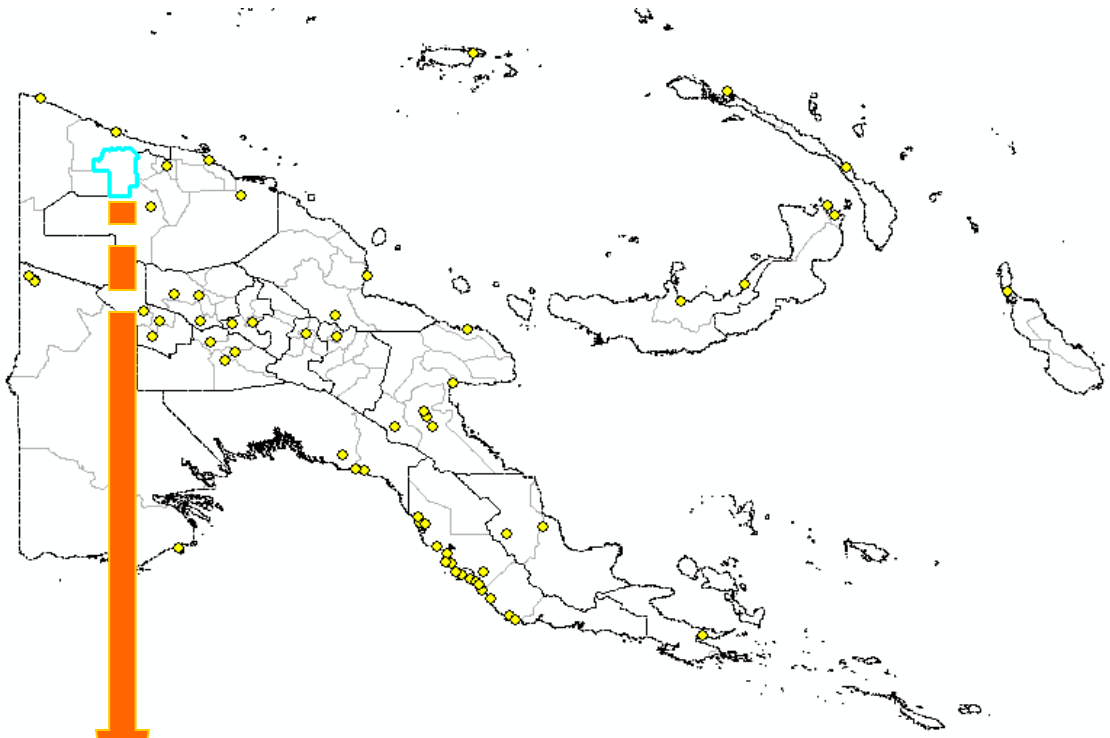
Basic concepts: Attribute Data

- Refers to the non-spatial information associated with spatial features, such as attributes or characteristics of geographic features

  e.g., name, population, elevation, land use, and other relevant information

- Stored in tabular format and linked to spatial data using unique identifiers, allowing for analysis and querying of spatial and attribute data together

Attribute table



Table

Districts

OBJECTID	NAME_1	TYPE_2	VARNAME_2	HRname	HRPcode	HRParent	SI
44	Jiwaka	District		North Waghi	PG103	PG10	
71	Sandaun	District		Nuku	PG182	PG18	
29	Eastern Highlands	District		Obura-Wonenara	PG066	PG06	
30	Eastern Highlands	District		Okapa	PG067	PG06	
16	East New Britain	District		Pomio	PG043	PG04	

62 (1 out of 87 Selected)

Districts

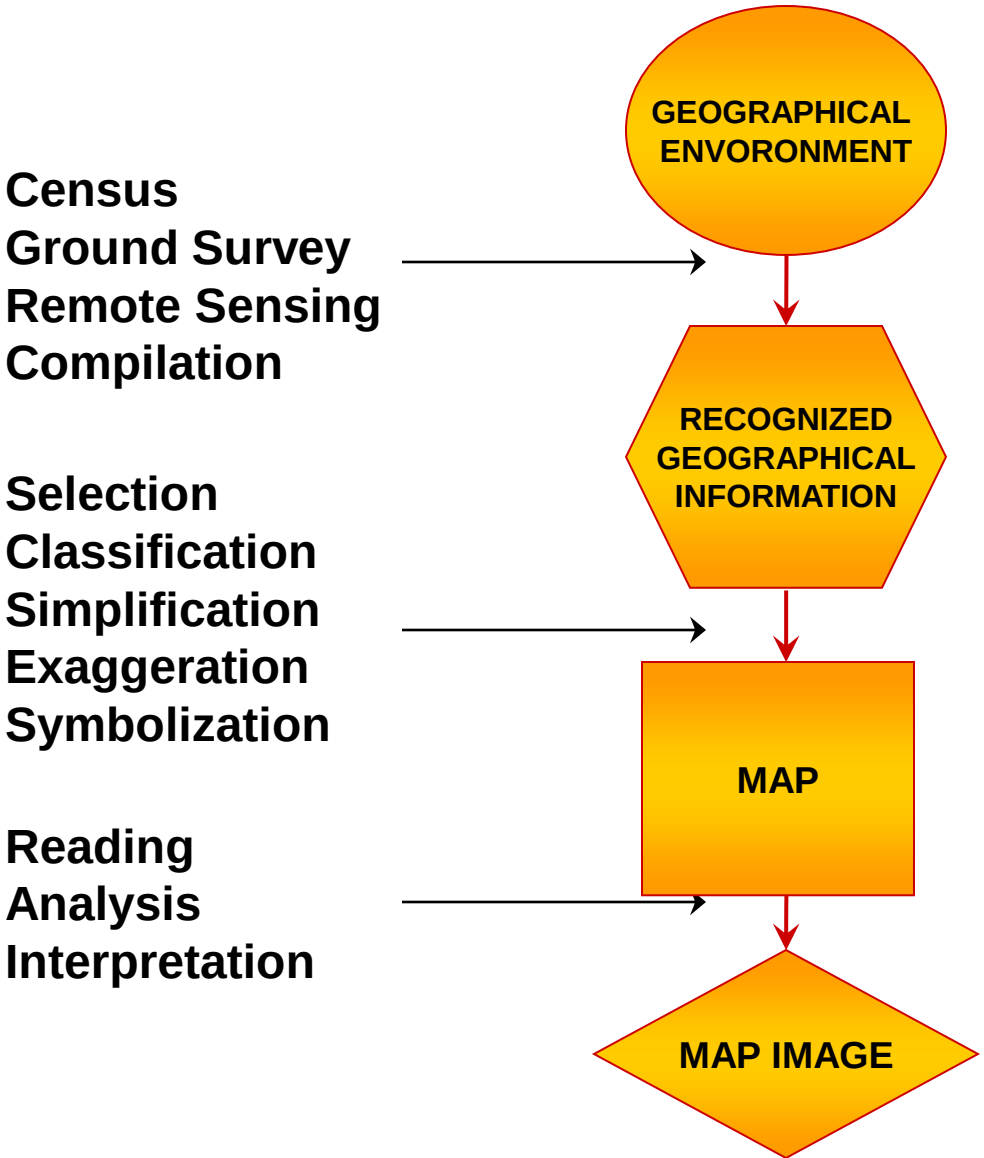
Data sources

- GIS data can be obtained from various sources, including:
  - Publicly available data, such as government agencies, academic institutions, and NGO
  - Commercial data providers that offer specialized GIS datasets for specific industries or applications
  - Crowdsourced data collected by individuals or communities, such as ***OpenStreetMap***
  - Field-collected data using ***GPS or other data*** collection devices
  - Remote sensing data, such as **satellite** imagery, aerial photographs, and LiDAR data

Data Consideration

- **Data quality** refers to the accuracy, precision, and completeness of the data
- **Data accuracy** refers to how closely the data represents the real-world features
- **Data scale** refers to the level of detail or resolution of the data
- **Data relevance** refers to how well the data meets the needs of the specific GIS application

The steps taken from feature data to Map Analysis



The map design process

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Consider what the real world distribution of the phenomena might look like	Determine the purpose of the map and it's intended audience	Collect data appropriate for the map's purpose	Design and Construct the map	Determine whether users find the map useful and informative

US Presidential Election 2020

Results mapped at county level showing the candidate with the largest vote share in each area

Results*

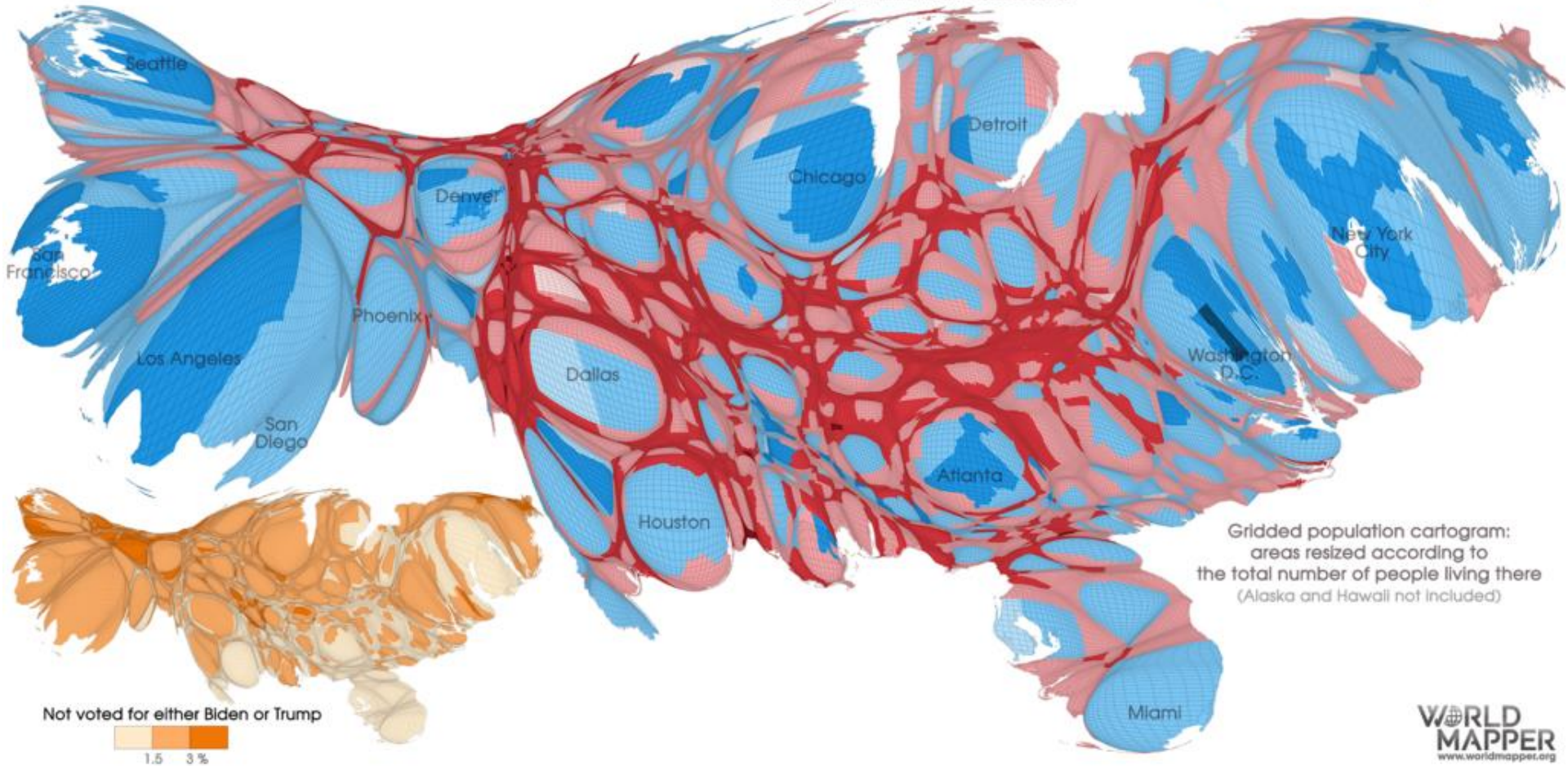
Biden
80,063,589 votes (51.1%)
306 electoral votes

Trump
73,904,195 votes (47.2%)
232 electoral votes

* preliminary results, last updated 27. Nov 2020
Source: Associated Press, New York Times, The Guardian

Vote share
of candidate with most votes

Alaska and Hawaii showing state-level outcomes



Gridded population cartogram:
areas resized according to
the total number of people living there
(Alaska and Hawaii not included)

Not voted for either Biden or Trump

WORLD MAPPER
www.worldmapper.org

GIS Software and Tools

- GIS software refers to the applications and tools used for creating, managing, analyzing, and visualizing geographic data

- Popular GIS software includes ArcGIS by Esri, QGIS, MapInfo, and Google Earth Pro

- These software provide a wide range of functionalities, such as data visualization, spatial analysis, data editing, and map production

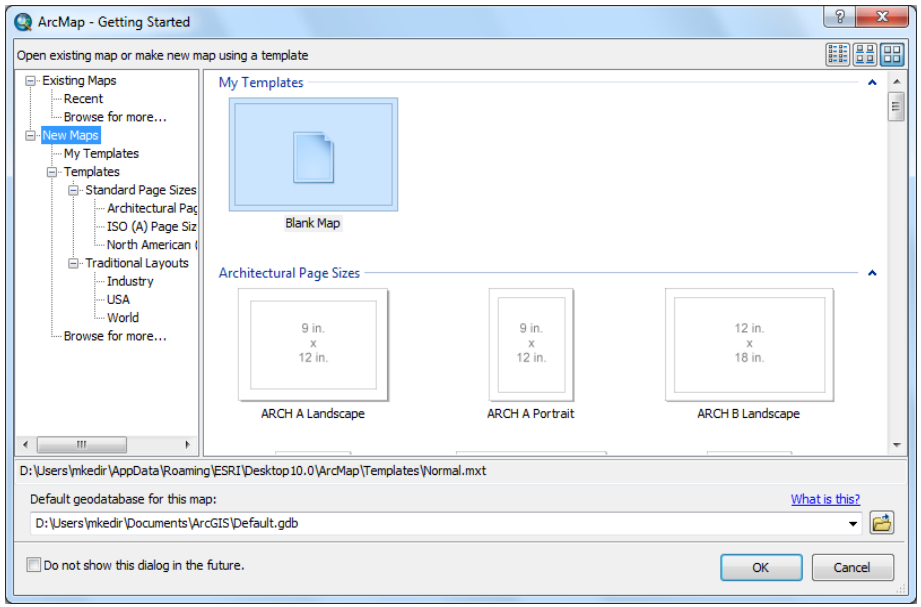
GIS Tools

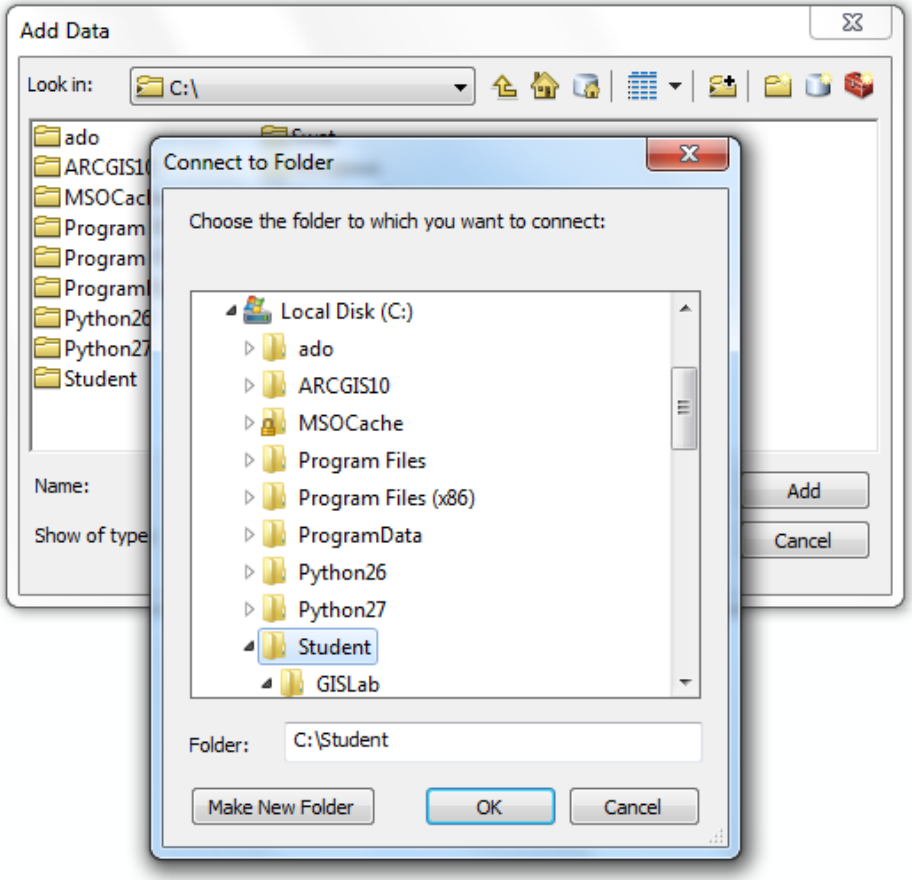
- GIS tools are specialized software or plugins that extend the capabilities of GIS software

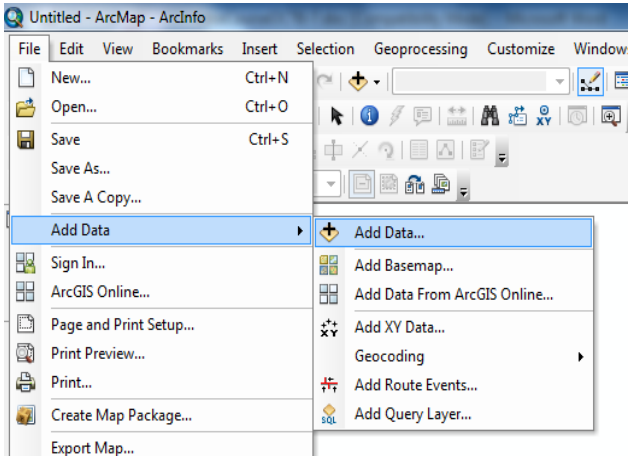
  E.g., spatial analysis tools, data management tools, geocoding tools, and remote sensing tools

- These tools enhance the functionality of GIS software and enable users to perform specific tasks or analysis on geographic data

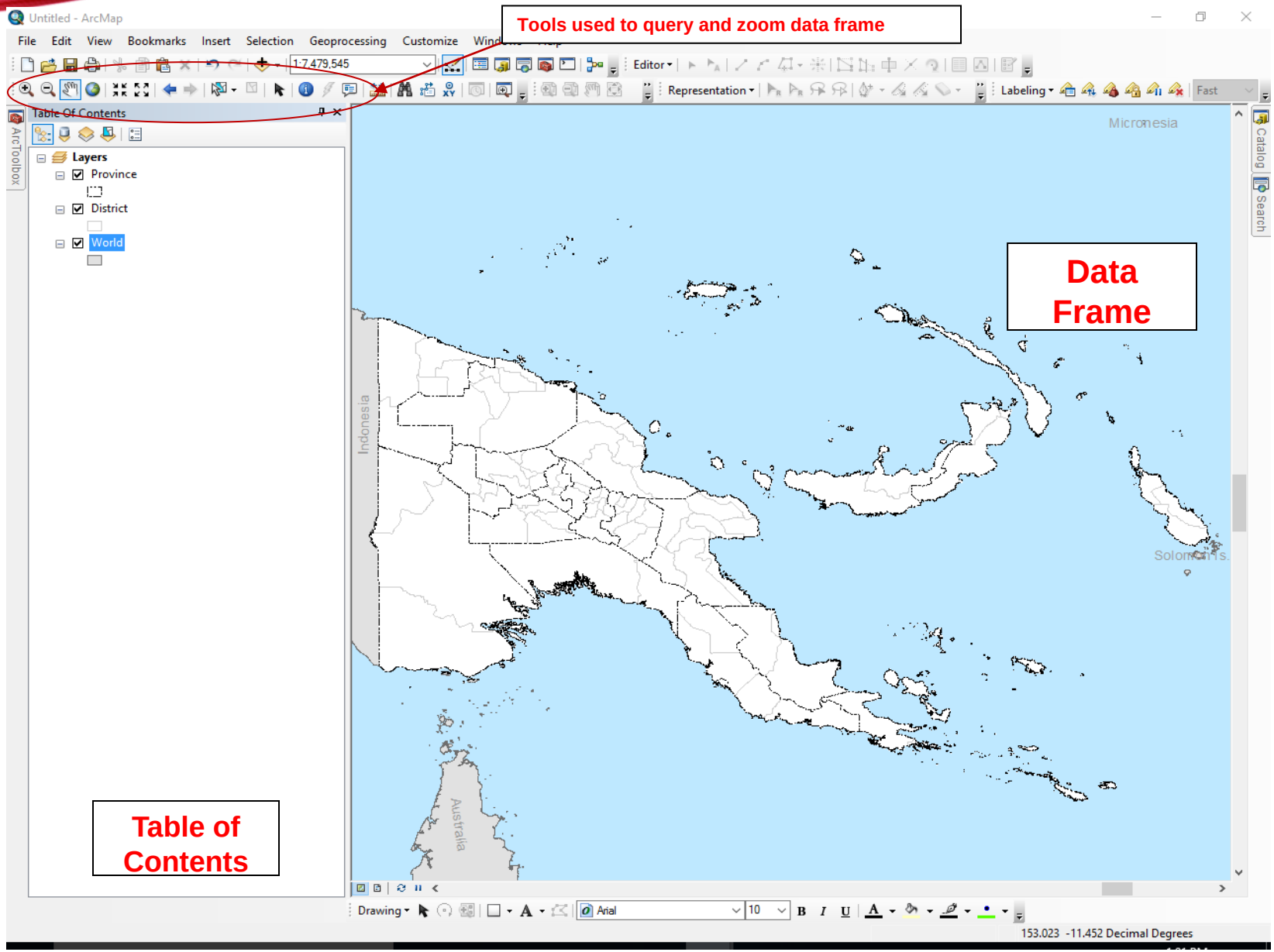
How to get started



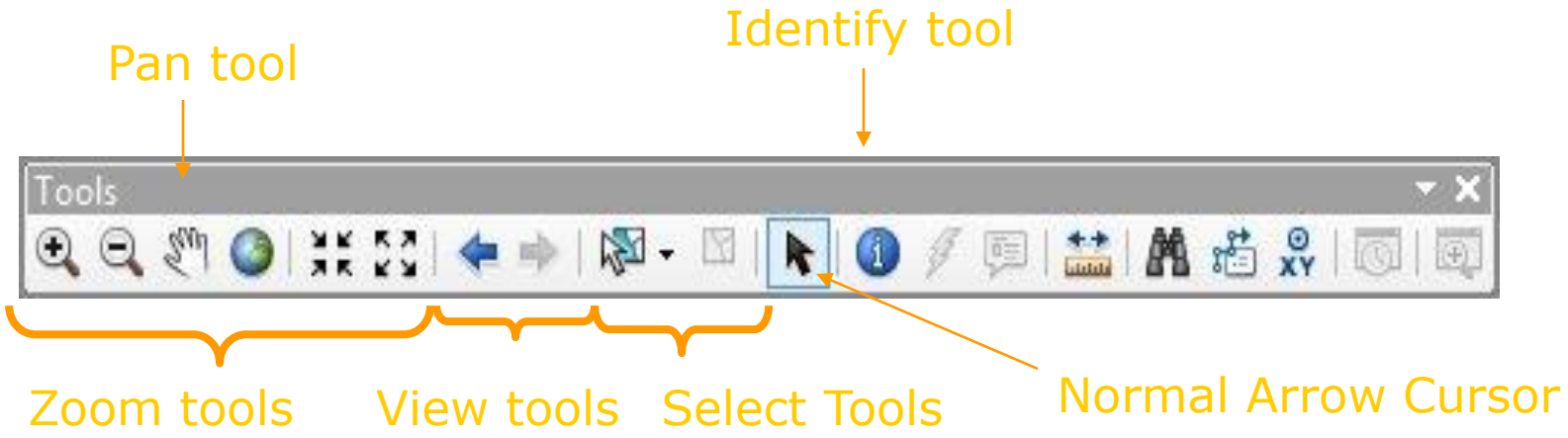




ArcGIS interface



Basic mapping toolbar



LAB 01

Overview:

Create a basic overview map of PNG.

