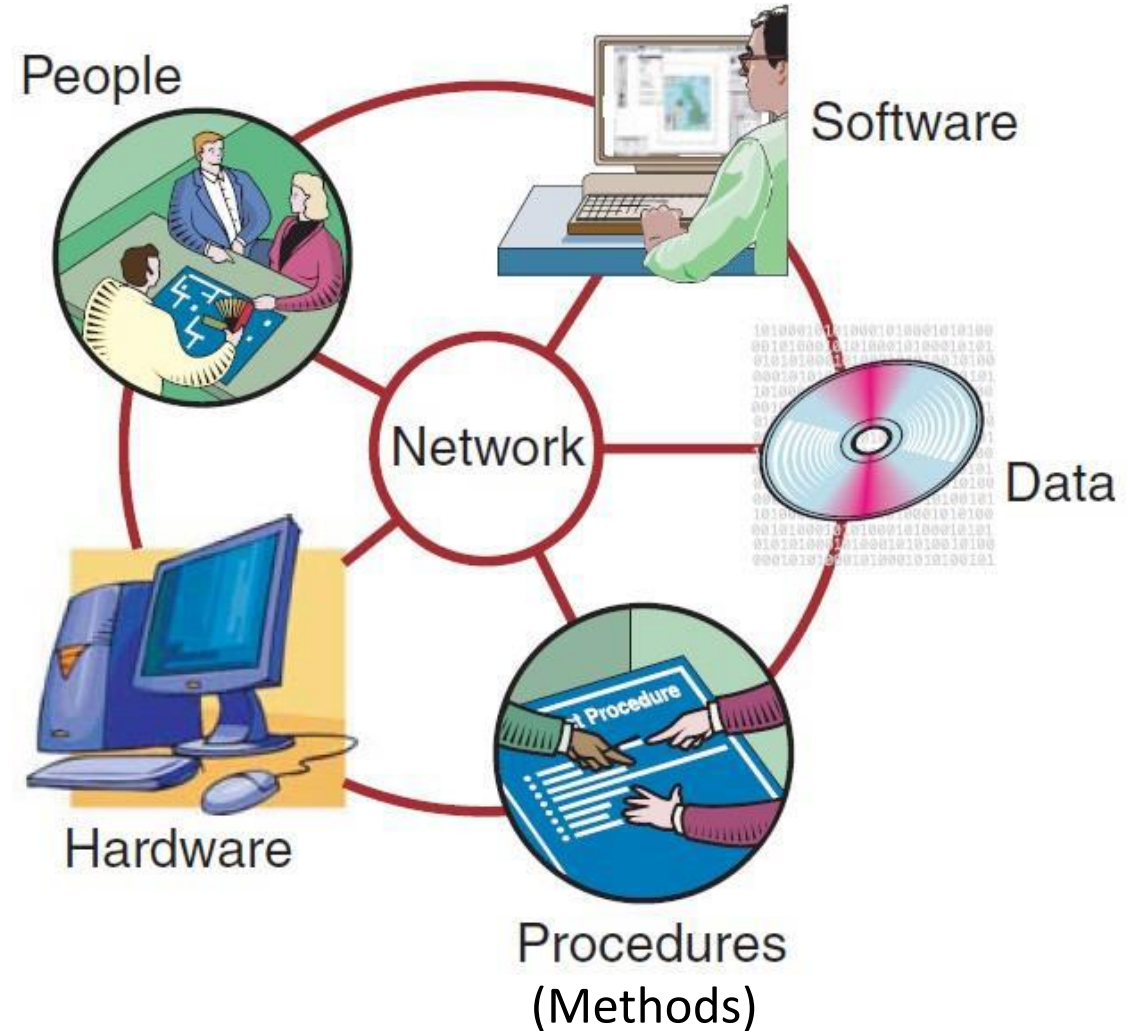## ➤ What is GIS ?

- ➤ A computer system for
  - collecting,
  - storing,
  - manipulating,
  - analyzing,
  - displaying, and
  - querying
  - reporting

geographically related information.

➤ Components of GIS

People

Software

Network

Data

Hardware

Procedures
(Methods)

➢ **What is GIS ?**

- A geographic information system—or GIS—is a special type of information technology that can help us understand and relate to the **"what," "when," "how," and "why" of the world by answering "where."**

- Geographic information systems are indeed about maps, but they are also about much, much more.

