The Choropleth Map

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- **Choropleth mapping** is a common technique for representing enumeration data
- These are maps where **enumeration units**, such as states or countries, are shaded a particular color depending on that unit's data value.

The Choropleth Map

- **Choropleth is derived from the Greek word choros (place), and plethein (to fill)**

The Choropleth Map

- Major concerns of the cartographer are:
  - **Data classification**
  - **Area symbolization**
  - **Legend design**

Mapping Rationale

- The **choropleth technique** is defined by the International Cartographic Association as follows:

  “A method of cartographic representation which employs distinctive color or shading applied to areas other than those bounded by isolines. These are usually statistical or administrative areas.”

A Typical Choropleth Map

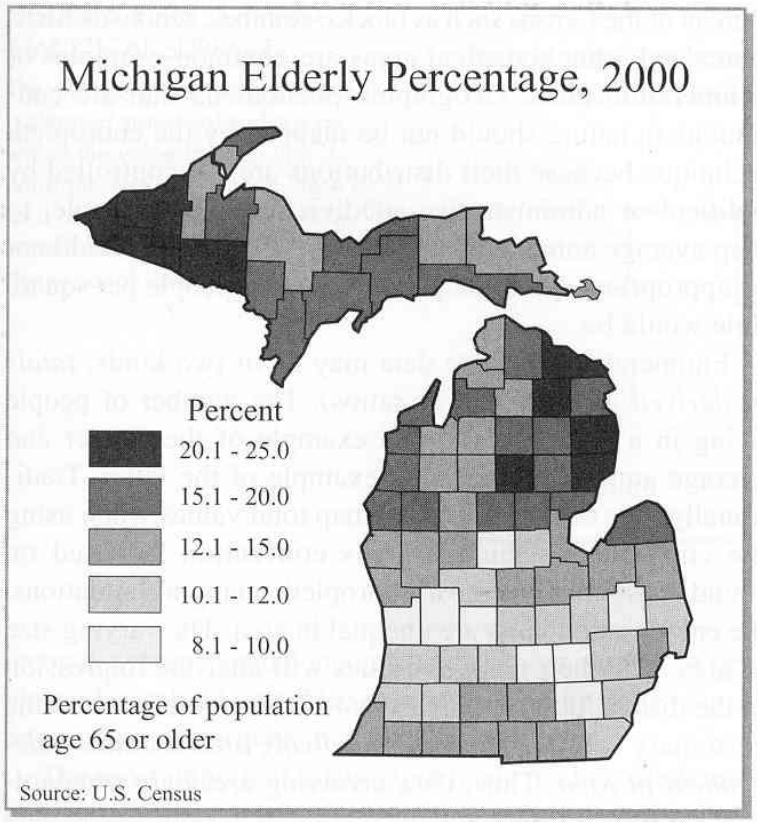


FIGURE 6.1 A TYPICAL CHOROPLETH MAP.
Each enumeration unit, in this case a county, has an areal symbol applied to it, depending on the class in which its data value falls. Over the entire map, it is possible to determine spatial variation of the data.

- Examples of enumeration units used in choropleth maps include:
  - **Countries**
  - **States**
  - **Provinces**
  - **Counties**
  - **Census tracts**

- Choropleth mapping may be thought of as a three-dimensional histogram or **stepped statistical surface**
- A choropleth map is a planimetric representation of this **three-dimensional prism model**

