GEOG 204

LECTURE 1

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GEOG 204
Introduction to GIS

Fall 2021

Lectures:
Thu: 11.30 - 12.20

Labs:
Room 8-125
Tue: 15.00 – 17.50
Wed: 15.00 – 17.50
Thu: 15.00 – 17.50

Tutorials:
Room 8-362
Mon: 14.30 – 16.20
Mon: 16.30 - 18.20

Outline and notes:
https://gis.unbc.ca

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Defining GIS

- A **geographic information system** (**GIS**)
  - is a system to store, manipulate, analyze, manage, and present geographic data
  - GI systems are under Geomatics. Geomatics is a broad field of study for the methods and tools used from data acquisition to data distribution.

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GIS: a part of the 'Geomatics' field

The geomatics field

- Concerned with the gathering, storing, processing, and delivery of geospatial information
  - Geographic Information Systems
  - Cartography
  - Remote sensing
  - Land surveying
  - Photogrammetry
  - ….

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For the Geographer

- GIS technology has made it possible to efficiently integrate, manage, and analyze geographical information from maps, remote sensors, and text.

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GIS: a definition

- "A geographic information system (GIS) can be defined as a computer application capable of performing virtually any conceivable operation on geographic information, from acquisition and compilation through visualization, query, and analysis to modeling, sharing, and archiving (Longley et al., 1999, 2010)."

Goodchild

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GIS and GIScience

- "Geographic information systems (**GIS**) were originally conceived as digital toolboxes for handling maps; the principles underlying such systems, and framing their design and use, became known as geographic information science (GIScience)."

Goodchild, 2004

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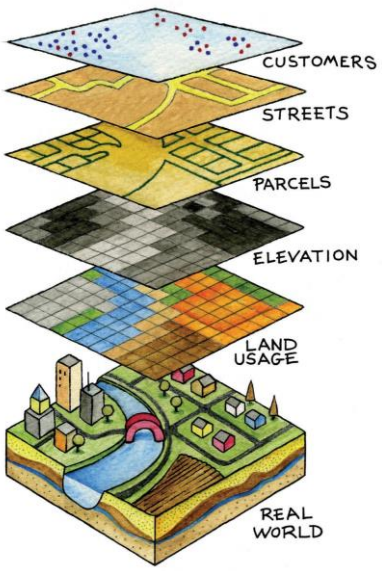
A GIS

Automated ….

- *Acquisition (input)*
- *Management*
- ***Analysis***
- *Display (output)*

*… **of 'spatial' data***



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GIS and GIScience

- Phenomena on the Earth's surface have both geographic and temporal dimensions.
  - In reality we are dealing with spatial-temporal phenomena
    - The problems GIS deals with have different characteristics over space and time.
  - Modelling phenomena has inherent challenges that are constantly being improved
  - GIScience then is an important field of study in its own right.

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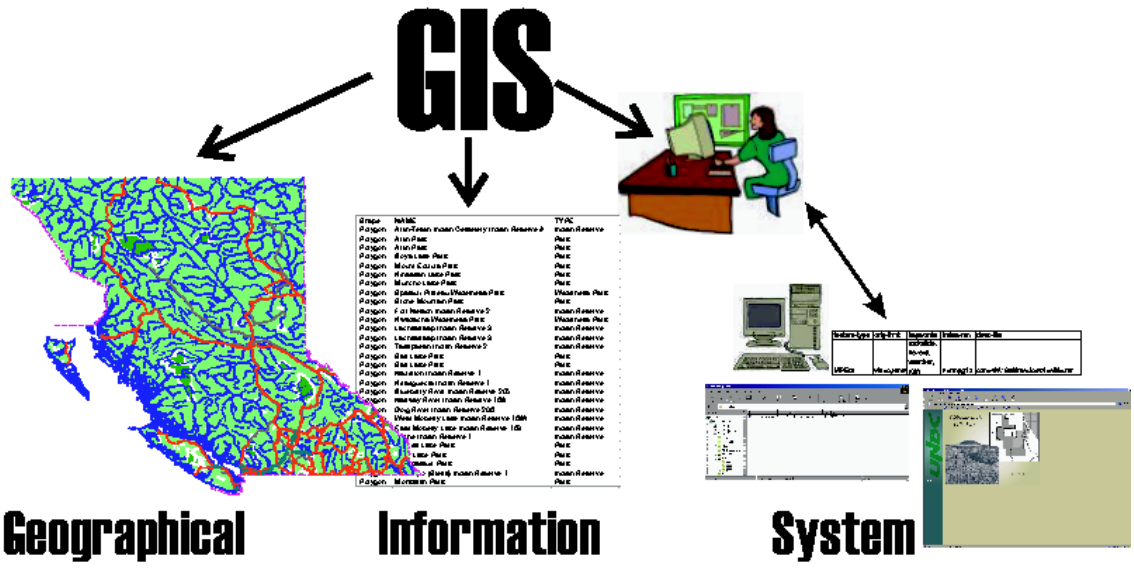