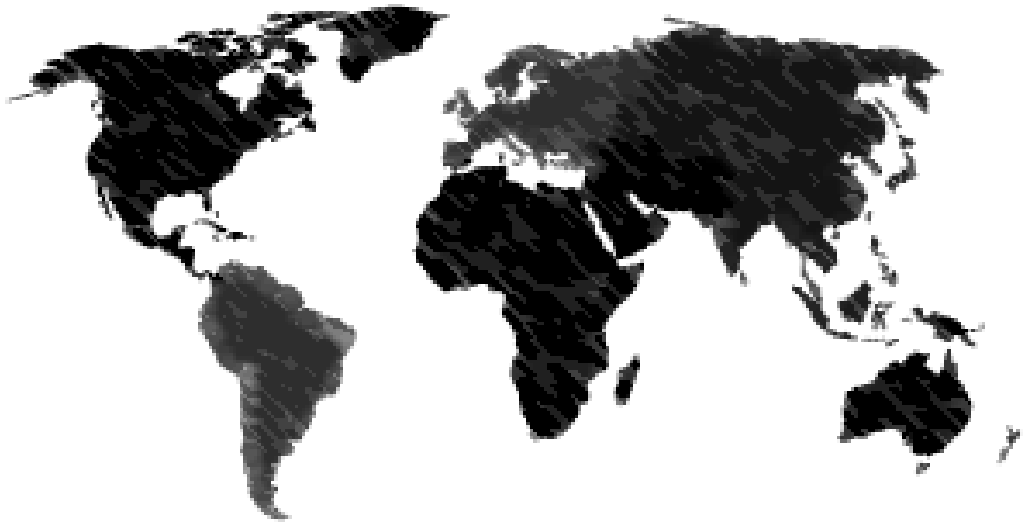
- Introduce the ArcMap Interface & Toolbars
- Basic Symbology & Symbol hierarchies
- Basic Querying
- Labeling
- Layout
- Final Output will be exported to PowerPoint

Questions?

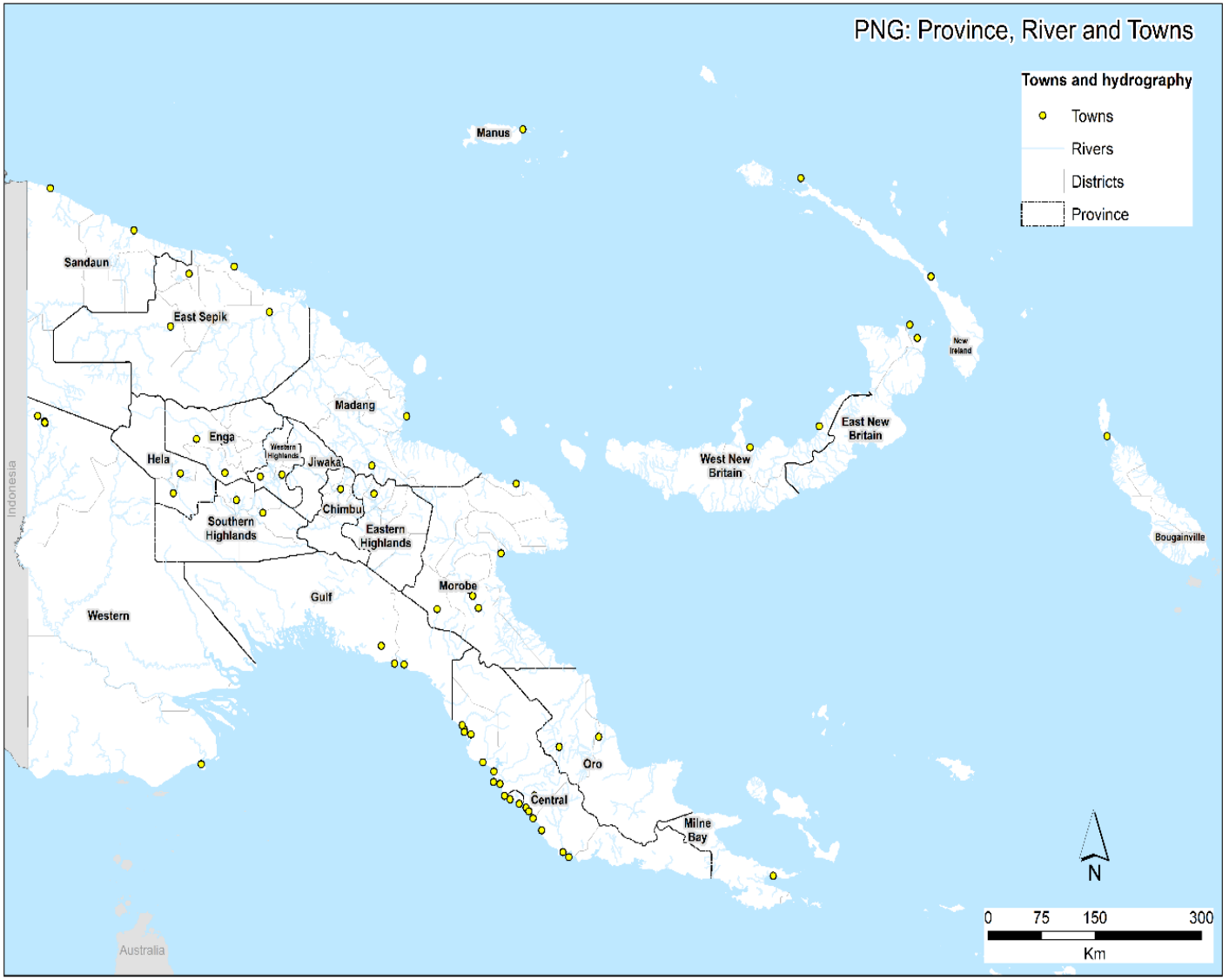
Let’s open up an ArcGIS session right now, and you can begin working on the first exercise

Advanced Symbology- Lab02

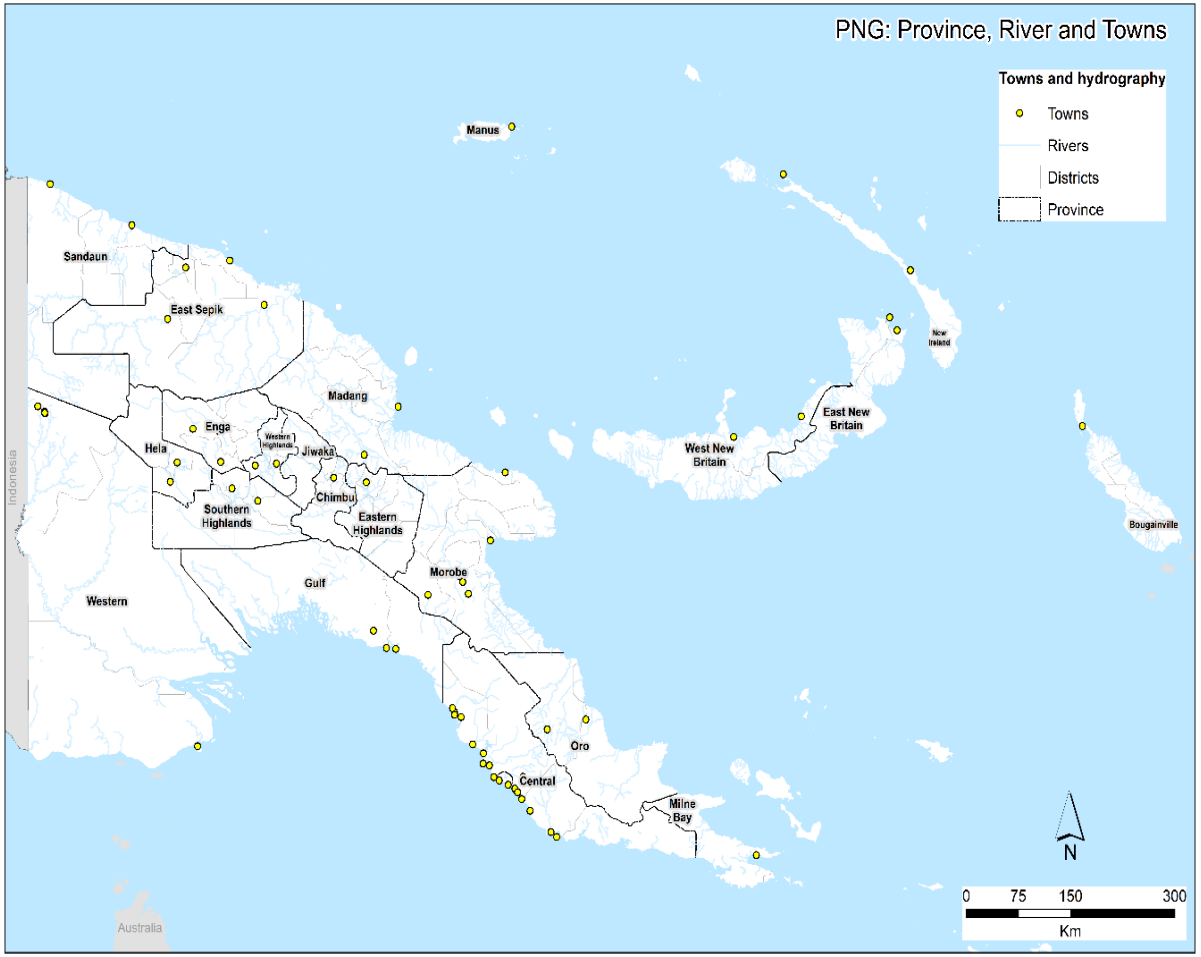
Hands - On Workshop



Lab01 –Questions?

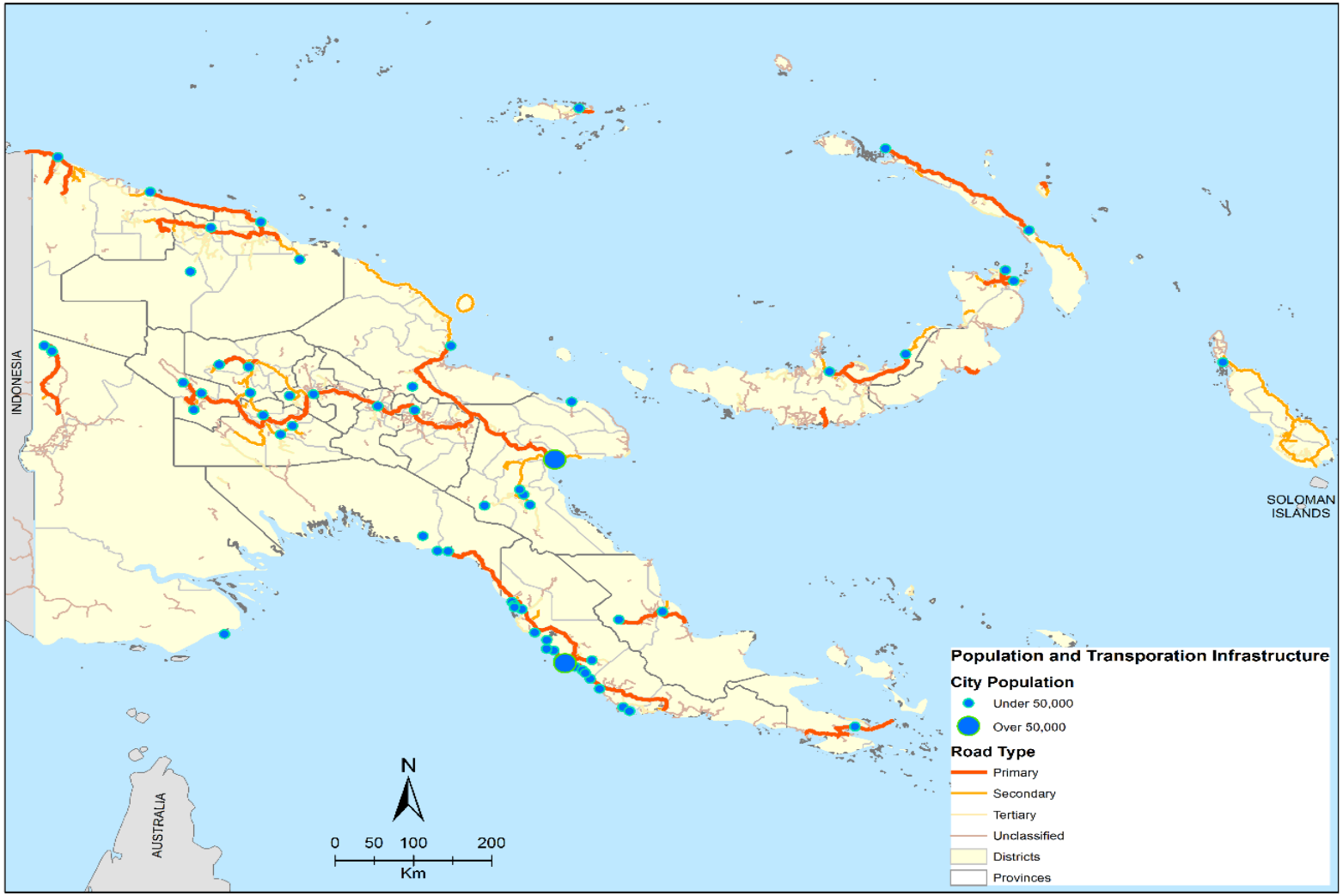


Lab 02: Advanced Symbology



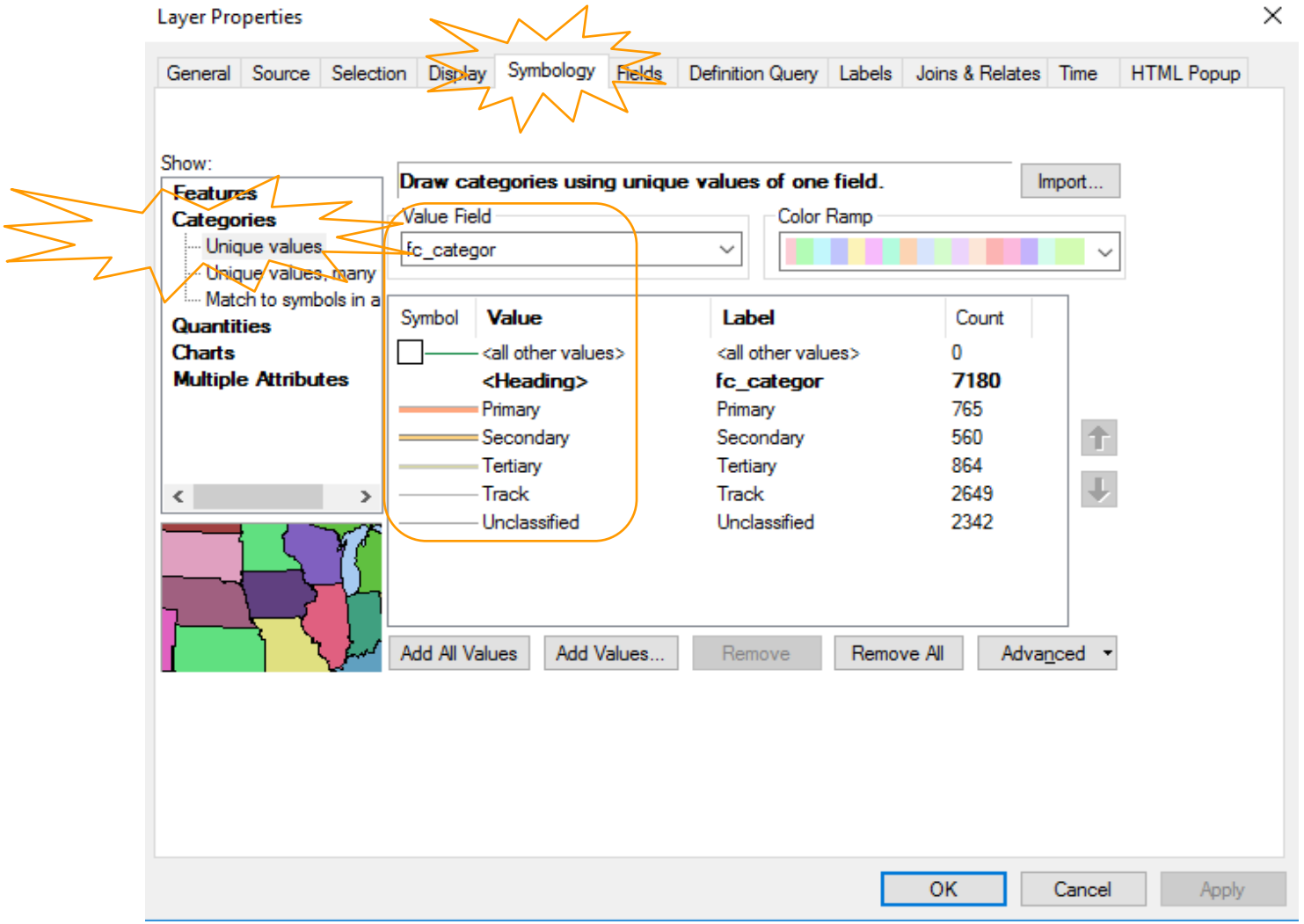
In Lab 01, we mapped the data, now we will begin to classify it and choose hierarchies to better understand spatial elements of the country!

Lab 02: Advanced Symbology

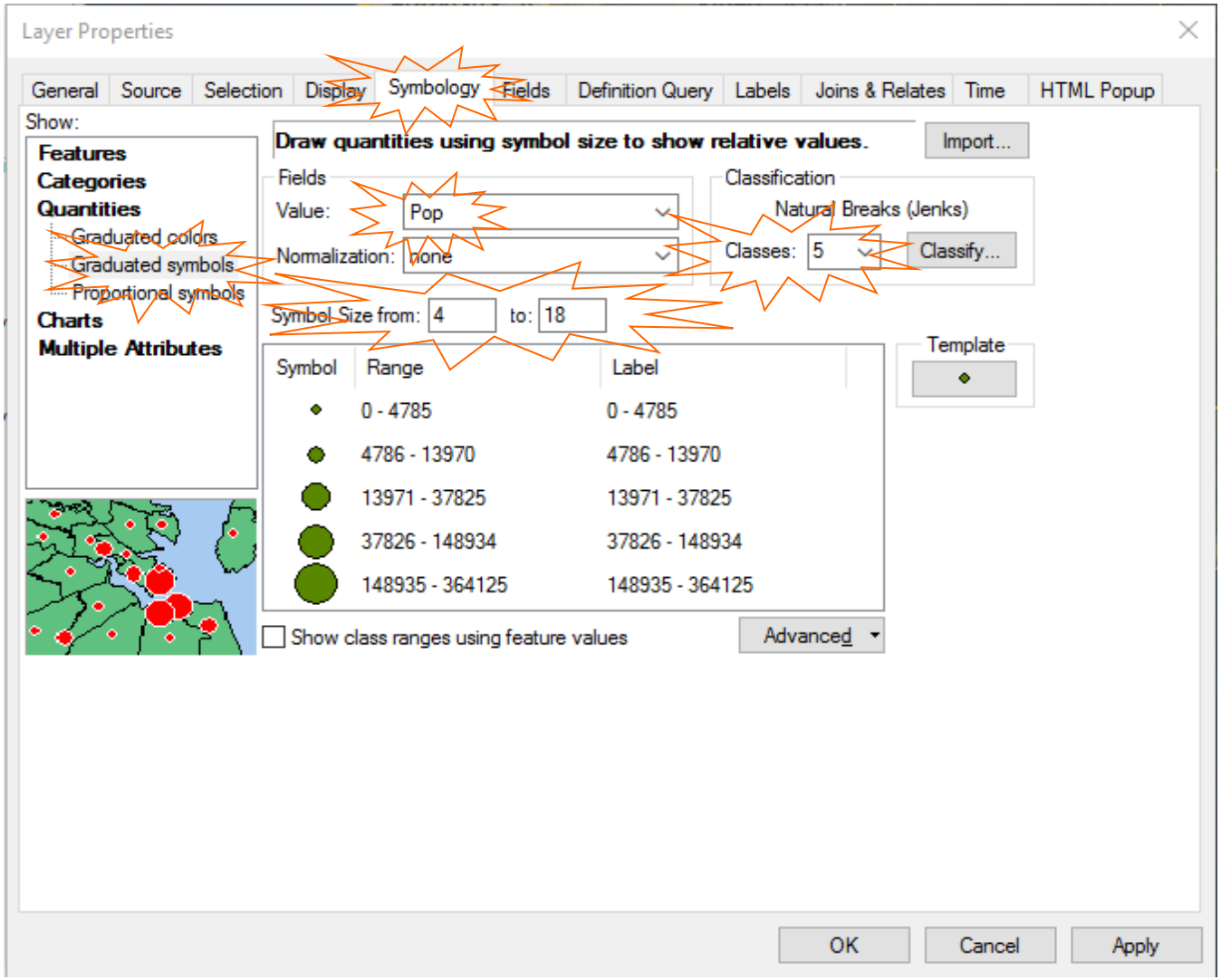


Instead of displaying single feature of town and road, we can map large vs. small cities, or primary, secondary, tertiary roads.