3D Histogram or Stepped Statistical Surface

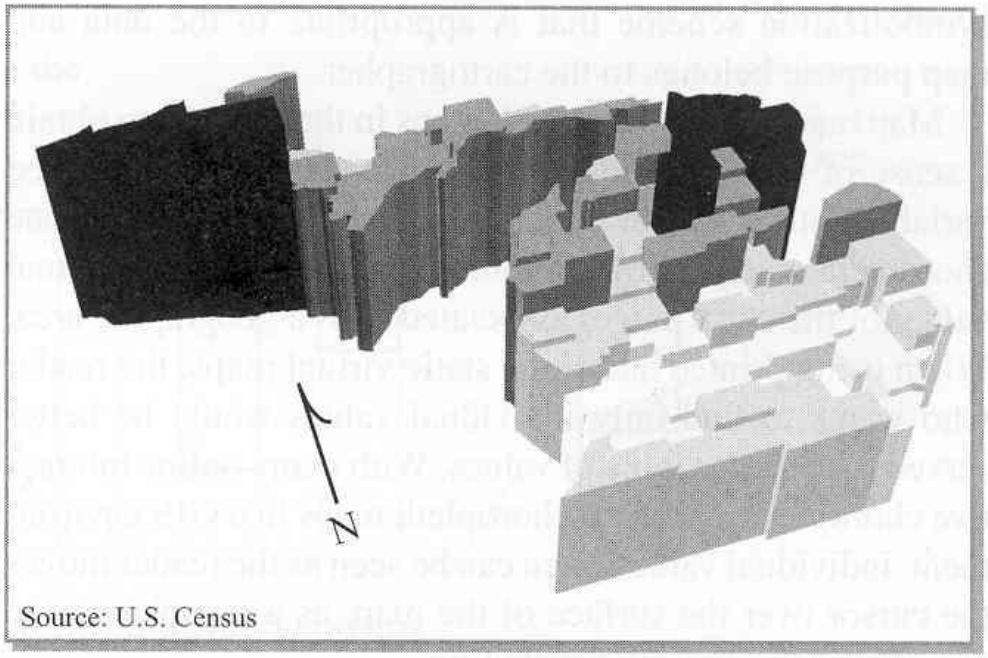


FIGURE 6.2 THE THREE-DIMENSIONAL HISTOGRAM OR STEPPED STATISTICAL SURFACE IN CHOROPLETH MAPPING.

In this conceptual model, each enumeration unit is a prism raised vertically in proportion to the value it represents. The attribute data is the same as in Figure 6.1.

Appropriateness of Data

- Typically, choropleth maps are constructed when data occur to **definite enumeration units** such as census tracts, counties or states
- Geographic phenomena that are **continuous** in nature should not be mapped by the choropleth technique because their distribution are not controlled by political or administrative subdivisions

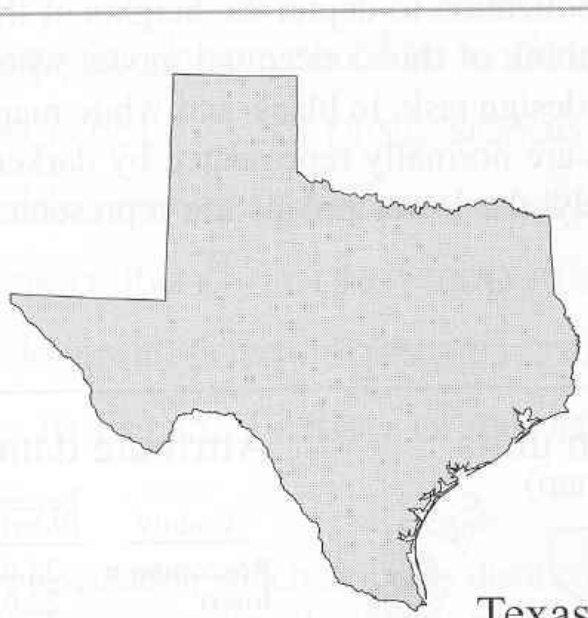
Enumeration Data

- **Enumeration data can be of two kinds:**
  - **Totals**
  - **Derived values (rates or ratios)**

Enumeration Data

- **Traditionally it is not acceptable to map total values when using the choropleth technique**

Total Values Should Not Be Mapped



Texas (left) and Rhode Island (right) are in proportion to each other.

	Texas	Rhode Island
Total Population:	20,851,820	1,048,319
Area (square miles):	264,436	1,045
Persons per square mile:	78.9	1,003.2

Source: U.S. Census (2000)

FIGURE 6.4 TOTAL VALUES SHOULD NOT BE MAPPED BY THE CHOROPLETH METHOD.