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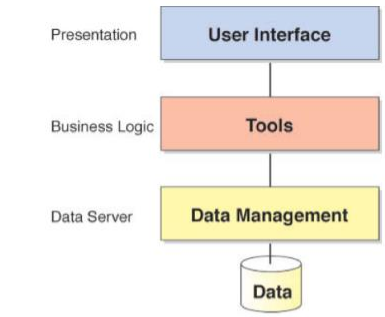
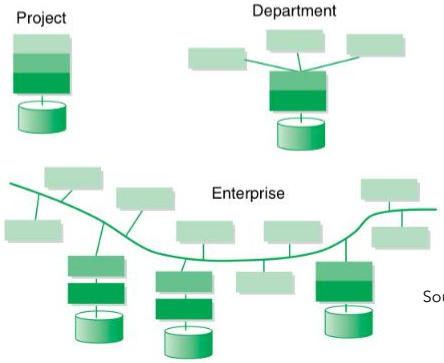
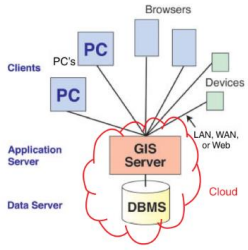
Typical Architecture of a GIS







Source: Longley et al 2015

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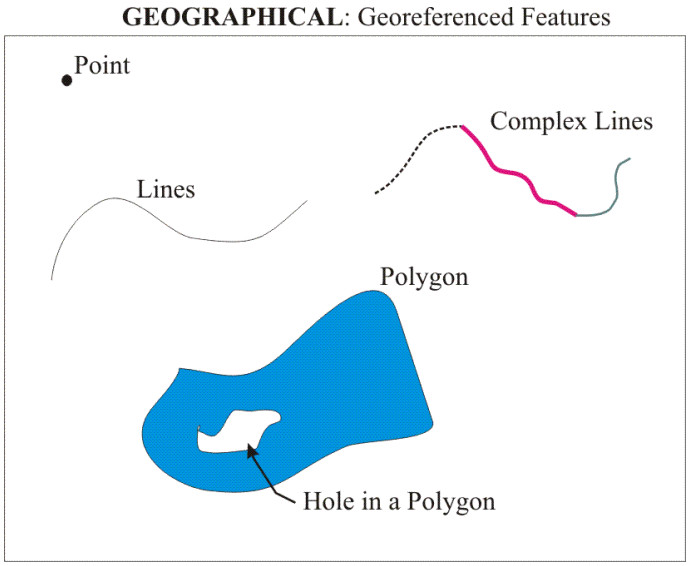
Spatial Features

- *Features* are the objects represented in a GIS – such as lakes, rivers, roads, buildings and points of interest



Presentation Title

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GIS Applications

- Examples
  - A community planner might want to assess the extent of anthropogenic impact on lands that should otherwise be protected. She may also want to understand why these impacts are only in certain areas and not others.
  - A biologist might be interested in the impact of the wildfires on the on the populations of deer species to obtain a better understanding of long-term threats to those populations.

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GIS Applications

- Examples
  - An analyst might like to identify areas at a high-risk for forest fires in BC by investigating rainfall patterns, terrain characteristics and fuel beds.
  - An analyst may be hired by a telecommunications company to determine the best sites for the company's relay stations, taking into account various cost factors such as land prices, population distribution, undulation of the terrain et cetera.

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GIS Applications

- Examples
  - A forestry consultant might want to optimize timber production using data on soil and current tree stand distributions, in the presence of a number of operational constraints, such as the need to preserve species diversity in the area.
  - A fisheries researcher might want examine depth and water quality indices at different sites in a freshwater lake to understand how the distribution of an invasive species has changed from a decade ago.

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GIS Applications

- Examples
  - A city planner will need to keep records of how the cadastral parcel boundaries as well as the locations of all the city's infrastructure.
  - A developer must ensure that all construction in a new subdivision is least 100m from the highwater mark. Does she need a GIS?