The layer properties; table links to the attribute table that you worked with in lab01



The manner in which you are able to classify your data depends on the data type (text vs. numerical)



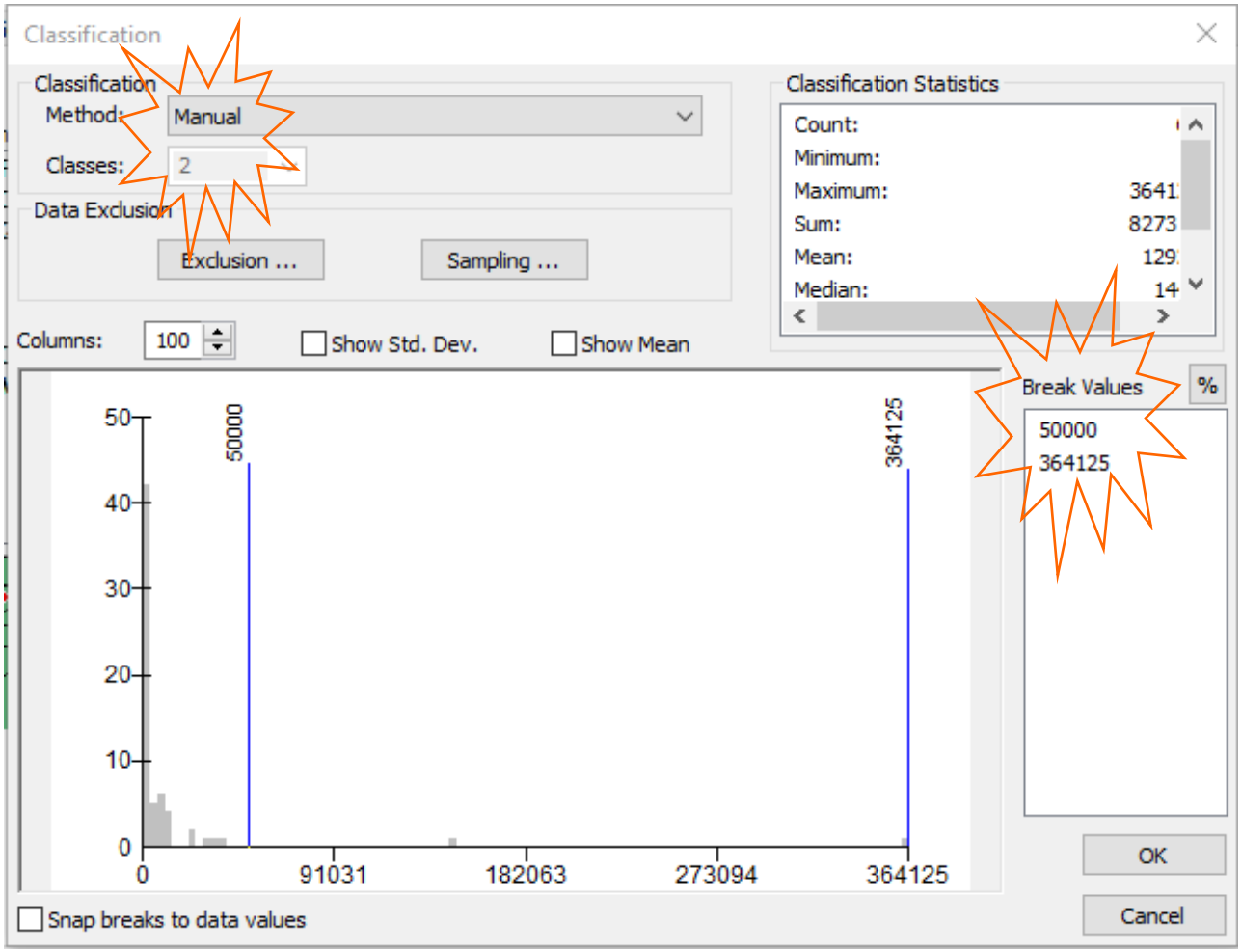
Within the layer properties there is a classification window

- Allows you to decide how to classify your data (Quintiles, Natural Breaks, Standard Deviation, Manual, etc.

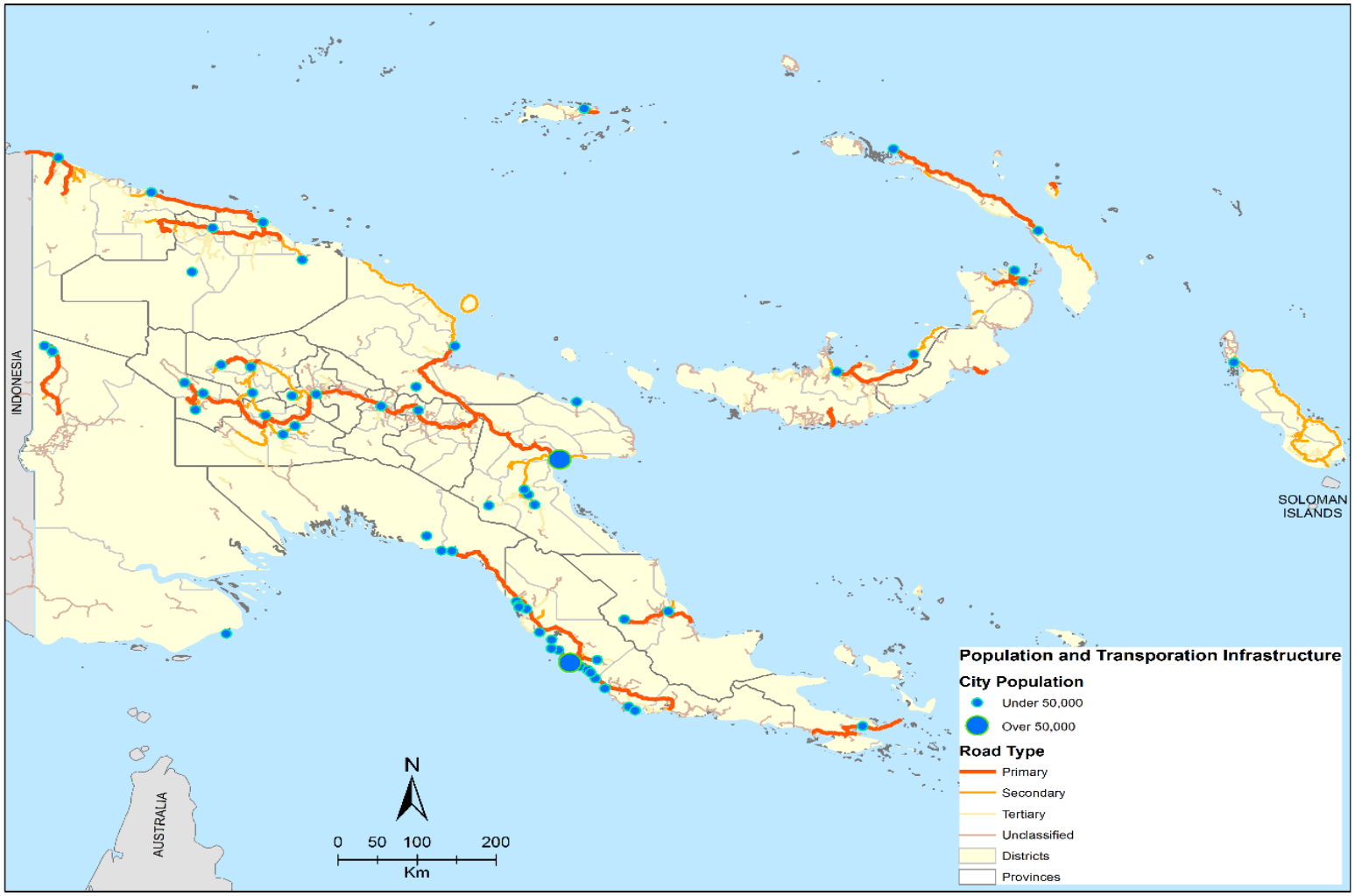
- Allows you to create your own "Break Values"

- Provides a histogram of the specific variable

- Gives Classification Statistics



At the beginning of Lab 02 exercise the road network had the same line symbol regardless of their level of importance.
This is sufficient for a basic informational map, but most GIS maps are used as a visual interpretation of tabular data, therefore we will learn how to visualize such data in this lab.



Questions?

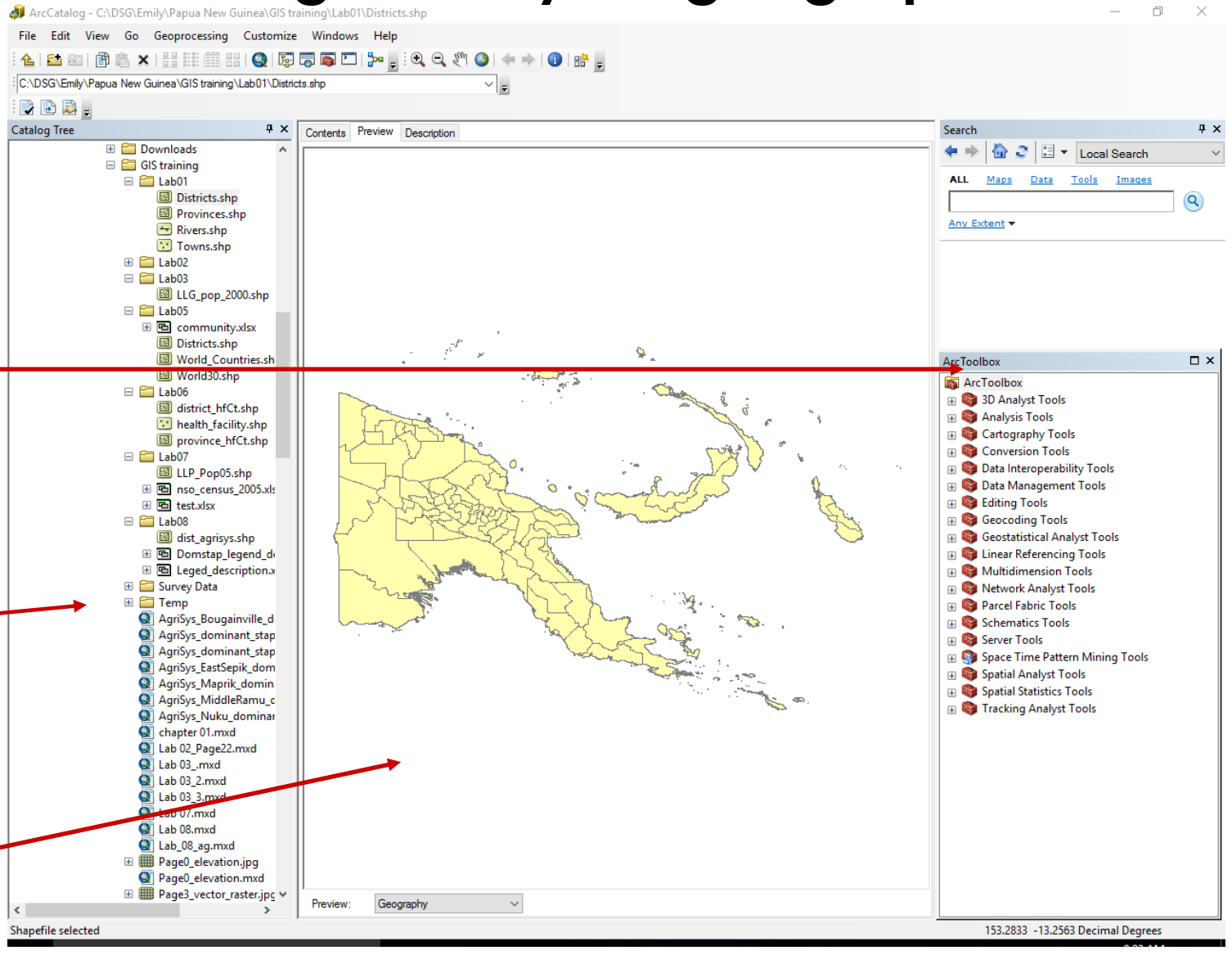
Data formats and ArcCatalog

ArcCatalog organizes your geographic data

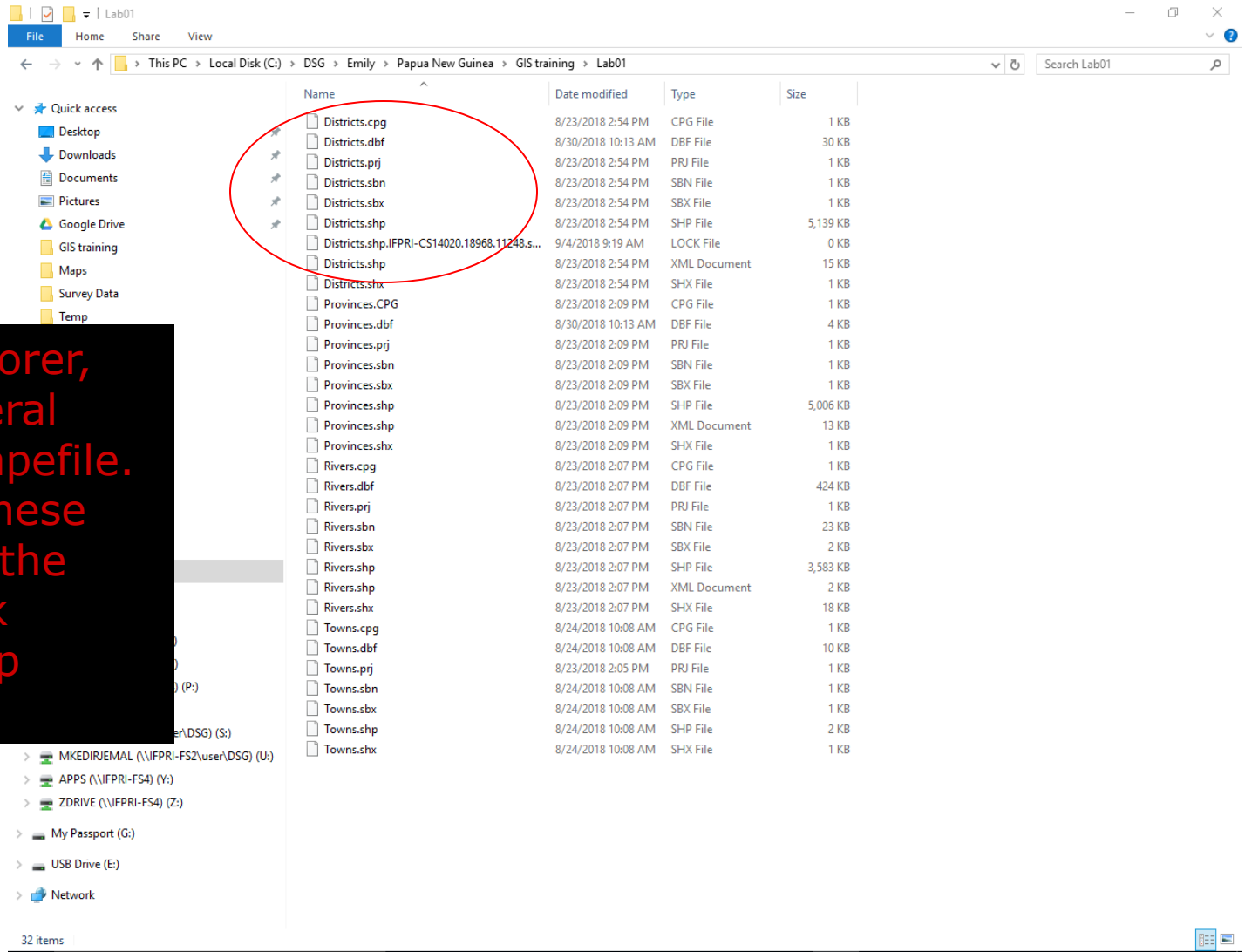
Toolbox

Data Folders and Files

Preview and Metadata

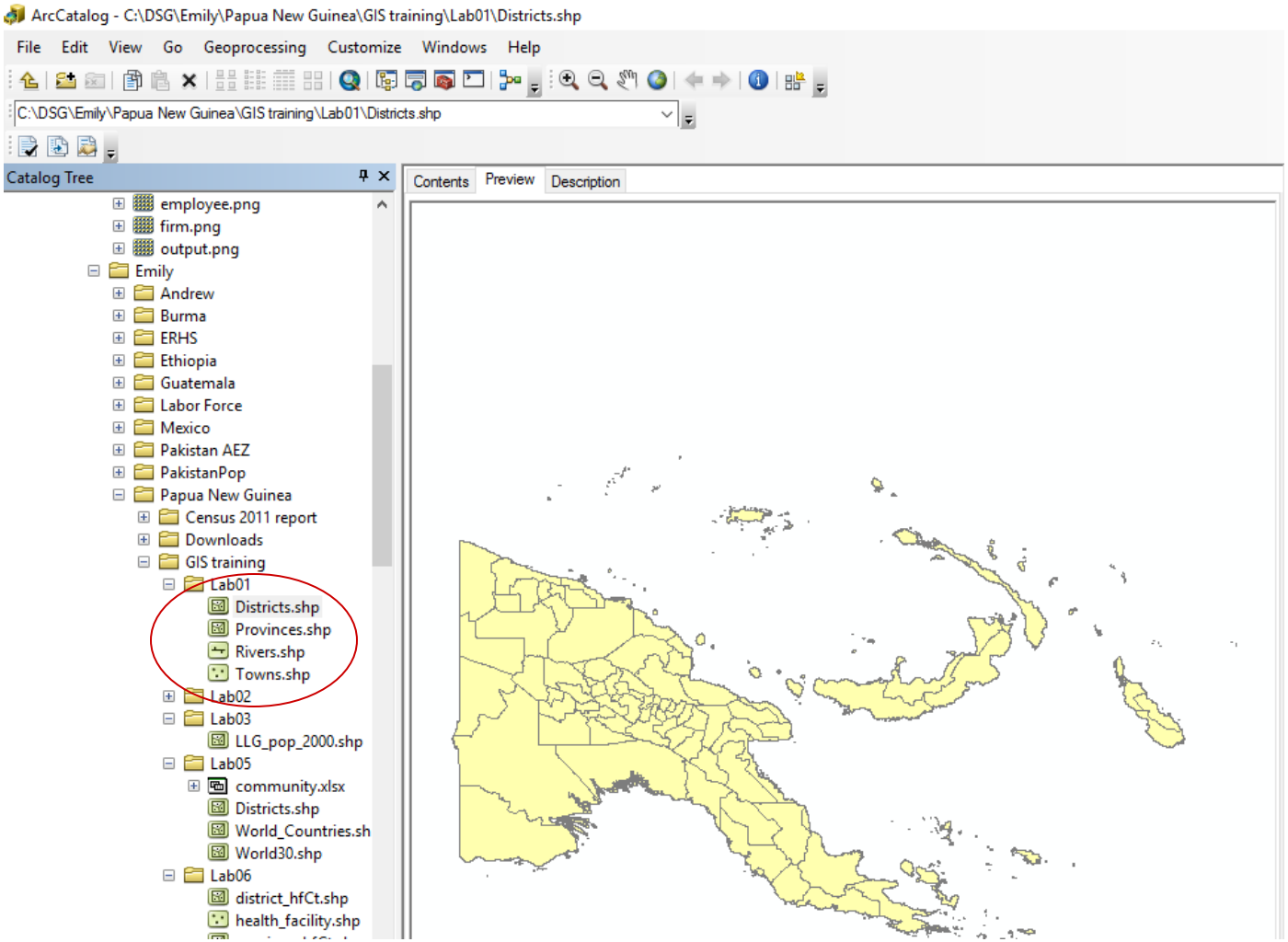


Several files comprise one shapefile



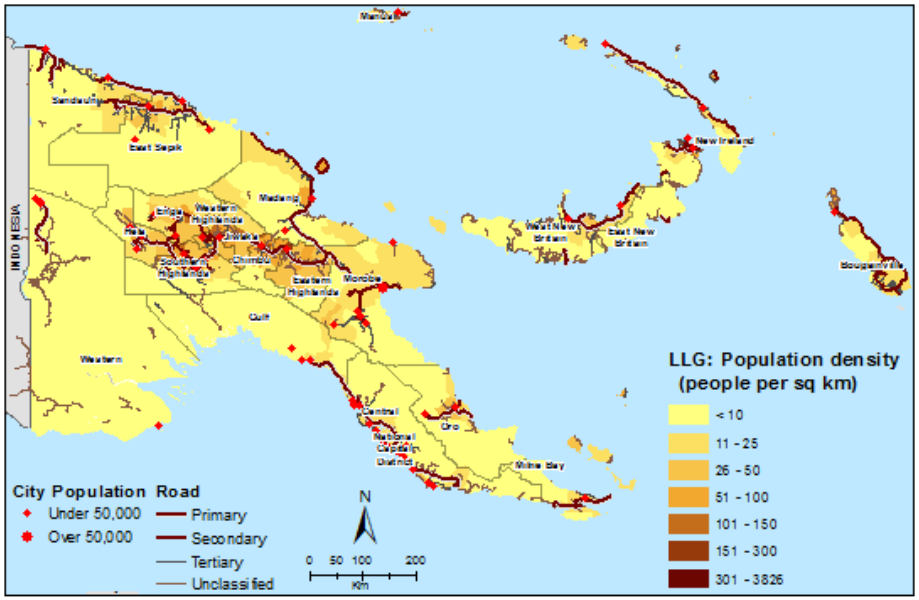
In Windows Explorer, you will see several files for each shapefile. You need all of these files in order for the shapefile to work properly and map within GIS.

In ArcCatalog, these files are packaged and presented as one file in order to facilitate copying from / to other folders.

