

Lesson 4: Mapping and Visualising Urban World with GIS

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Content

- Maps and Urban Environments
- Typology of Maps
 - Reference maps
 - Thematic maps
- Qualitative thematic mapping
- Quantitative thematic mapping
 - Number of classes
 - Data classification
 - Colour scheme

Learning objectives

By the end of this lesson, students will be able:

- to understand and explain the basic principles and methods of thematic mapping and cartographic design, and
- to use these understanding to design analytical maps to enlighten.

Visualising Urban Environments in a Map

An interface between geospatial data users and geospatial data.

Old proverb: A picture is worth a thousand words.

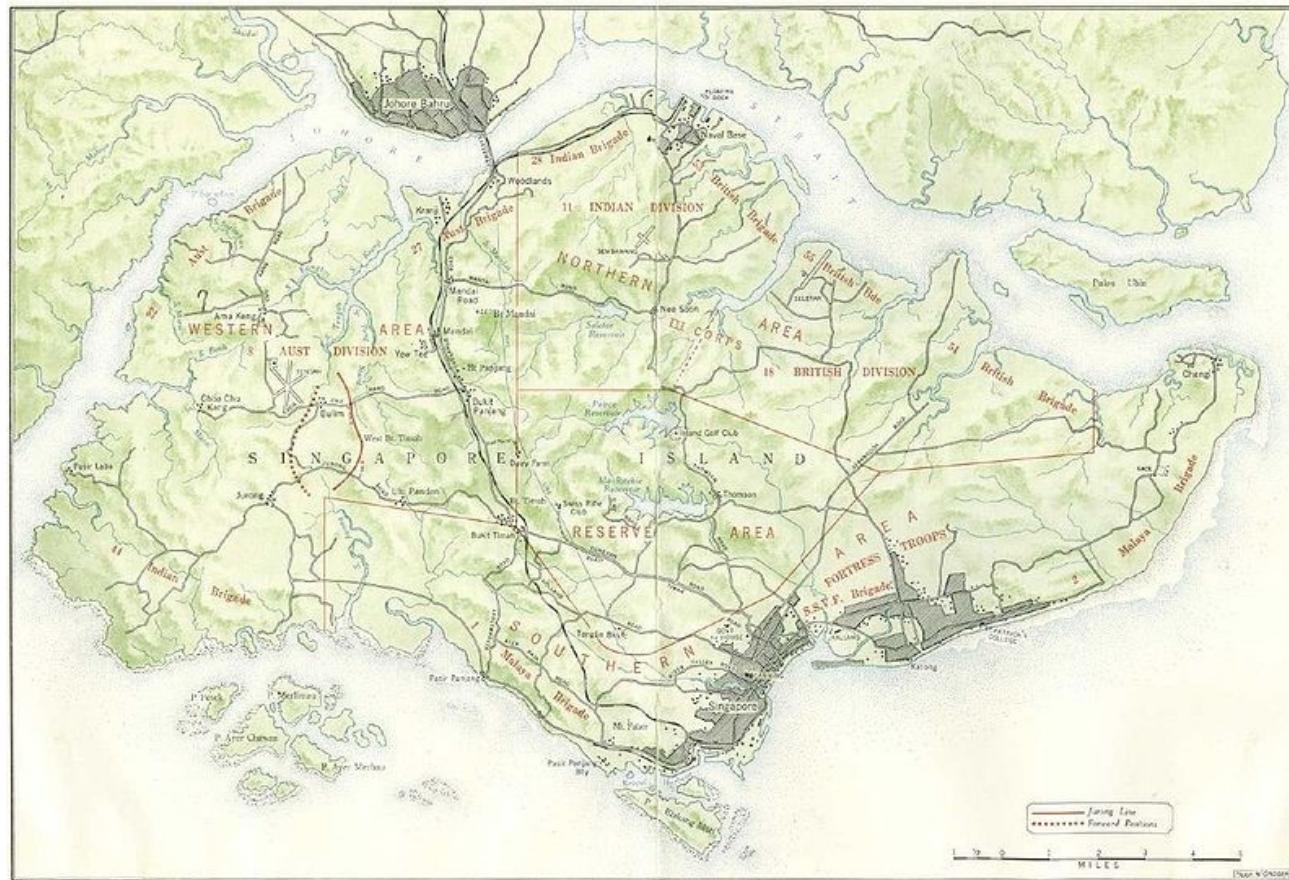


New proverb: A map is worth a thousand numbers, maybe more

Role of Maps

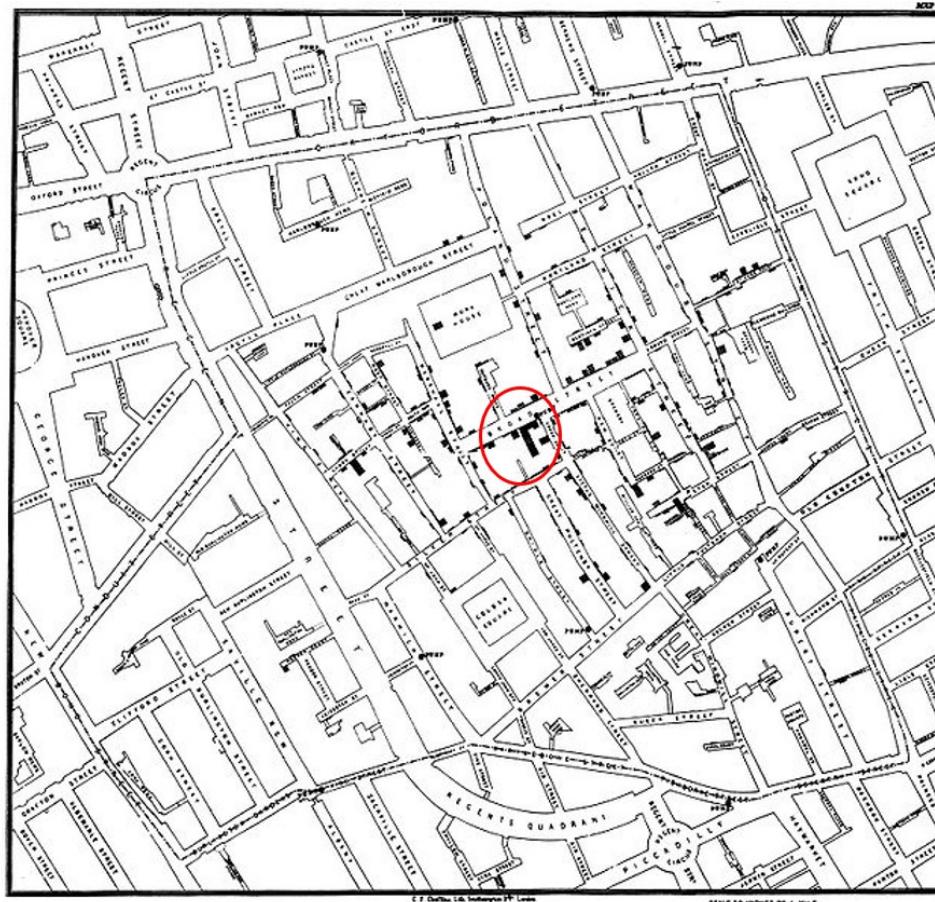
- Record and store spatially referenced data
- Serve as computational aids
- Serve as aids to mobility
- Summarise complex, voluminous spatial data
- Help us to explore spatial patterns
- Help us to visualise large volume of spatial data
- Serve as trigger devices to stimulate thought

Role of Maps: Map serves as a record



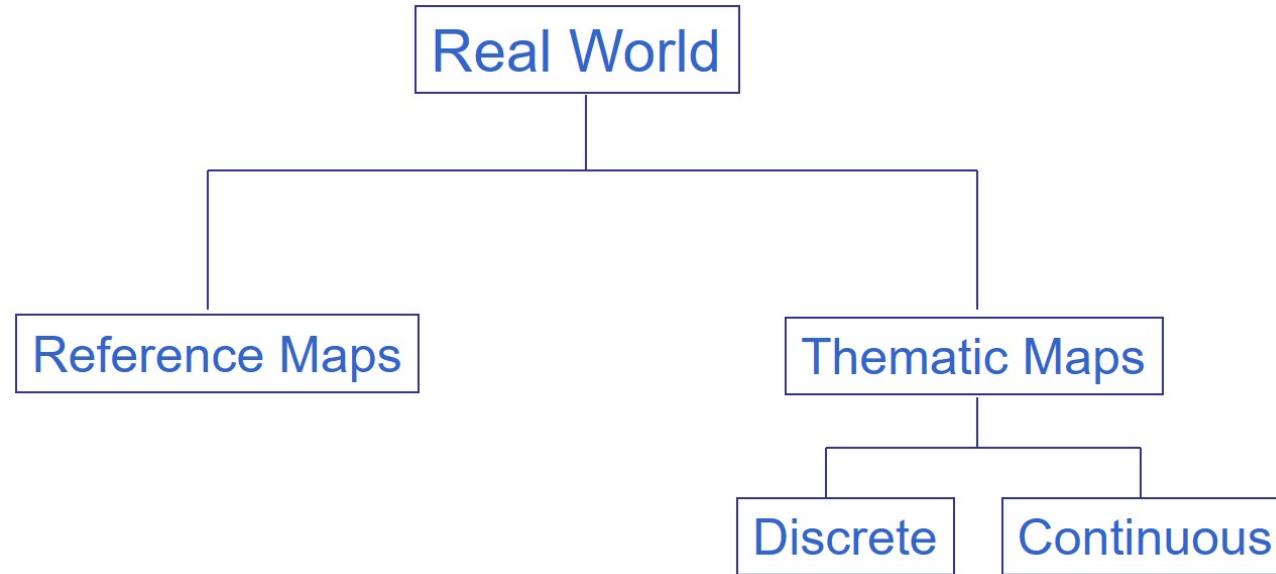
Source: http://en.wikipedia.org/wiki/Battle_of_Singapore