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GIS Operations

- Data Acquisition
  - Field Surveys, GPS sensors, aerial and satellite imagery, online databases, digitised from paper maps & paper records, IoT sensors…
  - Acquired data may need editing
    - to remove errors such as overlapping polygons, duplicate records
    - Geometric transformation
  - Most expensive part of a GIS project and thus a great barrier for many projects

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GIS Operations

- Data Attribute Management
  - Attribute data describe characteristics of spatial features
  - The data are normally arranged in a table. Relational database is commonly used DB for management.
  - Metadata *sometimes* contains more descriptions on the properties
  - Do not underestimate the effort required to come up with sensible attribute names

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GIS Operations

- Data Display
  - Maps – very effective for spatial information
    - Not all maps are equal
    - Map elements: Title, legend, scale bar, data sources, author, North arrow, neatline, border, acknowledgement
    - Maps can be dynamic or static
    - A well designed map should enhance communication.
    - Poorly designed maps can confuse, distort, fail to communicate

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GIS Operations

- Data Exploration (exploratory spatial analysis)
  - Explore general trends in data
  - Explore relationships
    - Use graphs/matrices to assess correlations
    - Spatial distribution and clustering
    - Data classification, aggregation,

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GIS Operations

- Data analysis and modeling
  - The use of analytical tools
    - Vector: Buffering, overlay, distance measuring…
    - Raster: Local, neighborhood zonal, and global operations
    - A model is simplified representation of a phenomenon or a system.
      - A model is extracted from multiple data layers

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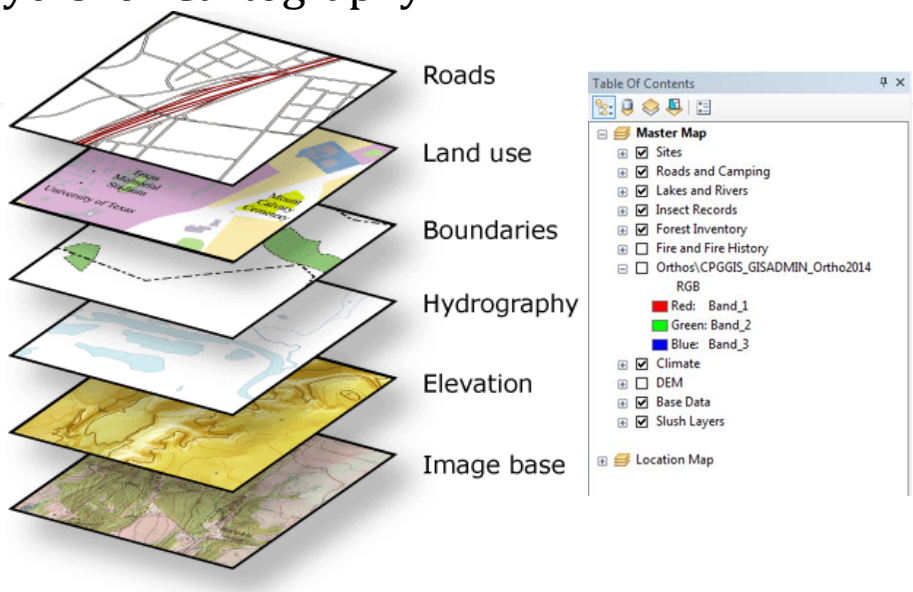
Layers for Cartography



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GIS as a Tool

- Consider a scenario
  - – A GIS specialist is given a problem to solve based on specifications described by other professionals
    – This specialist assembles the necessary data to complete the task
    – these data are modelled and analyzed
    – descriptive products that attempt to provide solutions for the problem are provided(such as maps, tabular information or statistics).

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GIS as a Tool

- The scenario above leads one to conclude that GIS is a tool
- However, this is a narrow conceptualization of the GIS technology
  - Any thoughts on why this is so?

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Course Evaluation

- Technical / Lab and Turorial based course
  - Lab work: 35% of final grade
  - Midterm Exam (Oct 20th) - 15%
  - Literature Review (Nov 8th) - 5%
  - Projects (Dec 6th) - 25%
  - Final Exam (Dec 2th) – 20%

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Communication

- Office Hours
  - Immediately before the Lecture
  - Email me

- Extenuating Circumstances
  - Email me ASAP
  - Email your TA regarding extensions for lab work
  - Much better to know before hand

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