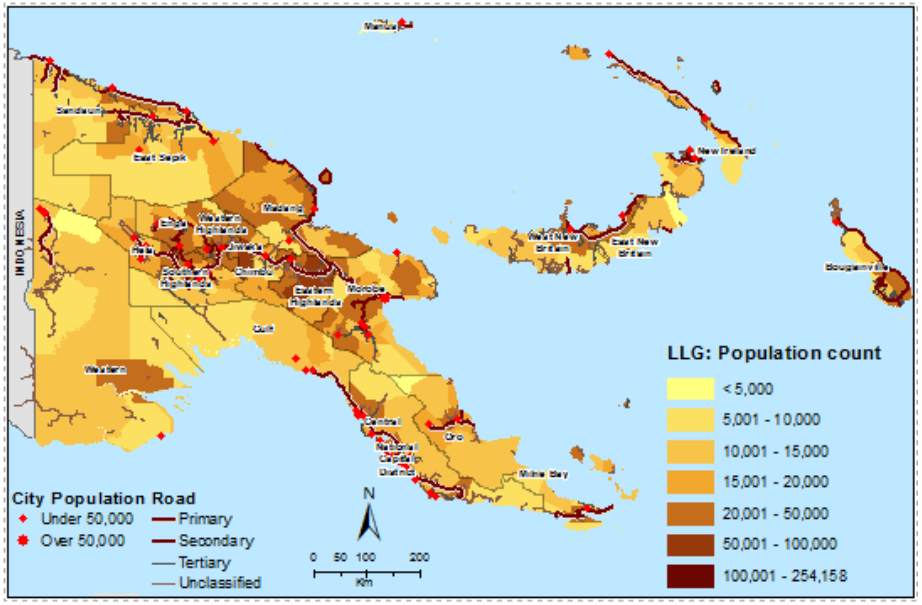


Lab 03: Choropleth Mapping

Understanding the spatial layout-dispersion and clustering of specific indicators

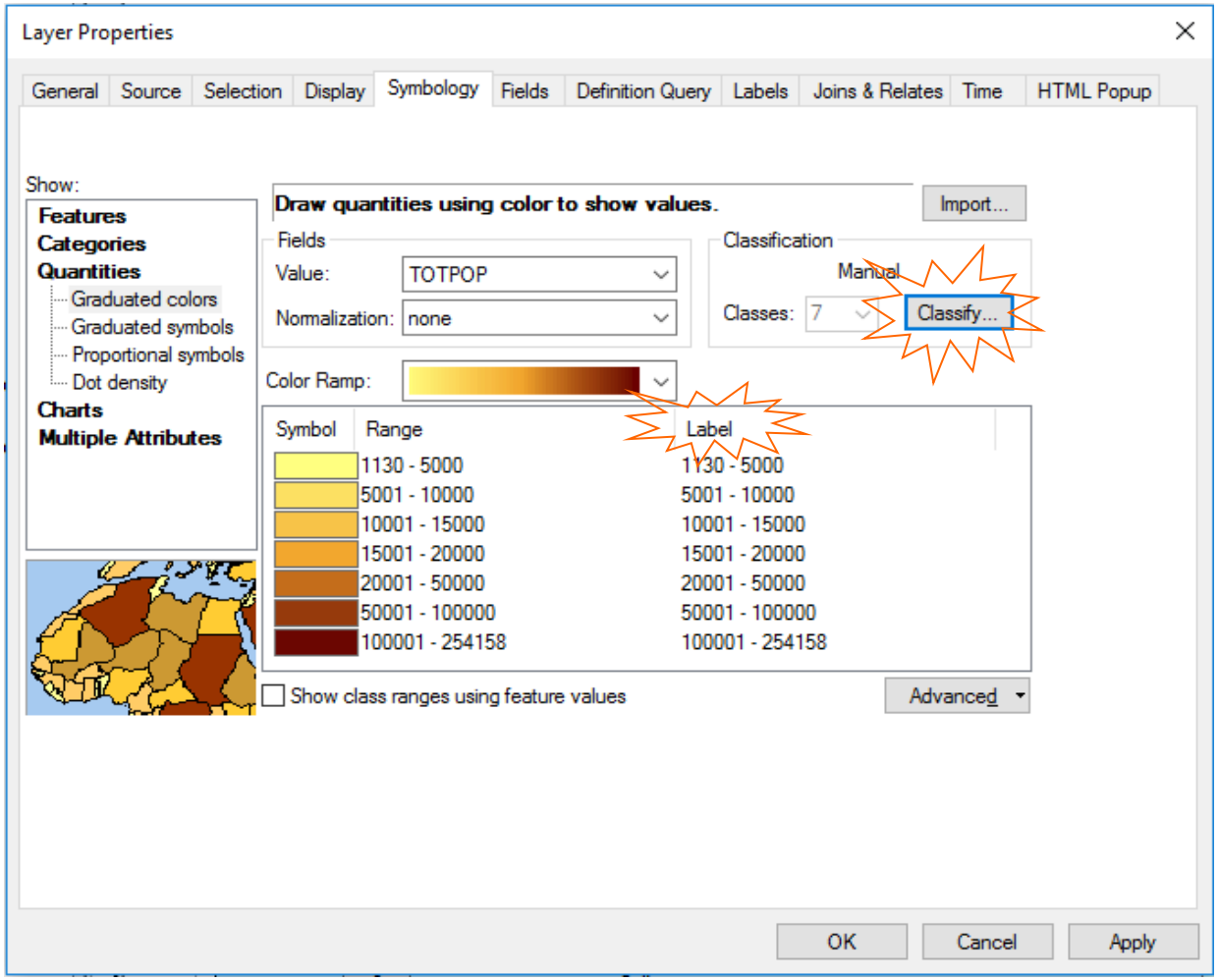


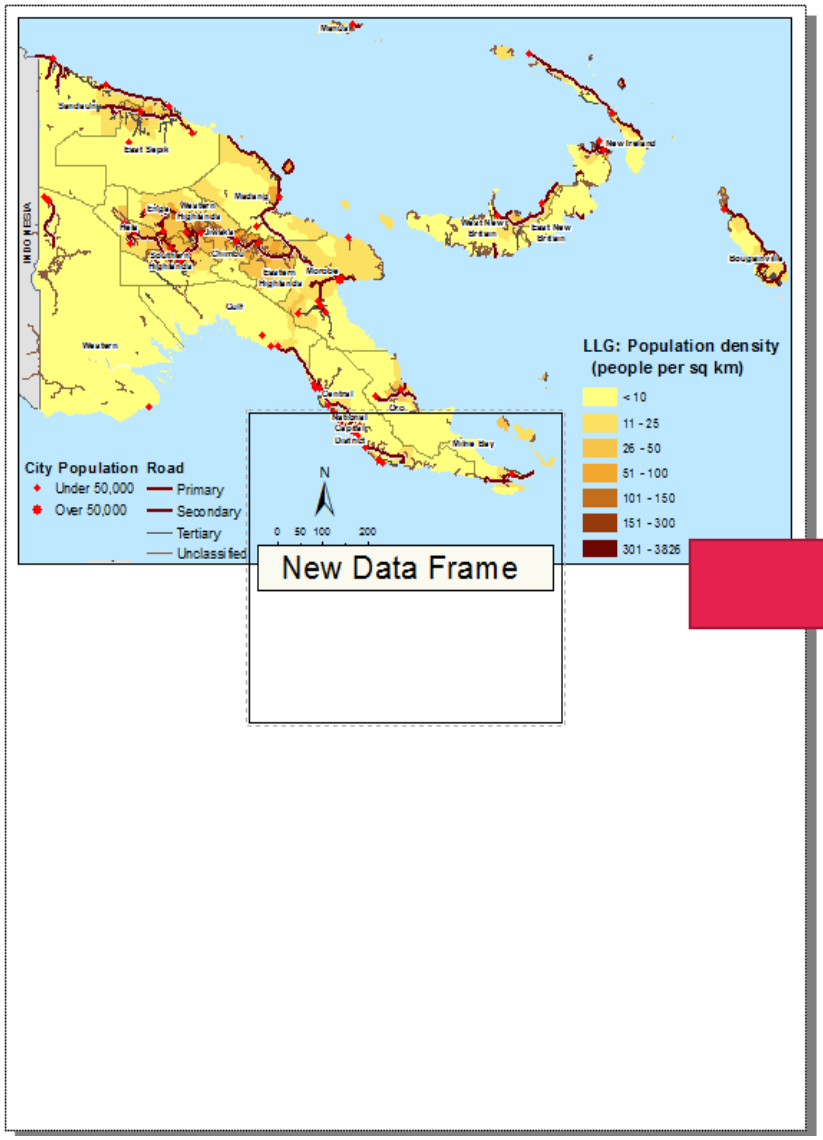
Population Density

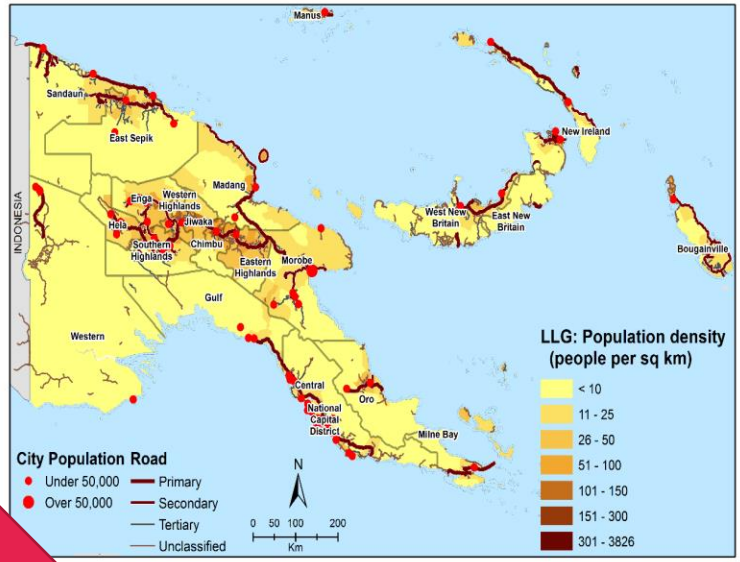


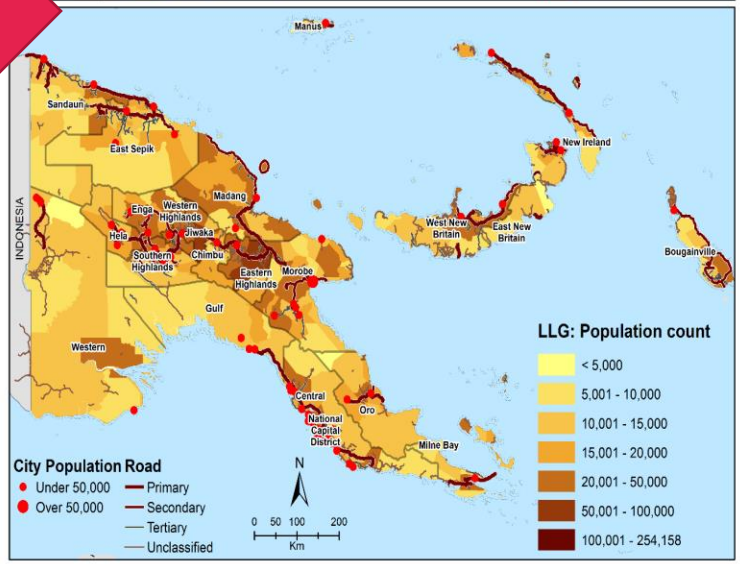
Population Count

Lab 03: Choropleth Mapping



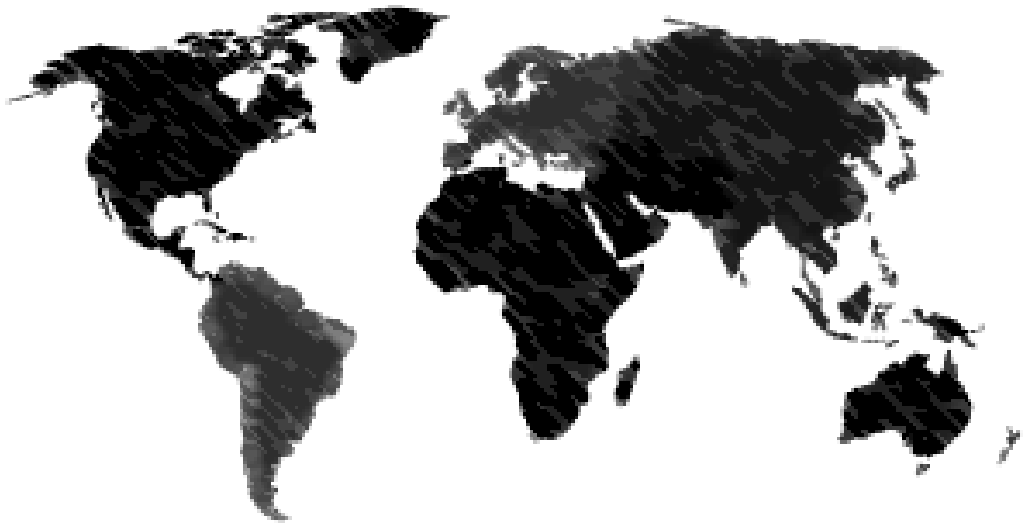

INDONESIA
East Sepik
Madang
Western Highlands
Enga
Hela
Jiwaka
Chimbu
Southern Highlands
Eastern Highlands
Morobe
Gulf
Western
Central
National Capital District
Oro
Milne Bay
West New Britain
East New Britain
New Ireland
Bougainville
LLG: Population density (people per sq km)
< 10
11 - 25
26 - 50
51 - 100
101 - 150
151 - 300
301 - 3826
City Population Road
Under 50,000
Over 50,000
Primary
Secondary
Tertiary
Unclassified
N
0 50 100 200
New Data Frame


INDONESIA
Manus
Sandaun
East Sepik
Madang
Western Highlands
Enga
Hela
Jiwaka
Chimbu
Southern Highlands
Eastern Highlands
Morobe
Gulf
Western
Central
National Capital District
Oro
Milne Bay
West New Britain
East New Britain
New Ireland
Bougainville
LLG: Population density (people per sq km)
< 10
11 - 25
26 - 50
51 - 100
101 - 150
151 - 300
301 - 3826
City Population Road
Under 50,000
Over 50,000
Primary
Secondary
Tertiary
Unclassified
N
0 50 100 200
Km

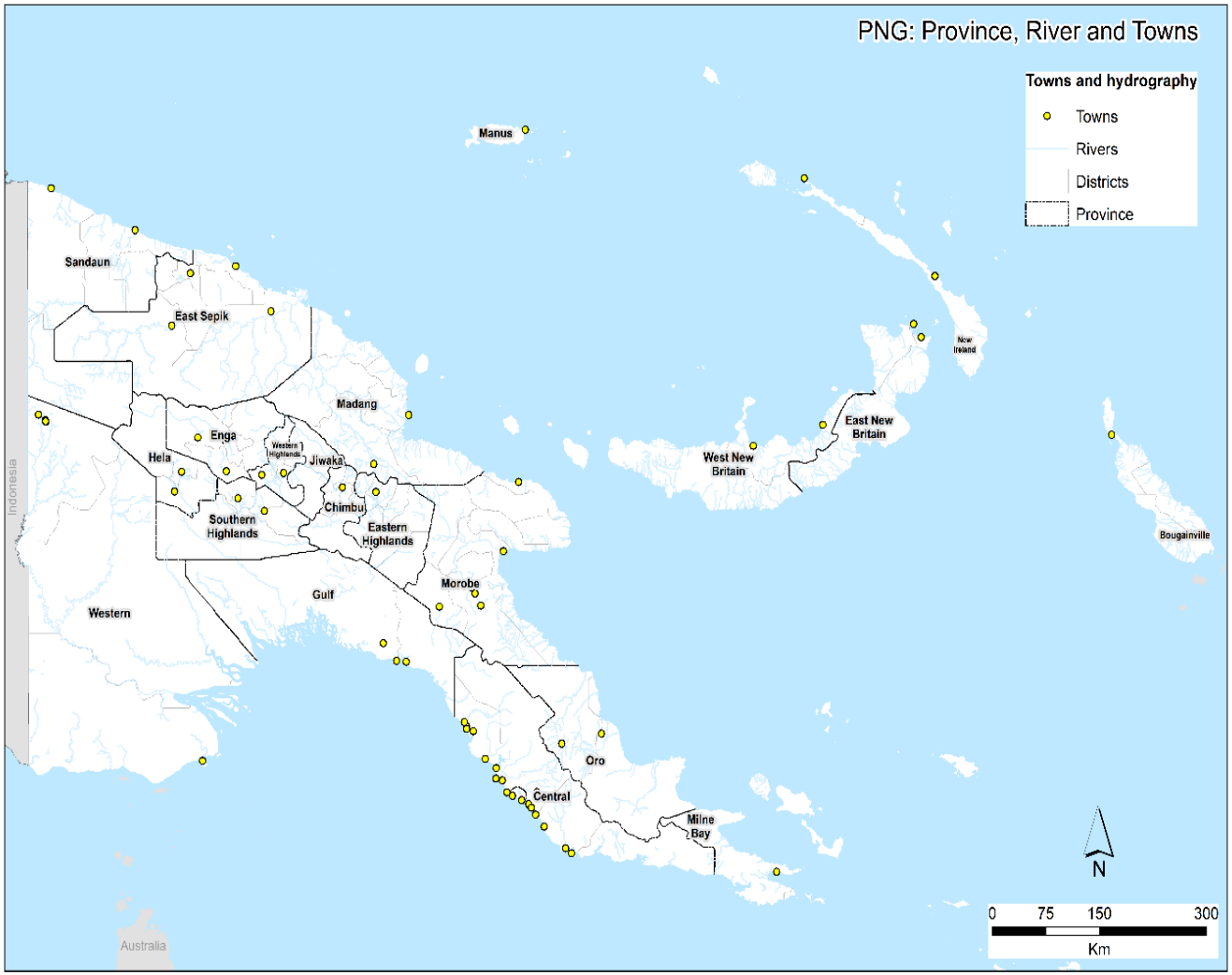

INDONESIA
Manus
Sandaun
East Sepik
Madang
Western Highlands
Enga
Hela
Jiwaka
Chimbu
Southern Highlands
Eastern Highlands
Morobe
Gulf
Western
Central
National Capital District
Oro
Milne Bay
West New Britain
East New Britain
New Ireland
Bougainville
LLG: Population count
< 5,000
5,001 - 10,000
10,001 - 15,000
15,001 - 20,000
20,001 - 50,000
50,001 - 100,000
100,001 - 254,158
City Population Road
Under 50,000
Over 50,000
Primary
Secondary
Tertiary
Unclassified
N
0 50 100 200
Km

Questions?

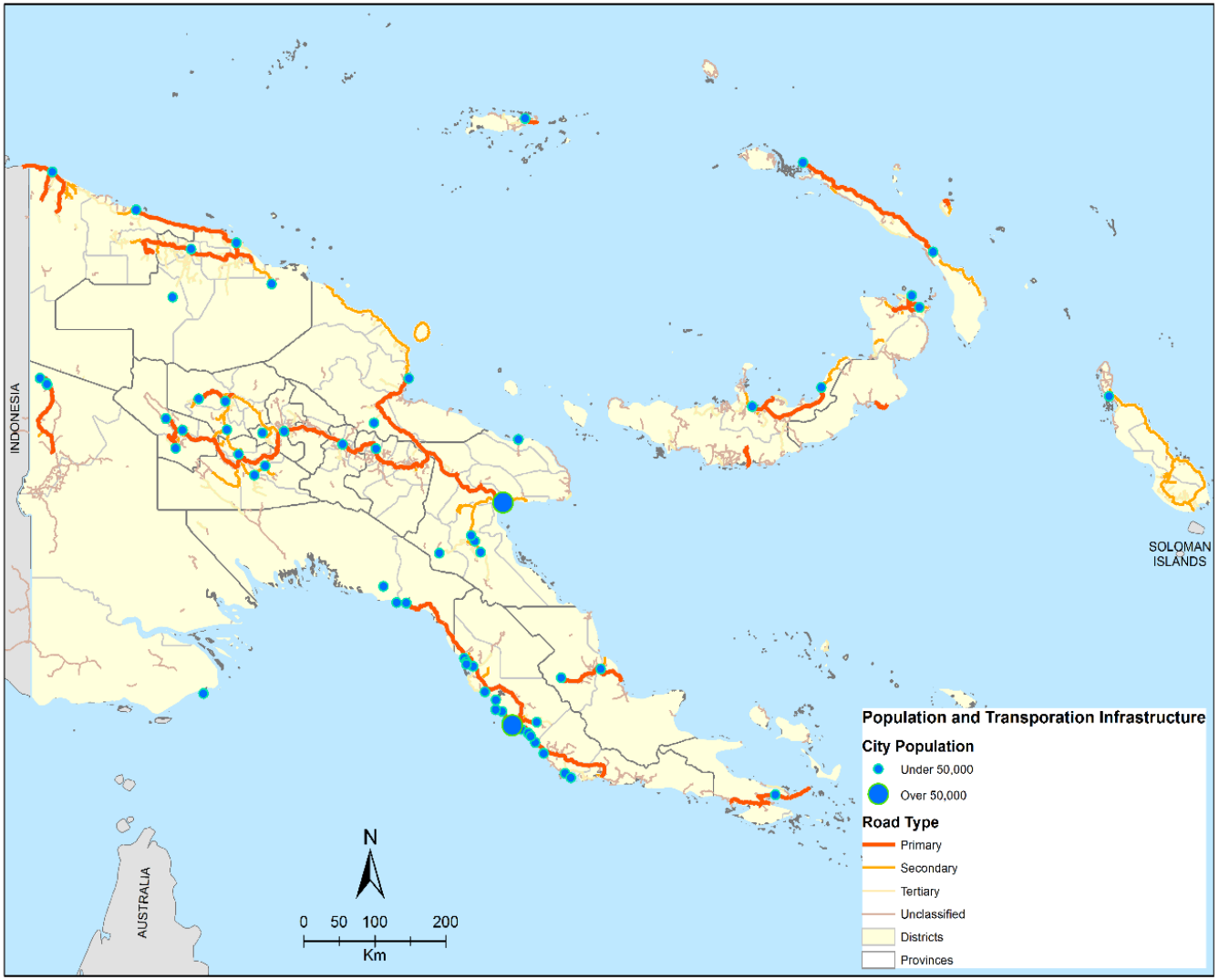
GIS PART II



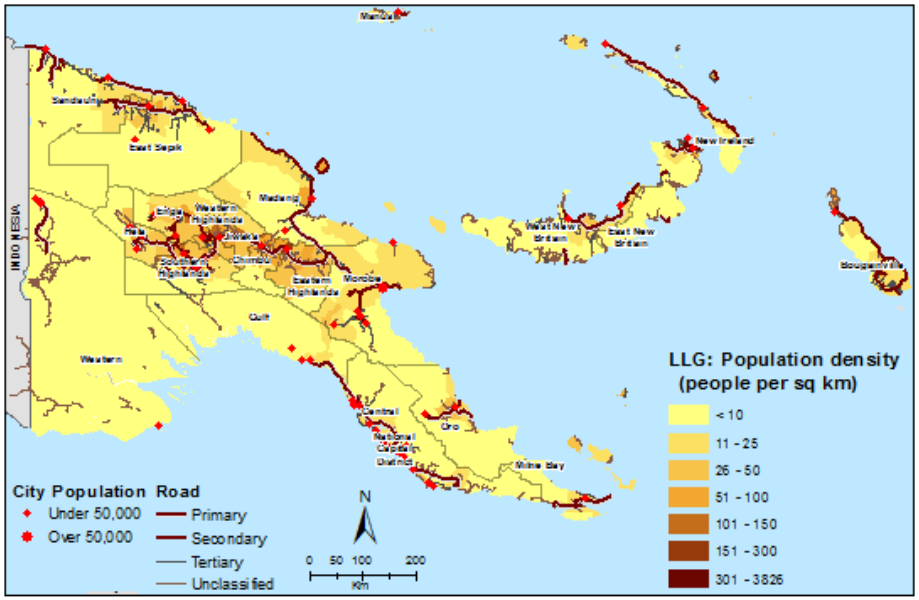
Questions from Lab 01?



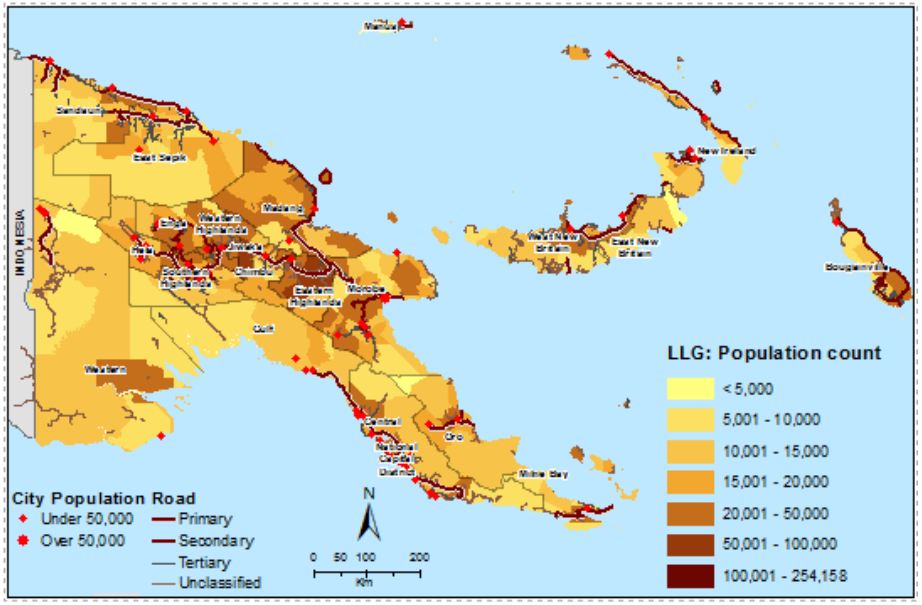
Questions from Lab 02?



