

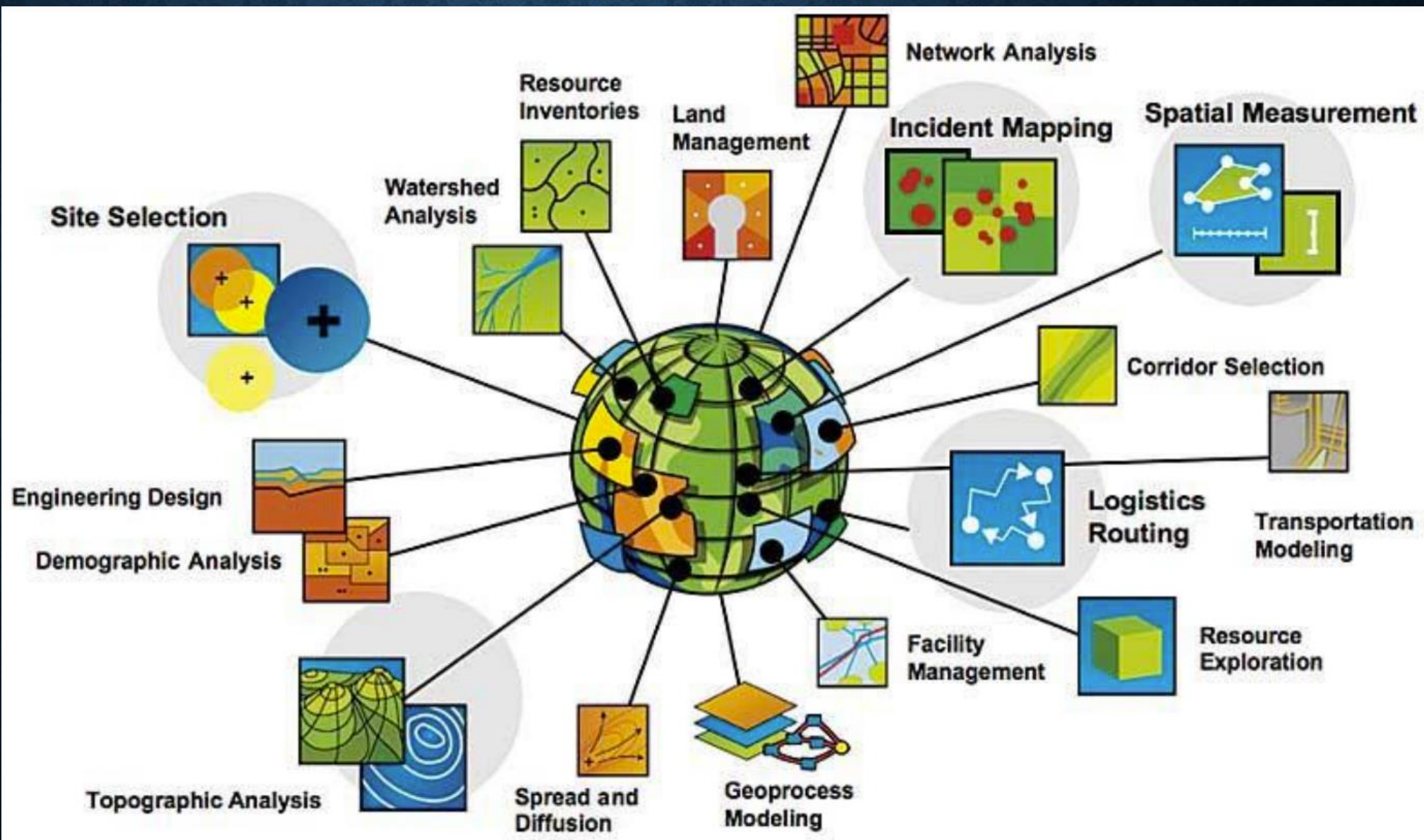
**COURSE: GEO-INFORMATICS IN EARTH SCIENCE,  
TECTONIC HAZARD AND INFRASTRUCTURE  
MANAGEMENT**

**LECTURE 1 - Geo-Informatics and Earth Science  
and System**

Lecturer: Dr. Tingneyuc Sekac, Ph.D. PNG University of Technology

# What is Geo-Informatics

Applied GIS around the world across disciplines, professions and organizations



# What is Geo-Informatics

## Data Source



Street Data



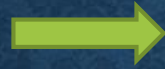
Building Data



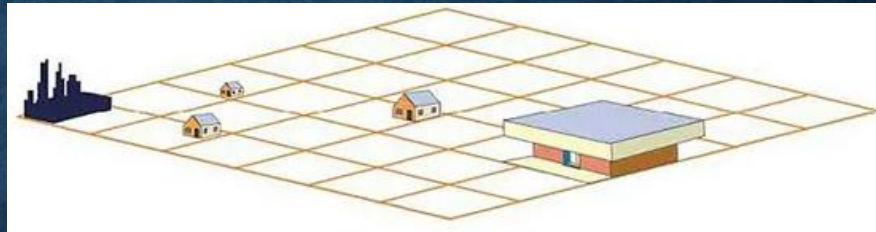
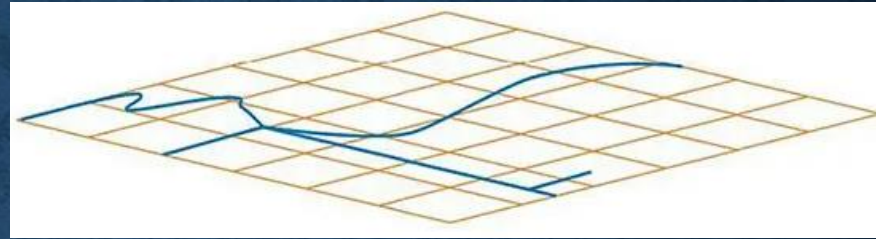
Vegetation Data



