

# Cartography and Output

Sr Prabakaran Supramaniam  
Seksyen Kartografi  
JUPEM

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# Content

- Introduction: Cartography and Map
- Map design
- Generalisation
- Types of Map

# Introduction

## Cartography

- The art, science and technology of the production of maps.
- 'in Greek **chartis = map** and **graphein = write**' is the study and practice of making geographical maps.
- Combining science, aesthetics, and technique, cartography builds on the premise that reality can be modeled in ways that communicate spatial information effectively.

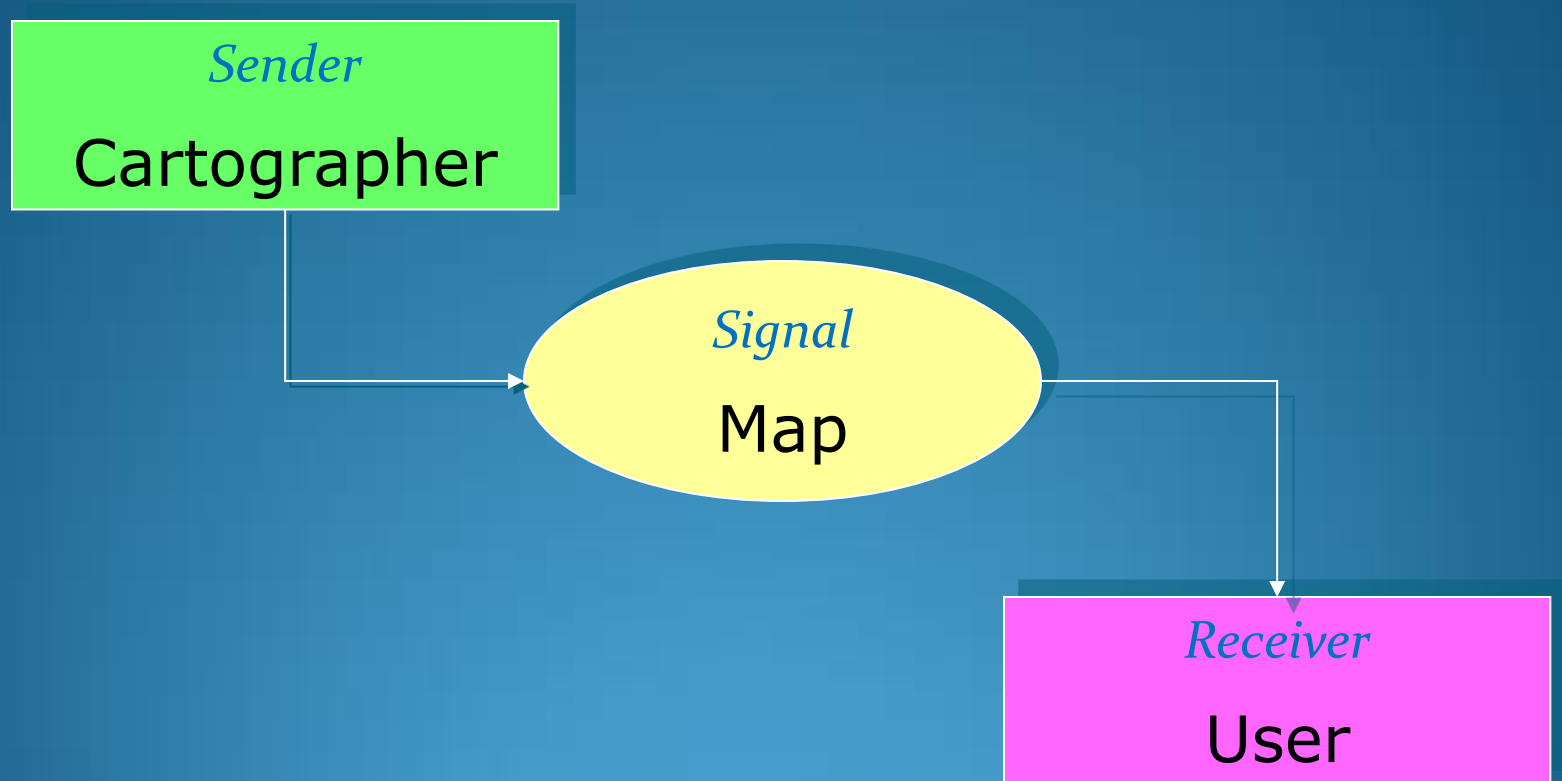
# Map

- A map is a scientific document which visualize the surface of earth in graphical form with scale on printed or digital media as per user requirement.
- A map is a visual representation of an area—a symbolic depiction highlighting relationships between elements of that space such as objects, regions, and themes.