Role of maps: Map reveals patterns

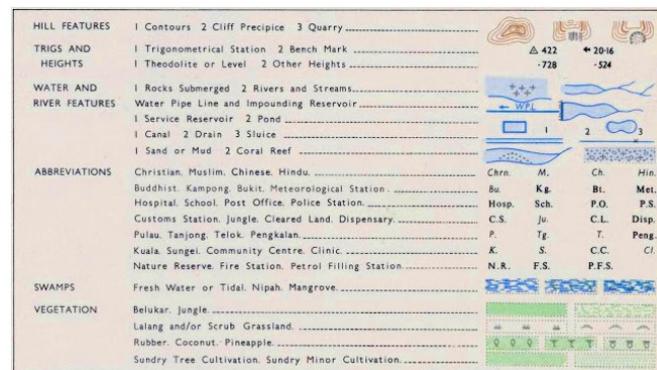
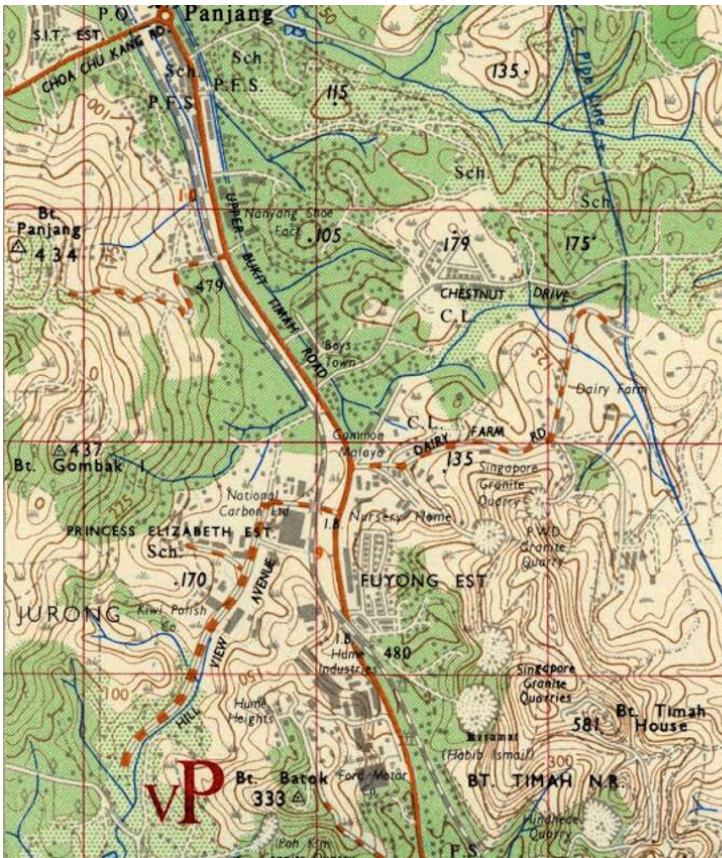