Integrated Data



## Data Layers



# What is Geo-Informatics

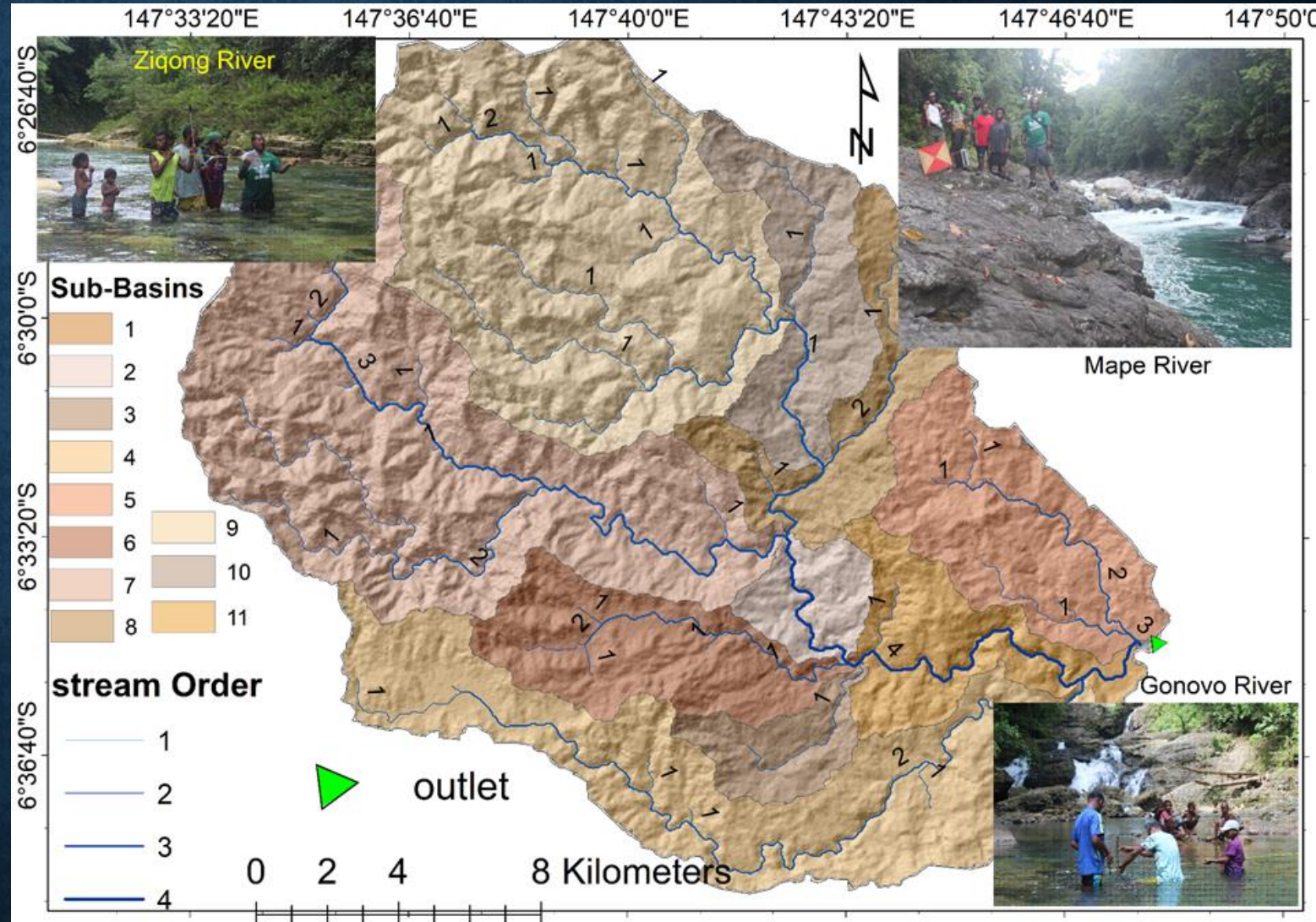
Geo-informatics integrates:

- geospatial analysis,
- database development,
- system design,
- human-computer interaction, and networking technologies,
- employing geo-computation and geo-visualization for geo-information analysis

# What is Geo-Informatics

## Branches of Geo-informatics:

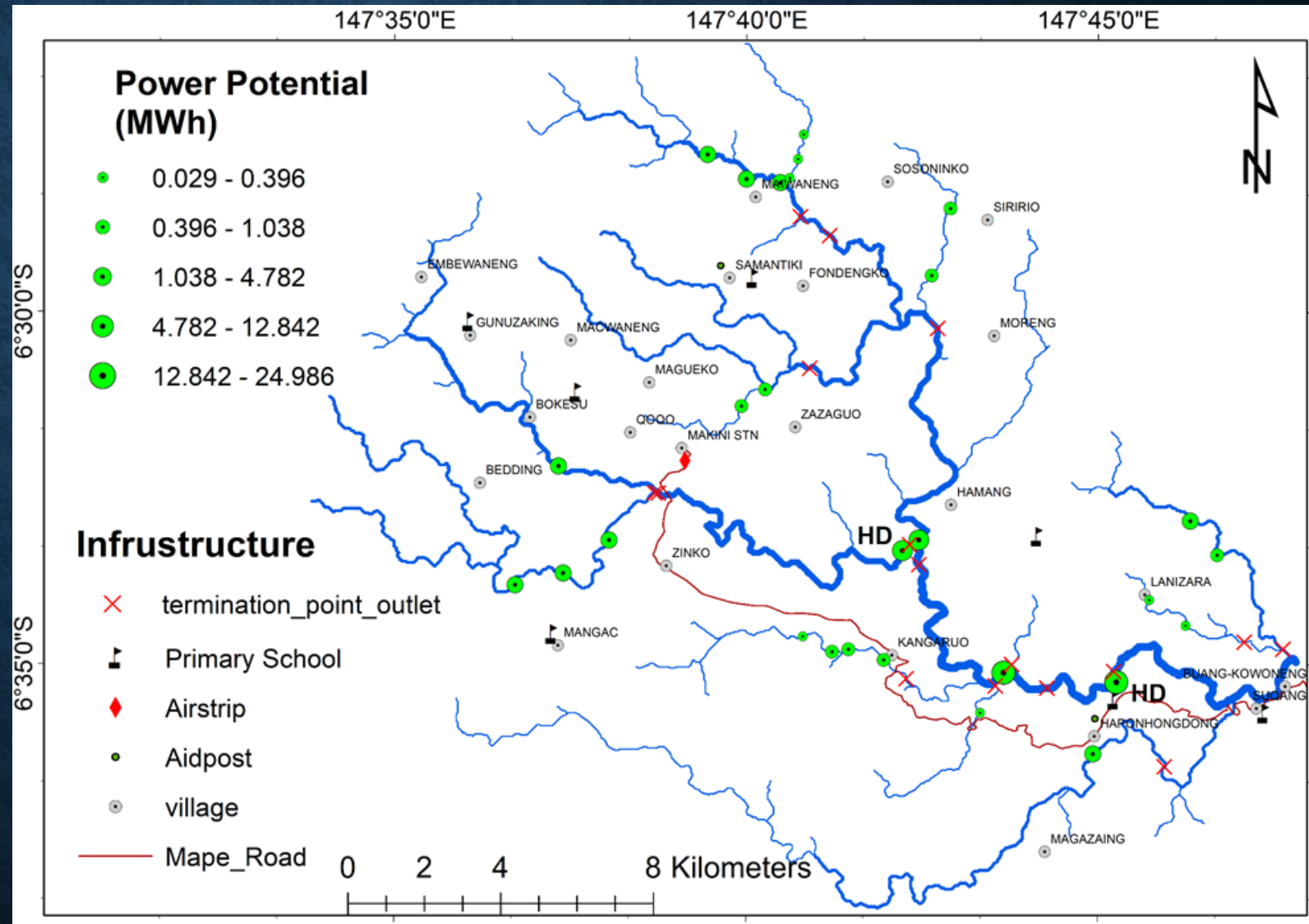
- Cartography
- GIS
- GPS/GNSS
- Remote Sensing
- Photogrammetry
- Database Management System
- Web mapping and GIS Web Application Development



# What is Geo-Informatics

## Cartography:

- ❑ Cartography is the art and science of mapmaking.
- ❑ It involves creating accurate and visually appealing maps to represent geographic information.
- ❑ Maps serve as tools for navigation, communication, and understanding spatial relationships