- **GIS is about geography and learning about the world in which we live.**
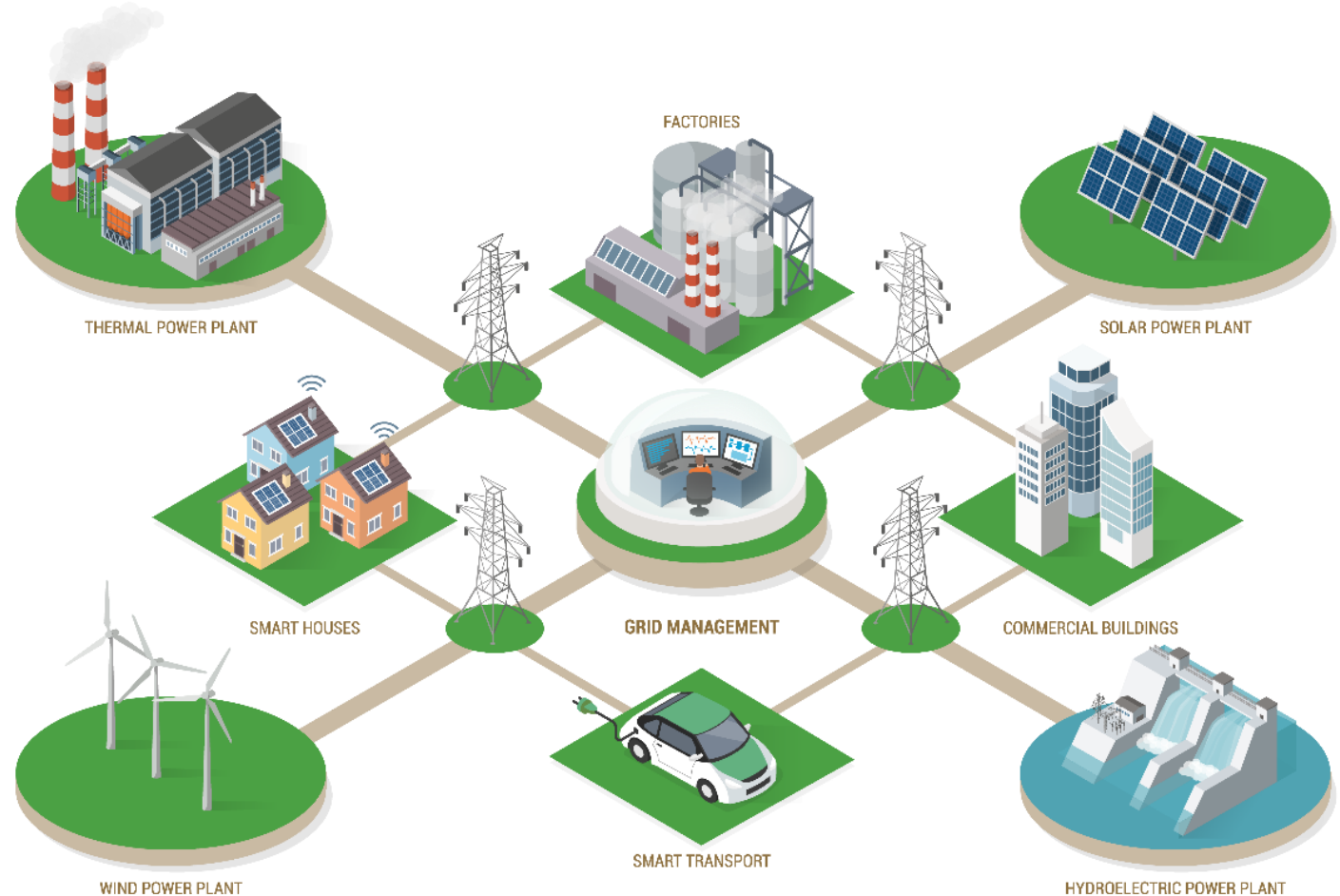
➤ **Spatial Thinking**

❖ How do we think geographically every day with **mental maps?**

❖ **Humans are <u>inherently spatial organisms,</u> and in order for us to live in the world, we must first somehow relate to it.**

- Mental or cognitive maps are **psychological tools that we all use every day.**

- As the name suggests, mental maps are maps of **our environment that are stored in our brain.**

- We rely on our mental maps to get from one place to another, to plan our daily activities, or to understand and situate events that we hear about from our friends, family, or the news.

- Mental maps also reflect the **amount and extent of geographic knowledge and spatial awareness** that we possess.

➢ **Spatial Thinking**

- What did you choose to draw on your map?

- Is your house or where you work on the map?

- What about streets, restaurants, malls, museums, or other points of interest?

- How did you draw objects on your map?

- Did you use symbols, lines, and shapes?

- Are places labeled?

- Why did you choose to include certain places and features on your map but not others?

- What limitations did you encounter when making your map?
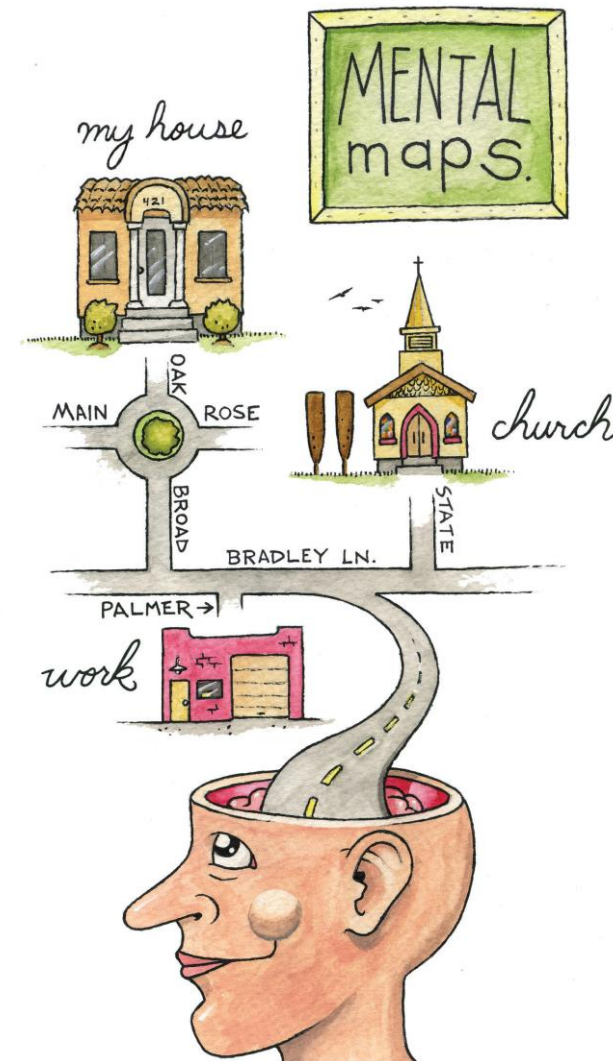
➤ Spatial Thinking – exercise

- This simple exercise is instructive for several reasons.

  1. It illustrates **what you know about where you live.**

  2. It highlights the way in which **you relate to your local environment.**

  3. If we were to compare your mental map to someone else's from the same place, certain similarities emerge that shed light upon how we as humans **tend to think spatially and organize geographical information in our minds.**

  4. This exercise reveals something **about your artistic, creative, and cartographic abilities.**

❑ To reinforce these points, consider the series of mental maps of Los Angeles provided in Figure **"Mental Map of Los Angeles A".**