Questions from Lab 03?



Population Density



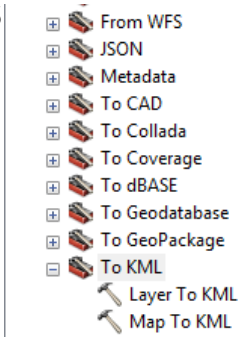
Population Count

Moving Forward …

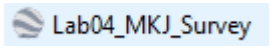
- Using Google Earth:convert layer(shapefile)/map to KML
- Projections
- GPS data from the field

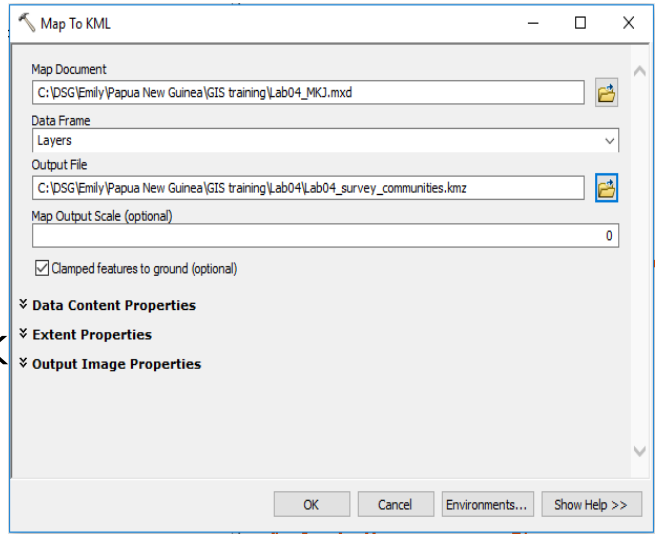
Convert map layer to KML (in ArcMap)

- **The Map to KML tool allows multiple layers in an ArcMap map document data frame to be simultaneously exported to a KML file.**
- **Each layer will be maintained as a distinct folder in the KML, unless the option is used to convert all layers to a single flattened image**



- Create or open a saved map document
- Open ArcMap's Toolbox
  - Navigate to Conversion Tools: Map to KML
    - Double-click 'Map to KML'
    - Locate the saved map document
    - Define the output file (KML)
    - Click 'OK'
- Locate the saved KMZ file and double click

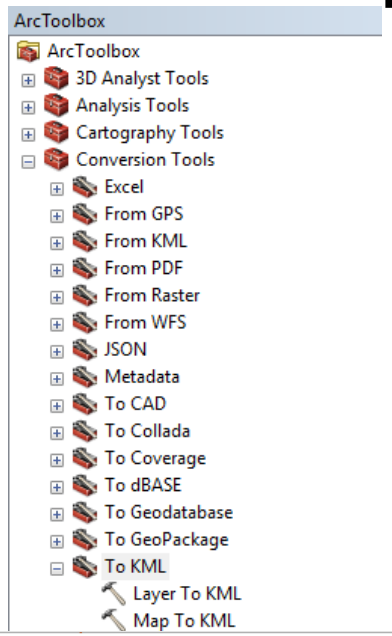


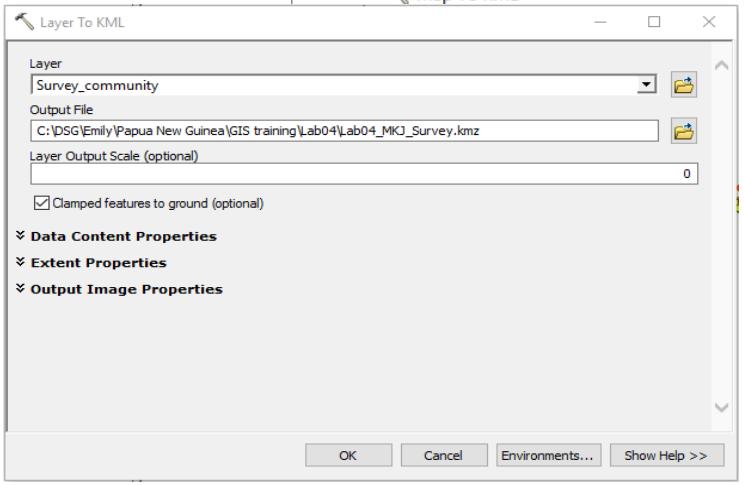



Melekeok
Micronesia
Bismarck Sea
Latangai Island
New Britain
New Guinea Highlands
Papua New Guinea
Bougainville Island
Owen Stanley Range
Daru Island
Port Moresby

Convert Shapefile to KML (in ArcMap)

- Open and Review Shapefile via ArcMap
- Define that Shapefile's symbology as desired
- Open ArcMap's Toolbox
  - Navigate to Conversion Tools: Layer to KML
    - Double-click 'Layer to KML'
    - Select the symbolized 'layer'
    - Define the output file (KML)
    - Click 'OK'
- Open Google Earth
- Open KML in Google Earth

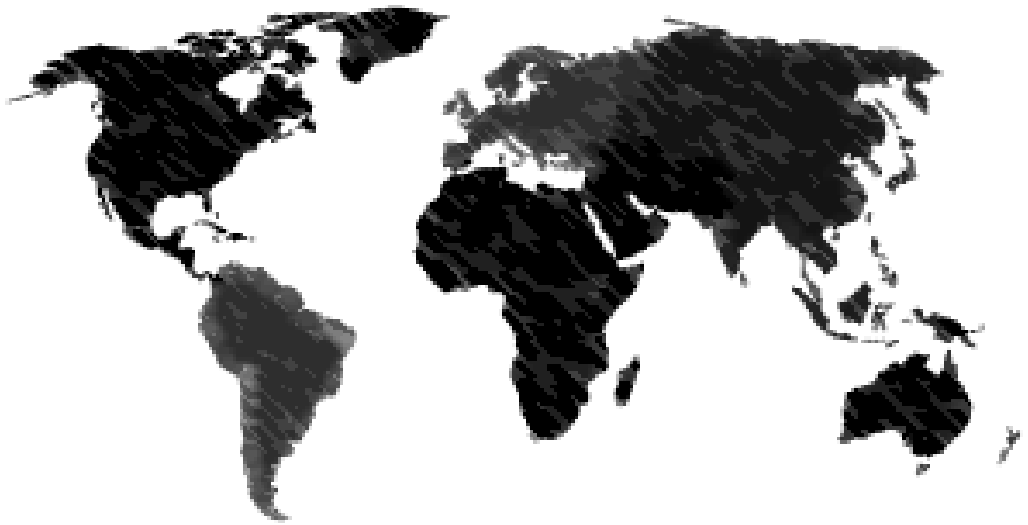




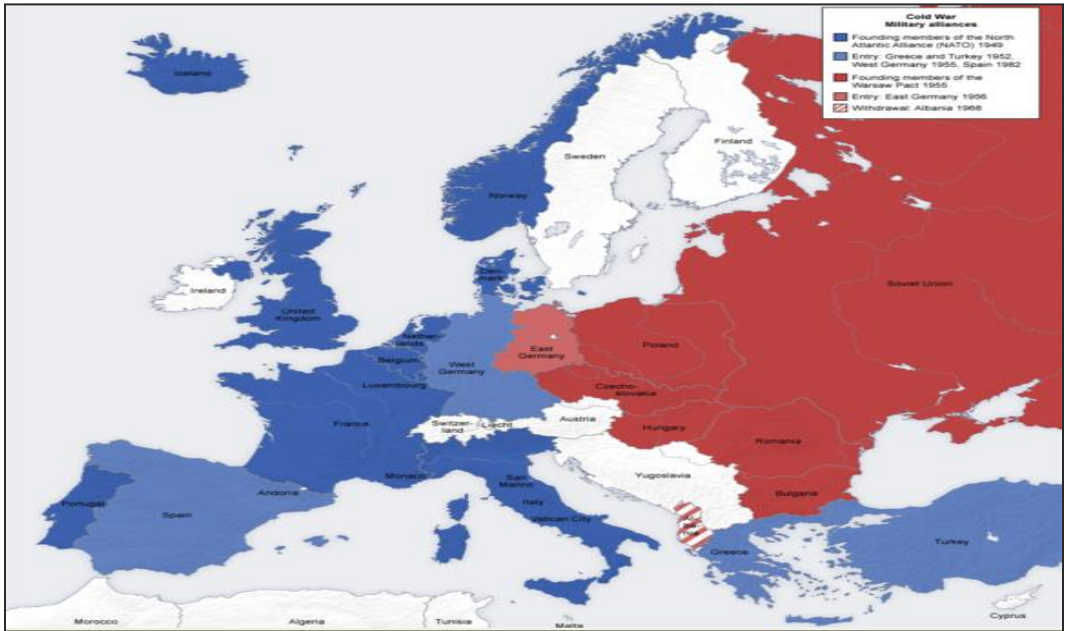

Bismarck Sea
Papua New Guinea
Daru Island
Dyke Ackland Bay
Port Moresby
160 km
Image Landsat / Copernicus
US Dept of State Geographer
© 2018 Google
Google Earth

Questions?

Geographic Projections



Cold War Cartography



Was the USSR really that massive!?

Mercator Projection

The USSR was big, but maybe not as big as we thought.

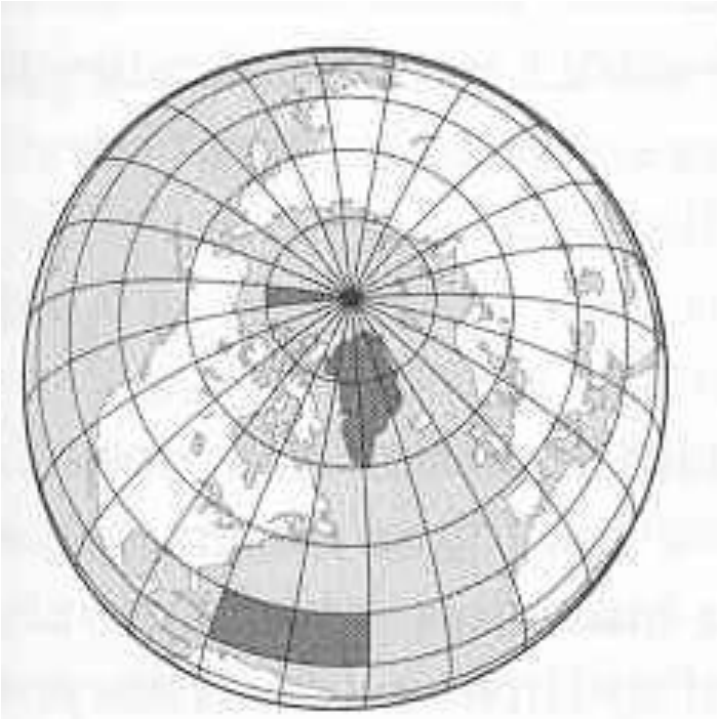
Orthographic Projection

Image 2. In *Time*, 12 February 1951. p.36. © by RMC, R. L. 02-S-41. www.randmcnally.com.

Time Magazine (1951): Rand McNally ad lambasting Mercator as the man who made USSR look so big.

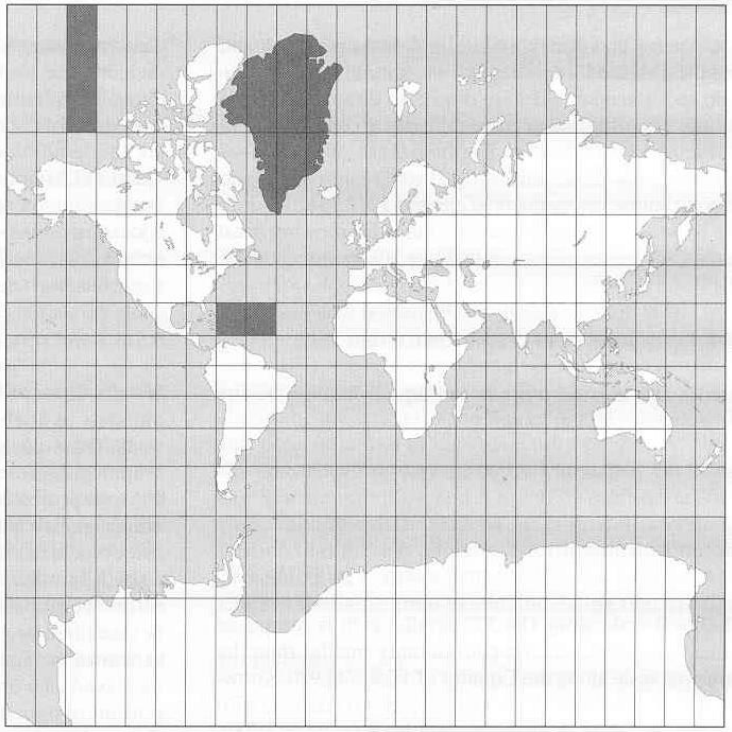
The creation of a flat map creates Distortion – How do we identify it?

A.



Orthographic projection

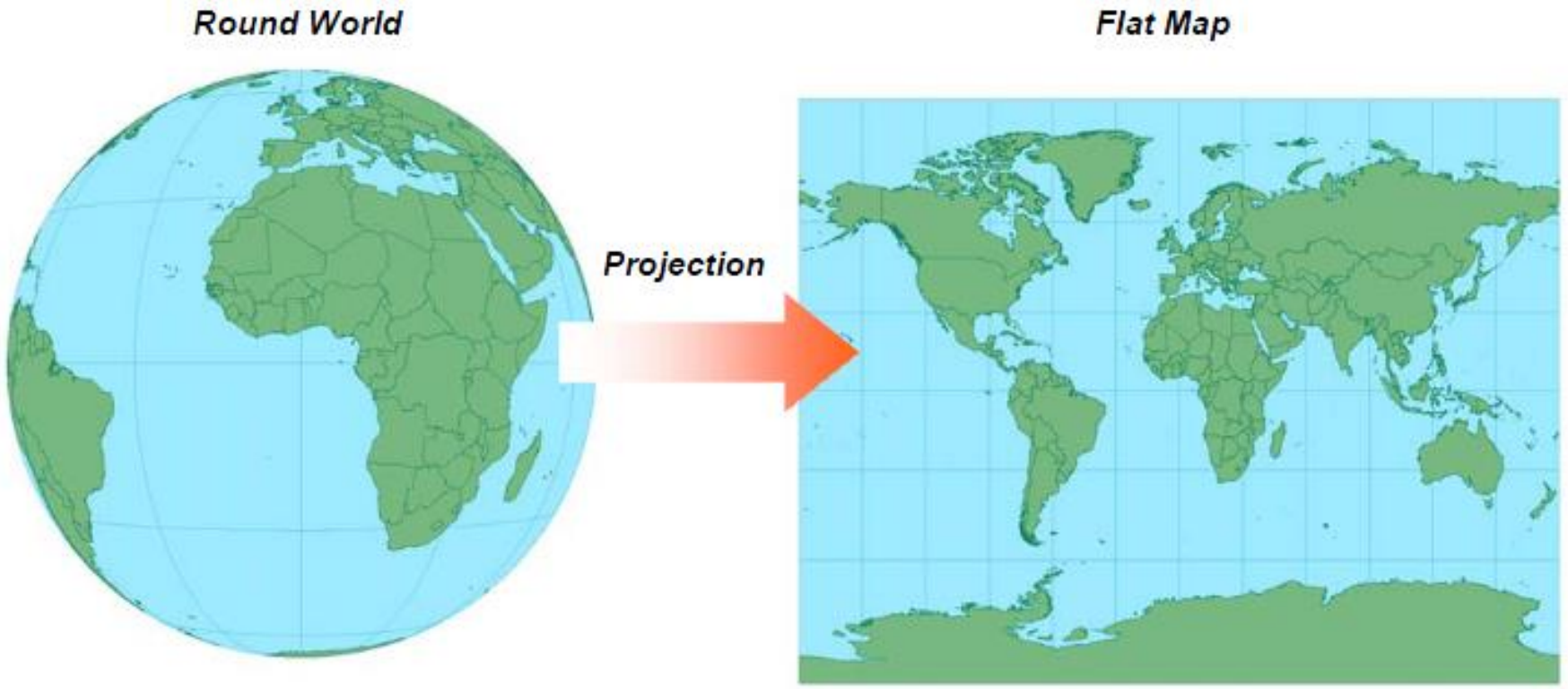
B.



Mercator Projection

Figure 8.15 – Slocum, Chapter 8

Transformation to the plane



Map Projection Techniques

Step 1

Reduce the Earth's size to that of an imaginary globe

Reference Globe

A model of the earth at a reduced scale, that is used to project the landmasses and graticule onto a flat map

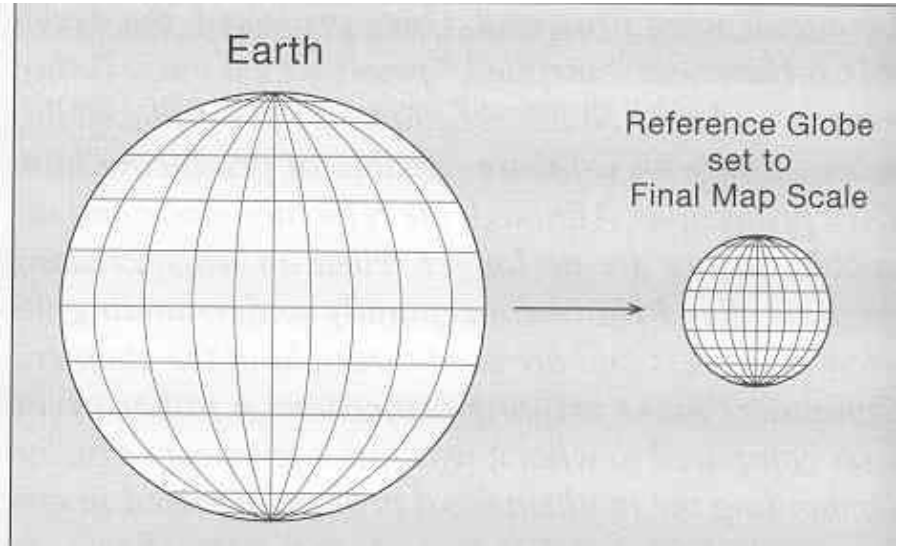


Figure 8.1 – Slocum, Chapter 8

Map projection techniques

Step 2

Project the graticule from the reference globe onto the developable surface

Developable Surface

A mathematically definable surface onto which the land masses and graticule are projected from the reference globe

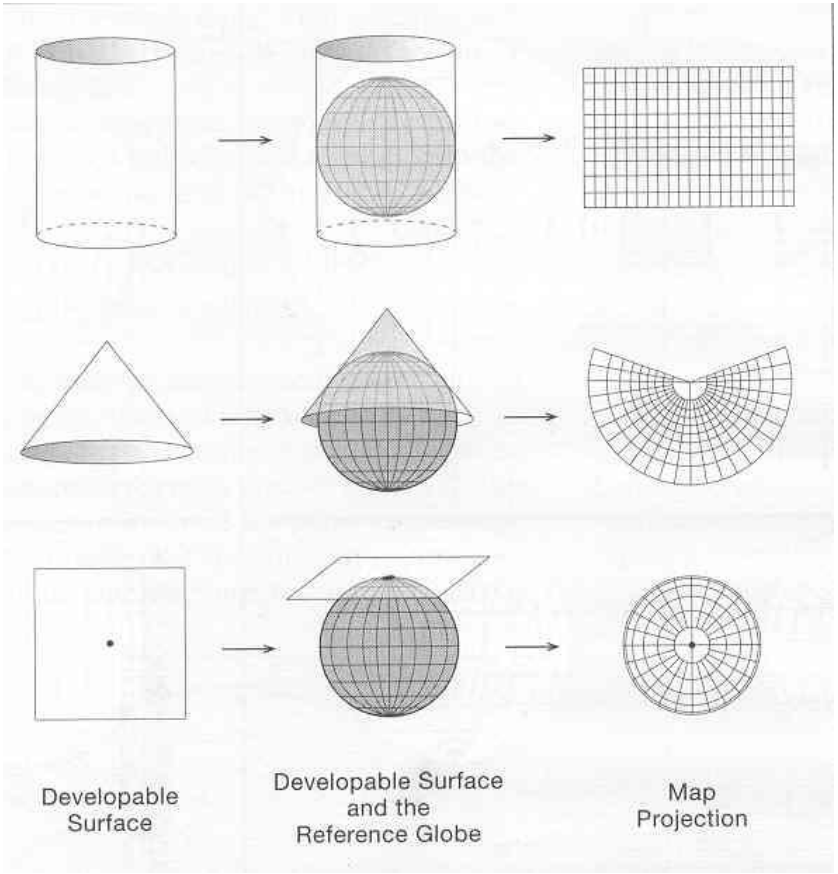


Figure 8.2 – Slocum, Chapter 8

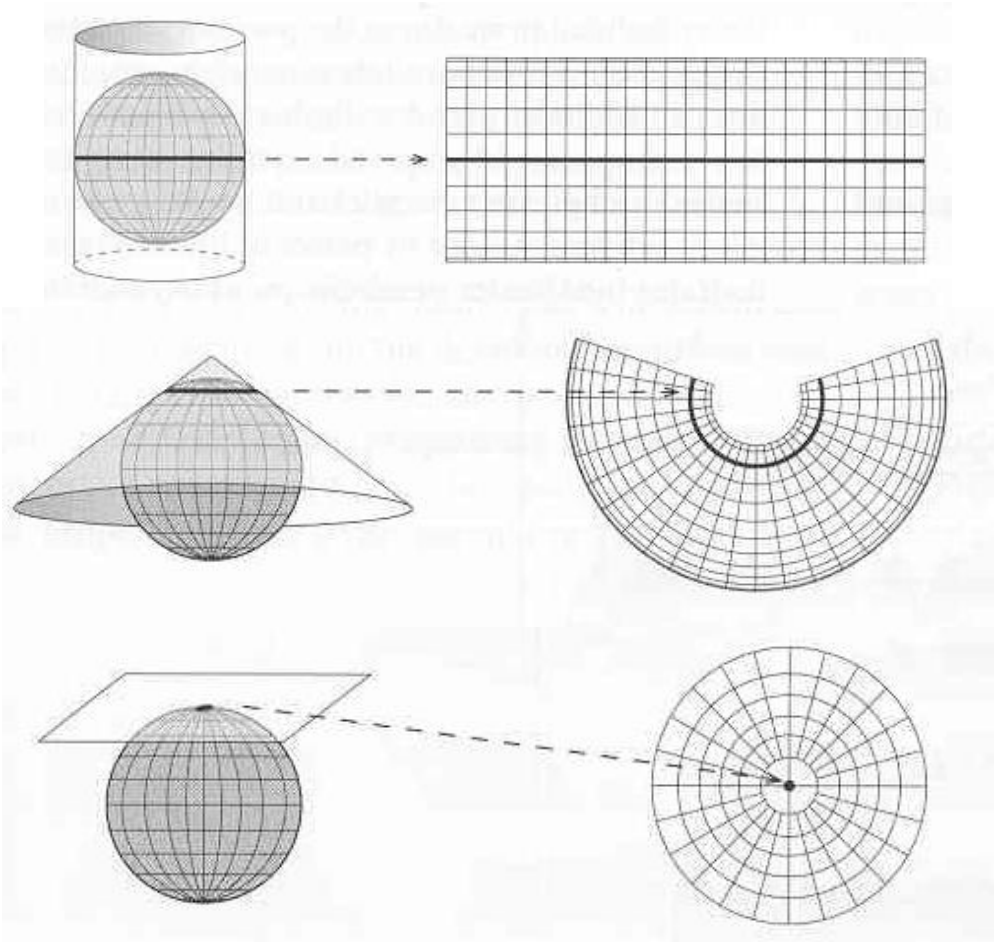
Case

The Case of a projection relates to how the developable surface is positioned with respect to the reference globe