## 4 processes in Cartography:

- Collecting and selecting the data for mapping.
- Manipulating and generalizing the data, designing and construction the map.
- Reading or viewing the map.
- Responding to or interpreting the information.

# Cartographic Communication



# Map design

## How to say what to whom and is it effective?

### Characteristics:

- Theme → Map layout
- Marginal information
- Map content and perception level of data
- Scale and Accuracy
- Symbol
- Color
- Visual variable
- Text and placement
- Multimedia elements and GUI; *Interaktiviti, animasi, audio dan video*

# Map layout

- 2/3 of the area – must be map area.
- 1/3 of the area – is the marginal information.
- 75% info from the map, not from the legend.



...cont.

# Frame Map

Main Title  
Subtitle

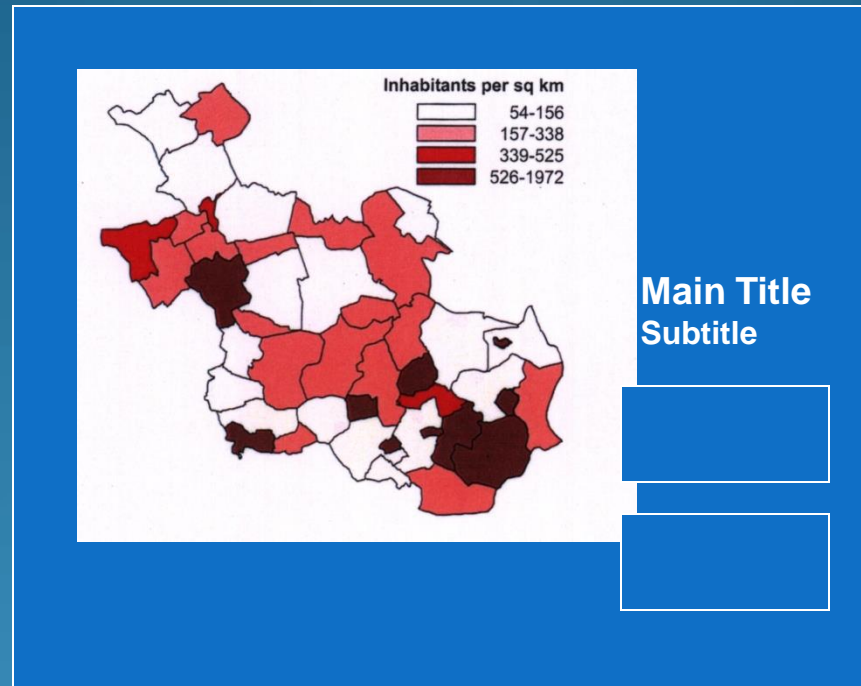
Text, text

Text, Text, text  
text,text,text  
test,text,text,text,  
text,text,text.text

- Conventional map – with rectangular/square frame.
- Frame separates map area and marginal information.
- Suitable for series map such as topographical map.

...cont.

