Cartography & Maps

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Cartography

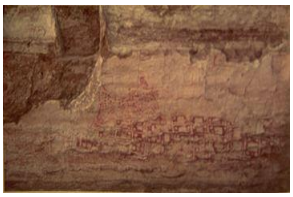
- χάρτης **chartis**(map) and γράφειν **graphein**(write)
- The body of practical & theoretical knowledge about making distinctive visual representations of the Earth's surface in the form of maps
- the art, science and technology of making maps together with their study as scientific documents and works of art.

Cartography

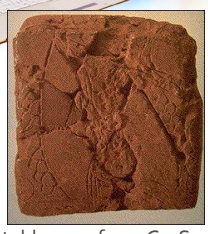
- Discipline as old as humankind and as young as today's newspaper
- It includes all types of maps, plans, charts, sections, 3D models, and globes representing the earth or any celestial body at any scale.

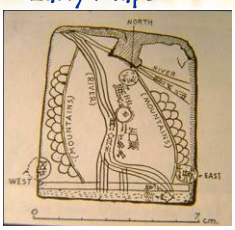
Brief History of Cartography Early Maps

- Wall painting depicting the ancient city of Catal Hyuk
- 6000 B.C.
- Town plan consisting of 80 buildings
- positions of the streets and houses of the town together with some topographic features



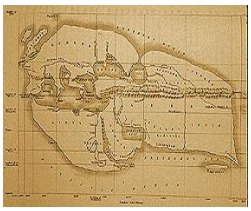
Brief History of Cartography Early Maps

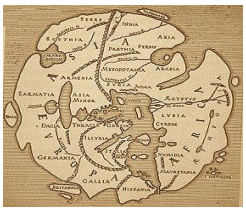




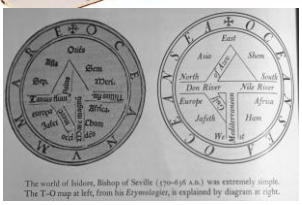
- Clay table map from Ga-Sur (2300 B.C.)
- drawn with cuneiform characters and stylized symbols scratched in the clay and inscriptions name some places and features.

Brief History of Cartography Early Maps



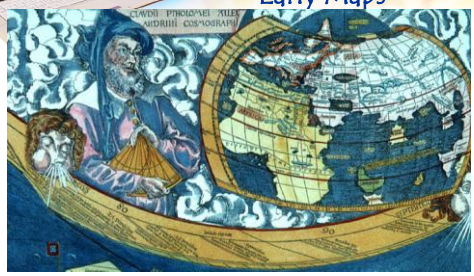


Brief History of Cartography
Early Maps



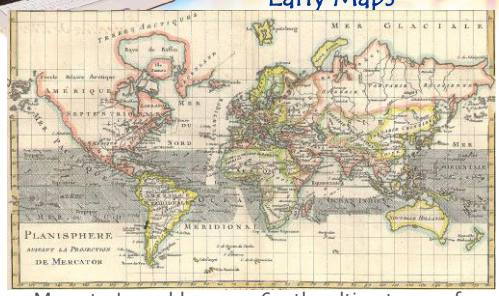
- T and O maps
- Depicting the Earth as a circle covered with water

Brief History of Cartography
Early Maps



- Waldseemüller's world map, 1507, the first map to incorporate New World discoveries

Brief History of Cartography
Early Maps



- Mercator's world map, 1569, the ultimate map for navigation of the world

Cartography

- 15th century – discovery of Ptolemy's writing and maps
- 16th century – interest in the outside world
- 17th century – scientific method
- 18th century - maps were less decorative and more accurate and improved method of measuring earth distances
- 19th century - introduction of metric system and invention of lithography and color-printing
- 20th century – advances in electronic technology have led to a new revolution in cartography

Types of Cartographers

- Geocartographer
- Topocartographer
- Aerocartographer
- Cartotechnician

How do cartographers make maps?