Mapping Boundaries

- In choropleth mapping, the **boundaries** of the polygons or the enumeration units (sometimes called **statistical units, chorograms or areal units**) have no numerical values associated with them

Legend Design

- **Choropleth legend boxes are usually rectangular in form**
- Need to be large enough to provide a visual anchor for the map reader to correctly interpret the symbolization but not so large as to detract from the map
- **Class ranges** are usually placed on the right side of boxes in a vertical presentation and underneath the boxes in the horizontal presentation

Continuous and Non-continuous Class Ranges

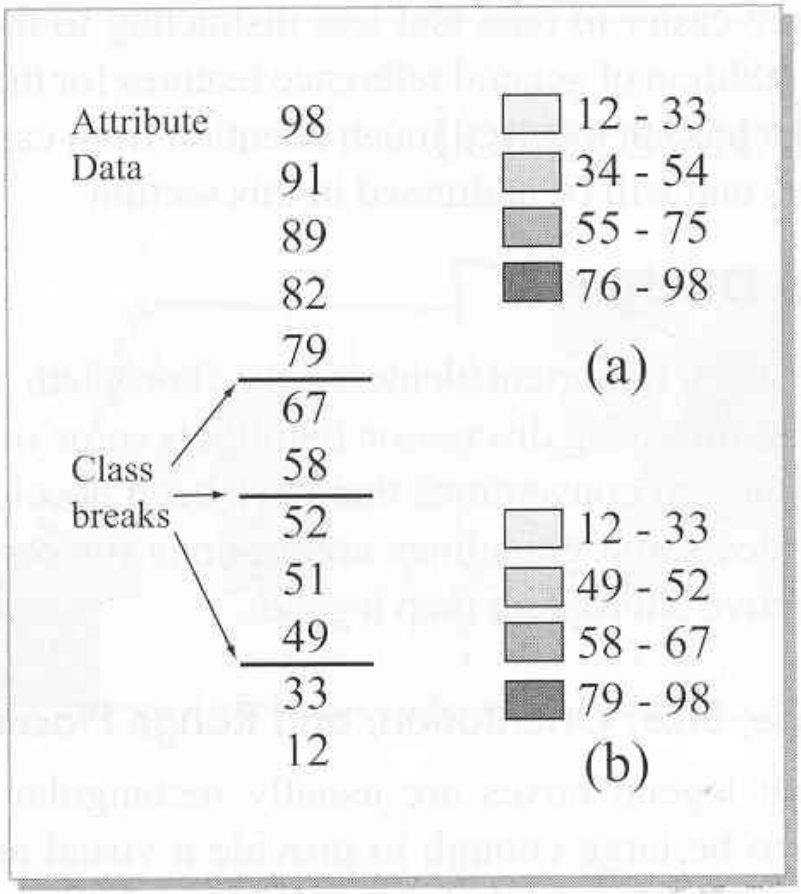


FIGURE 6.9 CONTINUOUS AND NONCONTINUOUS REPORTING STYLES FOR CLASS RANGES.

