

An Open Geomatics Textbook

UBC

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Preface

This is the very first part of the book, which will eventually include the textbook's introduction. For now, here's some useful info for you:

0.1 Contacts

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0.2 Project Wiki

github.com/ubc-geomatics-textbook/docs/wiki

0.3 Style Guide

0.3.1 Audience

1. Audience is undergraduate or graduate student studying GIS, geomatics, and remote sensing with no prior knowledge in these subject areas (i.e., introductory).
2. Assume only first year-level knowledge (or equivalent concurrent learning) of mathematics, science (biology, chemistry, physics), and geography.
3. Assume a multicultural reader who is not necessarily familiar with Canadian geography and history.

0.3.2 General Style

1. Word spellings should follow *The Oxford Canadian Dictionary (2 ed.)*.

2. Every chapter begins with 1-3 paragraphs of introductory text. The introductory text should be for general interest and not introduce any important terms that will be defined later in the chapter. The last sentence of this introductory text should summarize what students will learn.
3. Posing questions to readers is encouraged in all sections. For example, “Have you ever wondered...?” “How do you think X relates to Y?”
4. At every opportunity, authors should highlight Canadian examples of technology and science in geomatics. Examples of geomatics applications are highly encouraged in the Canadian context. For example, the following list of environmental management problems that are important to Canada should be discussed whenever possible:
 - Northern communities
 - First Nations
 - Climate change
 - Boreal forest
 - Endangered wildlife
 - Freshwater management and ecosystems
 - Fisheries
 - Glaciers/ice monitoring
 - Environmental justice
 - Resource extraction

0.3.3 Learning Objectives

1. Every chapter will have a numbered list of learning objectives that follow the introductory text.
2. There should be no period at the end of each listed learning objective.

0.3.4 Summary

1. All learning objectives should be addressed in the summary section.
2. The summary section should never introduce any new concepts, terms, or definitions and should never reference figures, tables, or equations.

0.3.5 Key Terms

1. Every chapter will have an alphabetical, but unnumbered list of key terms.
2. At first mention in the chapter text, key terms should be boldened and defined.

0.3.6 Headings and Labels

1. Chapter titles should use title-case and are numbered.

2. Chapter sub-titles are also numbered and in title-case. Sub-titles should go no lower than level 3 heading (i.e., 1.2.3).
3. Level 4 headings are not numbered, all letters are capitalized, and should only be used in special call-out boxes:
 - LEARNING OBJECTIVES
 - REMEMBER THIS?
 - YOUR TURN!
 - CASE STUDY

0.3.7 Formulae

1. Do not format formulae using Microsoft Word or LaTeX. Instead, formulae should be formatted with RMarkdown.
2. Coordinates and Greek letters should always be formatted as formulae with RMarkdown.

0.3.8 Units

1. Standard International (SI) units should be used for the following:
 - Length = meter (m)
 - Time = second (s)
 - Amount of substance = mole (mole)
 - Electric current = ampere (A)
 - Temperature = Kelvin (K)
 - Luminous intensity = candela (cd)
 - Mass = Kilogram (kg)
2. Angle degrees are preferred over radians (rad) when referencing geographic position.
3. Rates should be expressed with a dot operator and negative exponent rather than a divisor (e.g., $m \cdot s^{-1}$ or $W \cdot m^{-2}$).

0.3.9 Numbers

1. Scientific notation is the preferred way to represent large and small numbers and should use the \times operator (not dot or asterisk) and be formatted as a formula (see Formulae): 1×10^2 .
2. Scientific notation should be limited to four significant figures (e.g., 1.234×100) except for specific numbers where the precision is important or meaningful like the speed of light ($2.99792458 \times 10^8 \text{ m} \cdot \text{s}^{-1}$) or Planck's constant ($6.62607004 \times 10^{-34} \text{ J} \cdot \text{s}^{-1}$).
3. Constants (like above) and other physical variables should use common notations (e.g., c for speed of light and h for Planck's constant) and be formatted as formulae (see Formulae).