Case can be described as

- Tangent or
- Secant

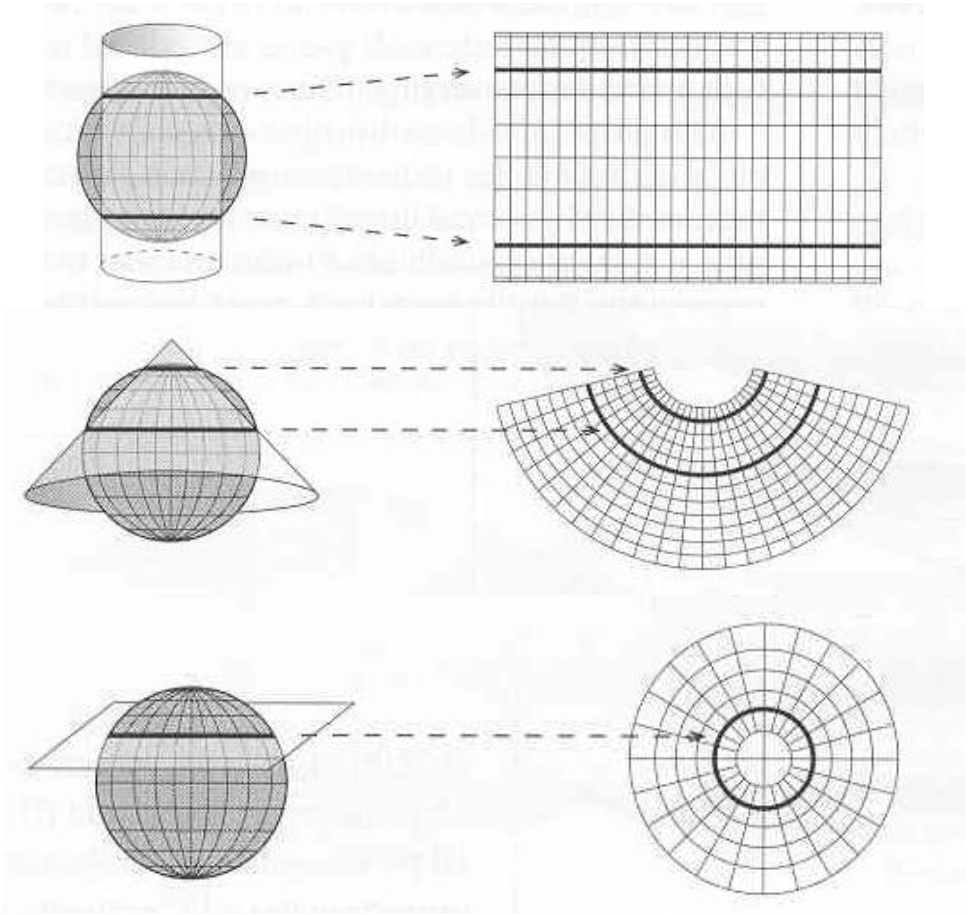
Tangency



In a tangent case of a map projection, the reference globe only touches the developable surface along one line, or at one point in the case of the planar projection.

Figure 8.9 – Slocum, Chapter 8

Secant case



A secant case of a map projection occurs when the developable surface *passes through* the reference globe, producing two lines of contact

Figure 8.9 – Slocum, Chapter 8

Standard line & scale variation

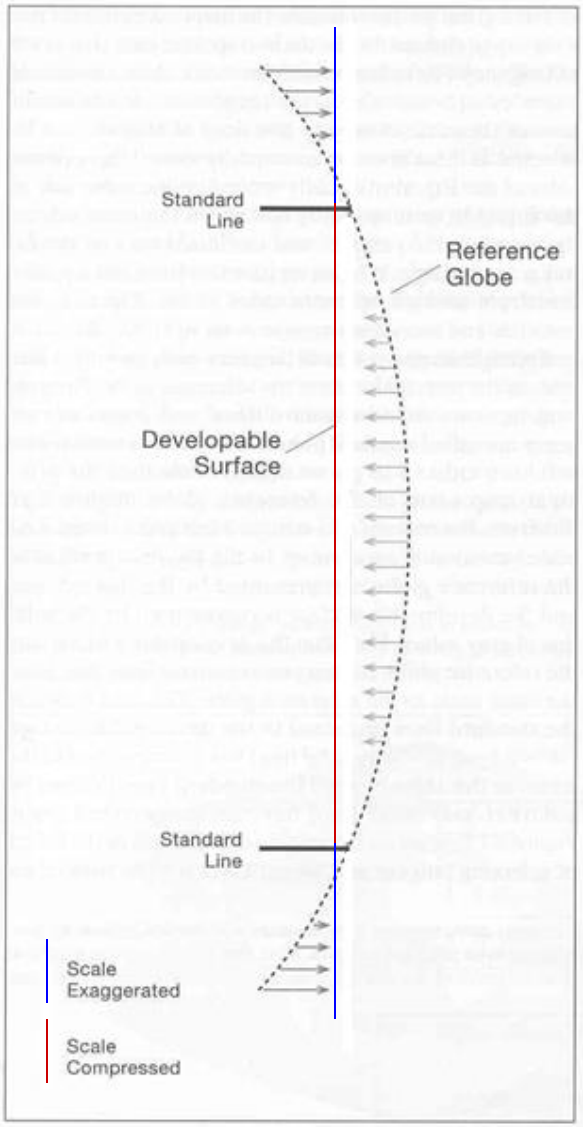


Figure 8.12 – Slocum, Chapter 8

Back to the USSR: Choosing tangent or Secant case

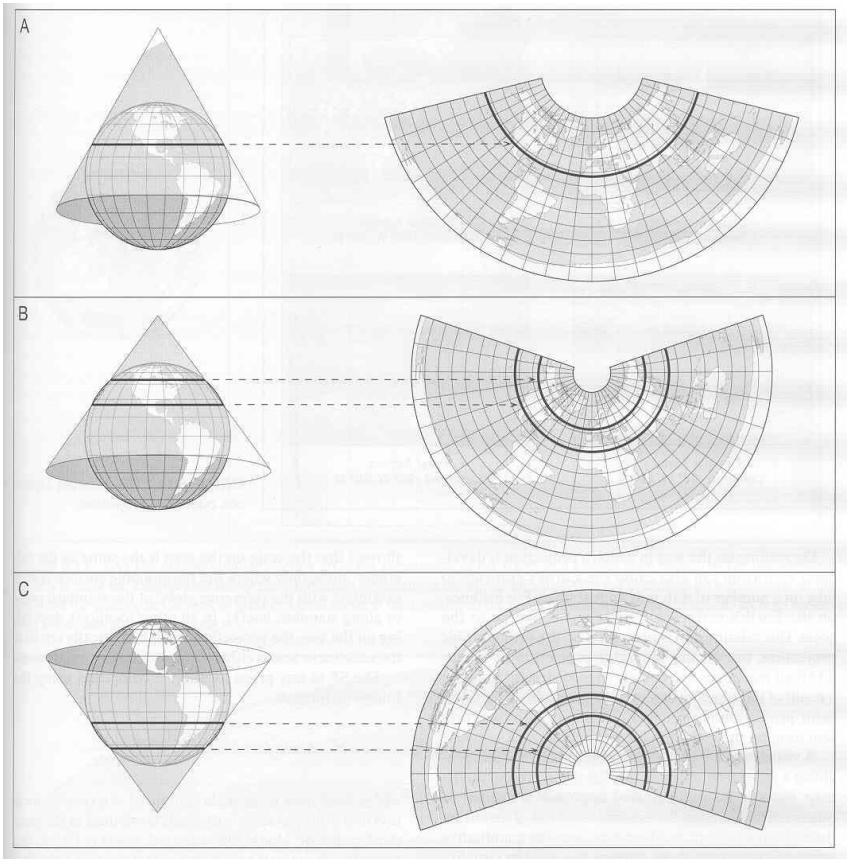
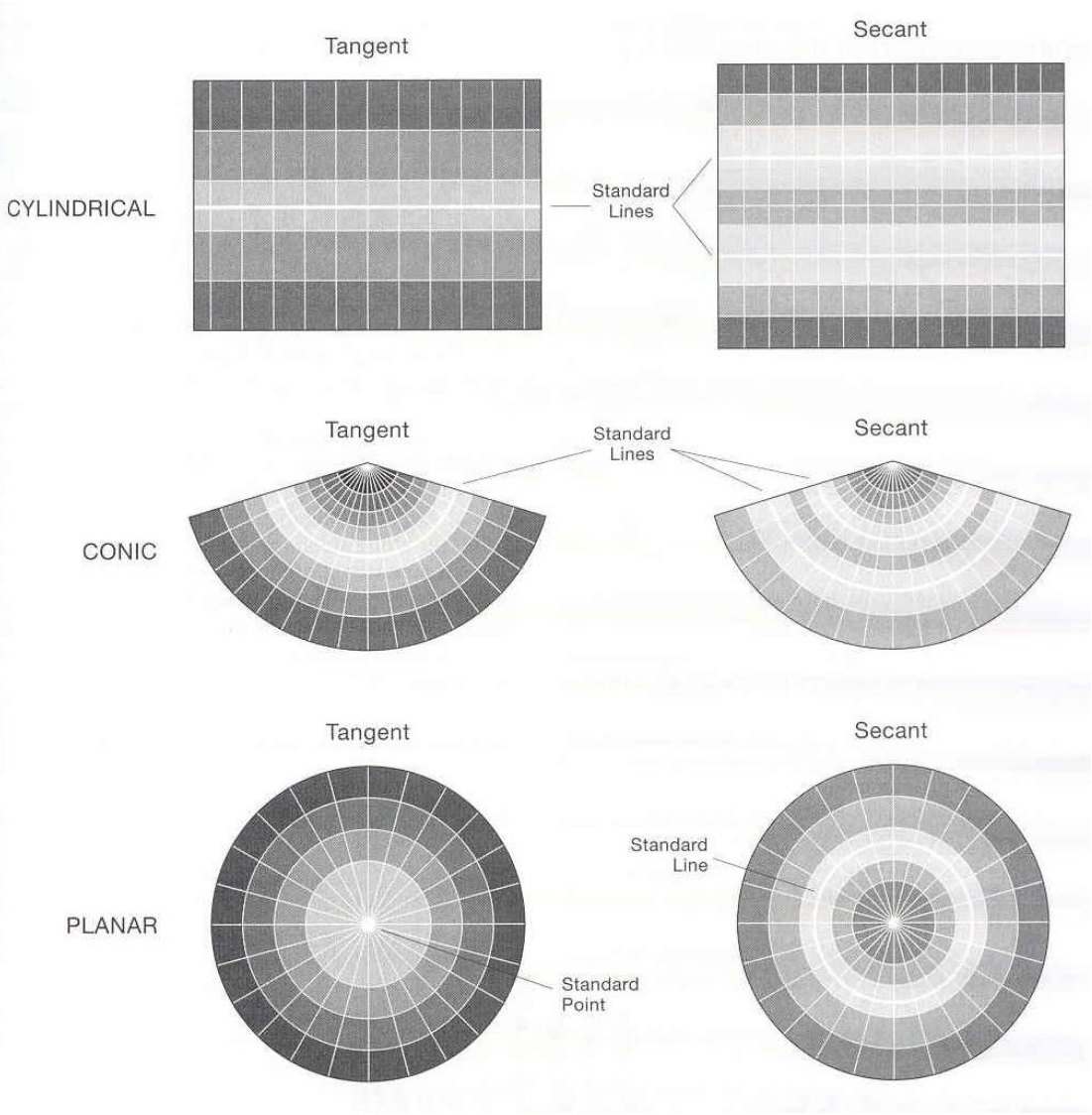
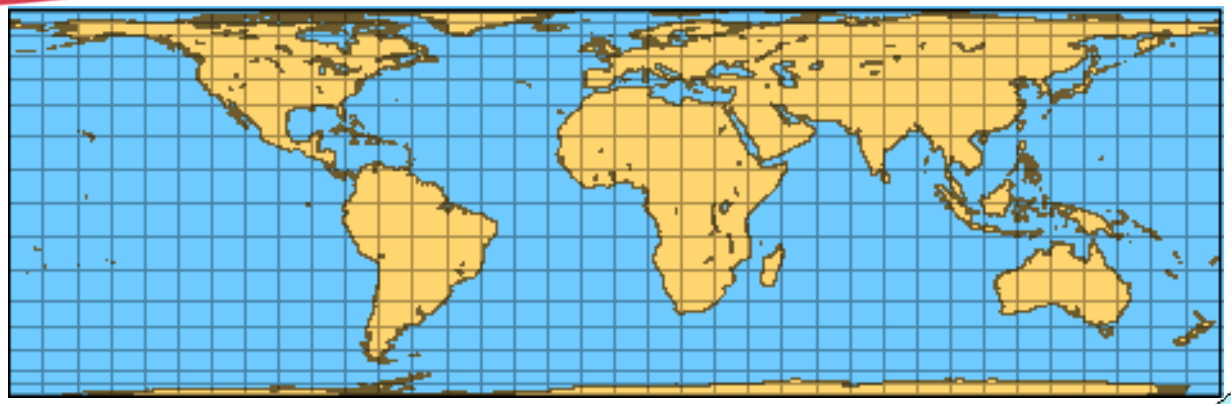


Figure 8.13 – Slocum, Chapter 8

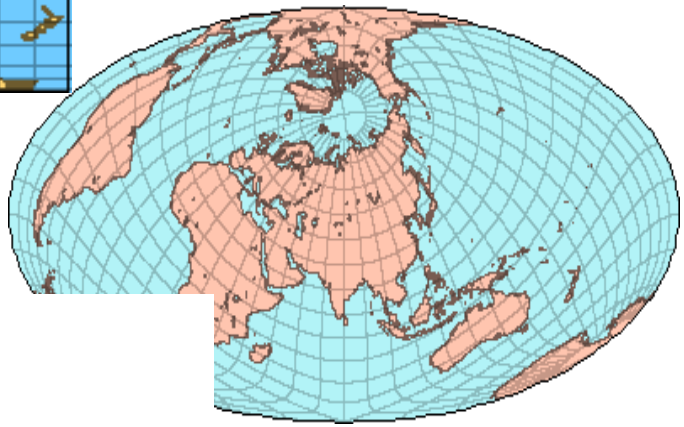
Distortion patterns



Types of Projections



Lambert Cylindrical Projection



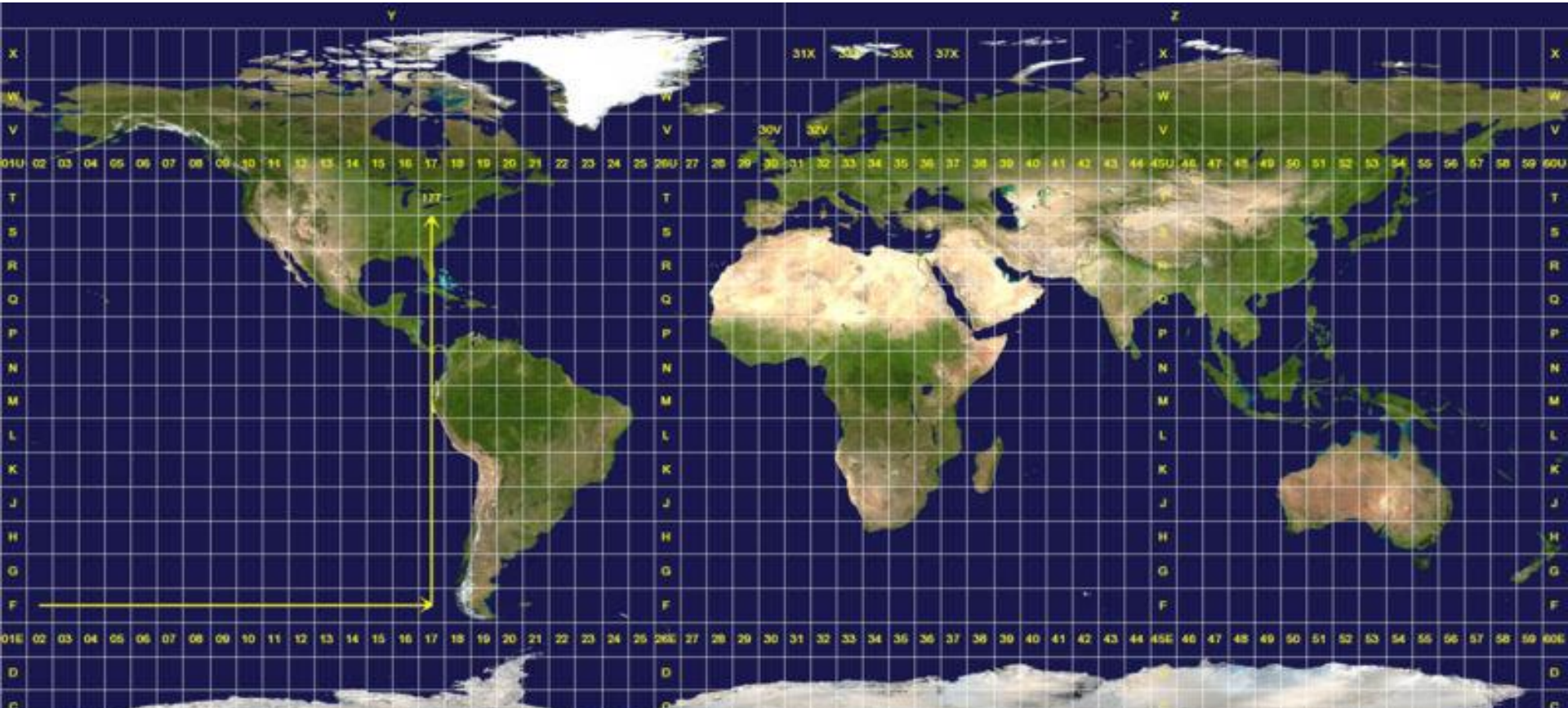
Hammer map
centered on Eurasia

Mercator Projection

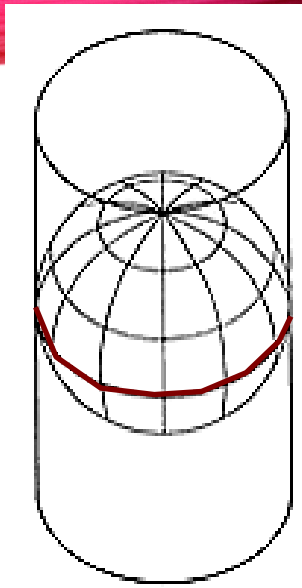
Sinusoidal Projection

Types of Projections cont.

- **Universal Transverse Mercator (UTM)**
  - The UTM system is not a single map projection
  - The system employs a series of sixty zones, each of which is based on a specifically defined secant Transverse Mercator projection.

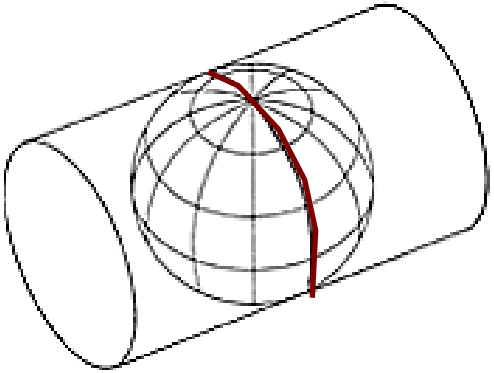


UTM projection cont.

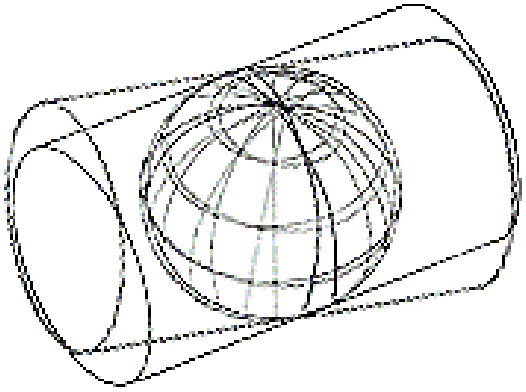


The **Mercator projection** maps the world onto a cylinder where the central ring of tangency is the Earth's Equator.

(Remember USSR?)



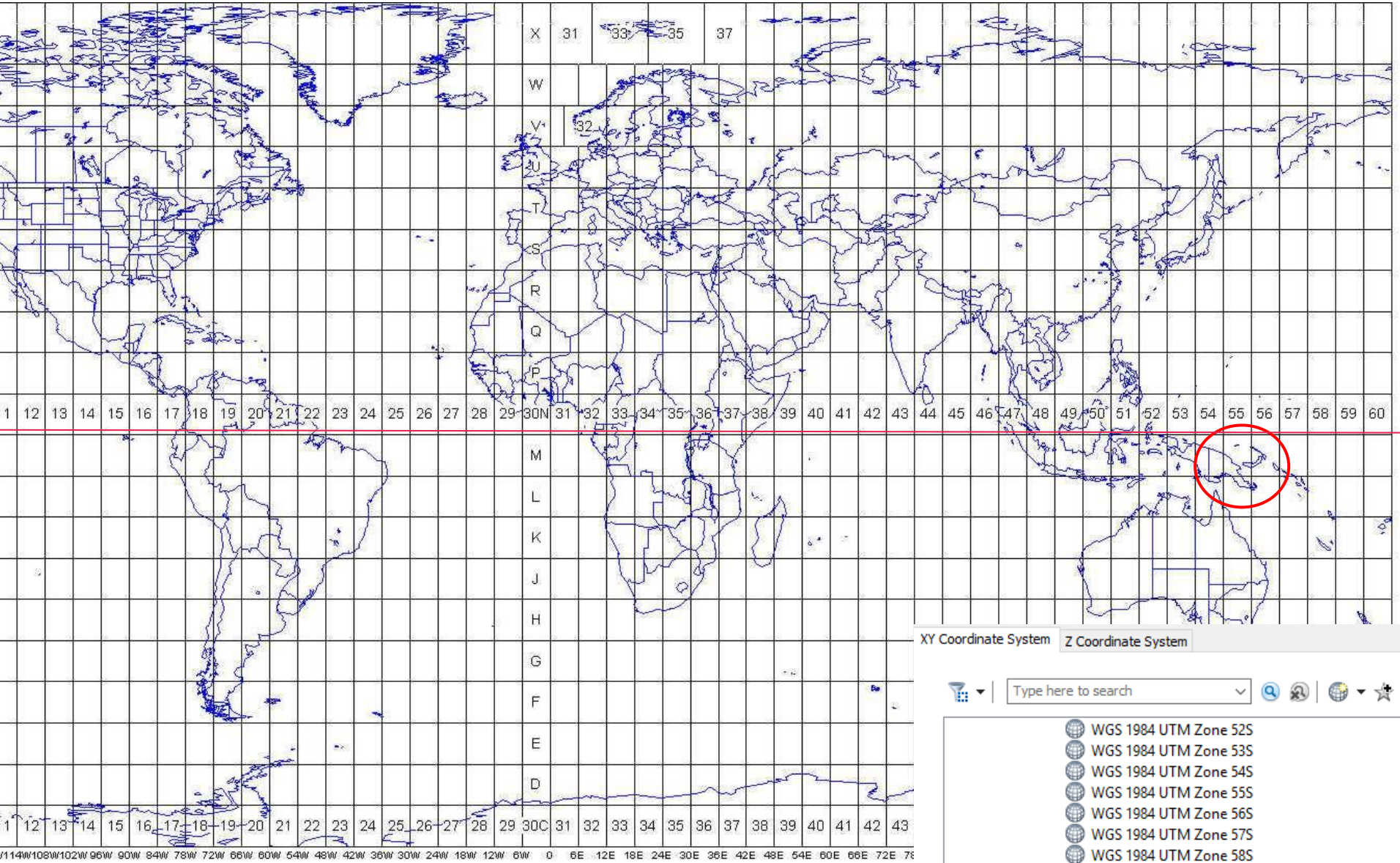
Turning the Mercator projection's cylinder so that it is tangent to the Earth along a meridian (longitude line) results in what is called a **Transverse Mercator** projection.