- Choose a scale
- Choose the map projection
- Cartographic generalization
- Design and graphic manipulation
- Drawing of maps
- Reproduction

Maps

- Two-dimensional, graphic representations that use lines and symbols to convey information about spatial relationships
- Graphic representation of the milieu
- Abstraction of reality used for analyzing, storing, and communicating information about the locations, attributes and interrelationships of physical and social phenomena that are distributed over the earth's surface

Maps vs. Globes

MAP	GLOBE
2-dimensional graphical representation of the Earth's surface	3-dimensional representation of the Earth
More information can be shown	Less information can be shown
Can show the whole world at one glance	Can only show half of the Earth at one glance
Specific areas of interest (e.g. countries, cities, etc) can be shown in great detail when individual maps of those areas are created	Cannot show specific areas of interest in great detail unless the globe becomes too large
Handy	Bulky

Elements of a Map

- Title
- Legend
- Scale
- Map Orientation
- Inset Map
- Coordinate Grid
- Map projection
- Source

Basic Elements of Map Composition

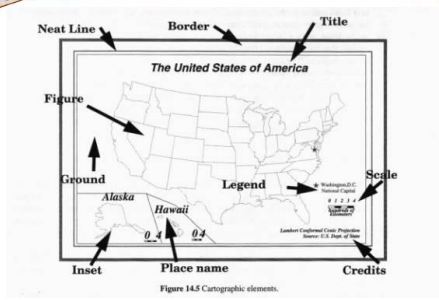
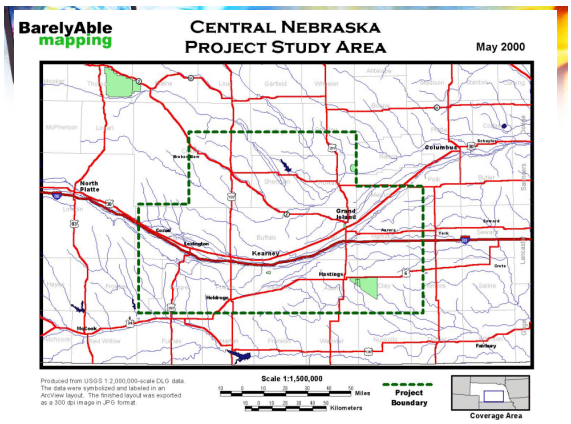
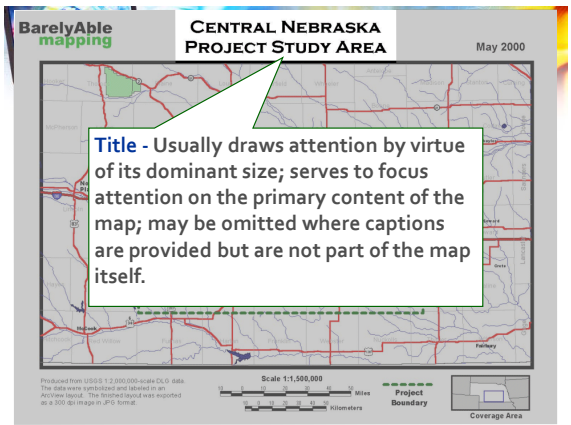
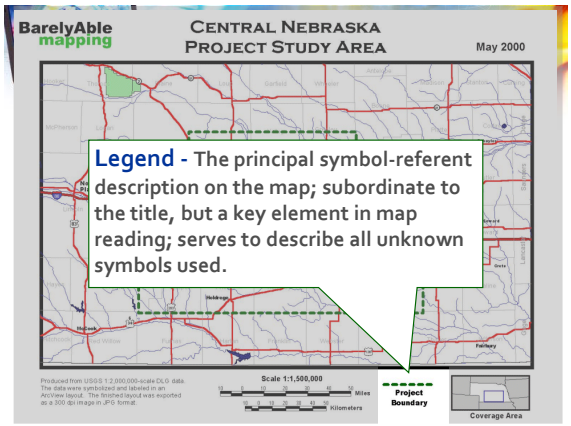
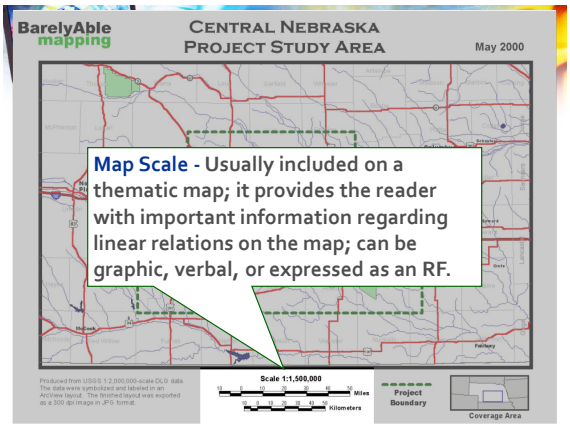