Source: http://en.wikipedia.org/wiki/John_Snow_%28physician%29

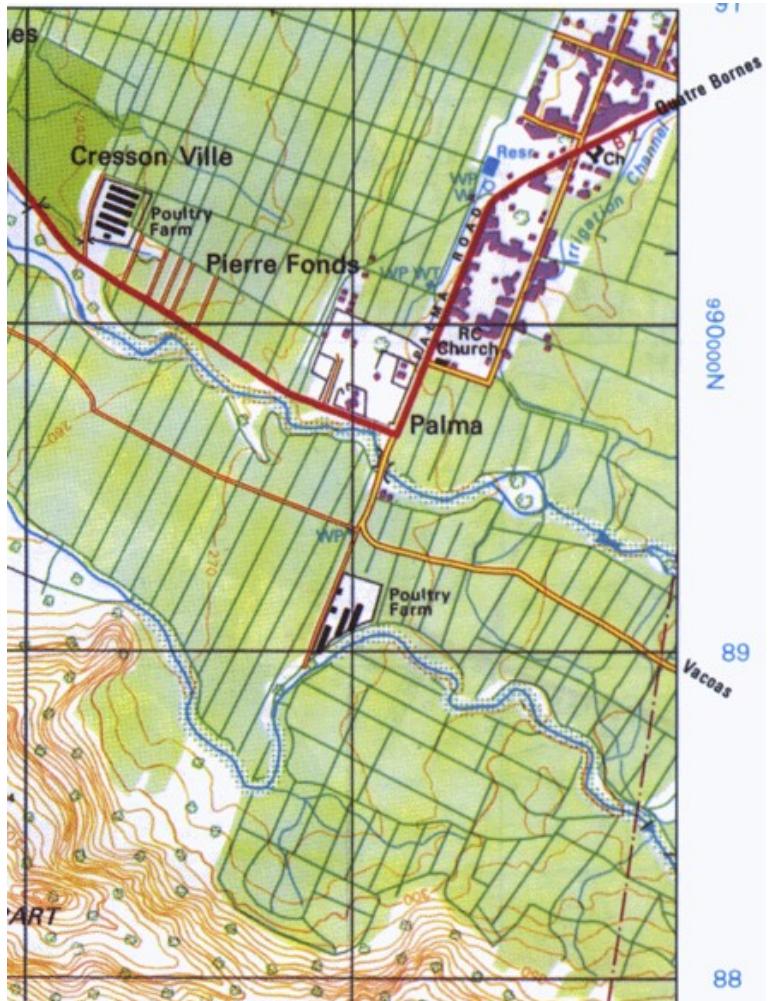
Typology of Maps



Reference map – Topography Map

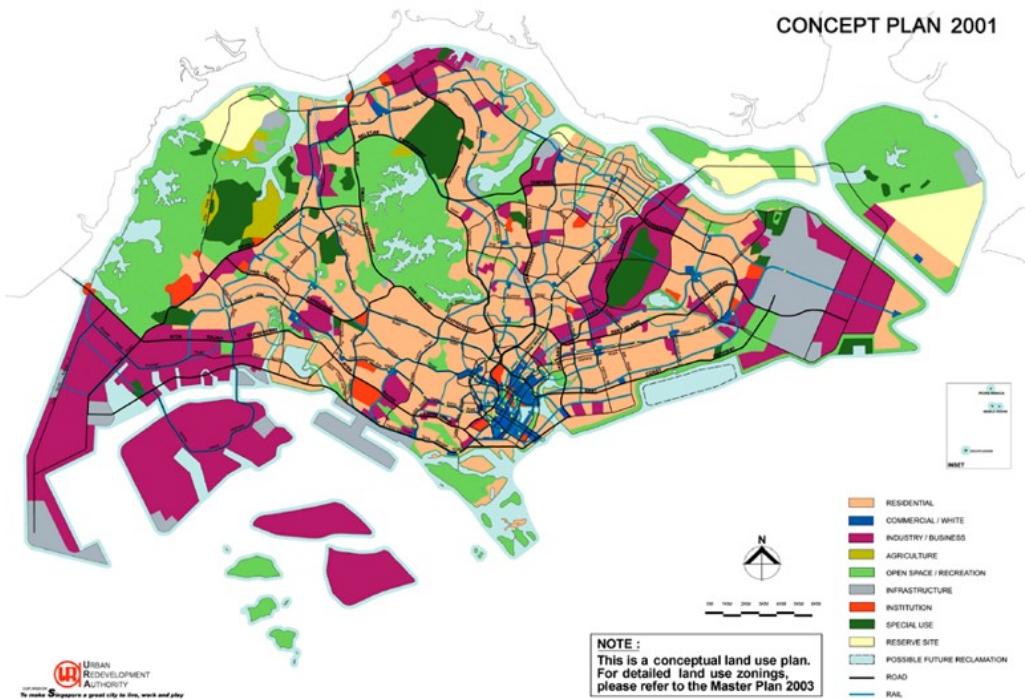


Reference map – Topography Map

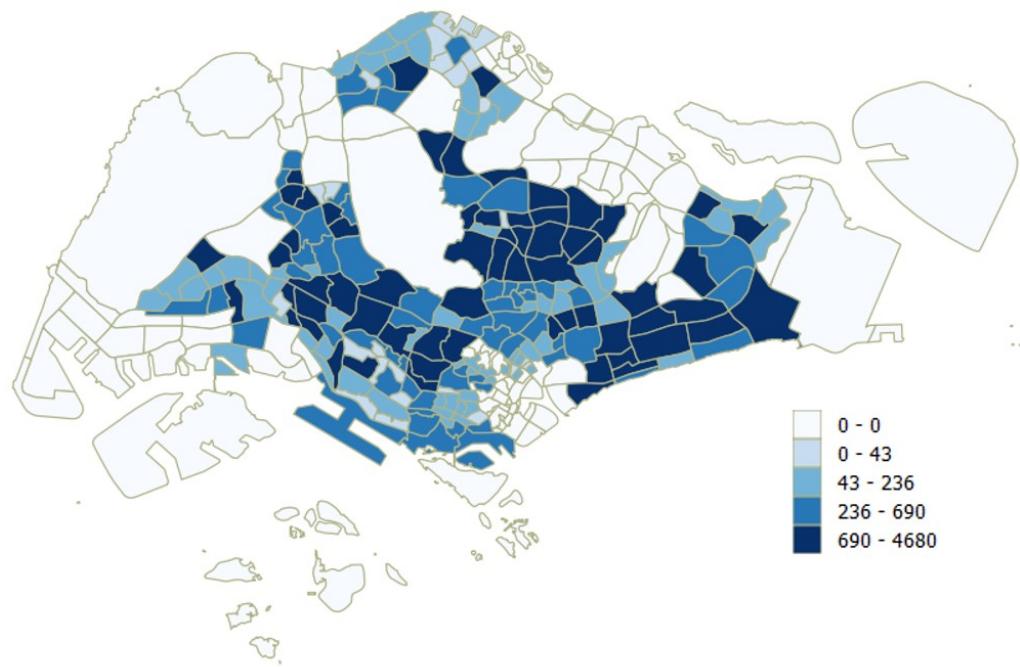


Thematic Mapping

Qualitative Thematic Map

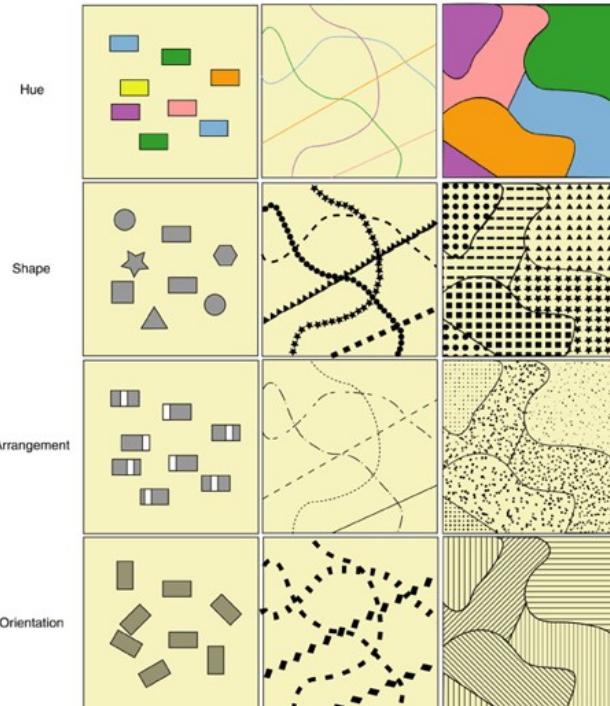


Quantitative Thematic Map

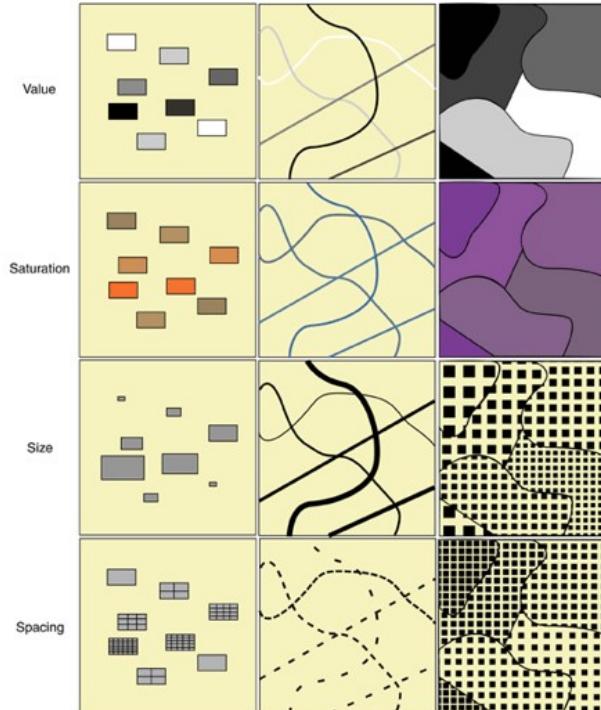


Visual Variables and Cartographic Symbols

Nominal or ordinal scales



Ratio scale



Qualitative Thematic Map

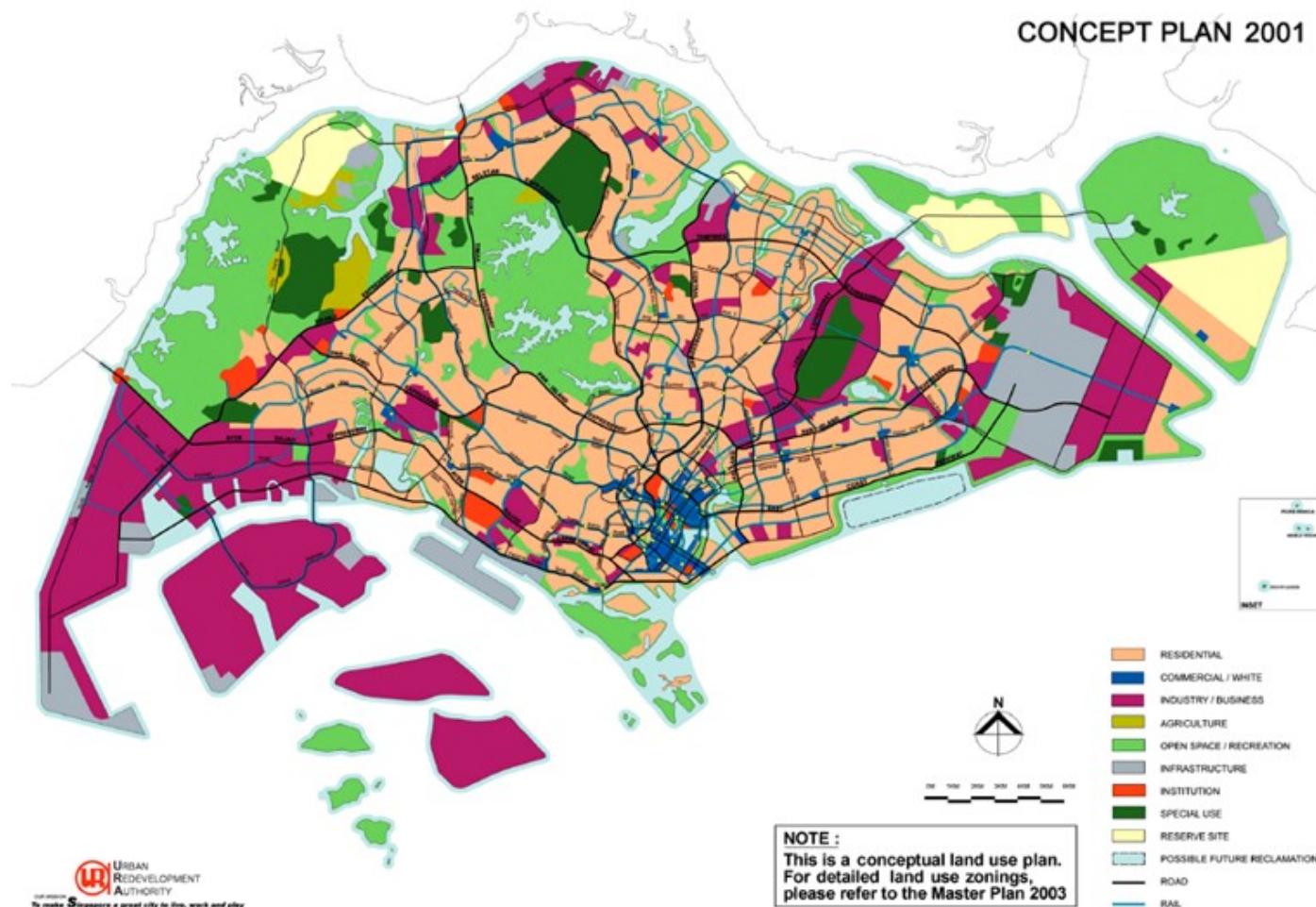
Point symbol Map



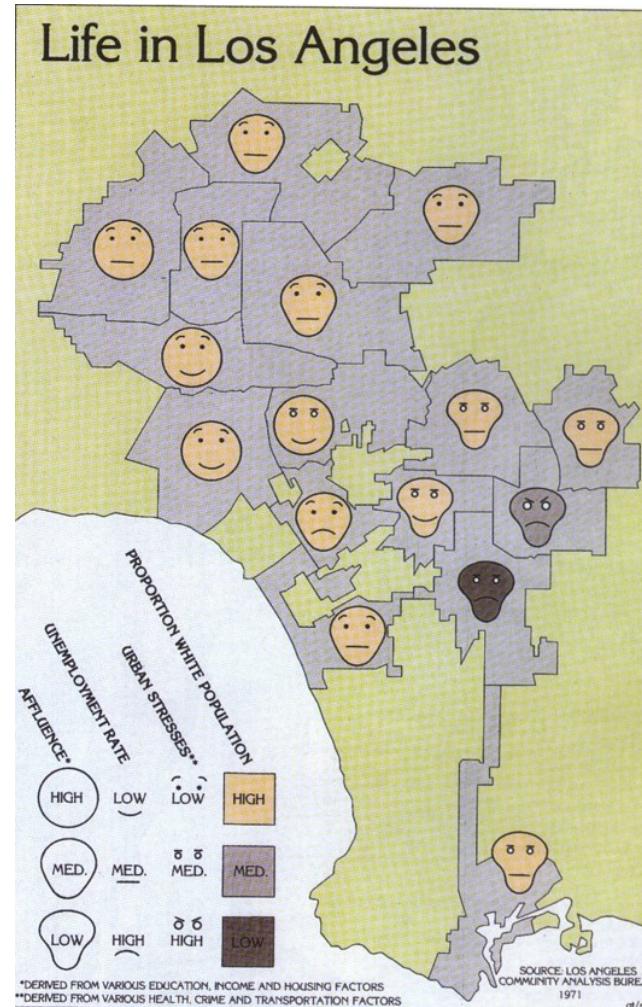
Line Symbol Map



Qualitative Thematic Map: Areas or Polygons

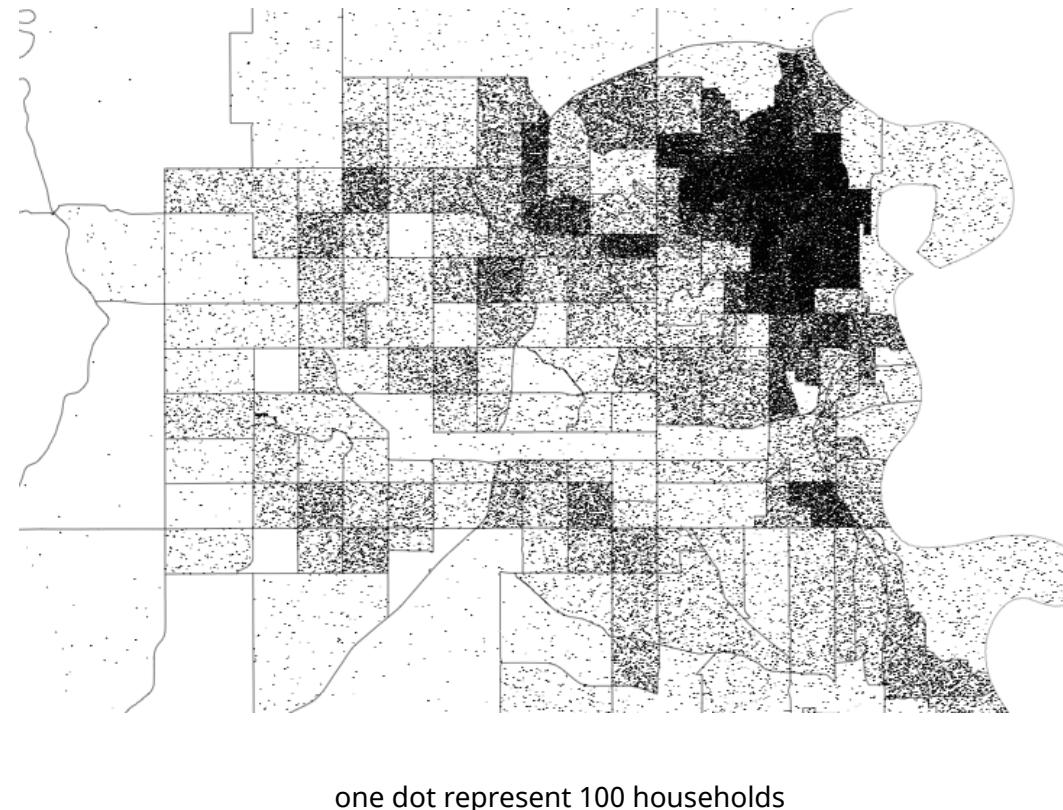


Qualitative Map: Multivariate Map



Quantitative Thematic Map: Dot Density Map

A dot-density map is a type of thematic map that uses dots or other symbols on the map to show the values of one or more numeric data fields. Each dot on a dot-density map represents some amount of data.