# What is Geo-Informatics

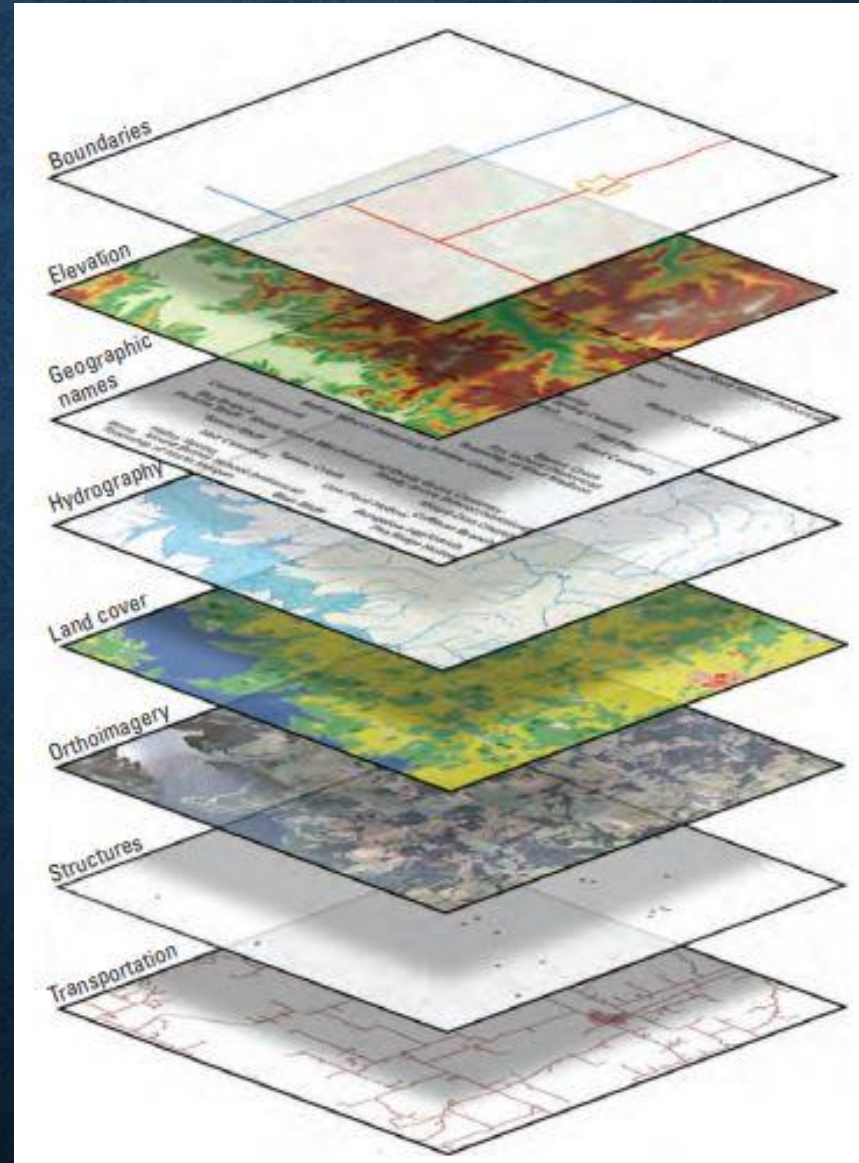
## Geographical Information System (GIS):

- ✓ GIS is a technology-based system for capturing, storing, analyzing, and visualizing spatial or geographic data.
- ✓ It integrates various types of data, including maps, satellite imagery, and attribute data, into a single database.
- ✓ GIS allows users to create maps, perform spatial analysis, and make data-driven decisions across multiple industries.

# What is Geo-Informatics

Geographical  
Information System  
(GIS):

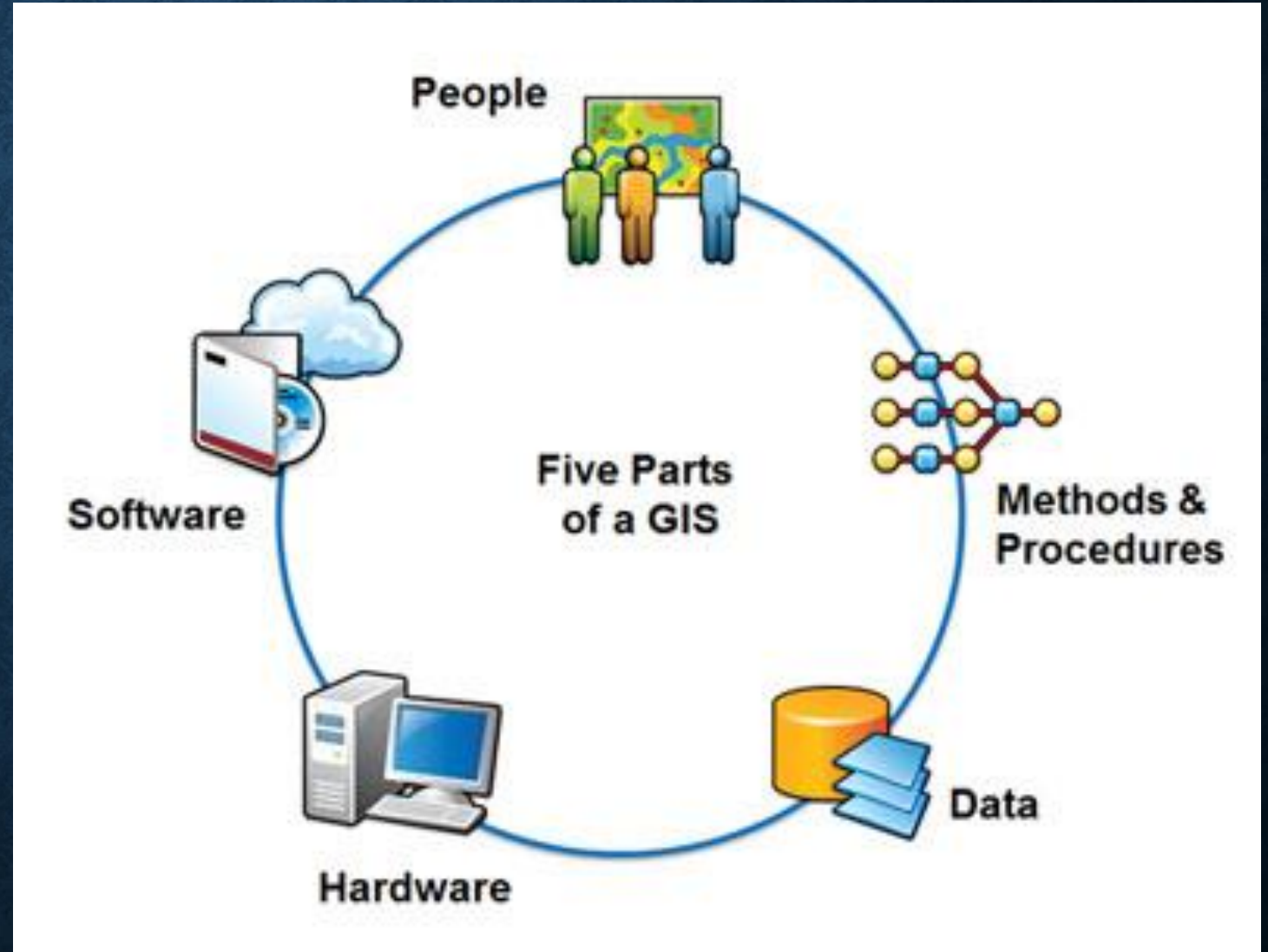
Eight Base layer of the national map



# What is Geo-Informatics

Geographical  
Information System  
(GIS):