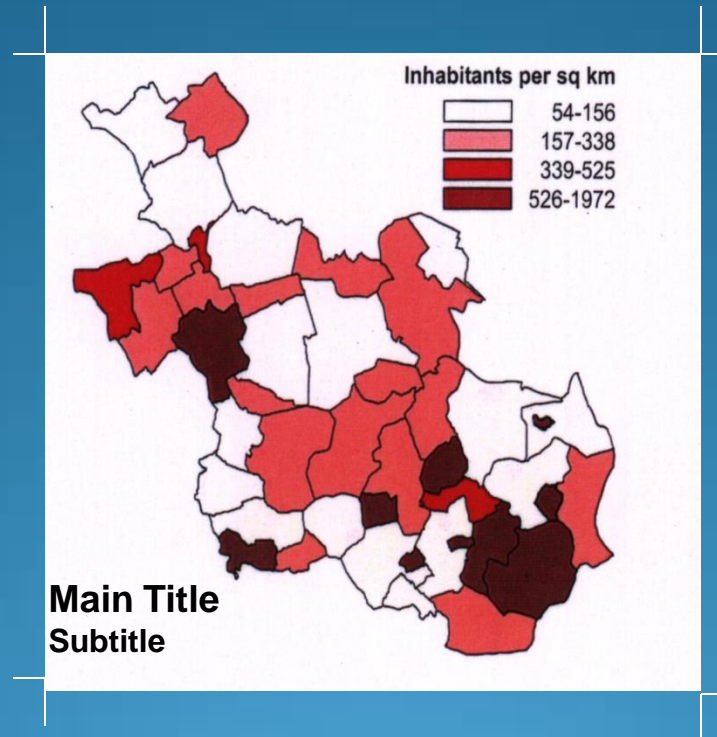
# Island Map



- Neatline acts as the frame.
- Irregular shape – gives freedom to use various types of layout.

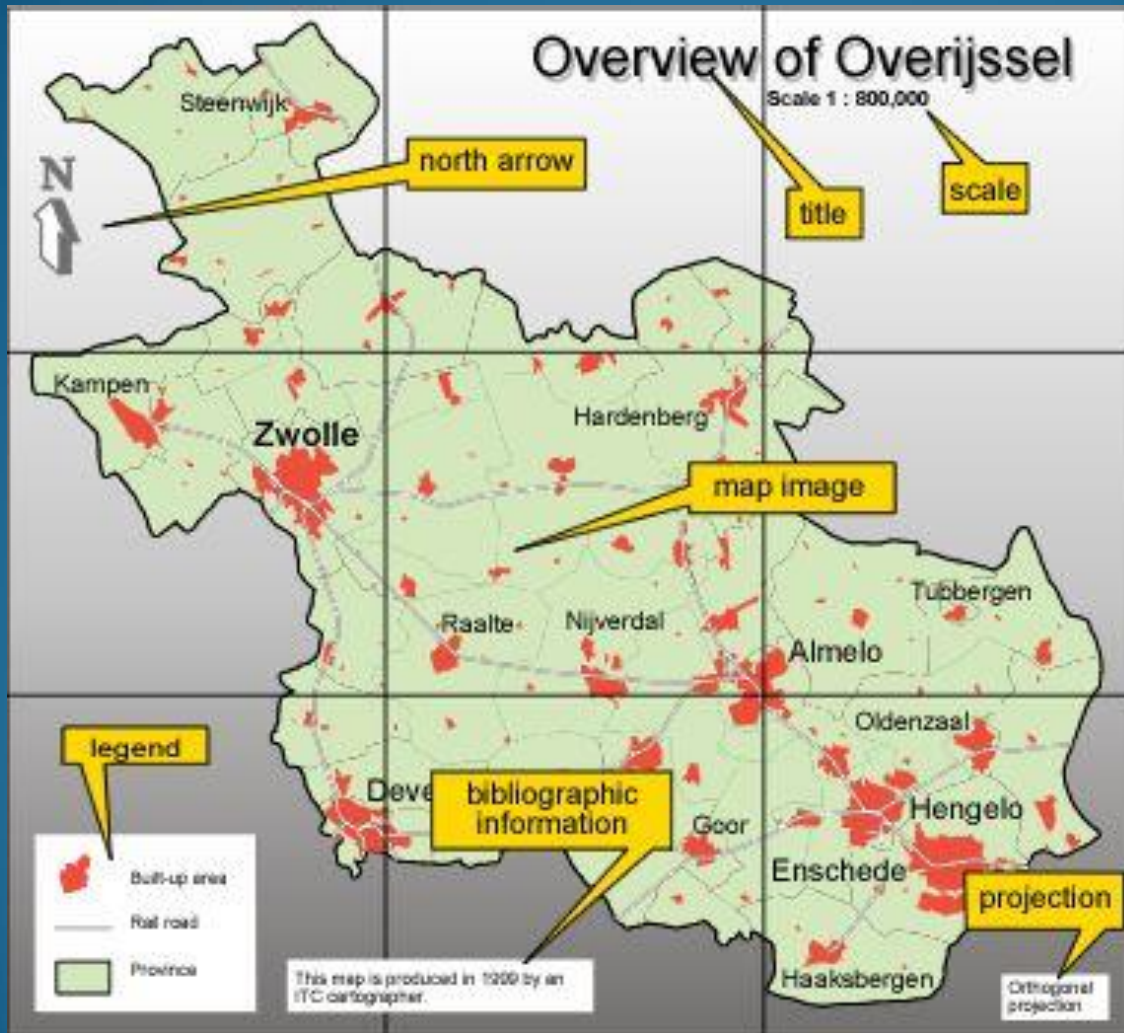
...cont.