Other Legend Hints and Info

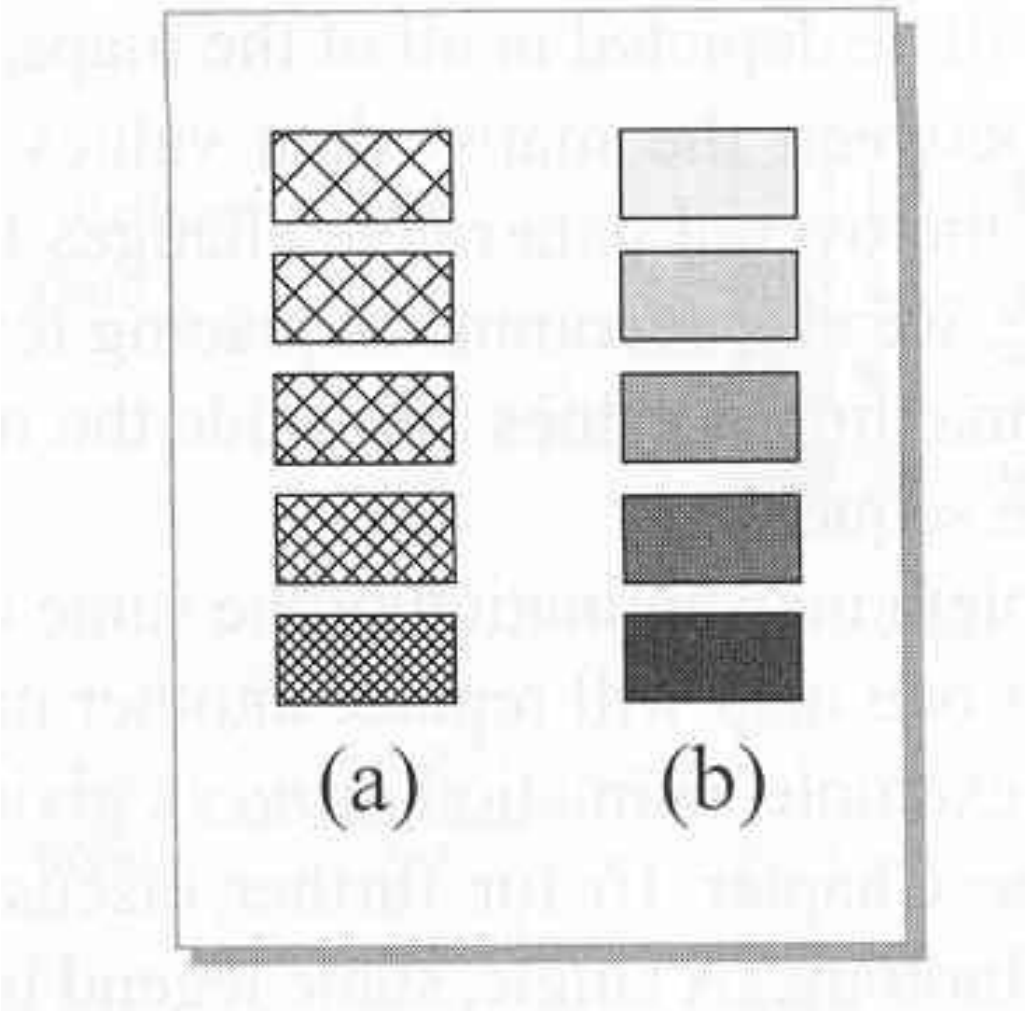
- Values for each class always increase from left to right
- Both a **dash** (501 – 925) and the word **“to”** (501 to 925) are used in depicting class ranges
- the word **“to”** should be used if there are negative numbers to avoid confusion between the dash and negative sign

Symbolization for Choropleth Maps

Black & White Mapping:

- **B&W maps** are lower cost and people with deficiency perceiving color don't have problems with grayscales