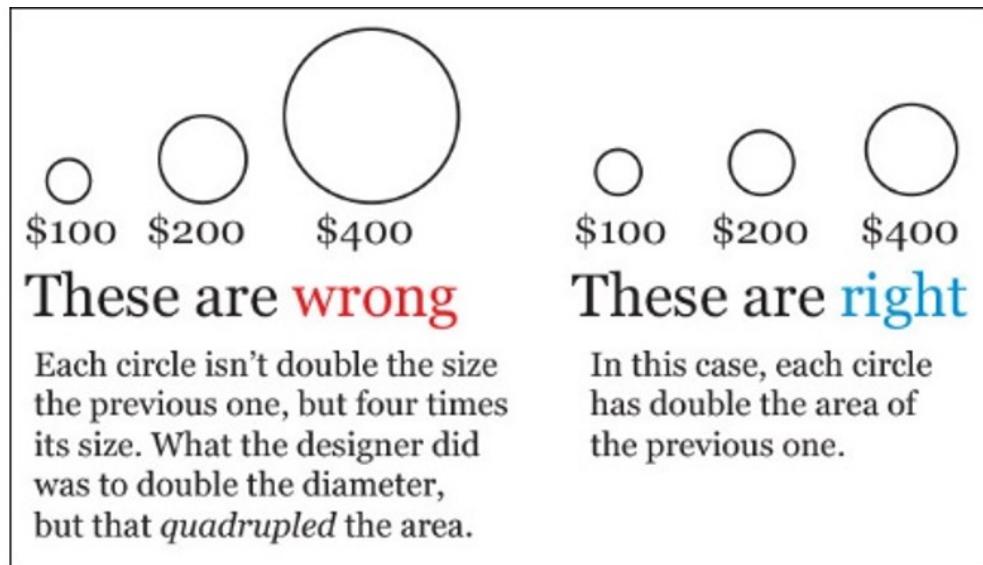
Reference: [Dot distribution map](#) at wiki and [Dot Density Maps](#)

Quantitative Thematic Map: Proportional Symbol Map



How to size circles incorrectly and correctly?

Figure below explains how attribute values are map on circles. One strategy to overcome this problem is to use square instead of circle.



Imagine that the largest circle on a map of monthly household income equals \$2,600. The radius of this circle (R_1) is 1.1 inches. How to calculate the radius (R_2) of a circle representing \$1,100?

$$R_2 = \sqrt{\frac{\text{New value (1,100)}}{\text{Largest value (2,600)}}} \times R_1 \rightarrow R_2 = \sqrt{0.42 \times 1.1} = 0.71 \text{ inches}$$

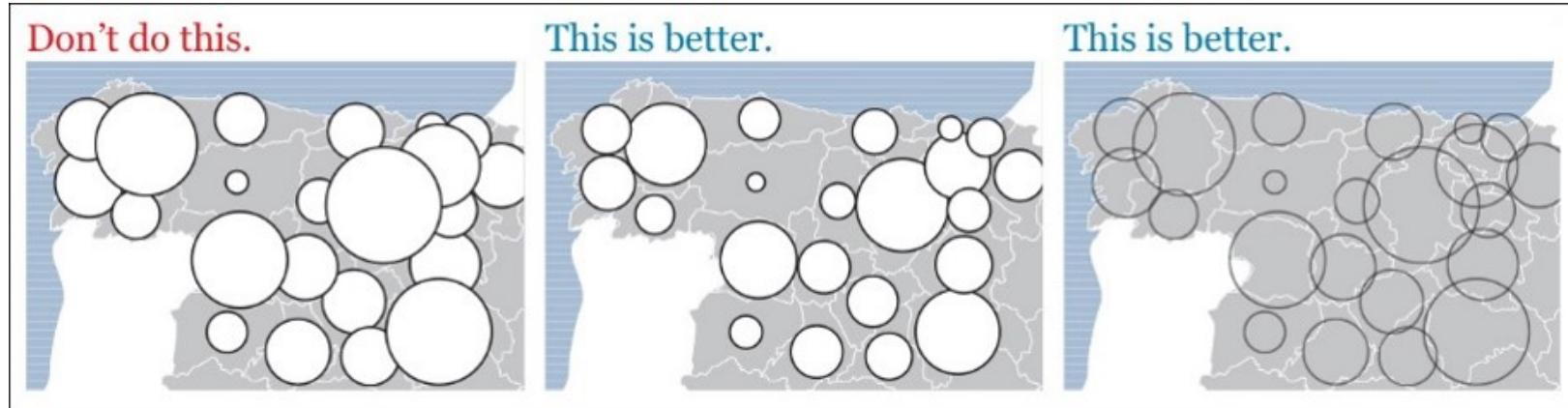
Quantitative Thematic Map: Proportional Symbol Map

Instead of using circle, square symbol shall be used.



How to make proportional symbol maps clearer?

Strategy to symbolise the circle.



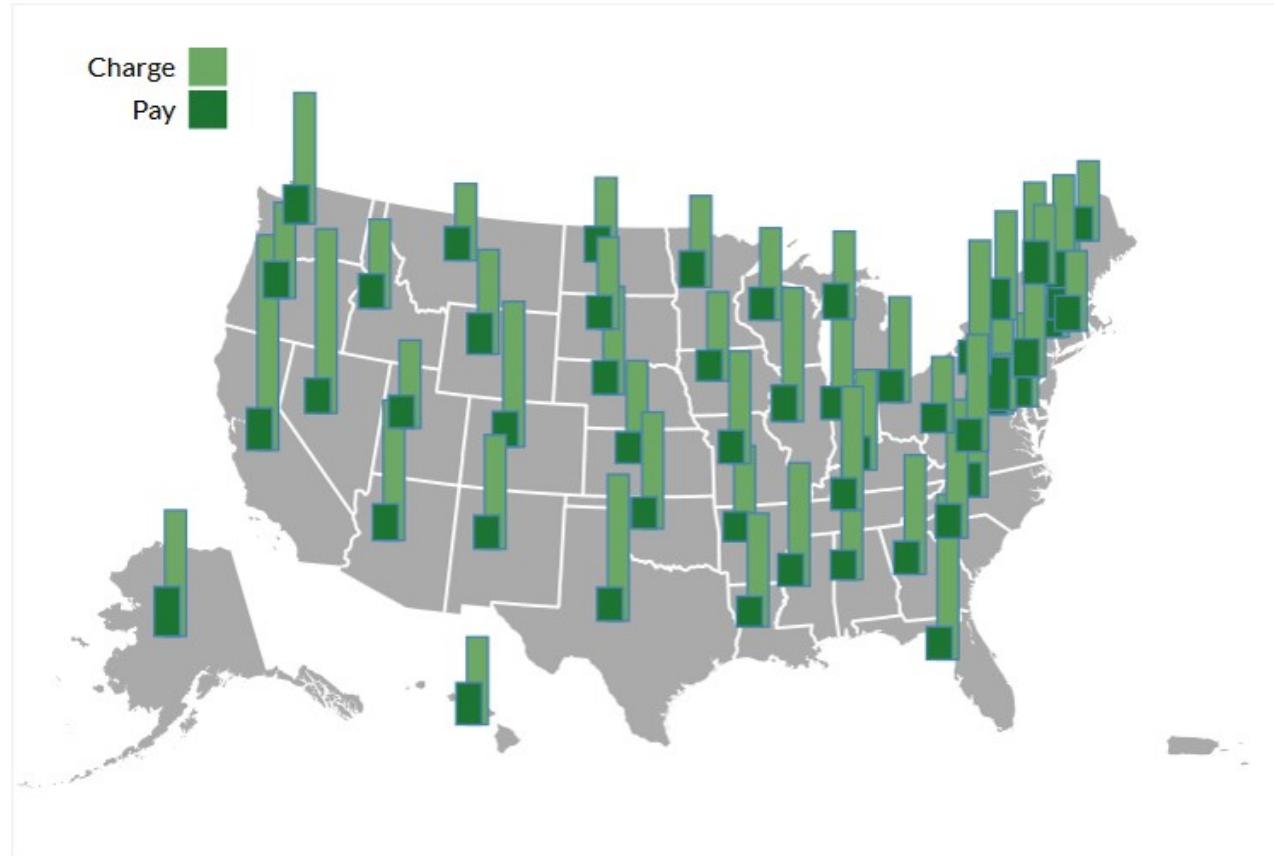
Proportional Symbol Map: Pie Chart Map

Proportional pie chart map places pie bar chart on a map based on the location of the observations.



Proportional Symbol Map: Bar Chart Map

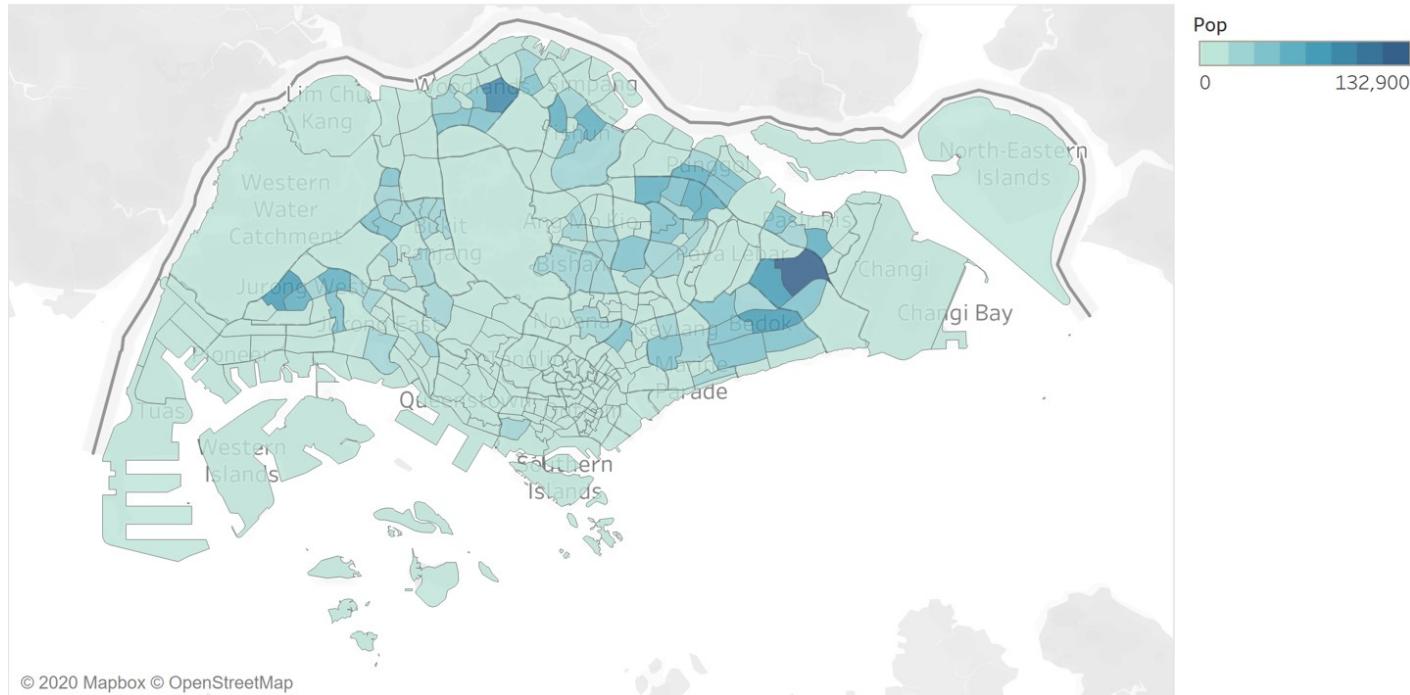
Proportional side-by-side bar map places side-by-side bar chart on a map based on the location of the observations.