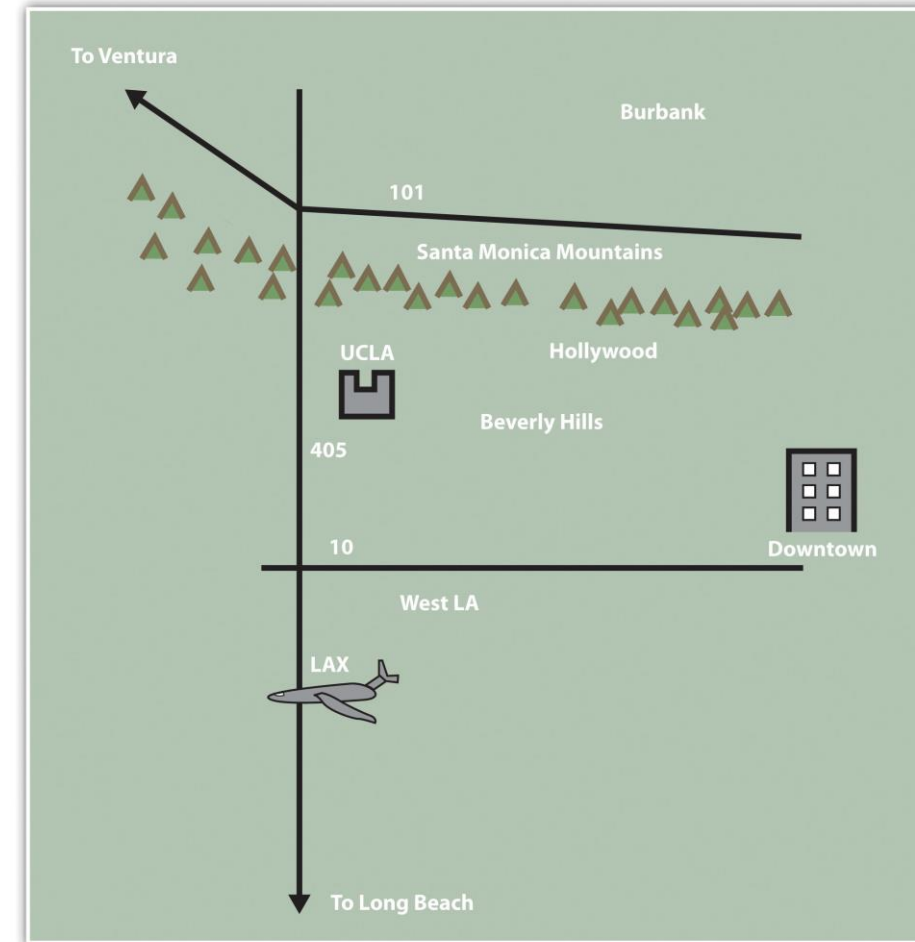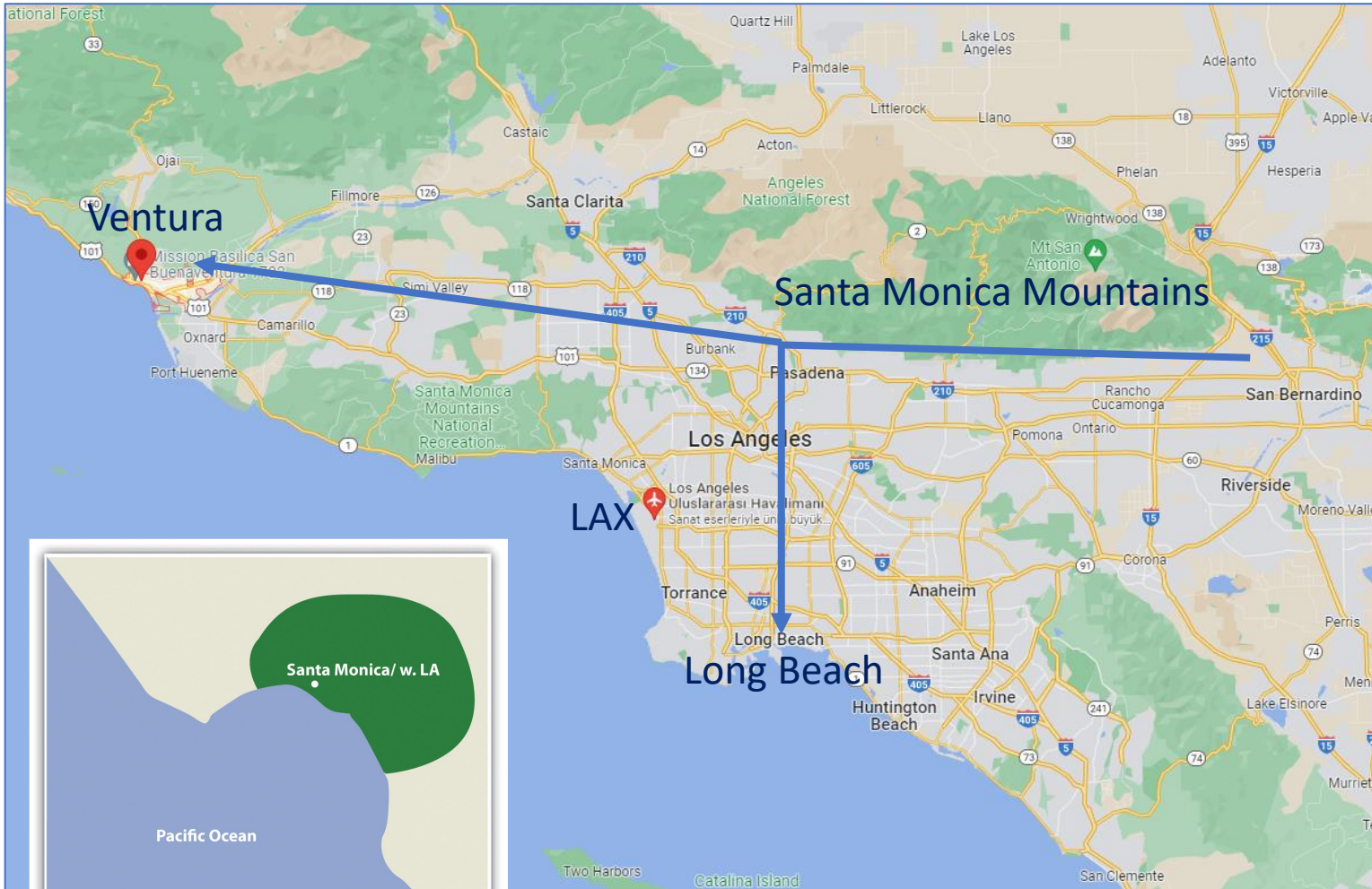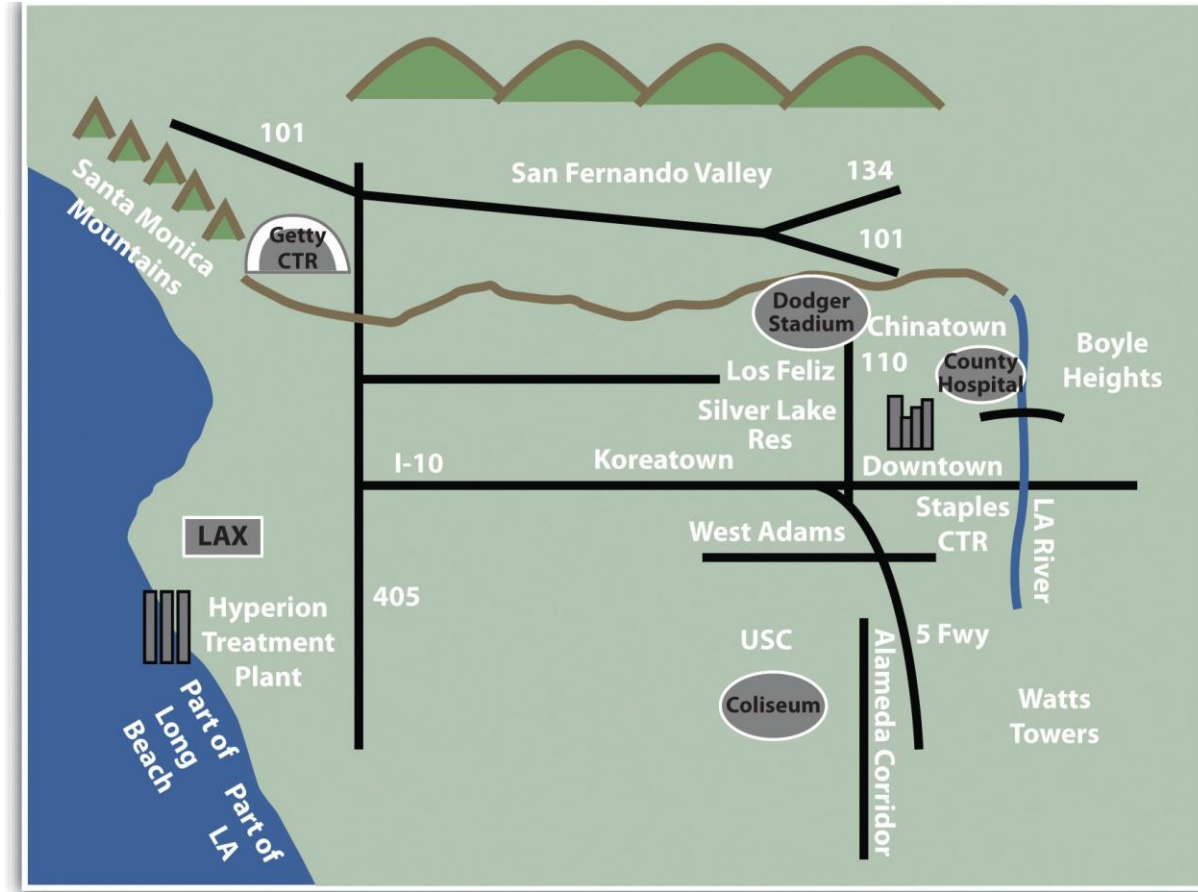