0.3.10 Dates and times

1. The Gregorian calendar should be adopted for recent dates. In these cases, use Common Era (C.E.) to indicate dates after 0 A.D. and Before Common Era (B.C.E.) for dates before 0 A.D.
 - For specific recent dates, use the format “20 February 2021” and omit C.E.
 - If many dates need to be summarized in a table, use the format “DD-MM-YYYY”
2. Times should be specified in either Local Standard Time (LST) or Coordinated Universal Time (UTC) using a 24-hour clock:
 - 00:00 = 12 A.M. midnight LST
 - 12:00 = 12 P.M. noon LST
 - 23:00 = 11 P.M. LST
3. For non-recent dates or when referring to geologic time scales, use the following:
 - Thousands of years before present = kilo annum (ka)
 - Millions of years before present = mega annum (Ma)
 - Billions of years = giga annum (Ga)

0.3.11 Tables

1. Tables are numbered in the order that they appear in text and begin with the number of the chapter:
 - Table 1 in Chapter 1 = 1.1
2. A short, descriptive caption should be written for a table.
3. Tables should only include information that is discussed or referenced in the chapter text.
4. Every table must be referenced in the chapter text.

0.3.12 Code blocks

1. Avoid code blocks in chapter text. Instead, try to place code blocks in TRY THIS! or CASE STUDY sections.
2. Only R code blocks should be embedded using RMarkdown.

0.3.13 Abbreviations

1. Abbreviations are shortened form of a word or phrase and should be punctuated with periods:

- e.g.
- Dr.
- Ph.D.

0.3.14 Initialisms

1. Initialisms are the first letters of several words and should always be defined at first use in the chapter text regardless if the initialism is introduced and defined in an earlier chapter.
2. Do not introduce initialisms in figure or table captions or table text.
3. Except for the specific cases in this style guide, do not punctuate initialisms with periods:
 - AVHRR
 - NDVI

0.3.15 Acronyms

1. Acronyms are combinations of the first letters of several words and are pronounced as words. Acronyms should never be punctuated with periods.
2. Many satellites and remote sensing systems have acronyms that vary capitalization.
3. Following are some preferred acronyms:
 - Light Detection and Ranging = LiDAR
 - Radio Detection and Ranging = RADAR
 - Moderate Resolution Imaging Spectroradiometer = MODIS

0.3.16 Punctuation

1. Use serial comma (Oxford comma) in lists: Yukon, Northwest Territories, and Nunavut.
2. Use italics for internal dialogue or when you infer what the reader might be thinking:
 - “At this point, you might be wondering, *why am I reading this sentence?*”
3. Avoid the use of semi-colons.
4. Use and punctuate common Latin abbreviations with periods:
 - “For example” = exempli gratia (e.g.)
 - “That is” = is est (i.e.)
 - “And other similar things” = et cetera (etc.)
5. Avoid phrases in parentheses () or brackets []. Instead, place the phrase in a proper sentence.

6. Use single spaces between sentences.
7. Use double quotation marks for direct quotes, but avoid reproducing verbatim large texts. Paraphrasing with proper citation is preferred to direct quotation.
8. Bullet points are preferred over long lists in sentences.

0.3.17 Citations

1. Style should follow American Psychological Association (APA) format.
2. In-text references are encouraged where necessary, especially in case studies.
3. References and Recommended Readings section is placed at end of each chapter. Where possible, Recommended Readings should be populated with Open Educational Resources.

Chapter 1

Making Beautiful Maps

A map *is not* the territory it represents, but, if correct, it has a *similar structure* to the territory, which accounts for its usefulness. —Alfred Korzybski, *Science and Sanity*, 1933

Making beautiful maps, or making effective maps, is comparable to being able to tell a good story. Just like a good story, a beautiful map comprises certain elements that, put together, frame the narrative in a way that makes it easy for others to understand and interpret. A map is a visual representation of the spatial relationships of the features for a specific area. Cartography is the art and science of designing maps and consists of certain principles and rules. The cartographer has a lot of power to decide how to portray information, and in addition to making aesthetic choices about the map, the cartographer also has a responsibility to convey accurate information about the data in the map. Making beautiful maps involves the art, and science, of selecting and modifying data and portraying concepts with clarity and precision. Decisions around colour, font size, graphical hierarchies, classification themes, and legends are all elements of maps that determine how effective they are in conveying information. In this chapter, you will learn about what elements go into making an effective map and the different categories of maps and when to use them.