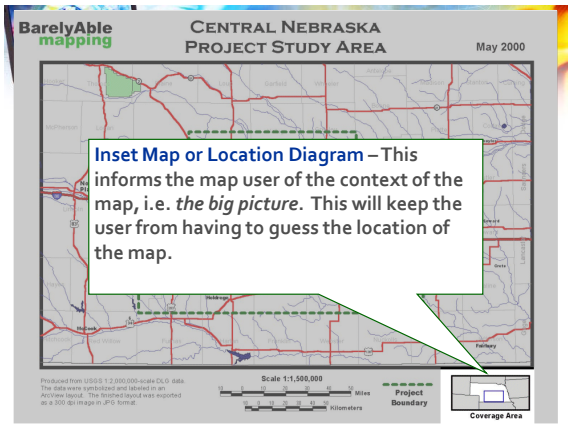
Figure 14.5 Cartographic elements.






BarelyAble mapping
CENTRAL NEBRASKA PROJECT STUDY AREA
May 2000
Legend - The principal symbol-referent description on the map; subordinate to the title, but a key element in map reading; serves to describe all unknown symbols used.
Scale 1:1,500,000
Miles
Kilometers
Project Boundary
Coverage Area


BarelyAble mapping
CENTRAL NEBRASKA PROJECT STUDY AREA
May 2000
Map Scale - Usually included on a thematic map; it provides the reader with important information regarding linear relations on the map; can be graphic, verbal, or expressed as an RF.
Scale 1:1,500,000
Miles
Kilometers
Project Boundary
Coverage Area


BarelyAble mapping
CENTRAL NEBRASKA PROJECT STUDY AREA
May 2000
Inset Map or Location Diagram – This informs the map user of the context of the map, i.e. the big picture. This will keep the user from having to guess the location of the map.
Scale 1:1,500,000
Miles
Kilometers
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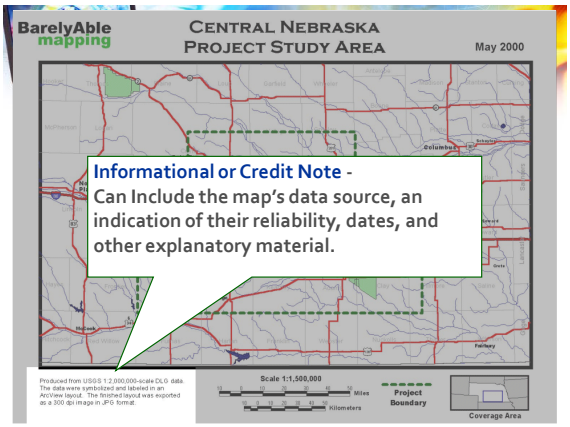
Coverage Area


BarelyAble mapping
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May 2000
Informational or Credit Note - Can Include the map's data source, an indication of their reliability, dates, and other explanatory material.
Scale 1:1,500,000
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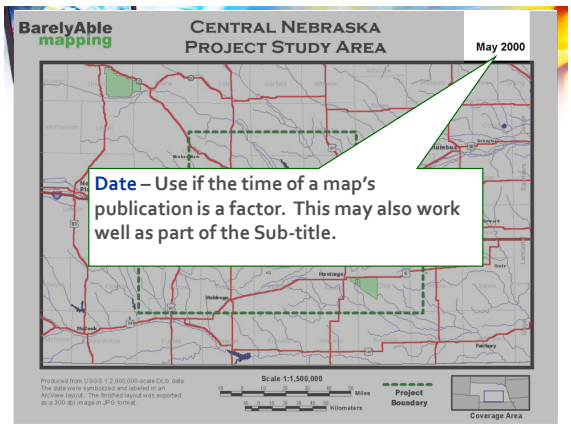
BarelyAble mapping
CENTRAL NEBRASKA PROJECT STUDY AREA
May 2000
Date – Use if the time of a map's publication is a factor. This may also work well as part of the Sub-title.
Scale 1:1,500,000
Miles
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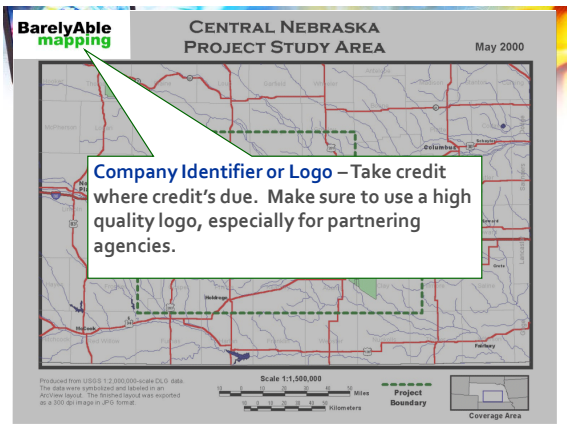
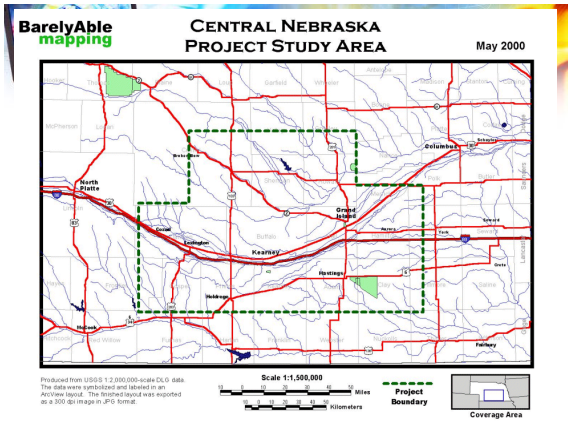