➢ **Spatial Thinking – exercise**
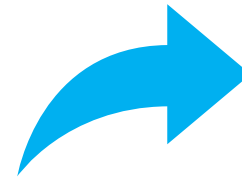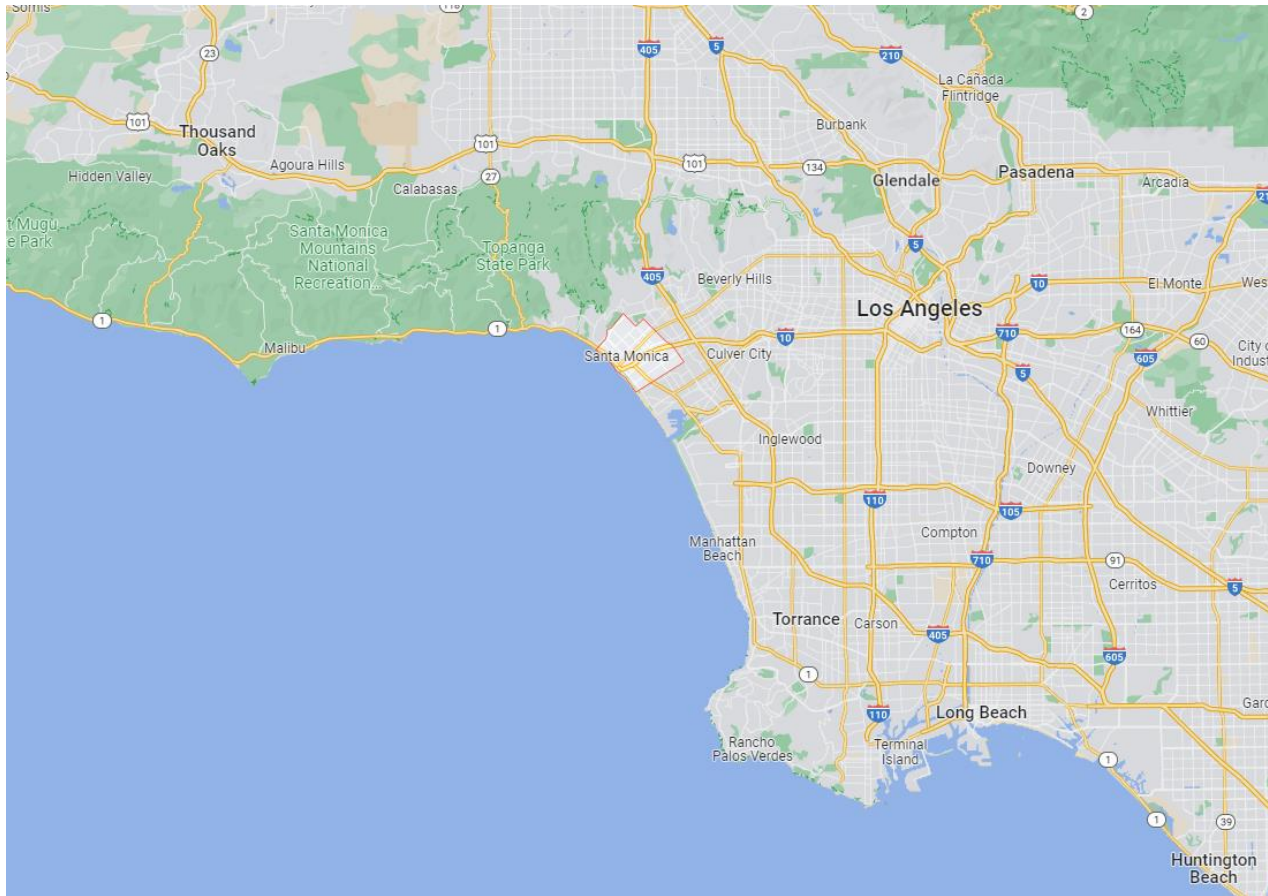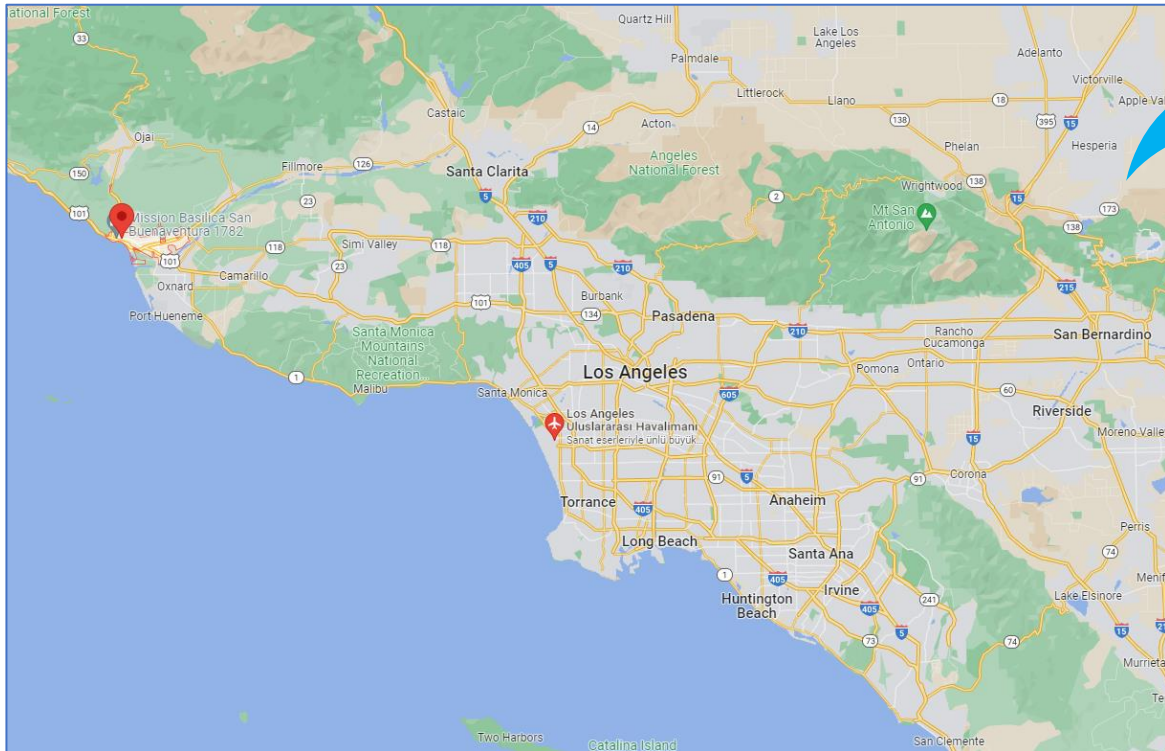
➢ **Spatial Thinking – exercise**