B&W Map Symbols



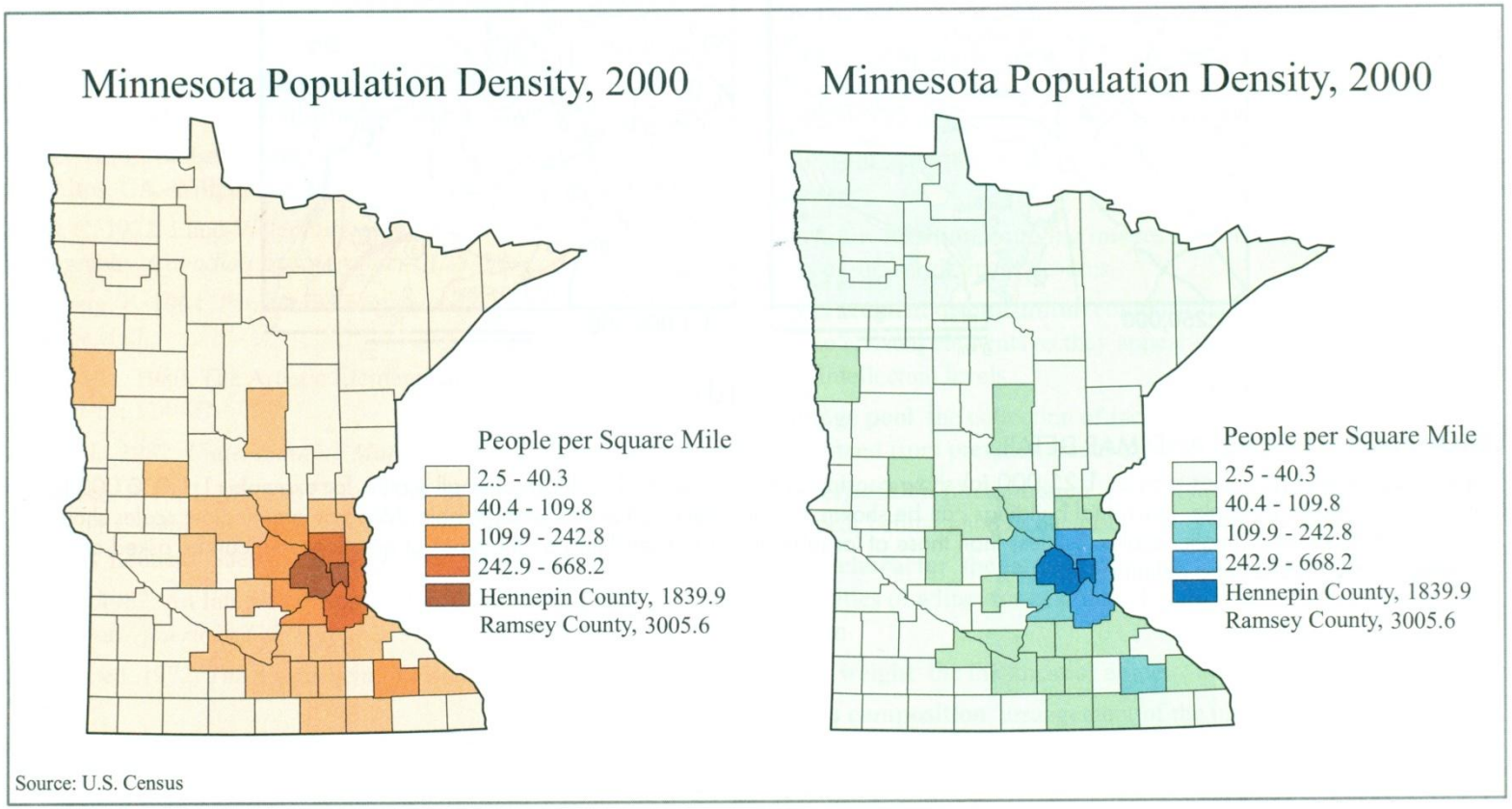
Color Map Symbolization

- Color use in choropleth mapping is becoming fairly standard owing to decreasing costs of color printing and increased use of virtual maps
- **Color gives more symbolization options**
- Also introduces a **higher degree of complexity** and subjectivity into the design process
- The choice of **hue, color value and color saturation** are all important

Hue

- **Hue** is the name we give to various colors:
  - **Reds**
  - **Greens**
  - **Blues browns**
  - **Red-orange**
  - **Etc**

Use of Hue in Area Symbols



Color Value

- **Color value** is the quality of lightness or darkness of colors

Color Saturation

- **Saturation** is also call **chroma, intensity** or **purity**
- The **vividness** of the color

Color Ramp

- Popular with GIS software in which the color variation is automatically applied by the software