BarelyAble mapping
CENTRAL NEBRASKA PROJECT STUDY AREA
May 2000
Company Identifier or Logo – Take credit where credit's due. Make sure to use a high quality logo, especially for partnering agencies.
Scale 1:1,500,000
Miles
Kilometers
Project Boundary
Coverage Area



Map Projection

- Method by which the curved surface of the earth is represented on a flat surface
- it has to maintain one or two of the following characteristics:
- **S**hape
- **A**rea/angle
- **D**istance
- **D**irection

Map Projection

- **Distortion** – the inevitable problem of map projection
- one projection distorts the size, the area, distance, and direction and can only maintain one or two of these characteristics
- There is no perfect projection. It depends on the country/area that you want to project

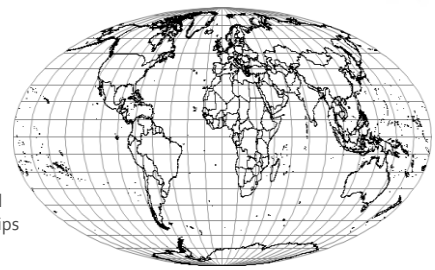
Map Projection

MERCATOR PROJECTION OF THE WORLD

- **Mercator Projection**
  - Preserves directional relationships, shape and distance
  - Distorts area

Map Projection

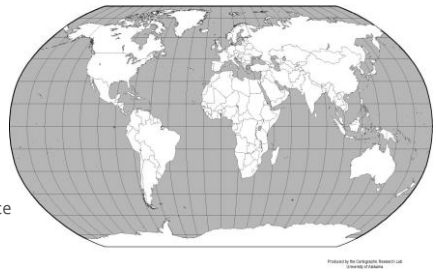
- **Mollweide Projection**
  - Preserves area
  - Distorts shape & directional relationships



Map Projection

ROBINSON PROJECTION OF THE WORLD

- **Robinson Projection**
  - Size and shape are distorted
  - Designed purely for appearance

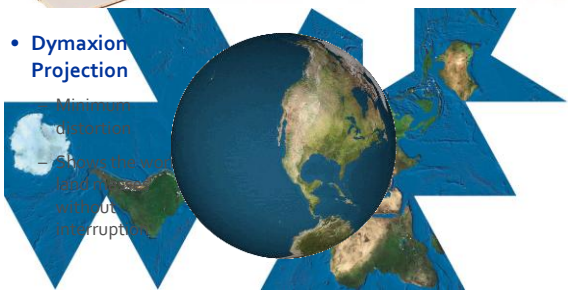


Map Projection

- **Peter's Projection**
  - Prominence to underdeveloped countries
  - Criticized on the grounds of aesthetics

Map Projection

- **Dymaxion Projection**
  - Minimum distortion
  - Shows the world's landmasses without interruption

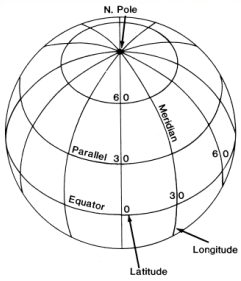


Coordinate Grid

- Grid that covers the Earth, allowing any point on Earth's surface to be accurately referenced.
- Made up of:
  - Parallels
  - Meridians
  - Latitude
  - Longitude

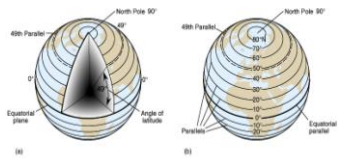
Parallels and Meridians

- Parallels – imaginary horizontal lines between poles
- Meridians – imaginary vertical lines from the north to south poles.