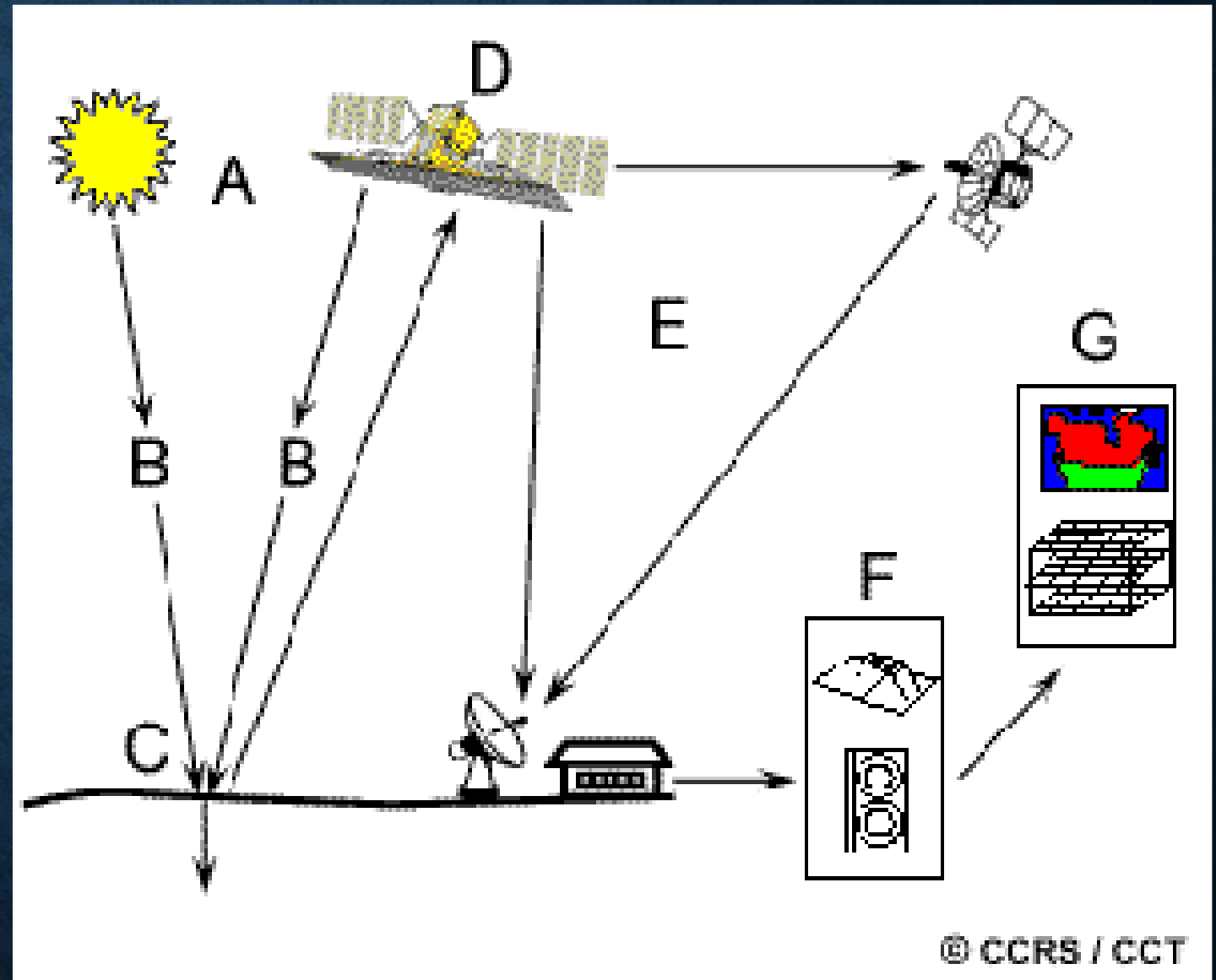
## Components of GIS





# What is Geo-Informatics

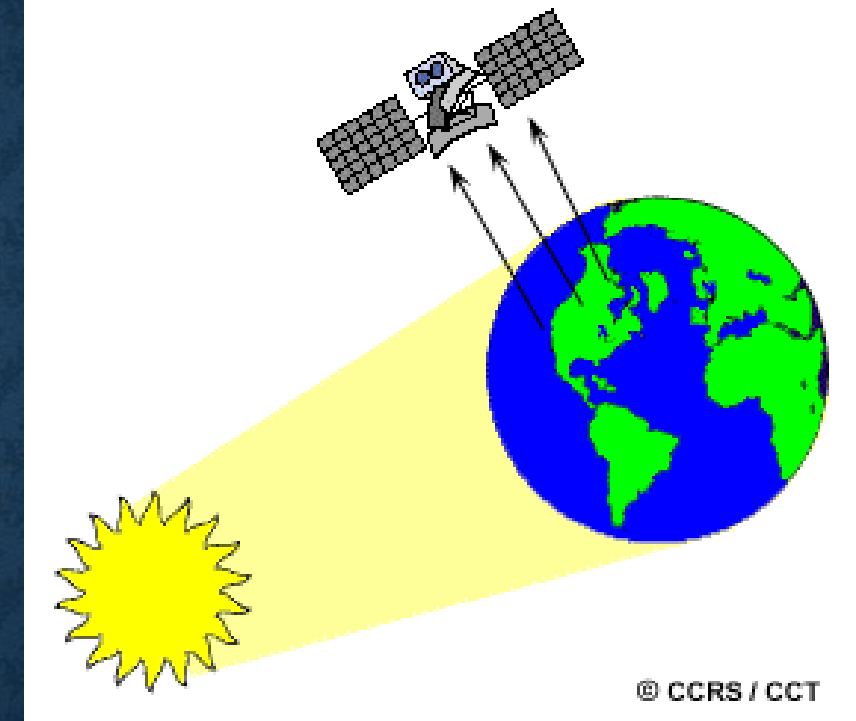
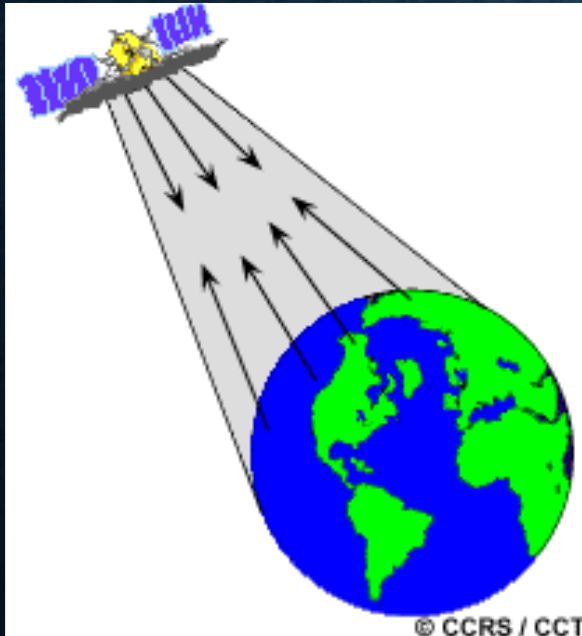
Remote Sensing:



# What is Geo-Informatics

## Remote Sensing Type:

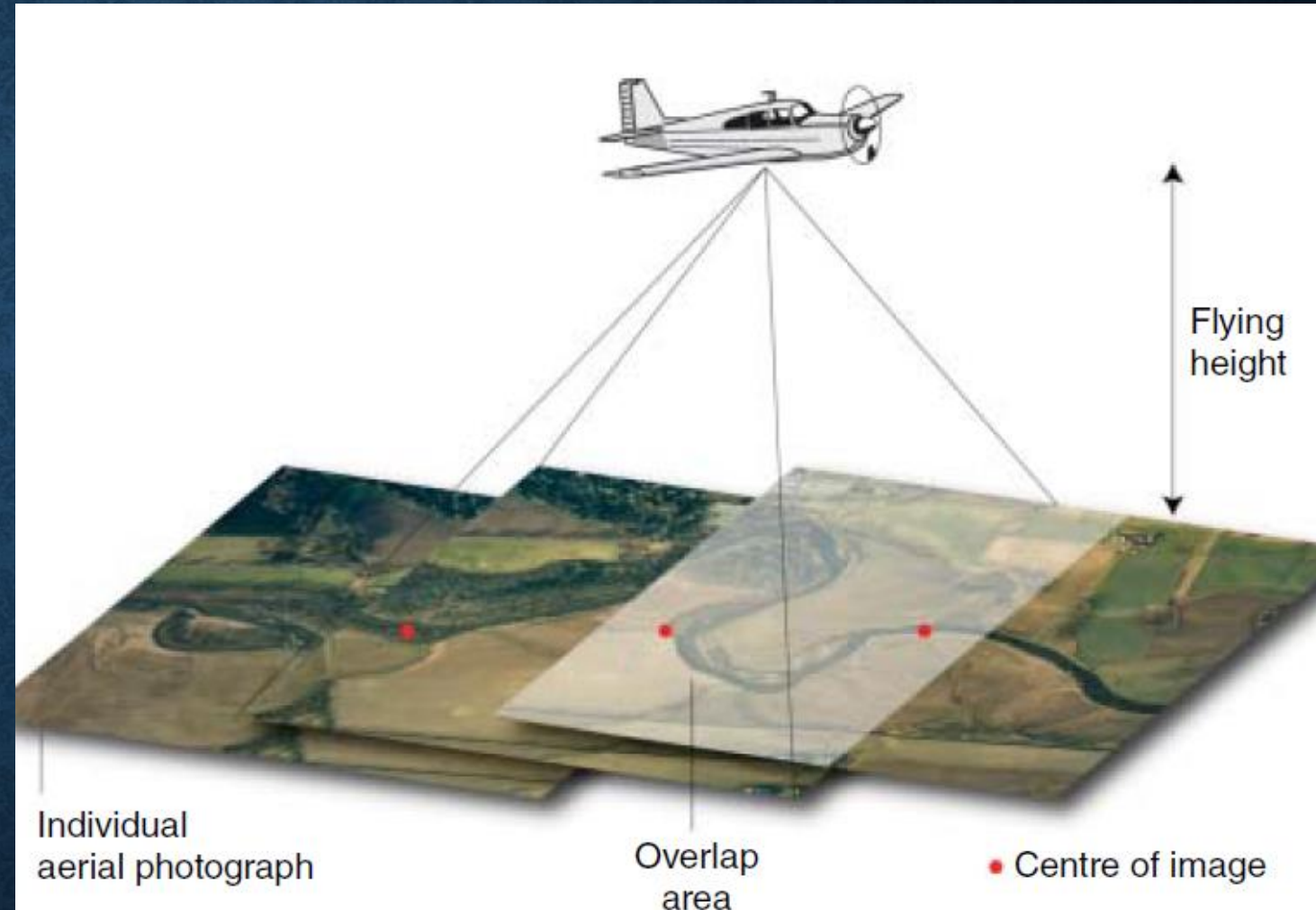
- ✓ Passive Remote Sensing
- ✓ Active Remote Sensing



# What is Geo-Informatics

## Photogrammetry:

Photogrammetry combines the precision of scientific measurement with the art of capturing reliable information through aerial photography

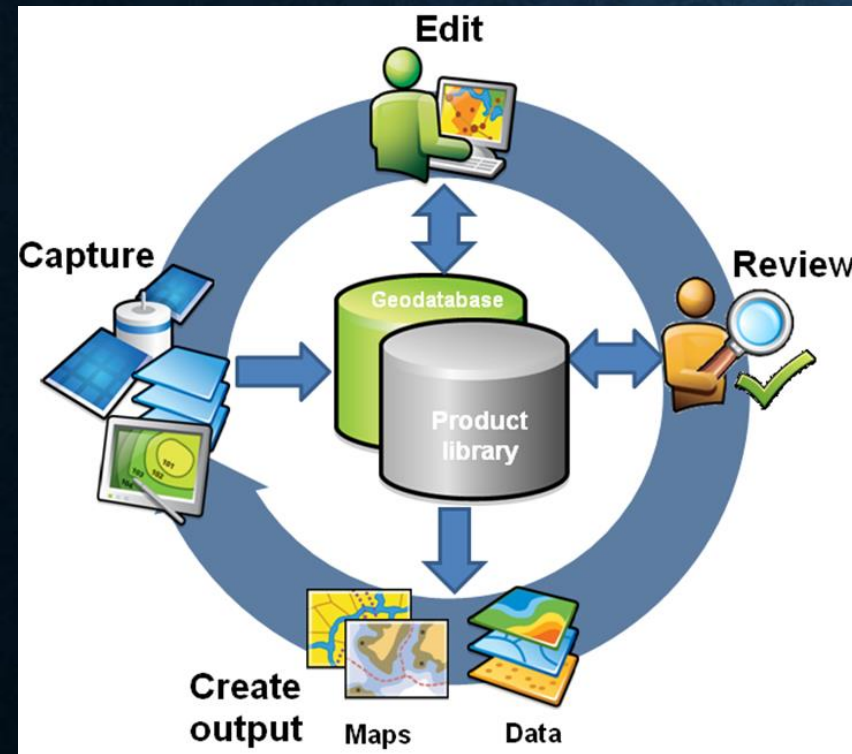


Source: Gilvear, D and Bryant, R (2016)

# What is Geo-Informatics

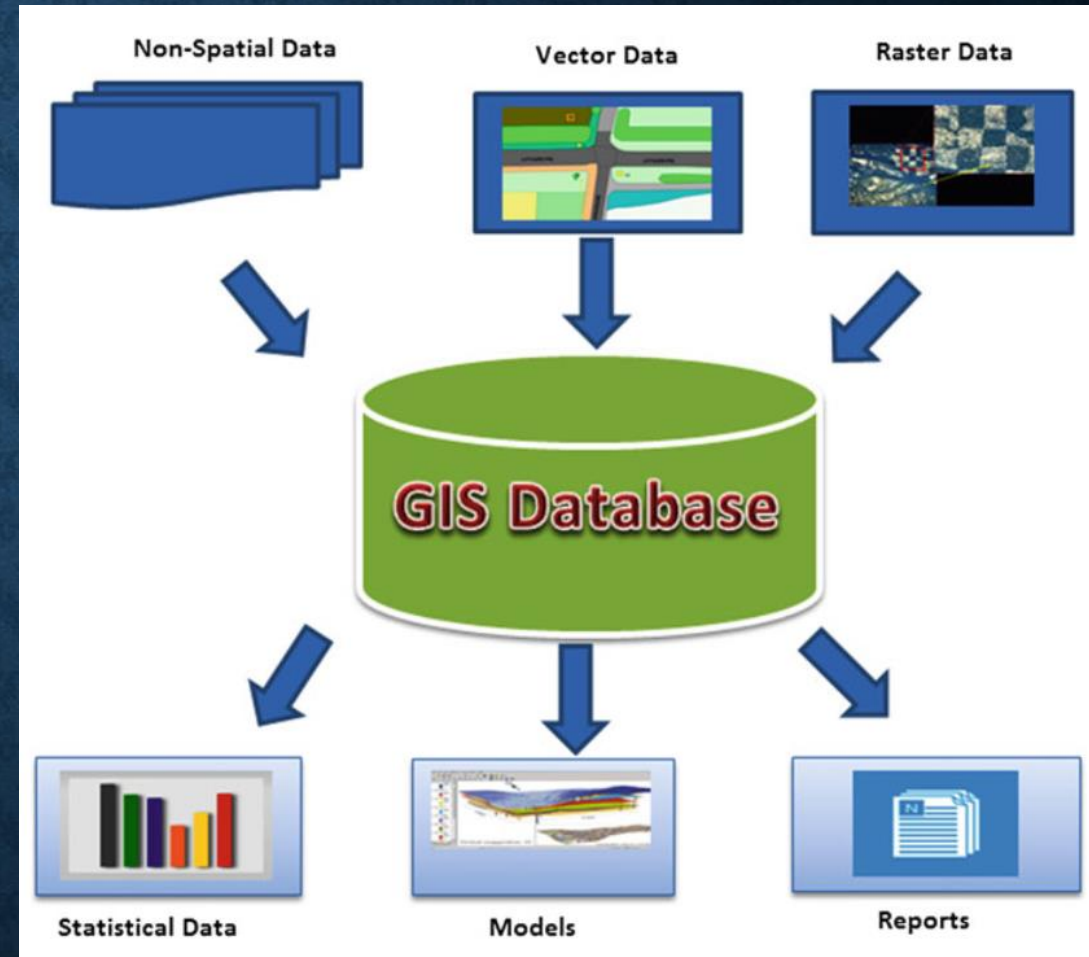
## Data Base Management System:

### Geodatabase Preparation



Backup geodatabase files. you can restore the geodatabase from the backup files.