## Bleeding Edge Map



- No frame and neatline.
- Map area until the trim edges of paper .

# Marginal information



- Title
- Map space/image
- North arrow
- Legend
- Scale
- Bibliographic info.
- Projection
- Metadata

# Map content and perception level of data

Visual hierarchy of map information content:

- **Primary content level**  
Main theme of map. Hotspots, mouse-over etc. supply information
- **Secondary content level**  
Topographic map as base map, pop-up menu supply additional information
- **Supportive content level**  
Marginal information eg. Legend, graphs, not directly related to main theme
- **Figure-ground relationship**  
Important features which are the 'figure' should be more prominent than background information which are the 'ground'.

# Content level

## Highways in Overijssel



primary content

secondary content

supportive content

### Legend

Highways

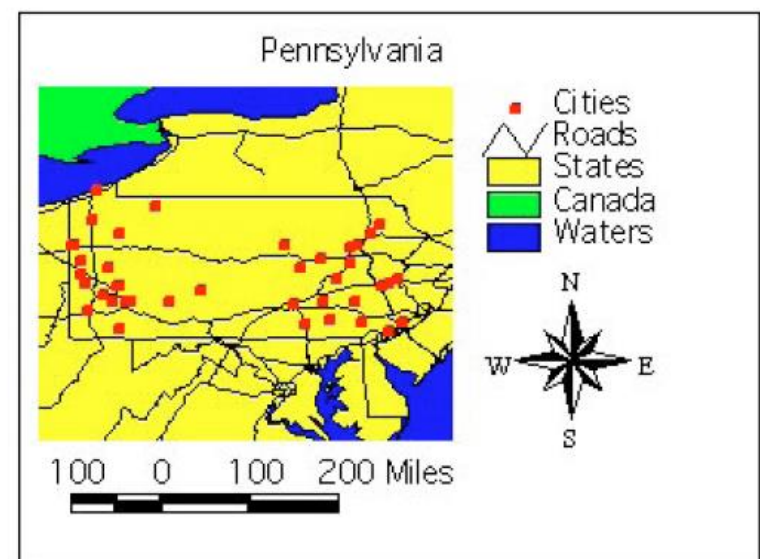
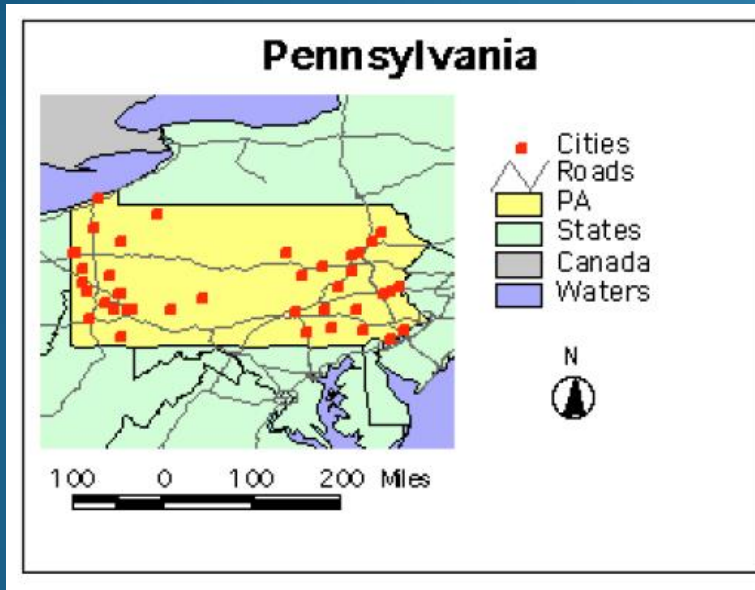
Main towns