Latitude

- Measured in terms of angular distances between parallels north or south of the equator
  - Equator = 0°
  - Tropic of Cancer = 23.5°



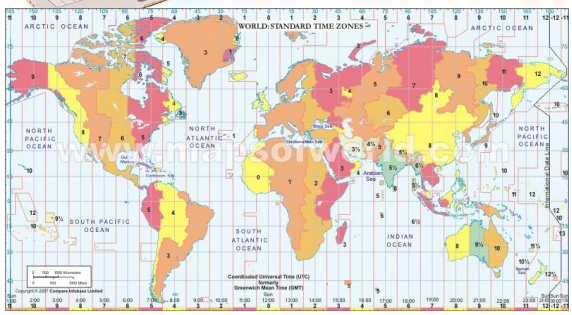
Longitude

- Measured in terms of angular distances east and west from the prime meridian
  - Prime Meridian = 0°

Time Zones

- Measured based on longitude
- An hour is equal to 15° of the Earth's rotation
- Reference point – Greenwich Meridian Time or the GMT

Time Zones



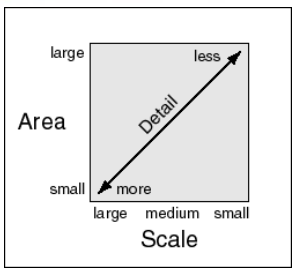
Classification of Maps

- A. According to Scale
- B. According to Function
- C. According to Subject Matter

According to Scale

- Map Scale – ratio between linear distance on a map and linear distance on Earth's surface
- 1. Small scale (1:500,000 or more)
- 2. Medium scale (between 1:50,000 and 1:500,000)
- 3. Large scale (1:50,000 or less)

Small- & Large-Scale Maps



Small-Scale Map

Large-Scale Map

According to Function

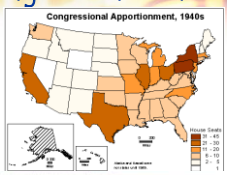
1. General maps (reference maps)
- Objective: To portray the spatial association of a selection of diverse geographical phenomena shown (roads, coastlines, bodies of water, elevation, etc.)

According to Function

- General Maps
  - Topographic maps
  - Road maps
  - Maps of states, countries & continents in atlases

According to Function

2. Thematic maps (special purpose maps)
- Objective: To illustrate a special theme usually of a scientific or lay-oriented character
  - Dot maps
  - Isolines
  - Choropleth maps
  - Located charts
  - Proportional symbol maps

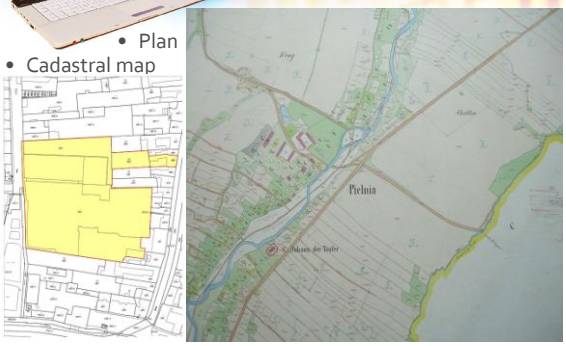


According to Subject Matter

- Cadastral map - shows the geographic relationship among the various parcels of land, records property boundaries
- Plan - a detailed map showing buildings, roadways, boundary lines and administrative boundaries
- Soil maps
- Geologic maps
- Climatic maps
- Population maps

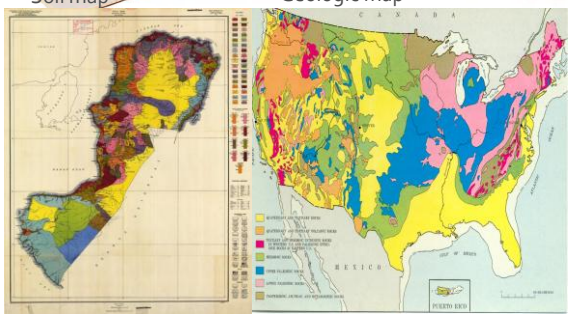
According to Subject Matter

- Plan
- Cadastral map



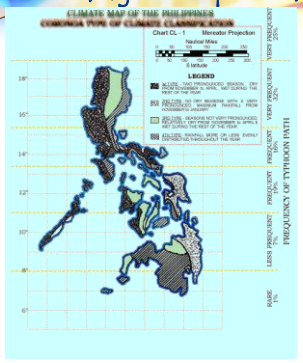
According to Subject Matter

- Soil map
- Geologic map



According to Subject Matter

- Climatic map



Why the need to understand maps?