Learning Objectives

1. Identify elements of cartographic design
2. Describe different types of maps
3. Describe different types of symbology and classification and their uses

Key Terms

Map elements, symbology, classification, cartography

1.1 Types of Maps

There are many different types of maps. Just try doing a Google search, and you will come across descriptions of thematic, cadastral, topographic, and physiographic maps, to name but a few. There is no standard agreement on how many different categories of maps exist. Although some differentiate between as many as five different types based on the functions they serve (ICSM 2021), all maps can also be categorized into just two types, general reference and thematic. General reference maps represent the human-made or natural features of the landscape and are sometimes thought of as basemaps.

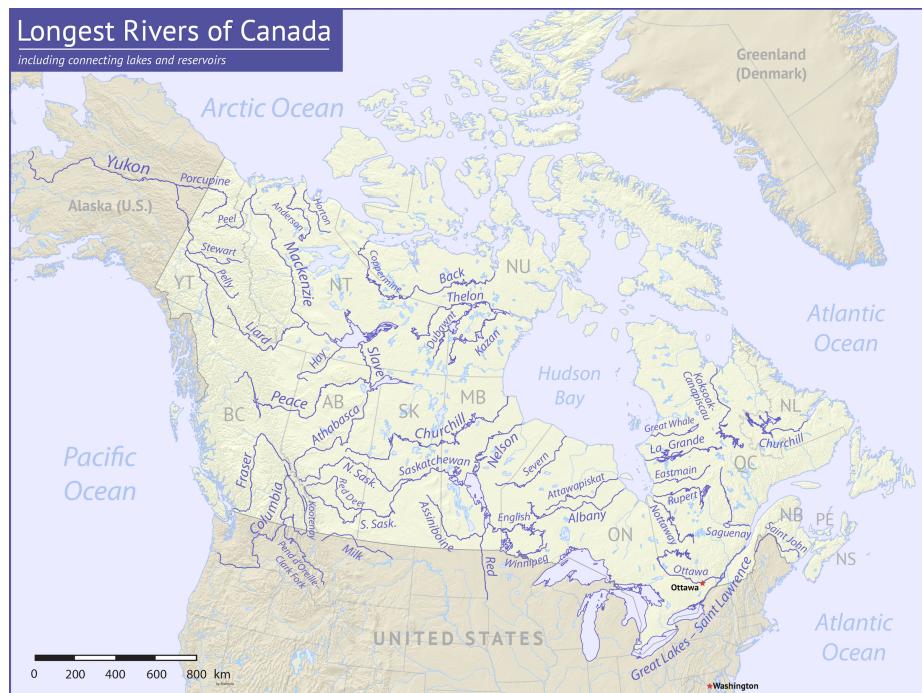


Figure 1.1: A good example of a general reference map. Longest Rivers of Canada(c) Shannon1, CC BY-SA

Thematic maps depict the spatial distribution of particular features, which are symbolized according to the quantitative or qualitative values of their attributes. There are many different kinds of thematic maps, including choropleth, proportional symbol, and dot density.

Terrestrial(c) Cephas, CC BY-SA 3.0 {.center}

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Figure 1.2: A thematic map.