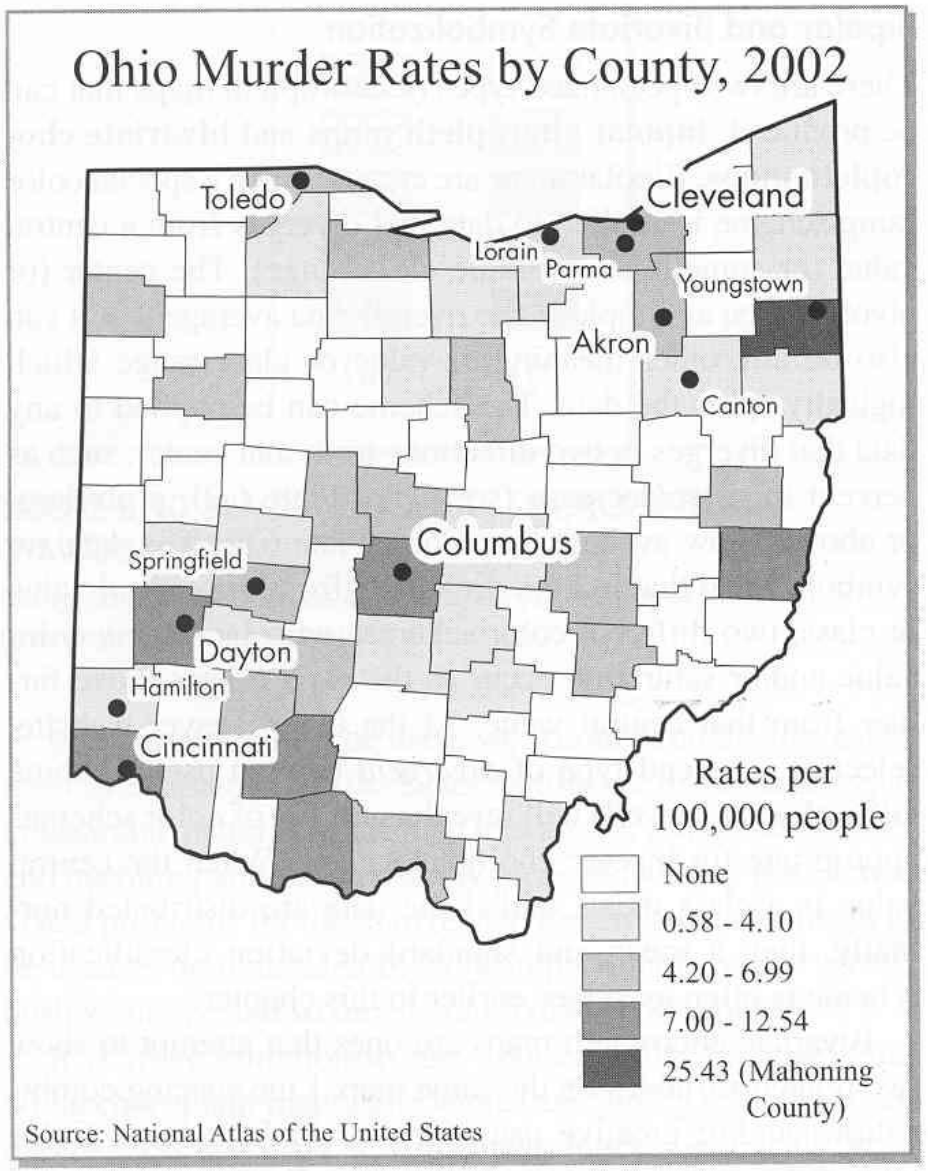
How does one choose a good color scheme?

- Make sure there's **enough differential** between the symbolization in the class ranges so that the difference can be clearly seen on the map
- If a map is a **virtual map**, be aware that different monitors and graphic cards reproduce color differently.
  - Use **ColorBrewer*** to help select color schemes
- * **http://colorbrewer2.org**
  - Avoid using qualitative discrete color fills that are normally reserved for categorical data