Look for files with extensions such as .gdb, .gdbtable, .gdbtblx, and .gdbindexes in your computer/harddisk.



# What is Geo-Informatics

## Web mapping and GIS Web Application Development:

Web GIS allows visual interaction with the geospatial data on the web.

Either on our:

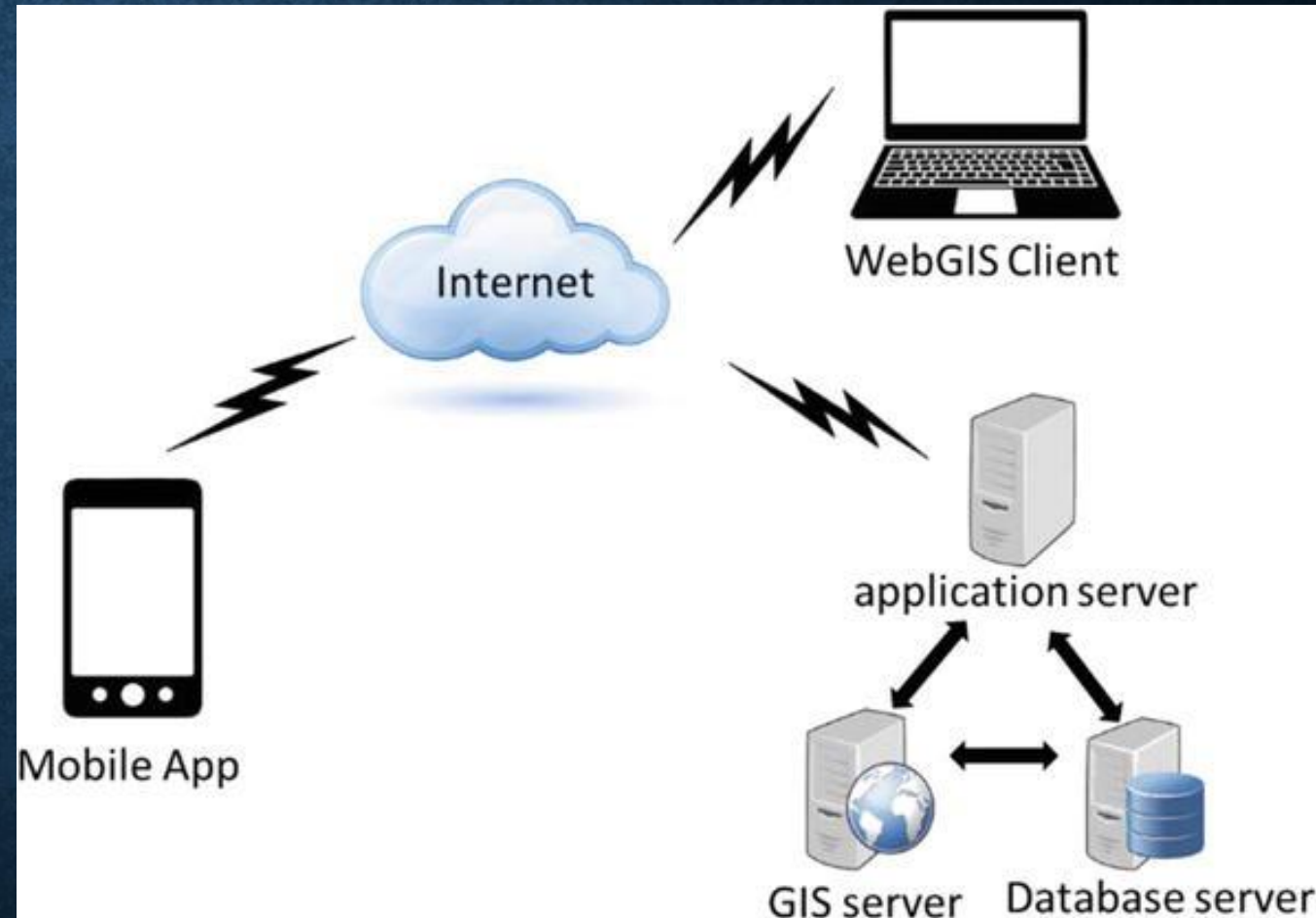
- mobile phones,
- desktop software,
- tablets and
- practically anywhere with a web browser.

# What is Geo-Informatics

## Web mapping and GIS Web Application:

### Characteristics of WebGIS:

- ❖ It serves a large number of users simultaneously
- ❖ Runs on browser and supports multiple platforms and operating systems.
- ❖ Follows unified updates.
- ❖ Easy access to map and satellite imagery for different applications.
- ❖ Available in customized dashboards with user-friendly interfaces.



# Earth Science and System

What is Earth Science:



# Earth Science and System

## What is Earth Science:

- ❖ Earth science, also known as geoscience, is the study of the Earth's physical components and processes.
- ❖ It examines the Earth's structure, materials, and the dynamic processes that shape its surface and interior.

# Earth Science and System

## What is Earth Science:

It is an exciting science with many interesting and practical applications;

- ❑ Study to locate and develop energy and mineral resources
- ❑ study the impact of human activity on Earth's environment, and design methods to protect the planet.
- ❑ determine how Earth's increasing population can live and avoid serious threats such as volcanic activity, earthquakes, landslides, floods and more

# Earth Science and System

What is Earth Science:

The four (4) Main Branches of Earth Science

1. Meteorology

2. Oceanography

3. Geology

4. Astronomy

# Earth Science and System

## What is Earth Science:

### The four (4) Main Branches of Earth Science

**Earth science includes several sub-disciplines, such as;**

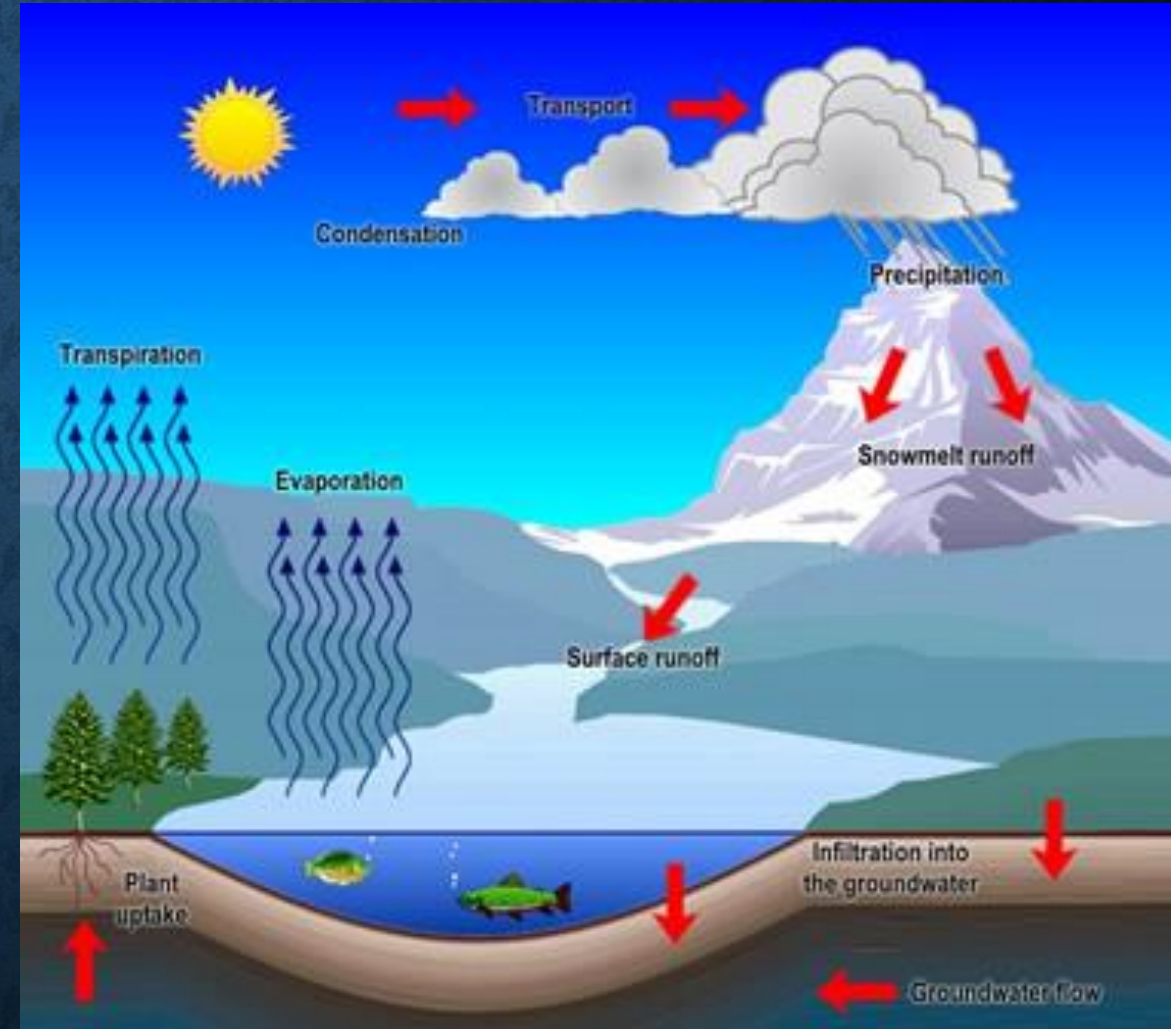
1. geology (study of the Earth's solid materials),
2. meteorology (study of the atmosphere and weather),
3. oceanography (study of the oceans and marine environments),
4. astronomy (study of celestial bodies beyond Earth).

# Earth Science and System

## What is Earth Science:

### Hydrologic Cycle:

- ❖ Earth Science involves the study of systems such as the hydrologic cycle.
- ❖ This type of system can only be understood by using knowledge of;
  - geology (groundwater),
  - meteorology (weather and climate),
  - oceanography (ocean systems) and
  - astronomy (energy input from the sun).
- The hydrologic cycle is always in balance.



# Earth Science and System

## Environmental Science:

- ❖ Environmental science and Earth science are related disciplines that study different aspects of the Earth and its environment.
- ❖ Environmental science is primarily concerned with the study of the;
  - ✓ interactions between living organisms (including humans) and their environment,
  - ✓ Study of Ecosystem and Biodiversity
  - ✓ Human Health

# Earth Science and System

Why is Earth Science Important to Study:

- ❖ **Understanding the Planet:**
- ❖ **Predicting Natural Disasters**
- ❖ **Resources management**
- ❖ **Climate Study**

# Earth Science and System

Why is Earth Science Important to Study:

## Understanding the Planet:

Earth Science helps us comprehend the Earth's processes, such as geological, meteorological, etc., leading to a better understanding of our planet's dynamics.



Image Source: Cattiaux, J, et al 2021

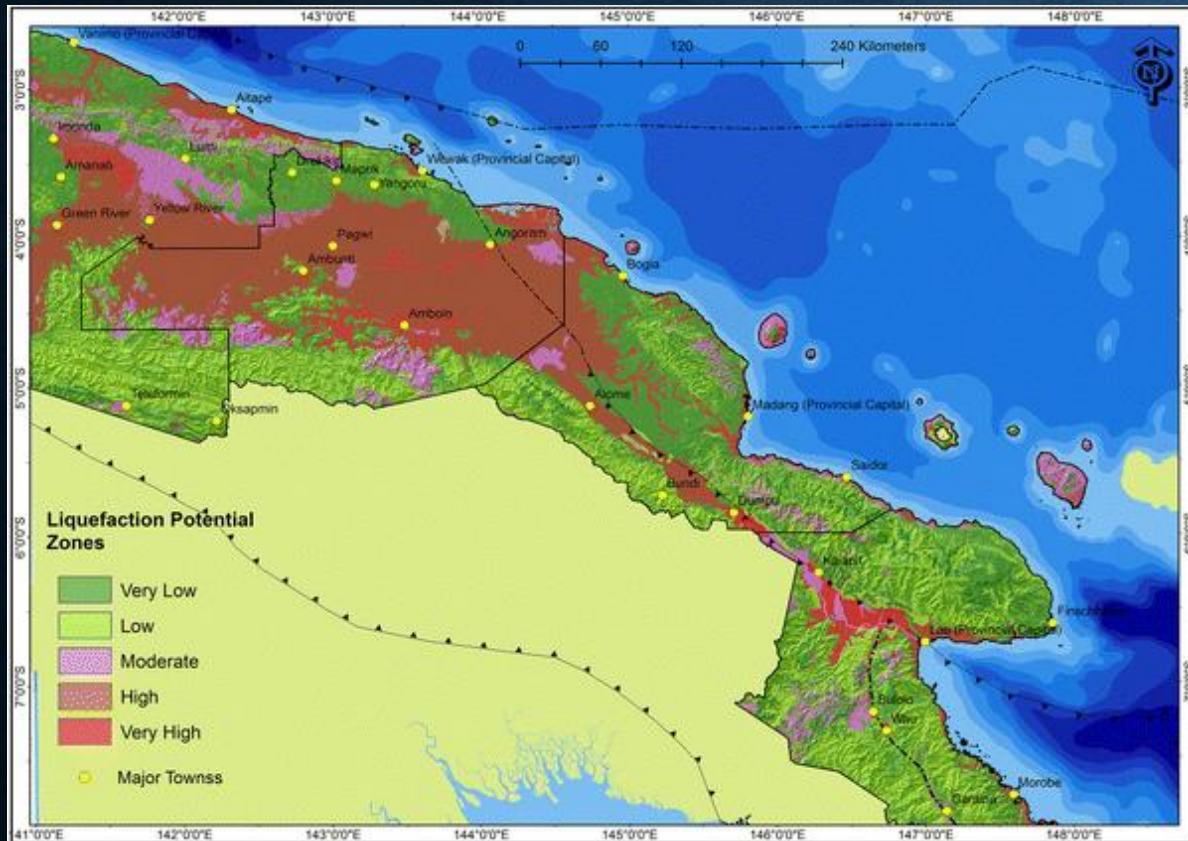


Image Source: Encyclopedia Britannica, 2023

# Earth Science and System

Why is Earth Science Important to Study:

## Predicting Natural Disasters:



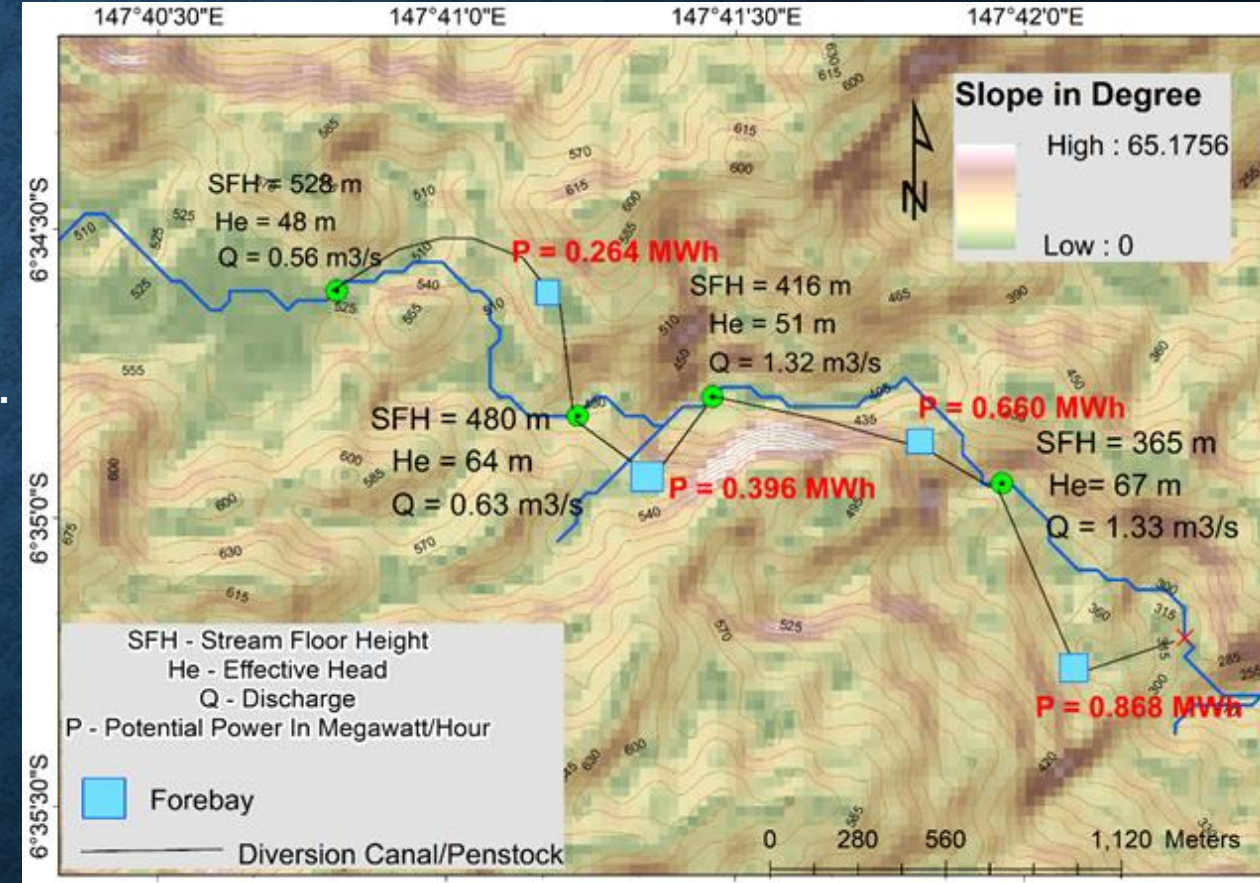
Earth Science provides insights into natural disasters like earthquakes, hurricanes, and tsunamis, aiding in prediction, mitigation, and response efforts, ultimately saving lives and reducing property damage.

# Earth Science and System

Why is Earth Science Important to Study:

## Resource Management:

It is vital for managing Earth's resources sustainably, from water and minerals to energy sources, ensuring their responsible use for current and future generations.

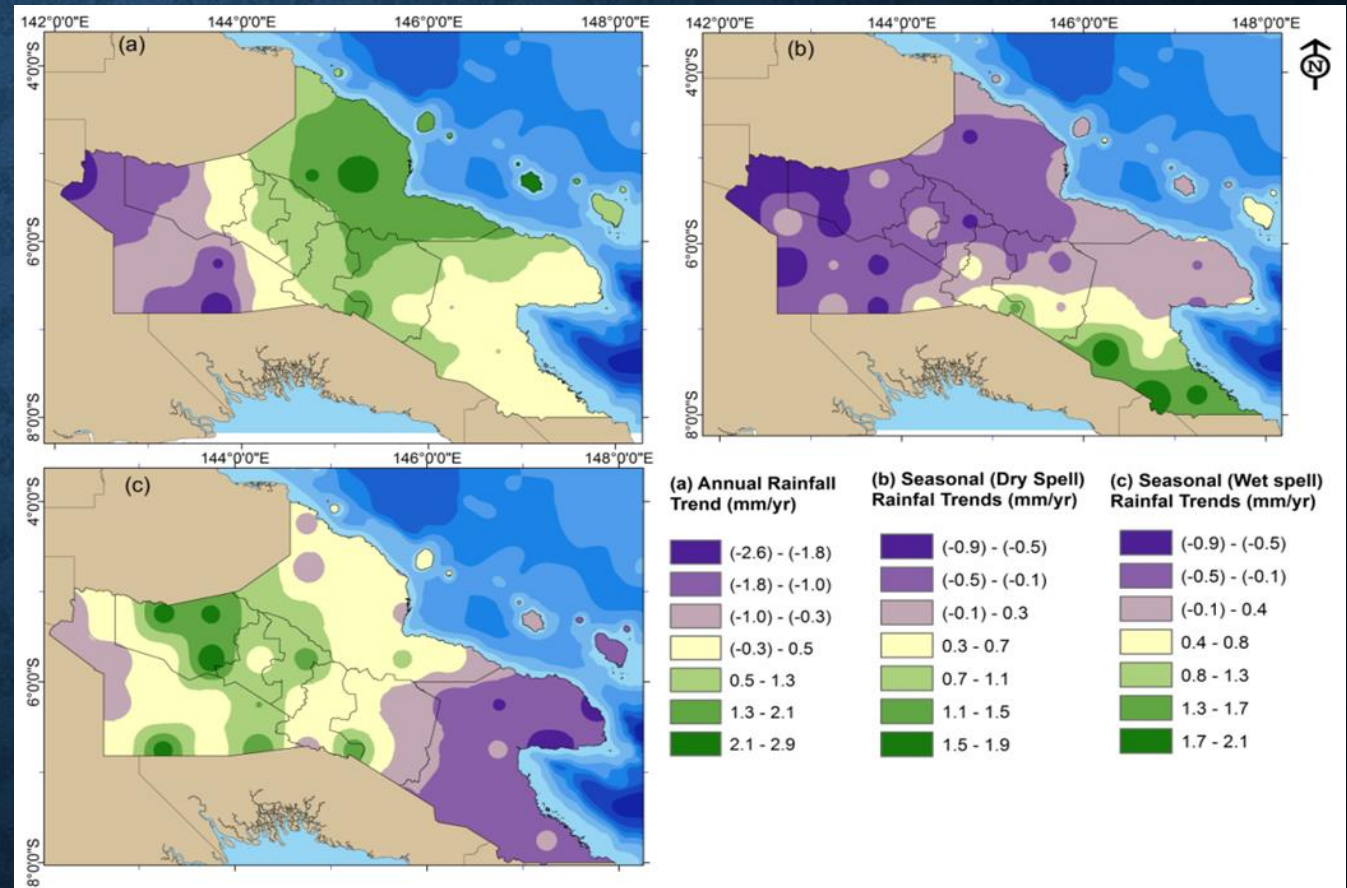


# Earth Science and System

Why is Earth Science Important to Study:

## Climate Study:

Earth Science contributes to climate research, helping us understand climate change, its impacts, and how to address it



# Earth Science and System

## Geo-Informatics in Earth Science:

- ❖ GIST plays a vital role in scientific research, with a broad array of applications for spatial data and visualizations in earth science.
- ❖ The professionals who use these methods to gather, analyze, manipulate and visualize geographic data can reveal fascinating details about our world and even other planets.

# Earth Science and System

## Geo-Informatics in Earth Science:

- ❑ GIST IN GEOLOGY
- ❑ GIST IN METEOROLOGY
- ❑ GIST IN OCEANOGRAPHY
- ❑ GIST IN ENVIRONMENTAL SCIENCE
- ❑ GIST IN ASTRONOMY

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