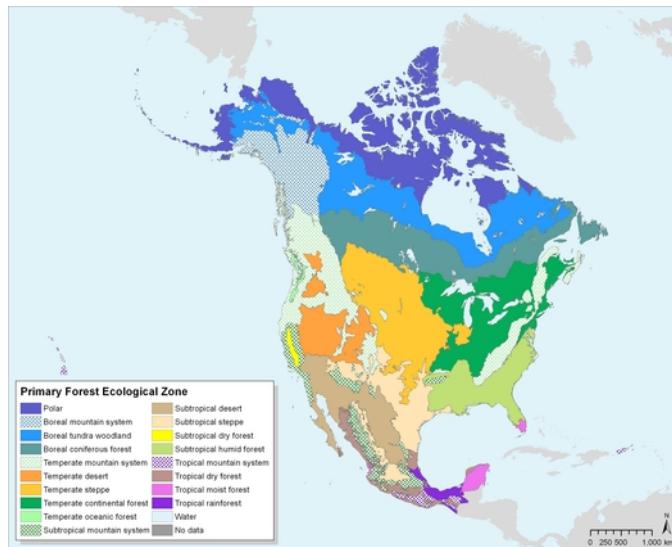


Figure 1.3: A thematic map. Terrestrial(c) Cephas, CC BY-SA 3.0

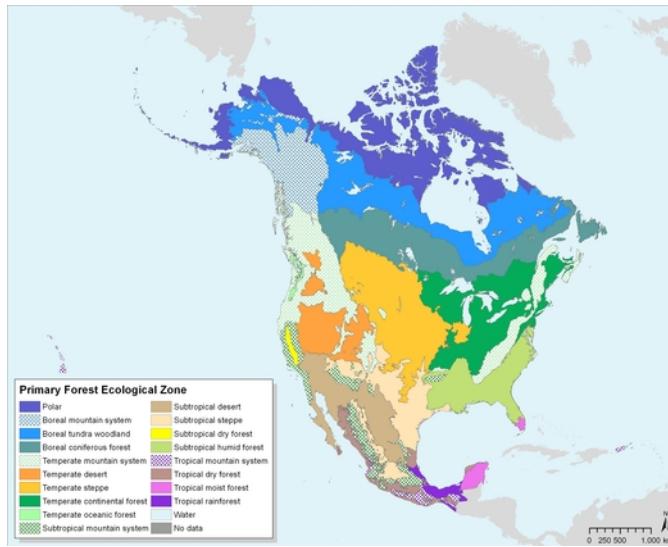


Figure 1.4: A thematic map.

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Figure 1.5: Figure caption text is also alt text.

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Your turn!

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1.2 Second Section Header

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Case studies should have at least one image or map (no more than 2 total) and the written length should be around 300 words (shown above). Any references to external literature should be hyperlinked with the Digital Object Identifier (DOI) permanent URL and entered into the bibliography. Avoid linking to external resources without a DOI and permanent URL. Contact Paul or try using the Leaflet package in R if you want to add an interactive web map.

1.3 Third Section Header

This is how we link to something. `{target=_blank"}` ensures that this link opens in a new window rather than navigating away from the textbook.

Your turn!

Ask the reader to undertake some activity or exercise. Have them explore data, an interactive tool, a web map. Avoid referencing, relying on, or using external URLs. If it can be built, coded, or hosted by us, then it should be.

Your browser does not support iframes

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Call out

This is a call out. Put some important concept or fact in here.

1.4 Summary

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Reflection Questions

1. Explain ipsum lorem.
2. Define ipsum lorem.
3. What is the role of ipsum lorem?
4. How does ipsum lorem work?

Practice Questions

2. Given ipsum, solve for lorem.
3. Draw ipsum lorem.

Cote, Paul. (2021). GIS Manual: Elements of Cartographic Style. *PbcGIS*. <https://www.pbcgis.com/style/>.

Intergovernmental Committee on Surveying and Mapping (ICSM). 2021. “Types of Maps.” *Overview to the Fundamentals of Mapping*. <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps>.

Korzybski, A. (1933). *Science and sanity: an introduction to non-Aristotelian systems and general semantics* (1st ed.). Retrieved from https://openlibrary.org/books/OL24876034M/Science_and_sanity

Thomas, I. (2001). Thematic cartography today: recalls and perspectives. *Cybergeo: European Journal of Geography*, 189. <https://doi.org/10.4000/cybergeo.34958>

Ensure all inline citations are properly referenced here.