Adding Other Reference Features to a Map

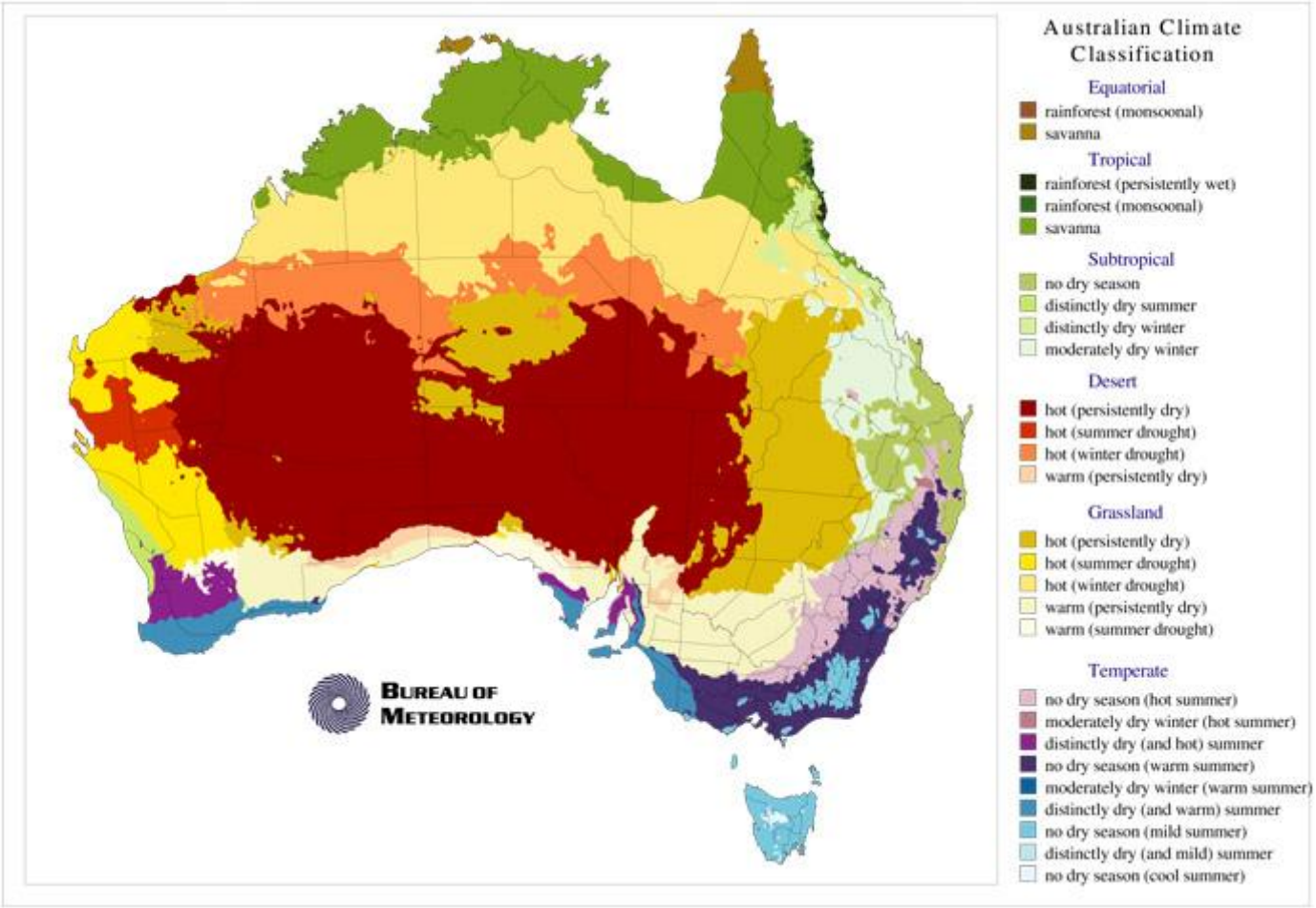
- Should you place general reference features such as cities, roads or rivers on the map?

Choropleth Map With Major Cities Included



Choropleth Map

Choropleth Map



Dynamic Choropleth Map

- http://www.turboperl.com/dcmaps.html

Visualization Tools

- http://www.cs.umd.edu/class/spring2005/cmsc838s/viz4all/viz4all_v.html