The **Universal Transverse Mercator** system of projections deals with this by defining 60 different standard projections.

Each projection has a different Transverse Mercator projection that is slightly rotated to use a different meridian as the central line of tangency.

So, what is the UTM projection of PNG?



So, what does this have to do with your analysis?

The first step in problem solving spatial data is to check the projection.

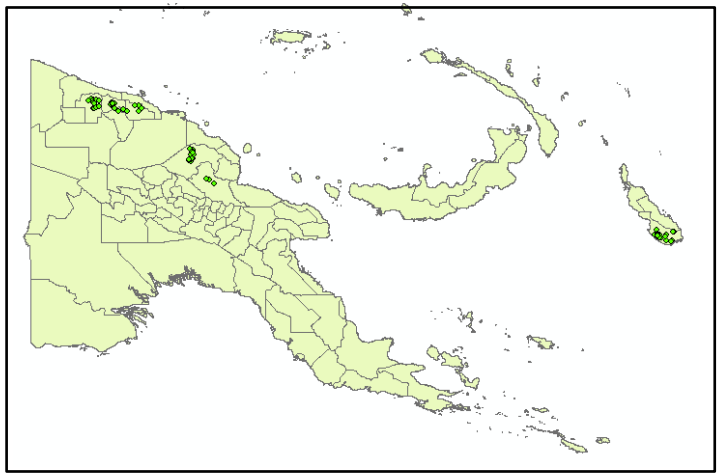
If the projection is ‘undefined’ or is different from the other ‘Layers’ in your Data Frame it will not merge nicely and you will not be able to do ANY spatial analysis!

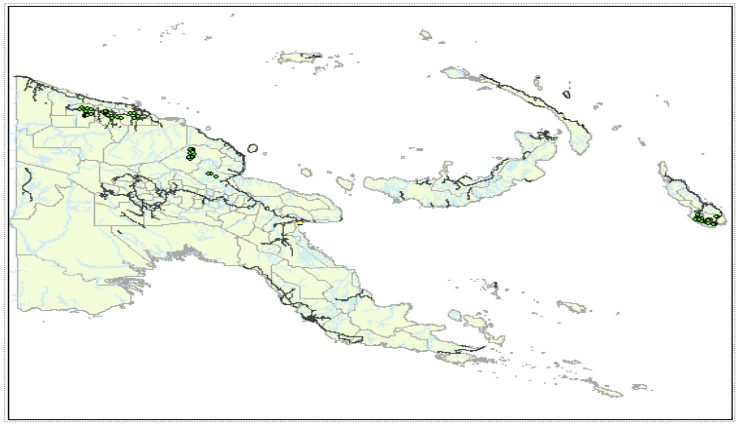
Exercise 5

You will experiment with different projections to understand what can be preserved and what is lost due to geographic projection decisions

You have been given detailed surveyed community point information, which was collected using GPS units in the field. Unfortunately, it is not displaying correctly in the data frame. You will need to project the data correctly and perform any analysis.

Surveyed community location





GPS data from the field, when projected correctly allows for new data creation and facilitates data comprehension when analyzing across geographic space.

Once you master projections, you can use data from a variety of sources in order to create more data and perform more analysis.

What are we looking at?

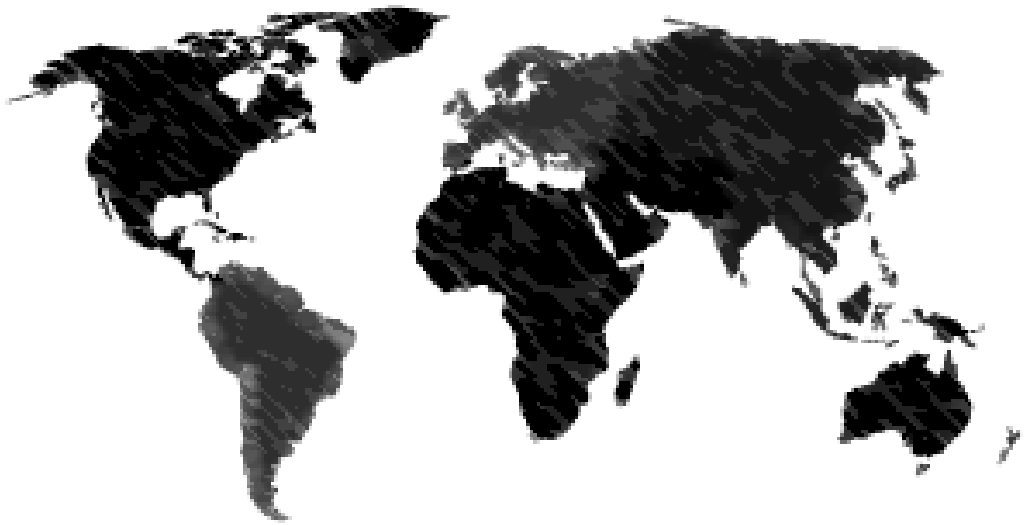
What can we question about population density and infrastructure?

P'yongyang

Seoul

Questions?

Spatial Joins



Moving along …

- Spatial Data Integration
  - Spatial Join
    - Spatial Join with the health centers in PNG
  - Tabular Join

Spatial data integration –Lab 06…

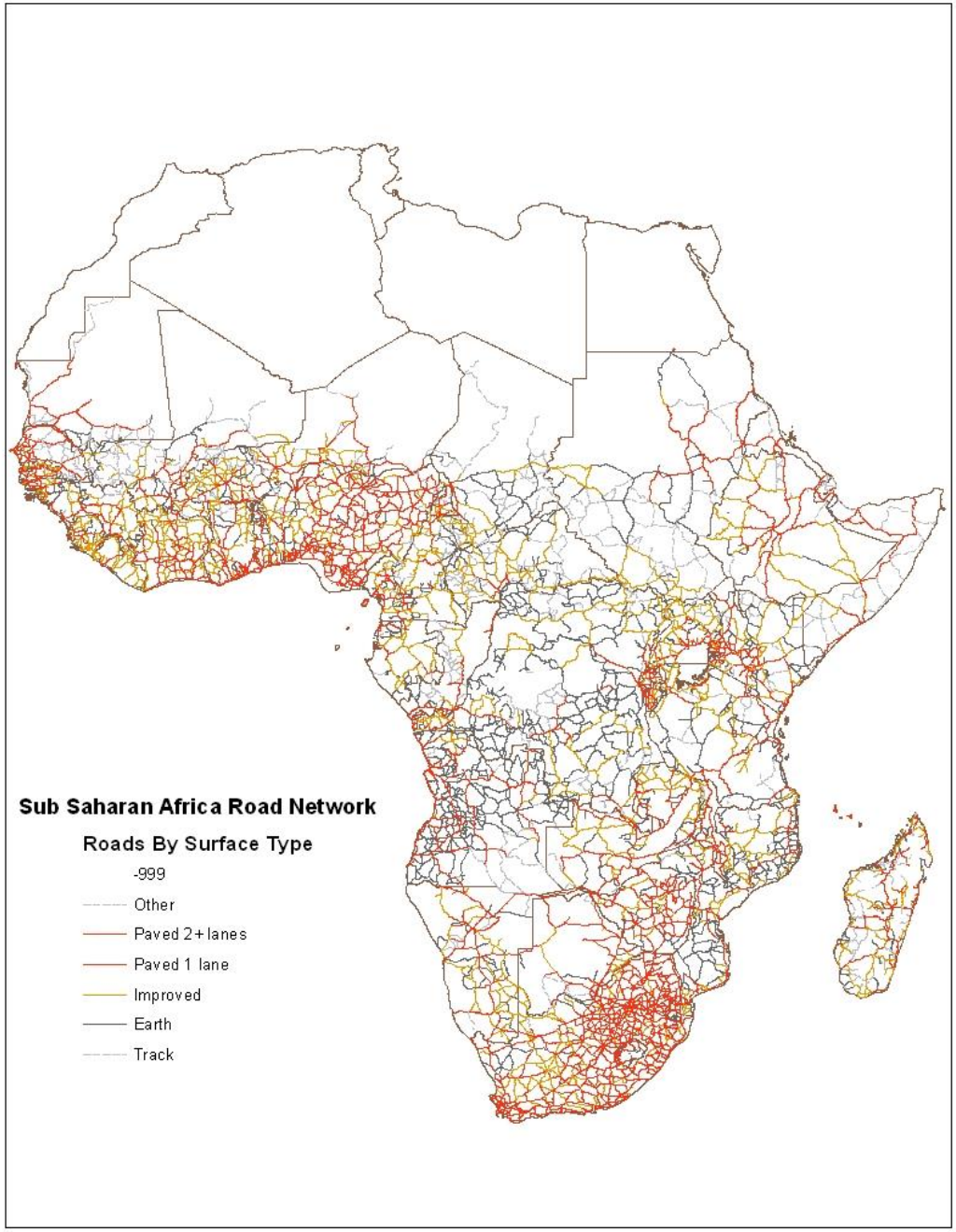
Two Types of Data to be managed in GIS

- Spatial Data (Where things are)
- Tabular data (What things are)

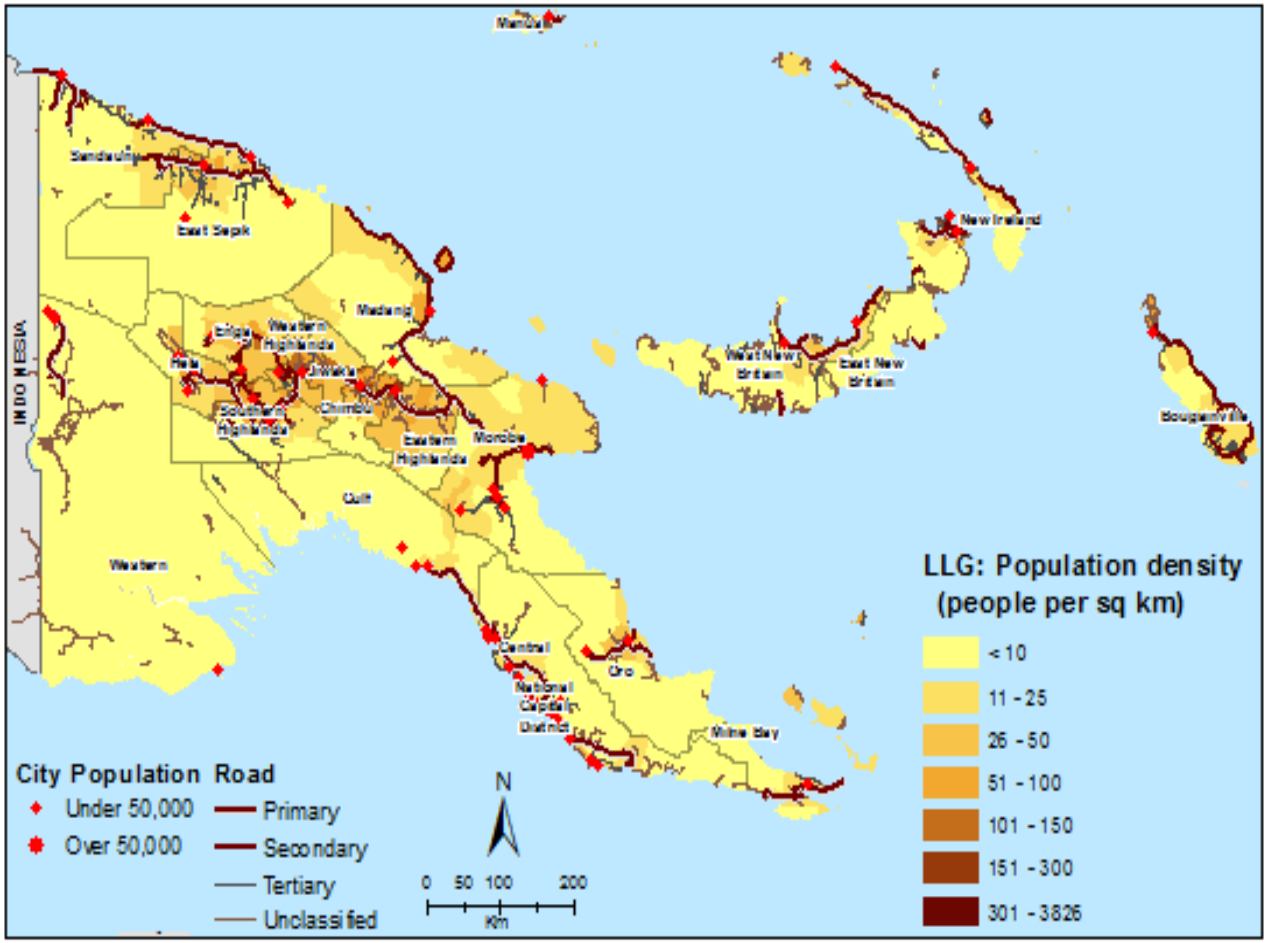
Spatial Joins can generate interesting statistics about SSA:

- Compare road density and surface type by country, province, district, etc.

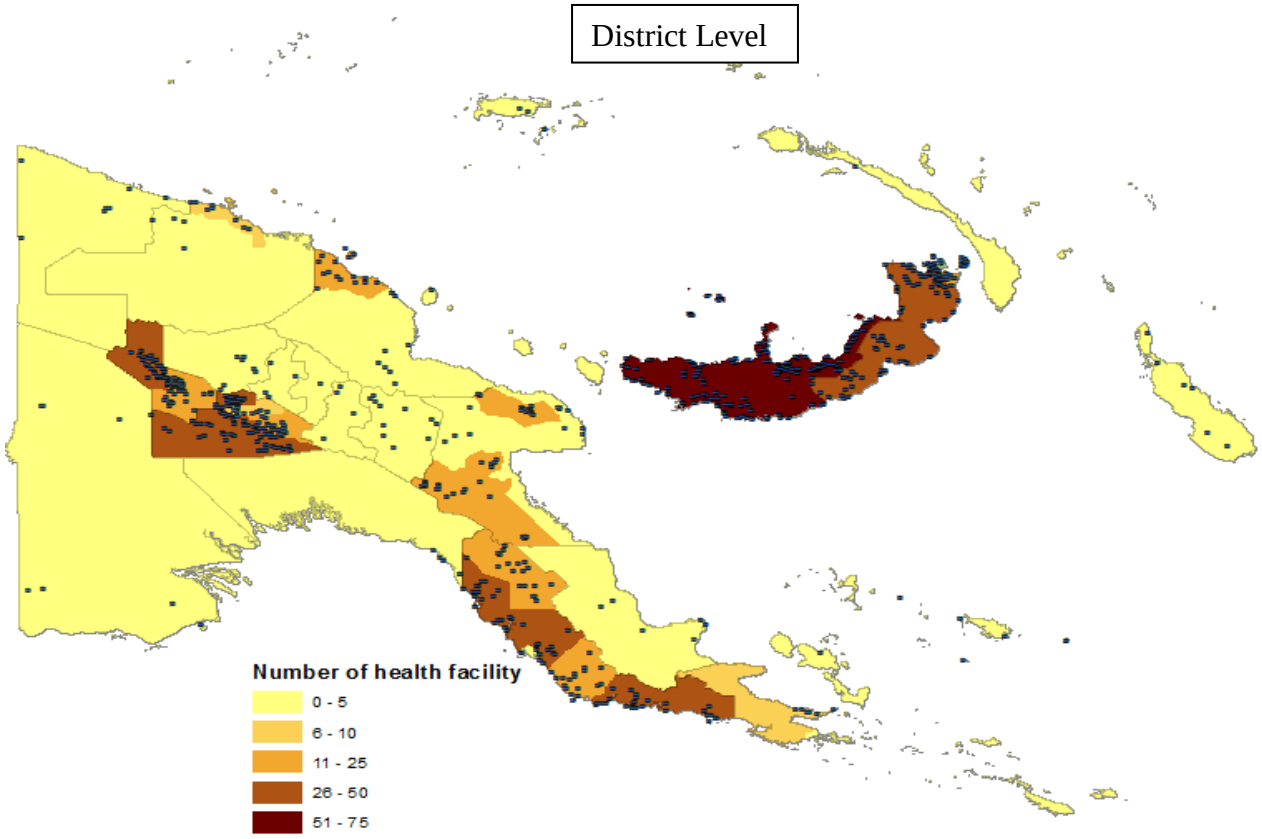
- Compare road kilometer length and surface type by country, state/province, etc.



Spatial join can also calculate population counts and densities within specified geographic regions

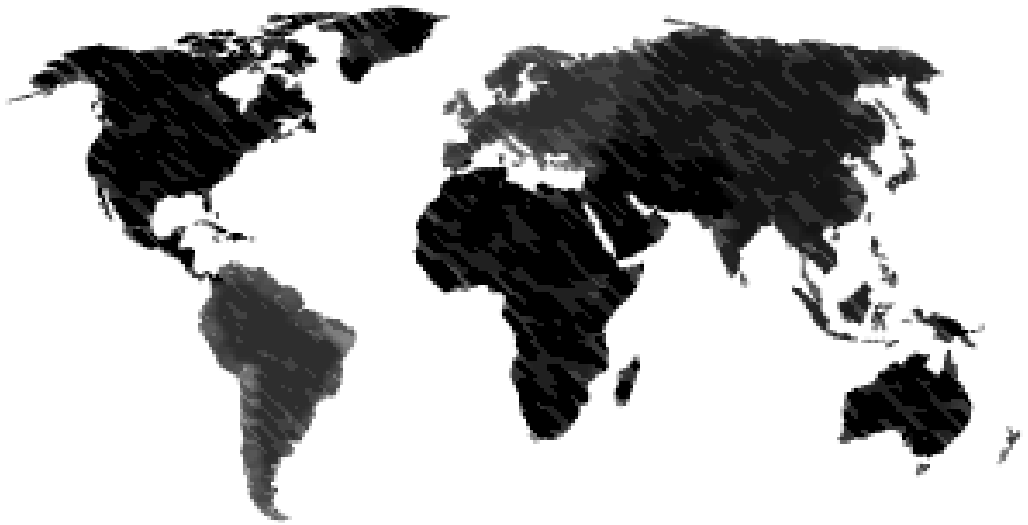


Lab 06



- How do the number of Health centers relate to the population density figures you worked with in Lab03?
- How would we calculate Health center per capita figure for district level statistics?