- a sense of the layout of features in a place: knowing what is where
- an awareness of an area or a place: what type of place this is and what variety there might be in it
- the capacity to give/follow routes: finding the way
- understanding spatial patterns: understanding effect of what is where
- planning for the future: appreciating the impact of change

The Value of Maps

- As a way of recording and storing information
- As a means of analyzing locational distributions and spatial patterns
- As a method of presenting information and communicating findings

Remote Sensing

- science and art of acquiring information about material objects, area, or phenomenon
- without coming into physical contact with the objects, or area, or phenomenon under investigation
- The collection of information about parts of Earth's surface by means of aerial photography or satellite imagery designed to record data on visible, infrared, and microwave sensor systems.

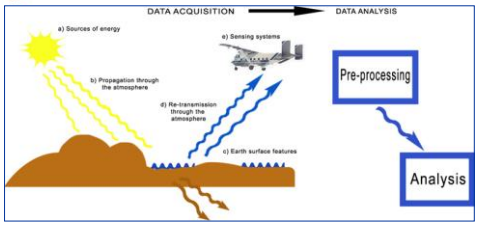
Remote Sensing

- Used for a variety of purposes:
  - Monitoring crop production
  - Measuring deforestation
  - Surveying endangered species
  - Preparing military maps

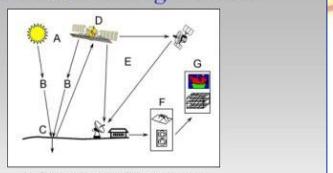
Remote Sensing

- The remote sensing process consists of:
- the sun as a source of radiant energy,
- transmission of solar radiation through the atmosphere,
- interaction of the solar radiation with the surface,
- transmission of reflected solar radiation back through the atmosphere towards the sensor,
- interception of the radiation by the sensor, and
- analysis.

Remote Sensing



Remote Sensing Process



- Energy Source or Illumination (A)
- Radiation and the Atmosphere (B)
- Interaction with the Target (C)
- Recording of Energy by the Sensor (D)
- Transmission, Reception, and Processing (E)
- Interpretation and Analysis (F)
- Application (G)

Canada Center for Remote Sensing (accessed June 25, 2002)

Geographic Information Systems (GIS)

- Integrated computer tools for the handling, processing, and analyzing of geographical data
- Computer- based system for the capture, storage, retrieval, manipulation, analysis and display of geographic information.
- GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps.

Geographic Information Systems (GIS)

- Organized collection of computer hardware, software and geographic data that is designed to capture, store, update, manipulate, and display geographically referenced information
- A GIS stores information about the world as a collection of *thematic layers that can be linked* together by geography.
- Incorporates programs to store and access spatial data, to manipulate those data, and to draw maps

Geographic Information Systems (GIS)

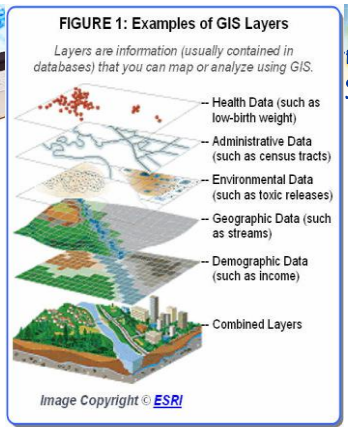
- Can render visible many aspects of geography that were previously unseen
- A GIS stores information about the world as a collection of *thematic layers that can be linked* together by geography.
- Incorporates programs to store and access spatial data, to manipulate those data, and to draw maps

Geographic Information Systems (GIS)

- Military applications of GIS:
  - Calculate line-of-sight from tanks and defensive emplacements
  - Allows cruise missiles to fly below enemy radar
  - Provide a comprehensive basis for military intelligence
- Other applications of GIS:
  - Decide how best to route emegency vehicles to accidents
  - Monitor the spread of infectious diseases
  - Identify the location of potential business customers
  - Identify the location of potential criminals
  - Provide a basis for urban and regional planning

Geographic Information Systems (GIS)

- Primary requirement data for GIS
  - Longitude
  - Latitude
  - Elevation
  - Variables that can be located spatially
- Data capture – time consuming component of GIS work
  - Integrating different sources of data, different systems of measurement, different scales, different systems of representation, etc.



SOURCES:

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- http://www.clarkab.org/maps/
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