Classified choropleth map

- A **classed choropleth map** combines areal units into a smaller number of groups. Interval levels may vary, but typically 4 to 7 are used in a map. There are different classification techniques used to divide up the intervals.

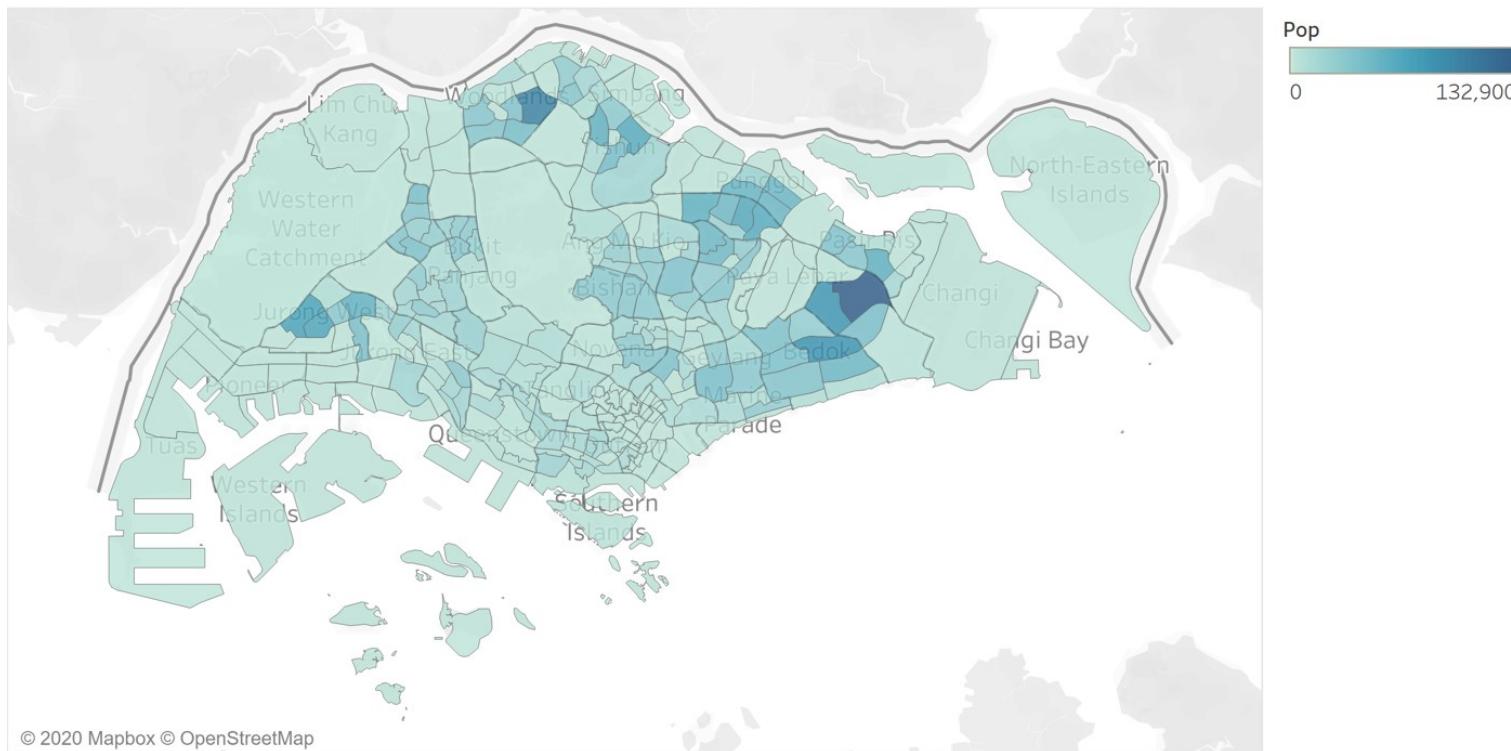
Distribution population by planning subzone, 2019



Unclassified choropleth map

- An **unclassified choropleth** map is similar to a classed choropleth map; however, unclassified choropleth maps do not have an averaged statistic towards each particular colour.

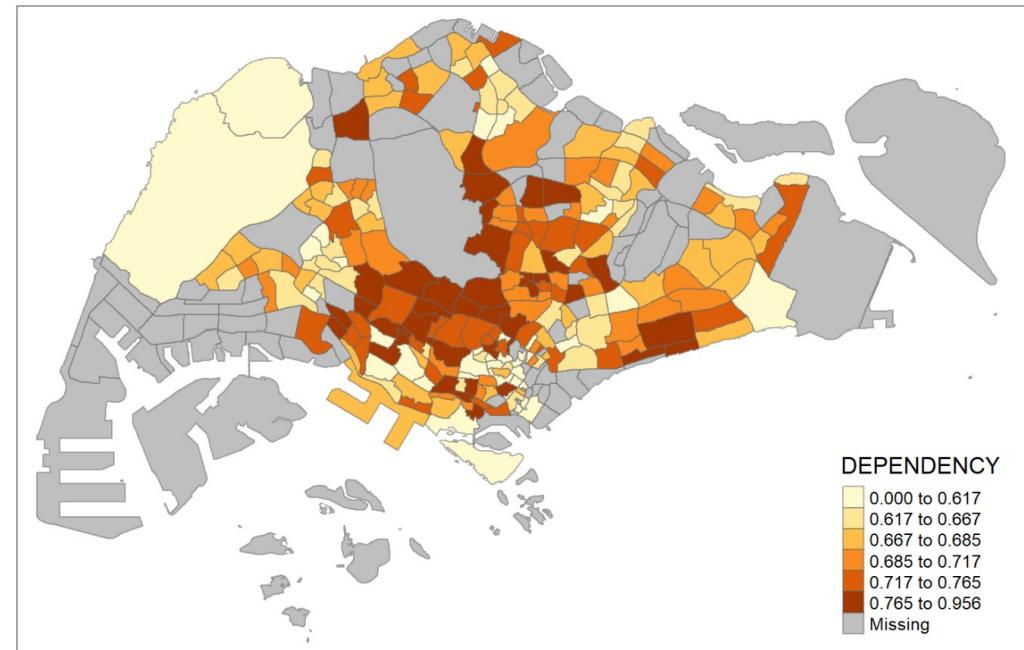
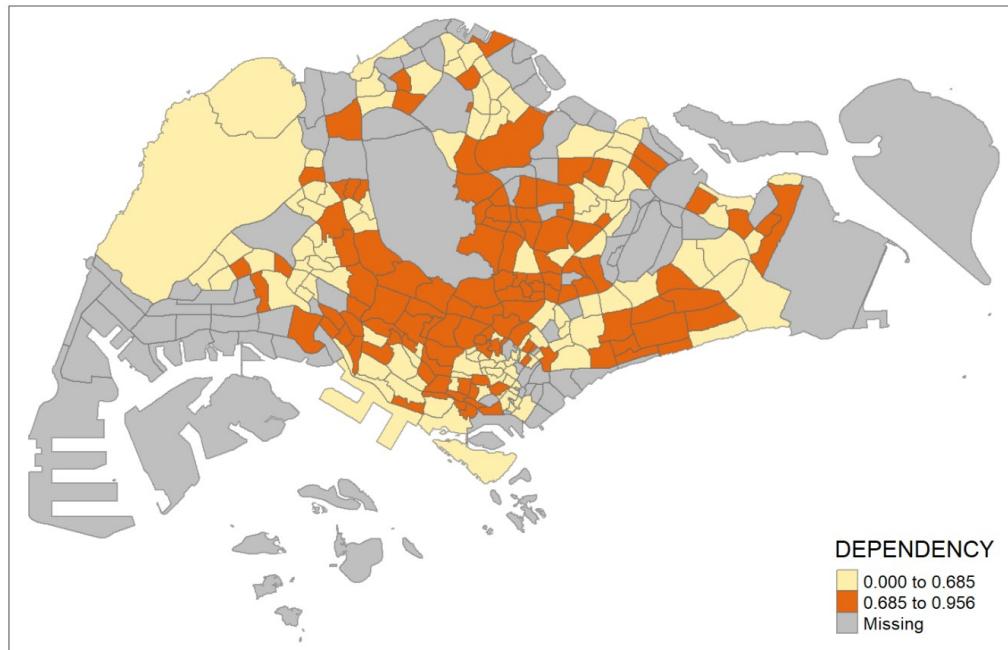
Distribution population by planning subzone, 2019



Choropleth mapping technique - Number of classes

The readability of a choropleth map will be affected by the number of classes used.

- When a small number of classes is used, the spatial distribution reveals will be very limited.
- When an appropriate number of classes is used, the spatial distribution reveals will be clear.



Choropleth mapping technique - Number of classes

Figure below provided a mathematical method to determine number of classes used for preparing a choropleth map.

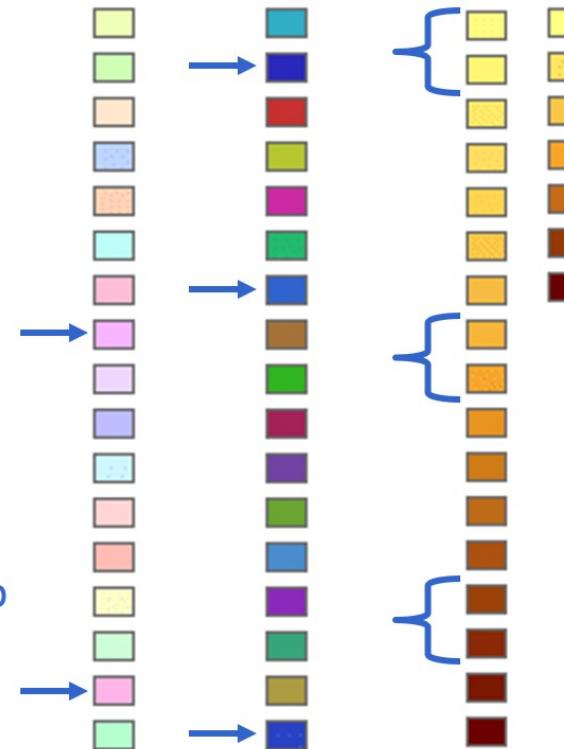
- Sturges' formula

$$k = 1 + 3.32 * \log n$$

n = number of values
k = number of classes

If n = 36
 $k = 1 + 3.32 * \log n$
k = 6 approx.