➢ **Spatial Thinking – exercise**

➤ **Spatial Thinking – exercise**

✓ Take a moment to look at each map and compare the maps with the following questions in mind:

1) What **similarities** are there on each map?

2) What are some of the **differences**?

3) **Which places or features** are illustrated on the map?

4) What **assumptions** are made in each map?

➢ **Spatial Thinking – question**

- Though there may be no such thing as a "dumb" question, **some questions are indeed better than others.**
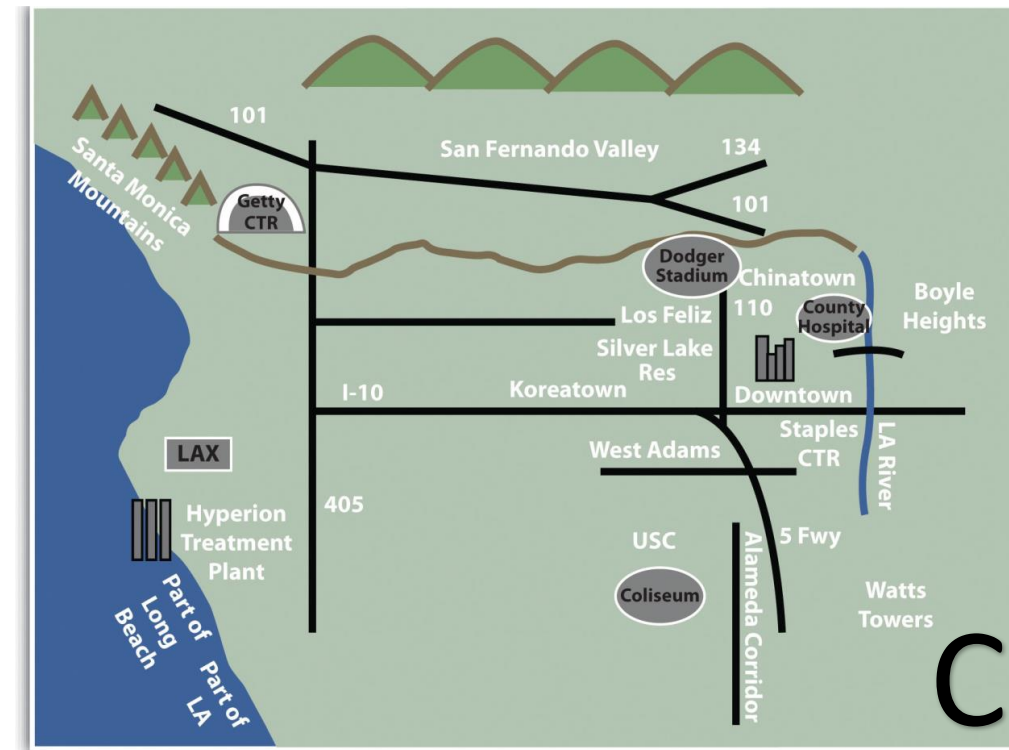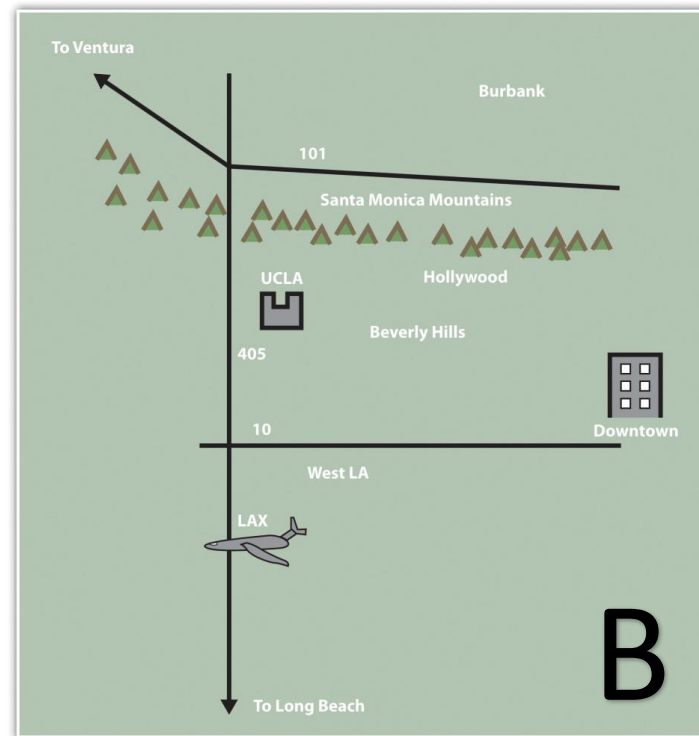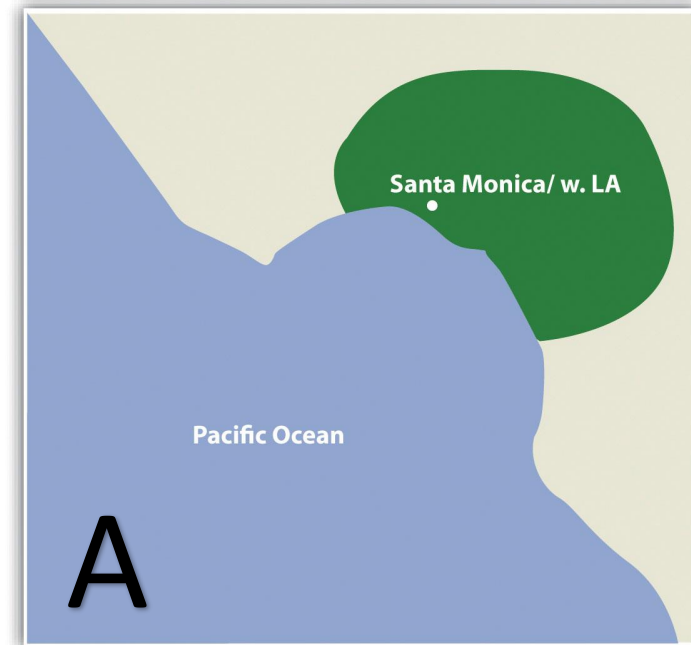
- **Learning how to ask the right question takes practice and is often more difficult than finding the answer itself.**

- However, **when we ask the right question, problems are more easily solved and our understanding of the world is improved.**

- **There are five general types of geographic questions** that we can ask and that GIS can help us to answer.

The position of a phenomenon on the surface of the earth.

1- Questions about **geographic location**:

- Where is it?
- Why is it here or there?
- How much of it is here or there?

2- Questions about **geographic distribution**:

- Is it distributed locally or globally?
- Is it spatially clustered or dispersed?
- Where are the boundaries?

Describes how phenonmena are spread across the surface of the earth.

➤ **Spatial Thinking – question**

• **There are <u>five</u> general types of geographic questions** that we can ask and that GIS can help us to answer.

3- Questions about <u>**geographic association**</u>:

• What else is near it?
• What else occurs with it?
• What is absent in its presence?

Refers to how things are related to each other in space.

Describes the linkages and relationships bewteen places.

4- Questions about <u>**geographic interaction:**</u>

• Is it linked to something else?
• What is the nature of this association?
• How much interaction occurs between the locations?

5- Questions about <u>**geographic change**</u>:

• Has it always been here?
• How has it changed over time and space?
• What causes its diffusion or contraction?

Refers to the persistence, transformation, or disappearance of phenomena on the earth.

➢ **Geographic Concepts**

✓ The objective of this section is to introduce and explain how the key concepts of **location, direction, distance, space, and navigation** are relevant to GIS.