Tabular Joins



- Tabular Data
  - Merging other datasets to GIS shapefiles
    - Census
    - HHS
    - DHS
    - Environmental Surveys

Excel to ArcGIS

Formatting Rules:

- No spaces in field names
- Numeric and text fields must be designated as such
- Field names no longer than 11 digits (to permanently append to the shapefile)

	A	B	C	D	E	F	G	H	I
1	Province	Prov_PCODE	District	Dist_PCODE	LLP	LLP_PCODE	ID	GEOCODE	TOTPOP
2	Sandaun	PG18	Vanimo-Green River	PG184	WALSA RURAL	PG1845	150416	15041600000	5994
3	Sandaun	PG18	Vanimo-Green River	PG184	AMANAB RURAL	PG1841	150412	15041200000	9579
4	Sandaun	PG18	Vanimo-Green River	PG184	GREEN RIVER RURAL	PG1843	150414	15041400000	10886
5	Sandaun	PG18	Aitape-Lumi	PG181	WEST WAPEI RURAL	PG1814	150104	15010400000	8987
6	Sandaun	PG18	Aitape-Lumi	PG181	EAST WAPEI RURAL	PG1812	150102	15010200000	7851
7	Sandaun	PG18	Nuku	PG182	YANGKOK RURAL	PG1823	150207	15020700000	12671

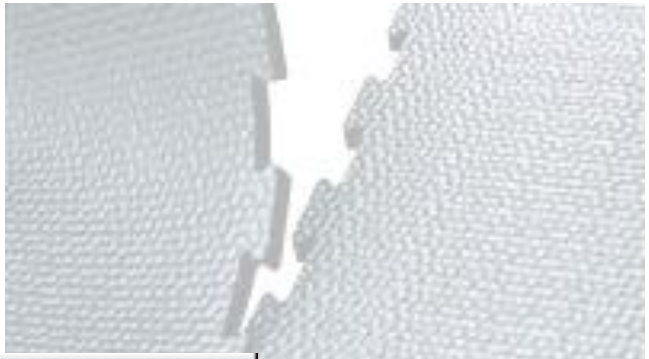
LLP_Pop05

	FID	Shape *	ID	NAME	GEOCODE	Province	Prov_PCODE	District	Dist_PCODE	LLP_PCODE
▶	0	Polygon	150416	WALSA RURAL	15041600000	Sandaun	PG18	Vanimo-Green River	PG184	PG1845
	1	Polygon	150412	AMANAB RURAL	15041200000	Sandaun	PG18	Vanimo-Green River	PG184	PG1841
	2	Polygon	150414	GREEN RIVER RURAL	15041400000	Sandaun	PG18	Vanimo-Green River	PG184	PG1843
	3	Polygon	150104	WEST WAPEI RURAL	15010400000	Sandaun	PG18	Aitape-Lumi	PG181	PG1814
	4	Polygon	150102	EAST WAPEI RURAL	15010200000	Sandaun	PG18	Aitape-Lumi	PG181	PG1812
	5	Polygon	150207	YANGKOK RURAL	15020700000	Sandaun	PG18	Nuku	PG182	PG1823
	6	Polygon	150308	NAMEA RURAL	15030800000	Sandaun	PG18	Telefomin	PG183	PG1831

Linking Tabular Data

Primary Key:

Unique Identifier for EACH row of information a particular data file



Table

LLP_Pop05

FID	Shape *	ID	NAME	GEOCODE	Province	Prov_PCODE	District
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1	Polygon	150412	AMANAB RURAL	15041200000	Sandaun	PG18	Vanimo-Green River
2	Polygon	150414	GREEN RIVER RURAL	15041400000	Sandaun	PG18	Vanimo-Green River
3	Polygon	150104	WEST				
4	Polygon	150102	EAST				
5	Polygon	150207	YANG				
6	Polygon	150308	NAME/				
7	Polygon	150205	MAWA				

0

LLP_Pop05 nso_census_2005$

Table

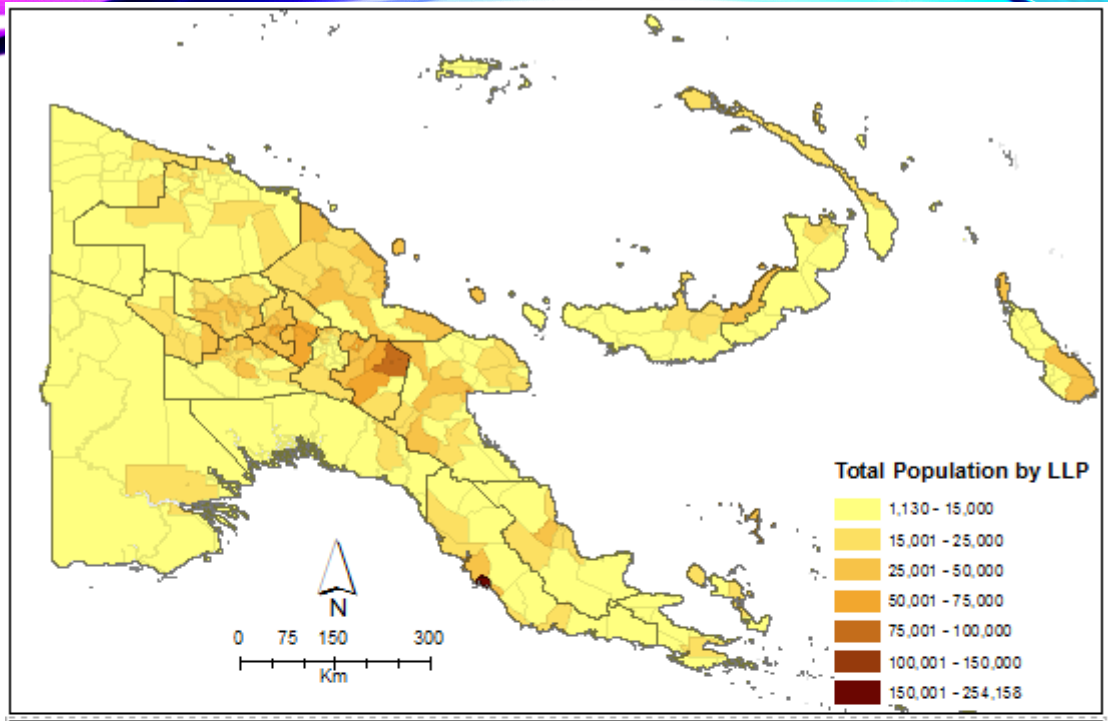
nso_census_2005$

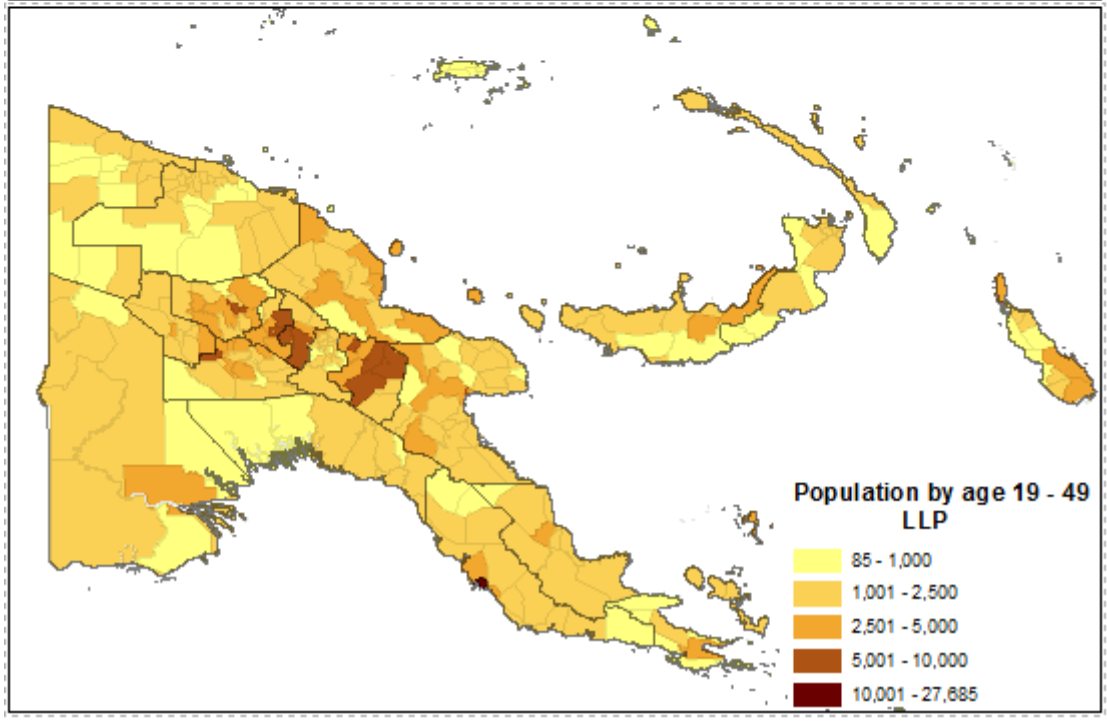
Prov_PCODE	District	Dist_PCODE	LLP	LLP_PCODE	ID	GEOCODE	TOTPOP	T
PG18	Vanimo-Green River	PG184	WALSA RURAL	PG1845	150416	15041600000	5994	
PG18	Vanimo-Green River	PG184	AMANAB RURAL	PG1841	150412	15041200000	9579	
PG18	Vanimo-Green River	PG184	GREEN RIVER RURAL	PG1843	150414	15041400000	10886	
PG18	Aitape-Lumi	PG181	WEST WAPEI RURAL	PG1814	150104	15010400000	8987	
PG18	Aitape-Lumi	PG181	EAST WAPEI RURAL	PG1812	150102	15010200000	7851	
PG18	Nuku	PG182	YANGKOK RURAL	PG1823	150207	15020700000	12671	
PG18	Telefomin	PG183	NAMEA RURAL	PG1831	150308	15030800000	7673	
PG18	Nuku	PG182	MAWASE RURAL	PG1821	150205	15020500000	21778	

0 (0 out of 297 Selected)

LLP_Pop05 nso_census_2005$

When tabular data are successfully merged with spatial attributes, we can evaluate variations among disaggregated variables, and trends over time and throughout space





Lab 07

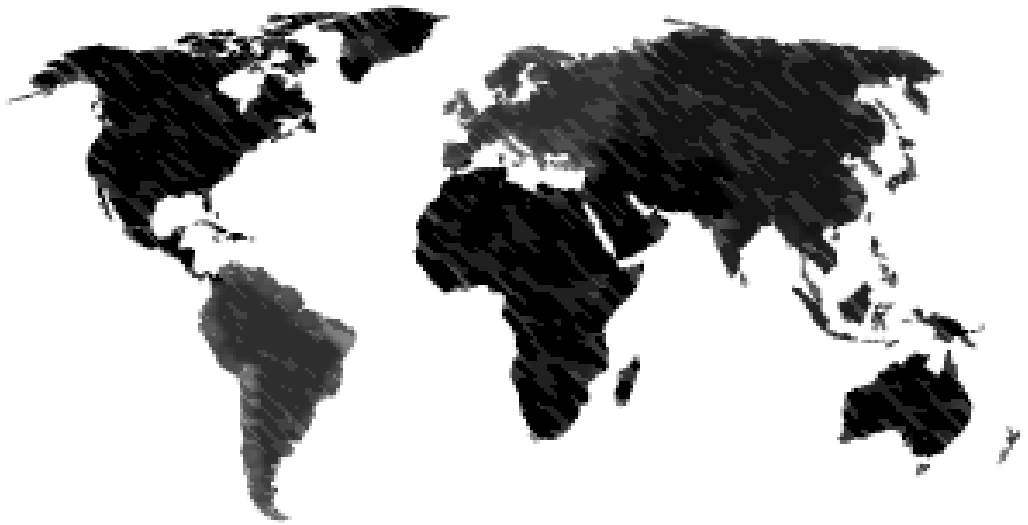
Exercise Overview

- You have received detailed Household Census information from NSO-PNG. The data is in Microsoft Excel format, and you need to integrate this information into ArcMap to create a thematic map.

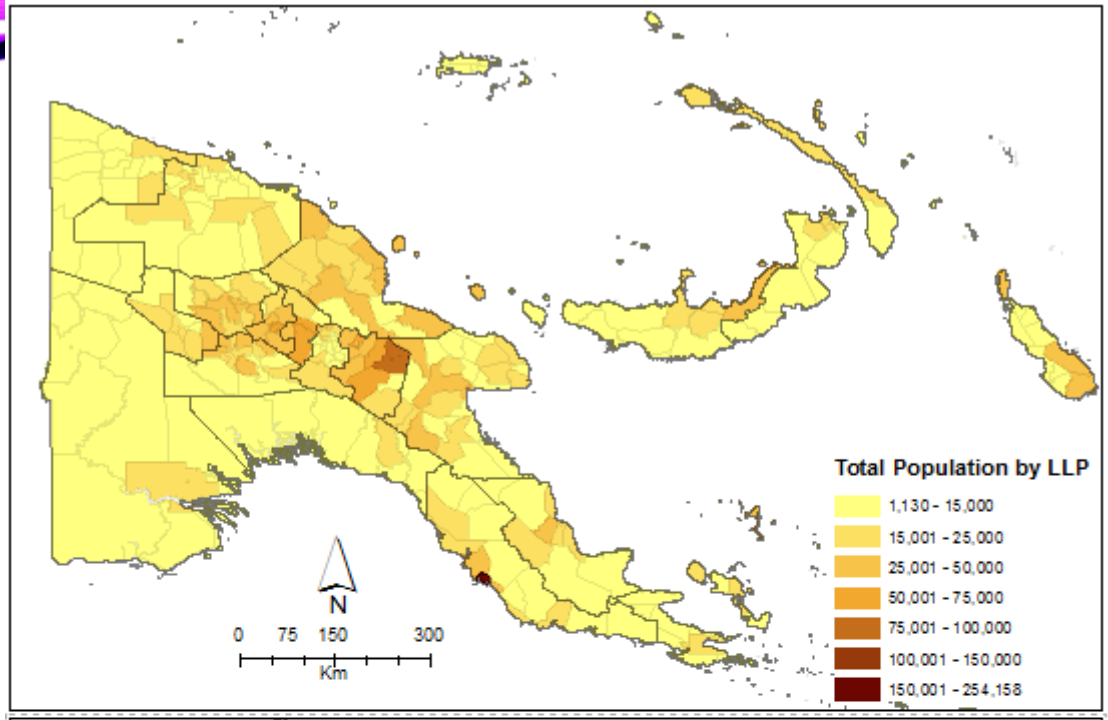
- To achieve this you must conduct a **Table Join**. A table join appends attributes of a non-spatial table, to the attributes of a map table. (Non-Spatial means "without geography", i.e.: without map attached). In order for this join to be successful there must be a way to match records in one table with appropriate records in another.

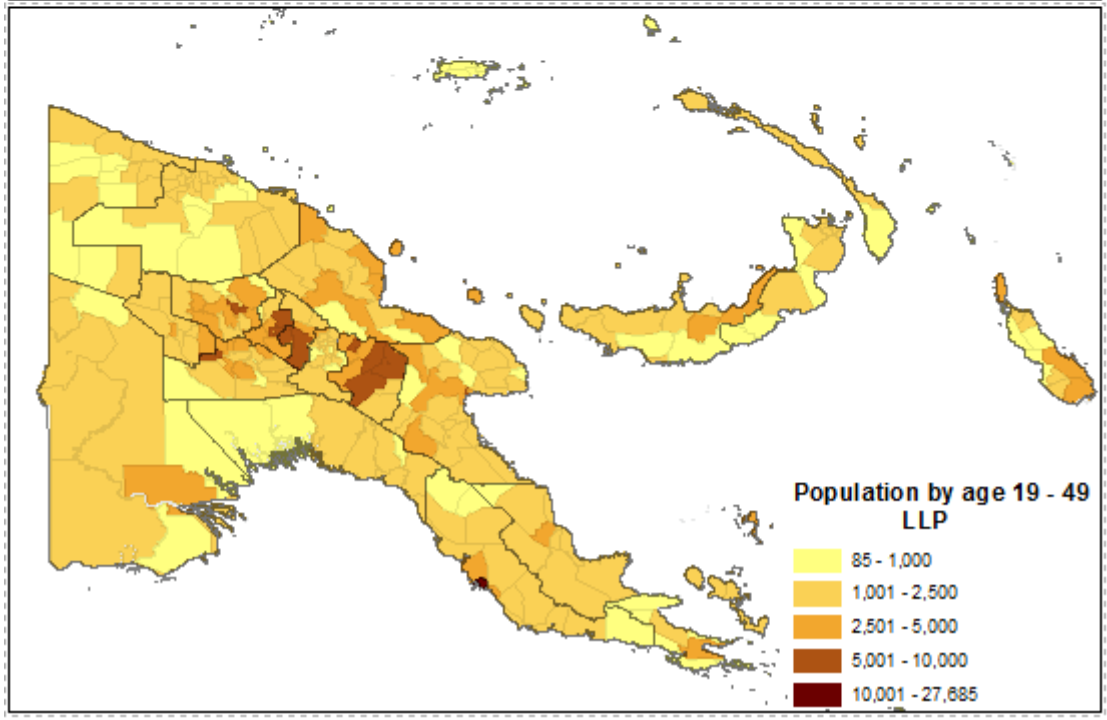
Tabular Joins cont'd

Agricultural system mapping



QUESTIONS ON LAB 7?

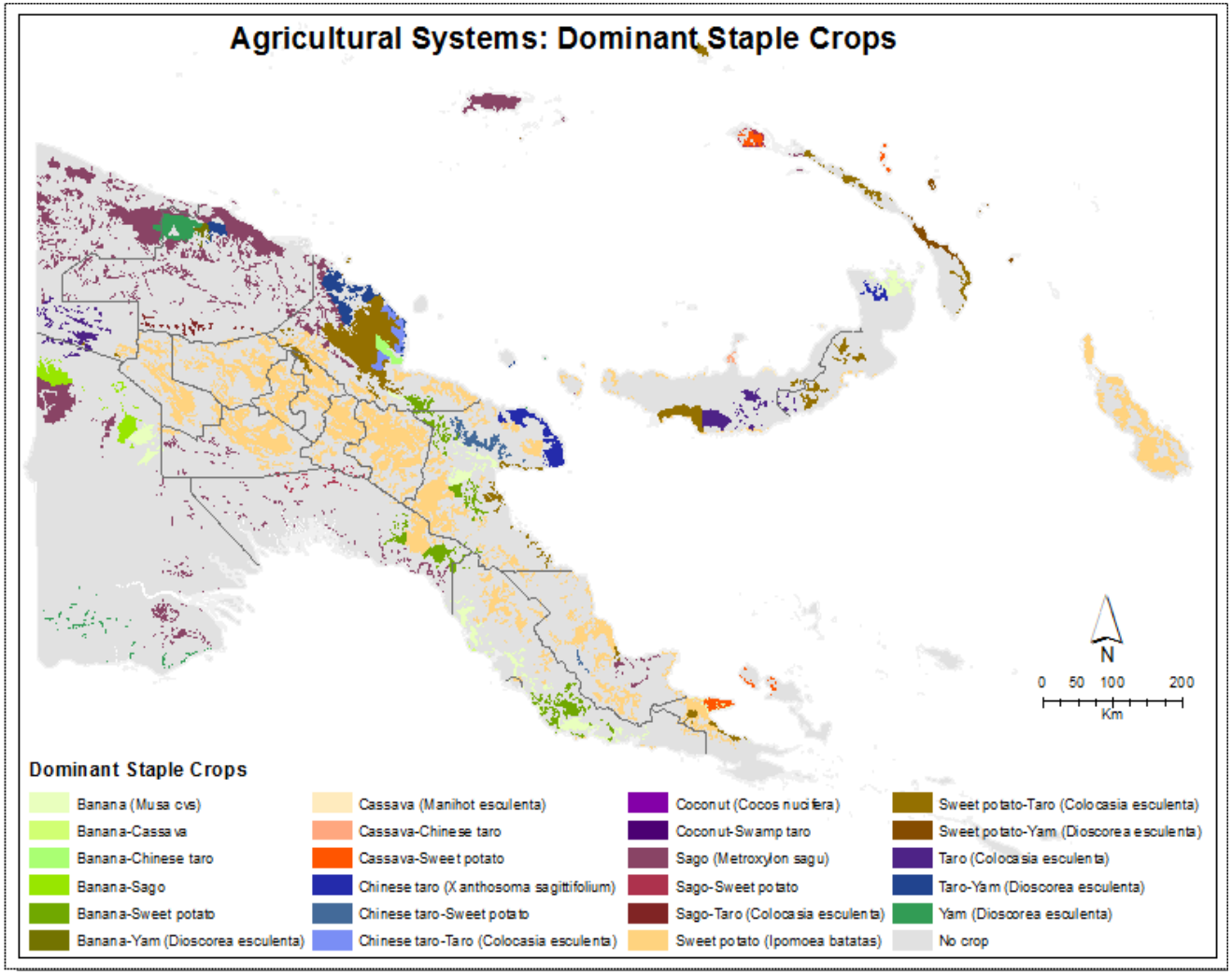


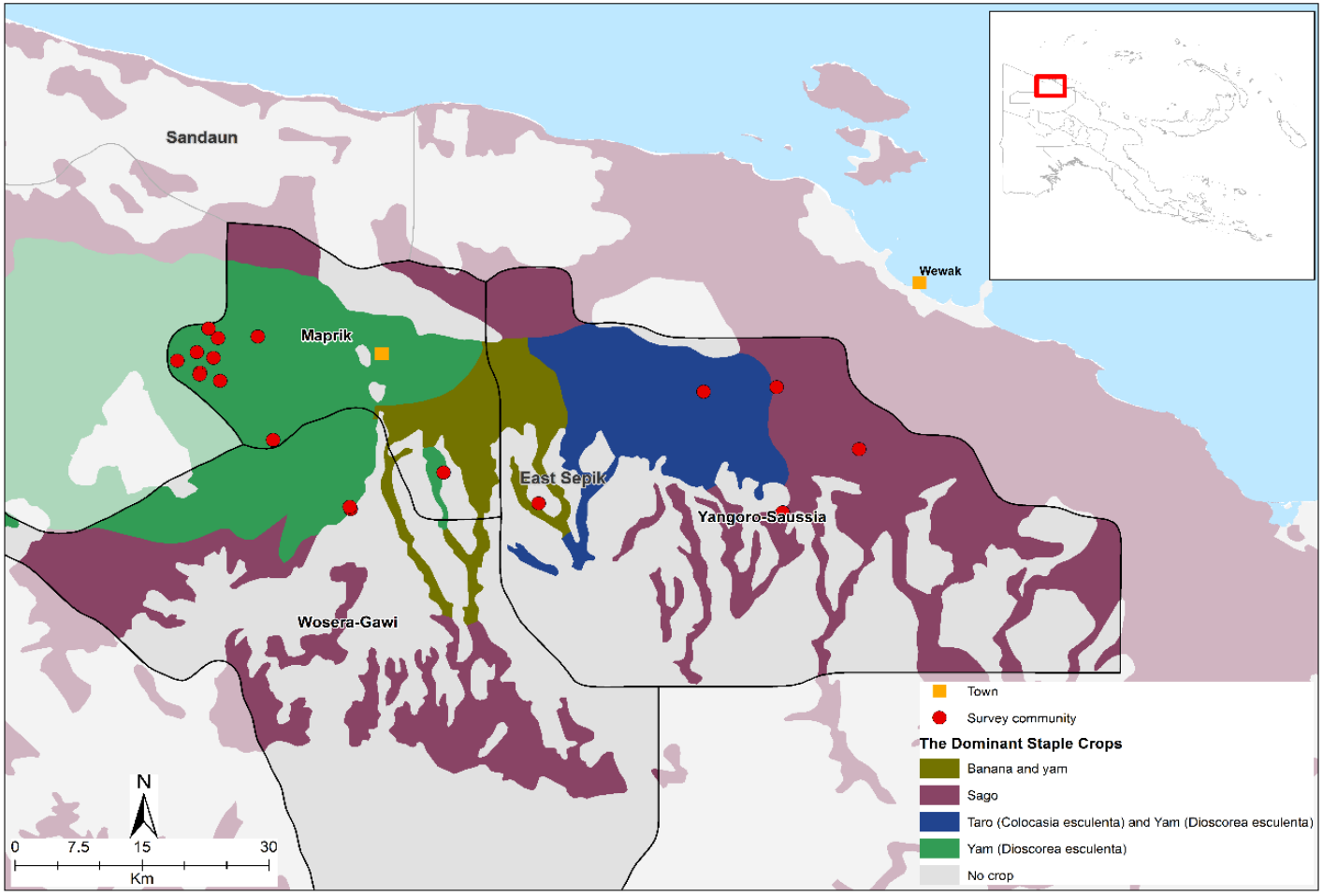


In the last lab we merged census tabular data to display in a more visual map format

Now we will continue with agricultural system map:

- The Papua New Guinea Agricultural Systems Project produced information on smallholder agriculture at provincial and national levels.
- Information was collected by field observation, interviews with villagers and reference to published and unpublished documents.
- The projected identified 287 discrete agricultural systems.


Agricultural Systems: Dominant Staple Crops
N
0 50 100 200
Km
Dominant Staple Crops
Banana (Musa cvs)
Banana-Cassava
Banana-Chinese taro
Banana-Sago
Banana-Sweet potato
Banana-Yam (Dioscorea esculenta)
Cassava (Manihot esculenta)
Cassava-Chinese taro
Cassava-Sweet potato
Chinese taro (Xanthosoma sagittifolium)
Chinese taro-Sweet potato
Chinese taro-Taro (Colocasia esculenta)
Coconut (Cocos nucifera)
Coconut-Swamp taro
Sago (Metroxylon sagu)
Sago-Sweet potato
Sago-Taro (Colocasia esculenta)
Sweet potato (Ipomoea batatas)
Sweet potato-Taro (Colocasia esculenta)
Sweet potato-Yam (Dioscorea esculenta)
Taro (Colocasia esculenta)
Taro-Yam (Dioscorea esculenta)
Yam (Dioscorea esculenta)
No crop


Sandaun
Wewak
Maprik
East Sepik
Yangoro-Saussia
Wosera-Gawi
N
0
7.5
15
30
Km
Town
Survey community
The Dominant Staple Crops
Banana and yam
Sago
Taro (Colocasia esculenta) and Yam (Dioscorea esculenta)
Yam (Dioscorea esculenta)
No crop

Questions?