Example



- Number of intervals?
 - Not less than 4
 - To avoid an overly generalized map
 - Not more than
 - 12 colors
 - 7 or 8 shades of the same color

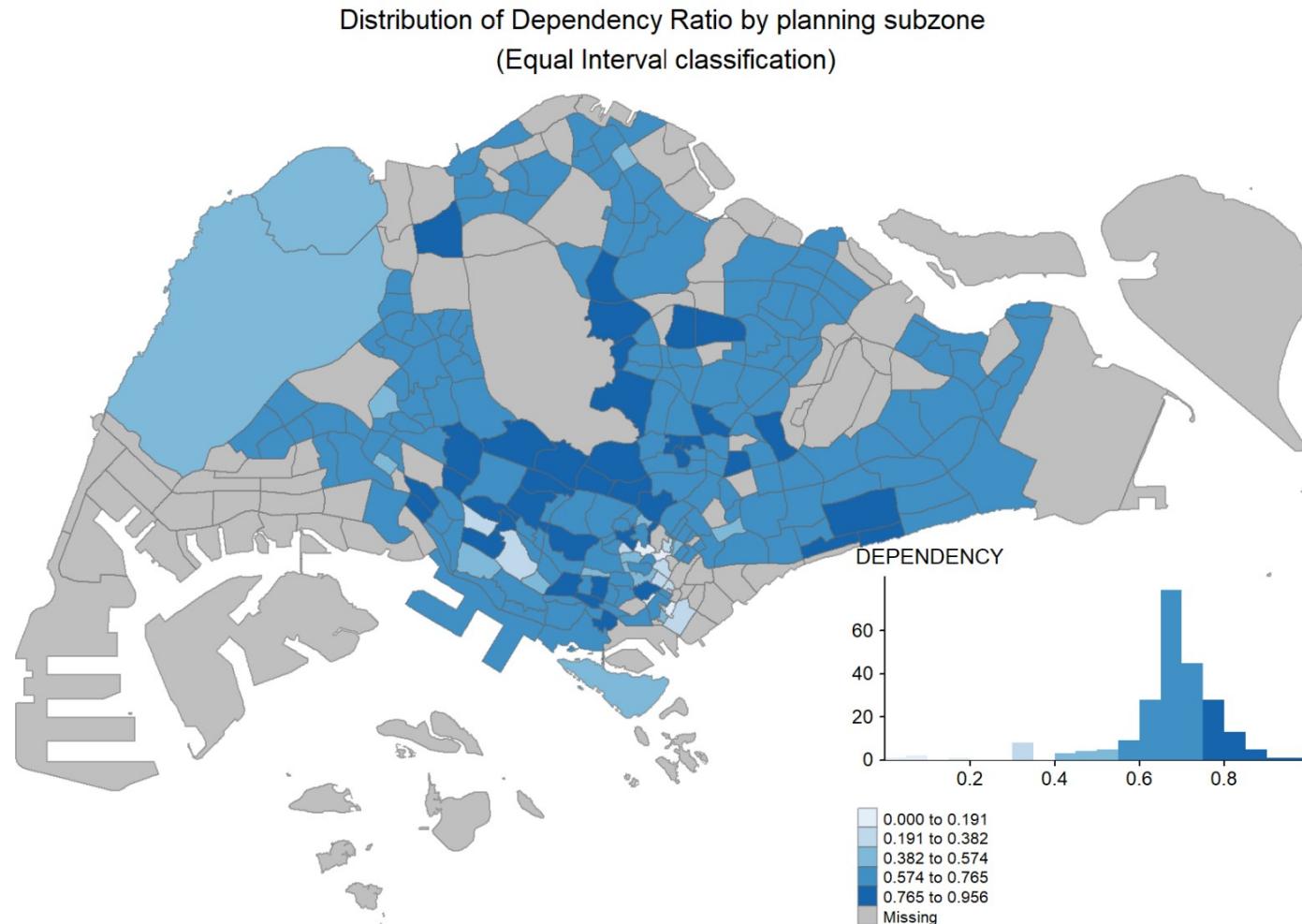
Choropleth map

Methods of choosing classes

- Based on the nature of the distribution
 - quantile, equal interval, natural breaks, standard deviations, defined interval
- Arbitrary
 - Can be based on round numbers.
 - Examples: Grouping according to age or census housing categories
 - Can result in empty categories

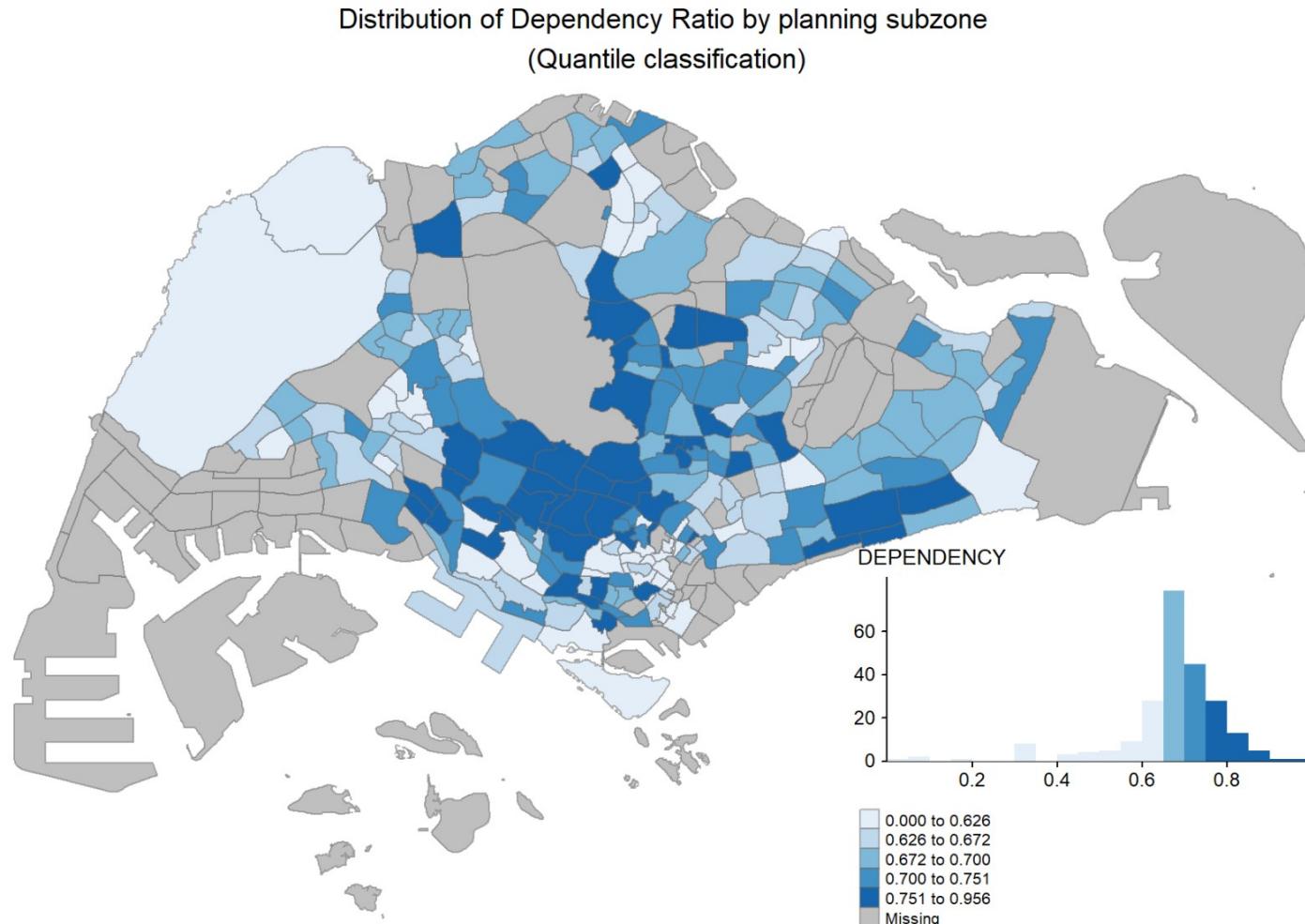
Data classification method: Equal interval

- Divides the range of attribute values into equally sized classes.