❖ **Location**
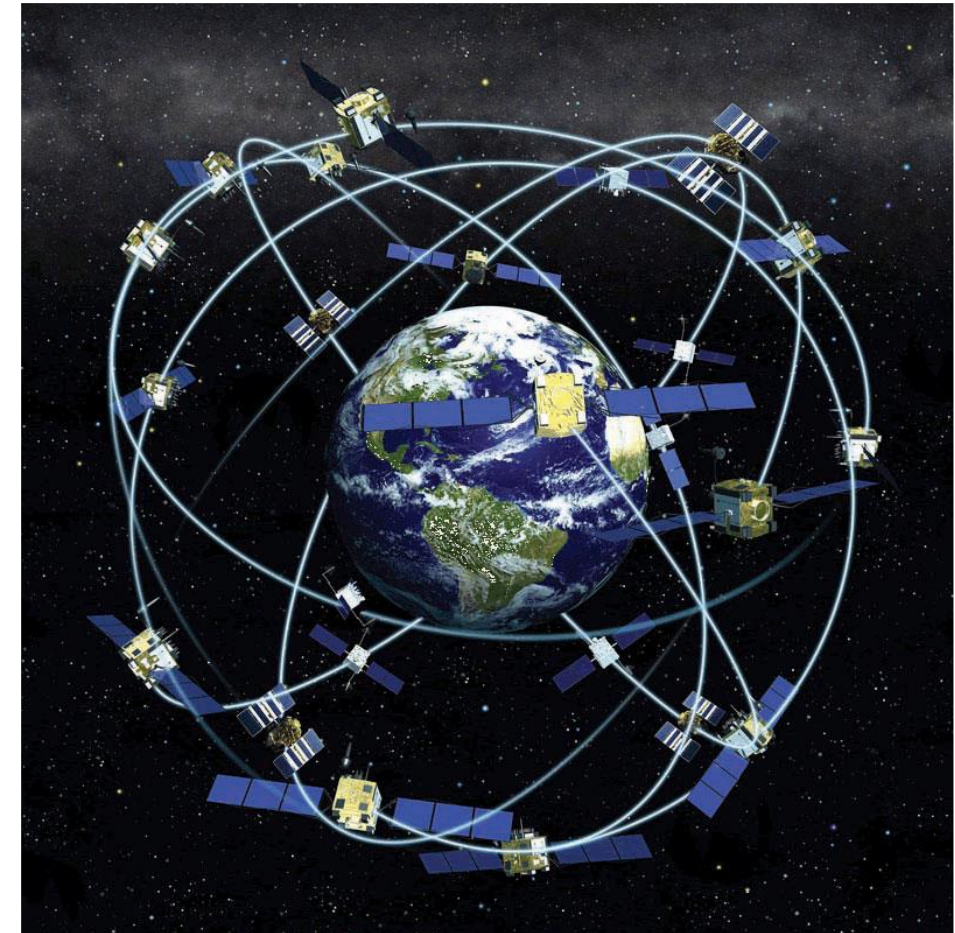
• The one concept that **distinguishes geography from other fields is location**, which is **central to a GIS.**

• Location is simply a **position on the surface of the earth.**

• What is more, nearly **everything can be assigned a geographic location.**

• Once we know the location of something, we can a put it on a map, for example, with a GIS.


Global Positioning System (GPS)

➤ **Geographic Concepts**

❖ **Direction**

- Like location, the concept of **direction is central to geography and GISs.**

- **Direction refers to the position of something relative to something else usually along a line.**

- In order to determine direction, a reference point or benchmark from which direction will be measured needs to be established.

➤ **Geographic Concepts**

❖ **Tobler's First Law of Geography (1970)**
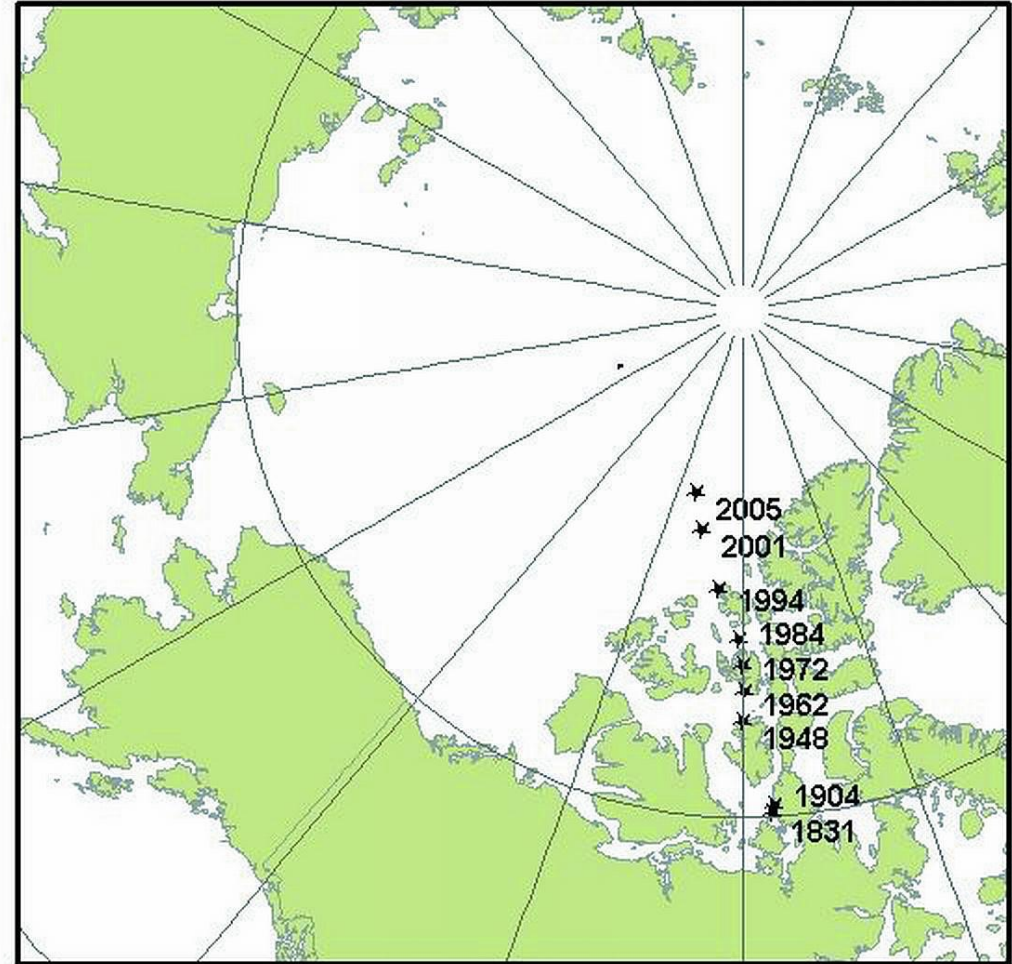
❖ **Distance**