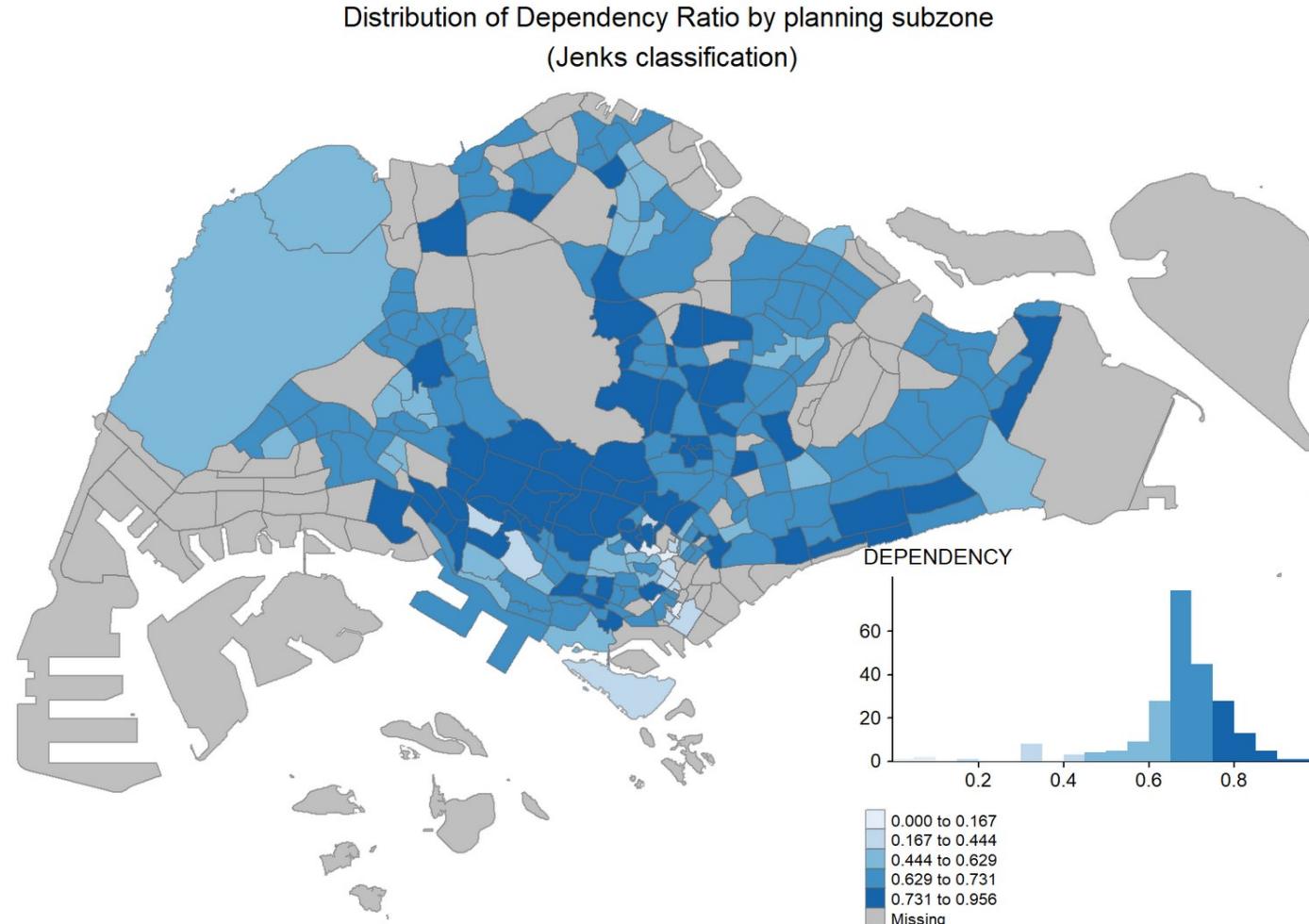
Data classification method: Quantile

- Same number of features per class.



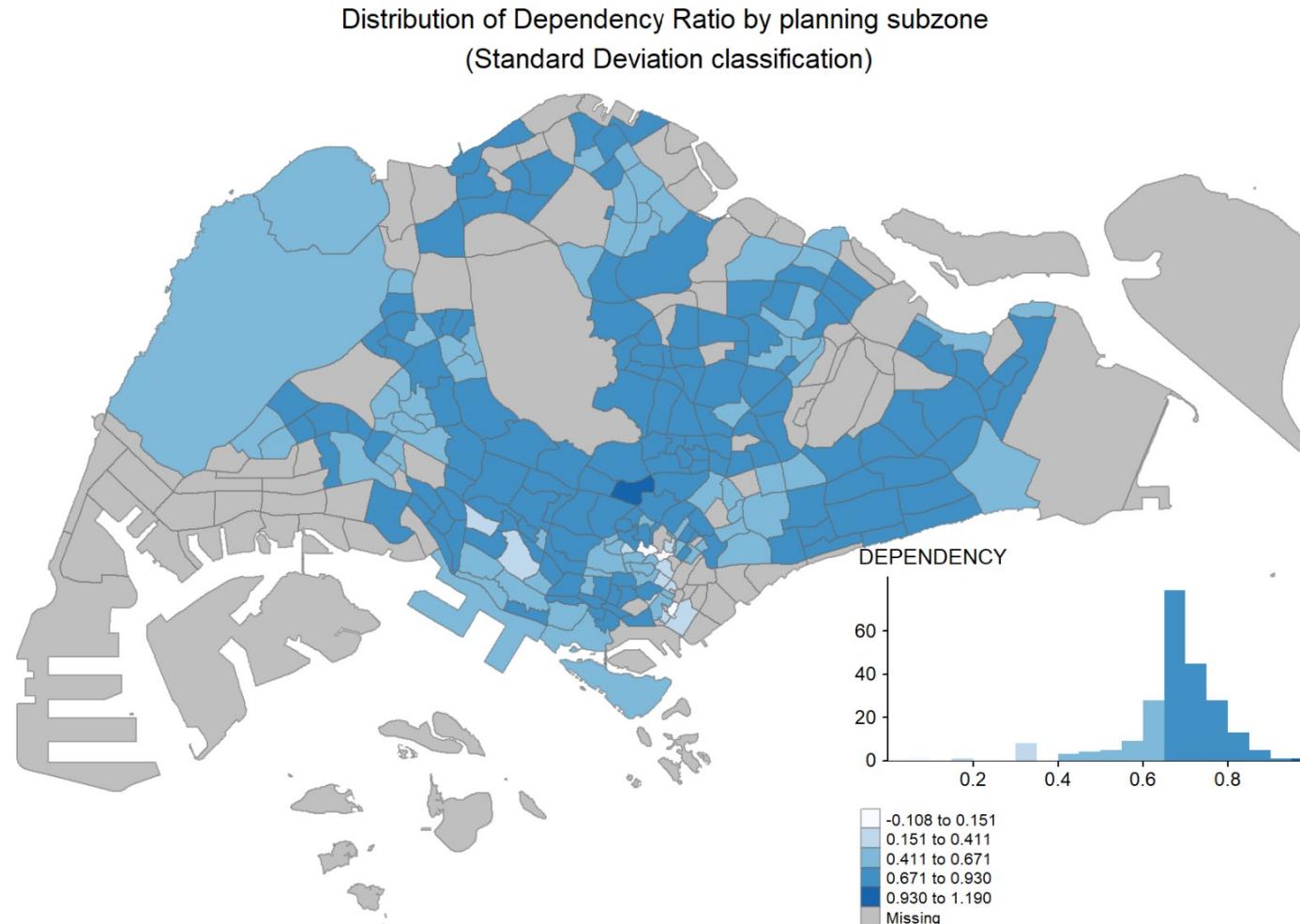
Data classification method: Jenks (also known as Natural breaks)

- Default Jenk's statistical optimization by finds natural groupings in the data.



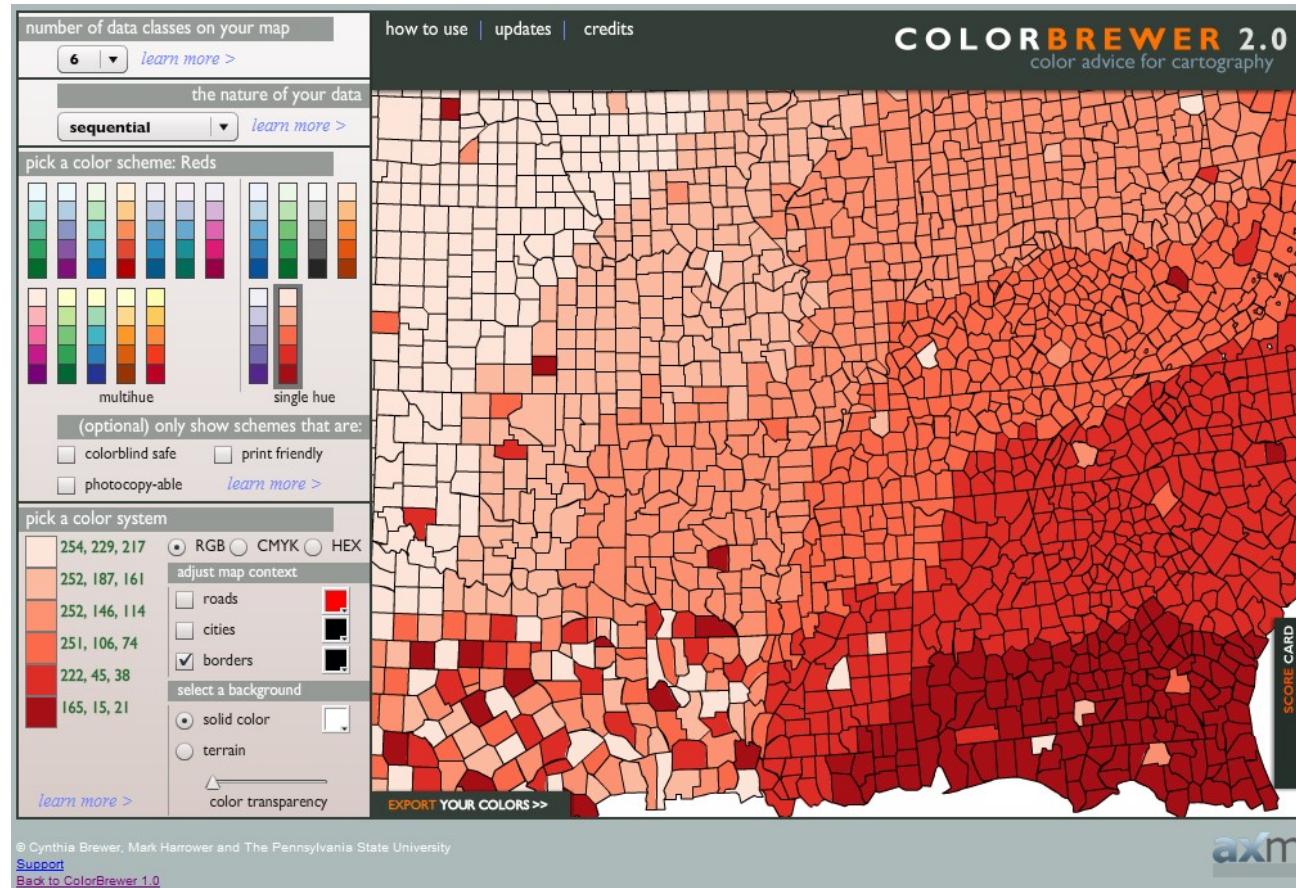
Data classification method: Standard deviation

- A measure of dispersion. Use if the distribution approximates a normal distribution.