- **Complementing the concepts of location and direction is distance.**

- Distance refers to the degree or amount of separation between locations and can be measured in **nominal or absolute terms with various units.**

- We can describe the distances between locations nominally as **"large" or "small,"** or we can describe two or more locations as **"near" or "far apart."**
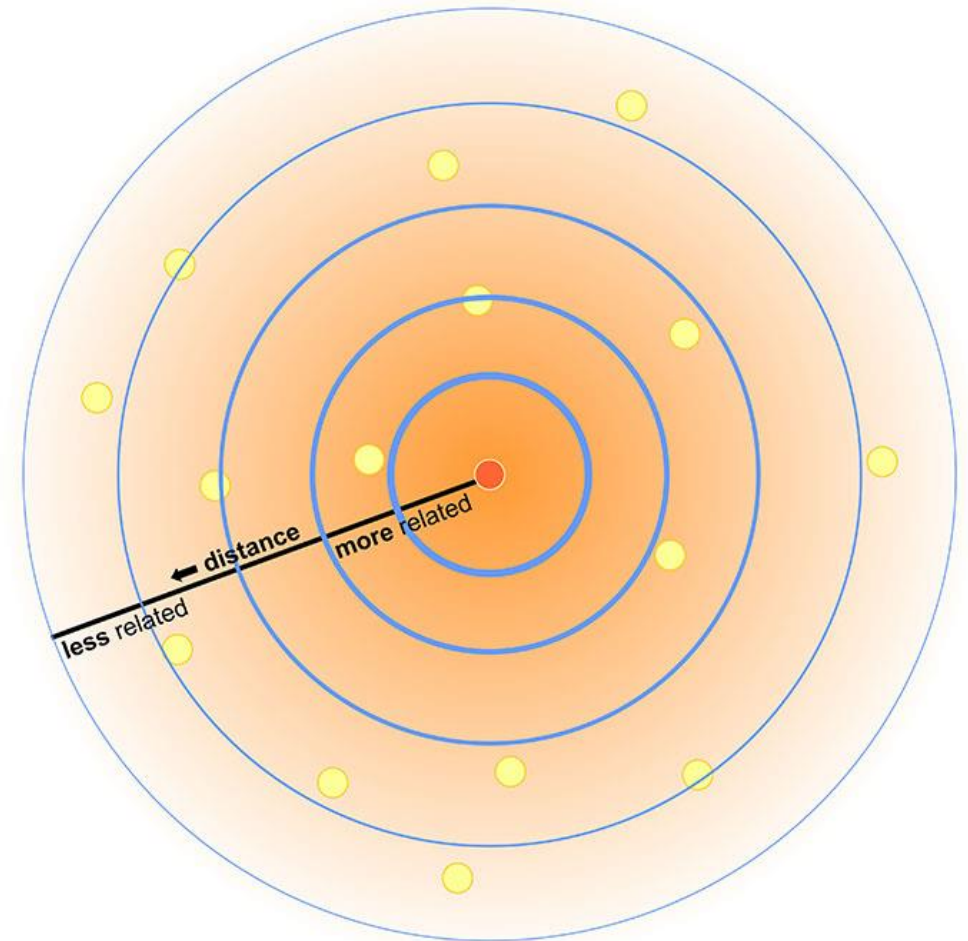
"...everything is related to everything else, but **near and recent** things are more related than distant things."

https://www.youtube.com/watch?v=0aV6HHwJuo4

➤ Geographic Concepts

❖ Space

- Where distance suggests a measurable quantity in terms of how far apart locations are situated, **space is a more <u>abstract</u> concept that is more commonly described rather than measured.**

- For example, **space can be described as "empty," "public," or "private."**

- Within the scope of a GIS, we are interested in space, and in particular, we are interested in what fills particular spaces and **how and why things are distributed across space.**

- In this sense, **space is a somewhat ambiguous and generic term that is used to denote the general geographic area of interest.**

➤ Geographic Concepts

❖ Navigation

- Transportation maps like those discussed previously illustrate how we move through the environments where we live, work, and play.

- **This movement** and, in particular**, destination-oriented travel are generally referred to as navigation.**

- **How we navigate** through space is a complex process that blends together **our various motor skills**; **technology; mental maps**; and **awareness of locations, distances, directions**, and the **space where we live.**

✓ **The destination-oriented travel through space.**

➤ **About GIS**

(a) Raster digital elevation model
(b) Raster land cover data
(c) Satellite image
(d) Digital colour aerial photograph
(e) Vector contours and roads
(f) Vector soil polygons
(g) Vector census polygon boundaries
(h) Vector land cover polygons

CUSTOMERS
STREETS
PARCELS
ELEVATION
LAND USAGE
REAL WORLD

➢ **About GIS - History**

Decade	Milestones for computer-based GIS
1960's	- Canada Geographic Information System (CGIS) developed: national land inventory pioneered many aspects of GIS - Harvard Lab for Computer Graphics and Spatial Analysis: pioneered software for spatial data handling - US Bureau of Census developed DIME data format - ESRI founded
1970's	- CGIS fully operational (and still operational today) - First Landsat satellite launched (USA) - CARIS founded - USGS begins Geographical Information Retrieval and Analysis System (GIRAS) to manage and analyze large land resources databases and Digital Line Graph (DLG) data format - ERDAS founded - ODYSSEY GIS launched (first vector GIS)

➤ **About GIS - History**

Decade	Milestones for computer-based GIS
1980's	- ESRI launches ARC/INFO (vector GIS) - GPS became operational - US Army Corp of Engineers develop GRASS (raster GIS) - MapInfo founded - First SPOT satellite launched (Europe) - IDRISI Project started (GIS program) - SPANS GIS produced - National Center for Geographic Information and Analysis (NCGIA) established in USA - TIGER digital data

➢ **About GIS - History**

Decade	Milestones for computer-based GIS
1990's	- MapInfo for Windows, Intergraph, Autodesk, others - ESRI produces ArcView and ARCGIS - $7+ billion industry

Decade	Internet
2000's	- Internet becomes major deliver vehicle - More than 1 million active users - Geospatial technology integration

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