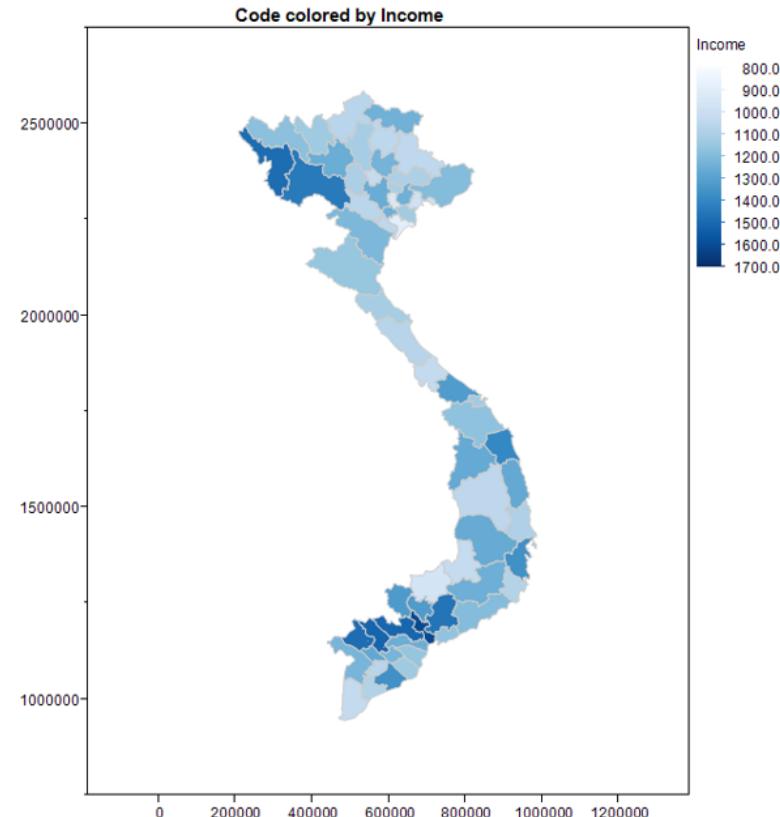
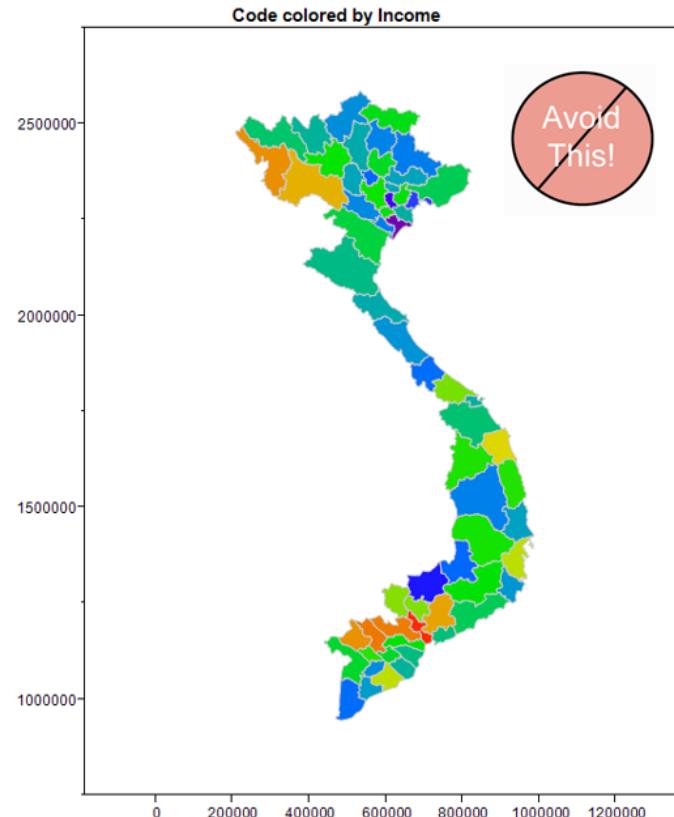
Choropleth map - Colour scheme

ColorBrewer is an online tool designed to help people select good color schemes for maps and other graphics.



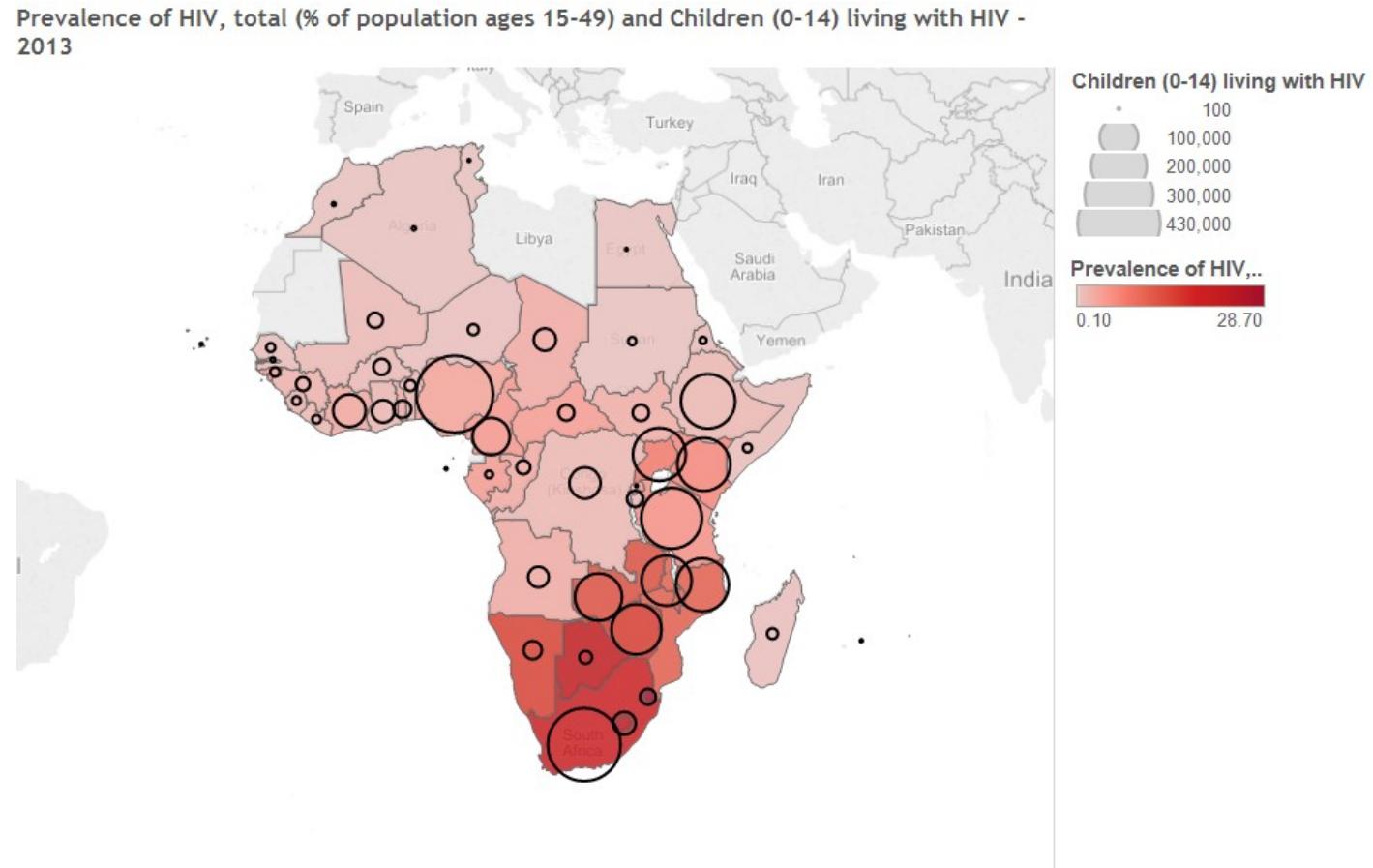
Colour Scheme Tip

- Avoiding multiple colours in choropleth mapping
- Stick with a single hue (or a small set of closely related hues) and vary intensity from pale colours for low values to increasingly darker and brighter colours for high values.



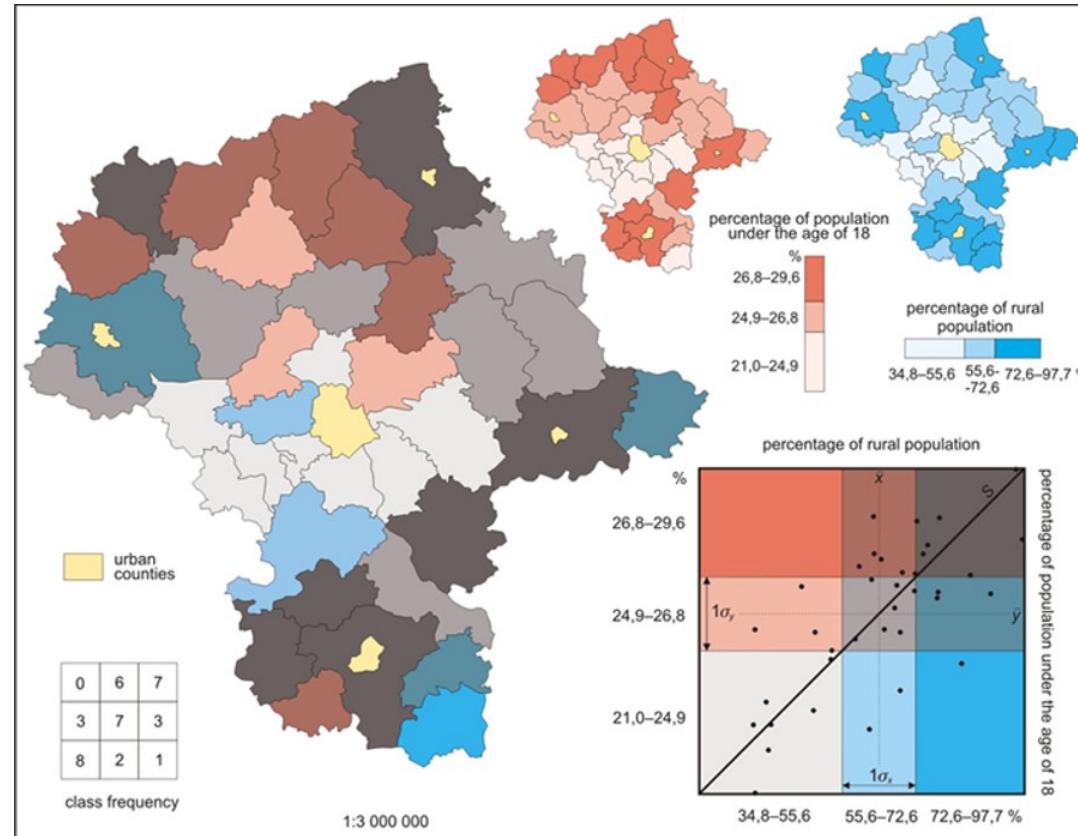
Quantitative Thematic Map - Bivariate

Symbolising features based on more than one attribute



Quantitative Thematic Map - Bivariate Choropleth Map

Symbolized features based on more than one attribute



Source: <http://kellystravelmap.blogspot.sg/2013/07/bivariate-choropleth-map.html> and
http://icaci.org/files/documents/ICC_proceedings/ICC2013/_extendedAbstract/278_proceeding.pdf

Reference

Proportional Symbols

Choropleth Maps

Dot Density Maps

The Basics of Data Classification

Should a map be interactive?

Map interaction