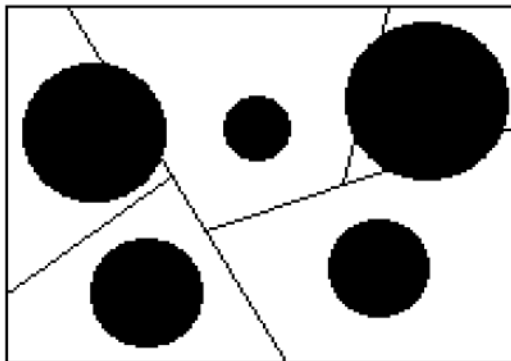
## Highways in Overijssel



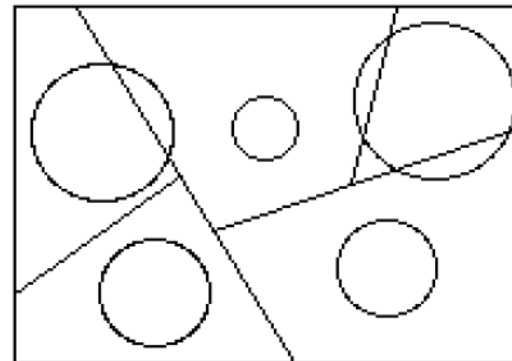
# Visual Hierarchy



# Figure-ground relationship



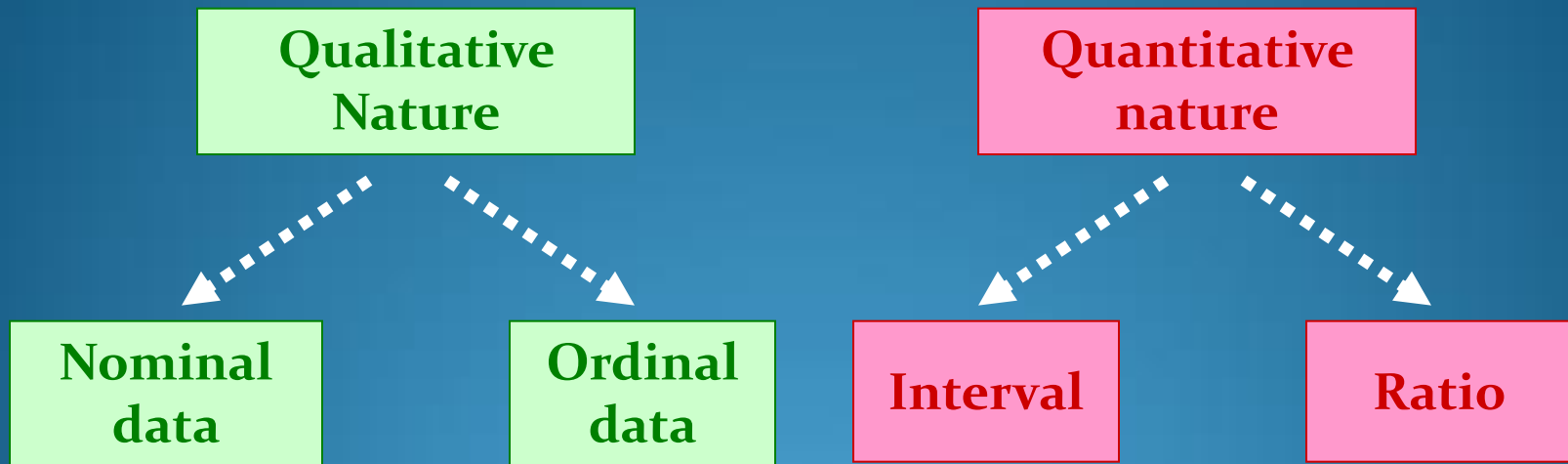
**Figure-ground clear**



**Figure-ground unclear**



# Perception level



# Measurement levels of spatial data:

- **Qualitative Nature**

A distinction purely based upon the nature of spatial data e.g. the difference between tree, river, road, etc.

- **Quantitative Nature**

A distinction on the basis of amount or sizes e.g. the distinction between a town with 20000 inhabitants, and a town with 50000 inhabitants

# • Qualitative nature

## Nominal data

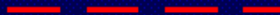


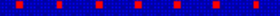
Qualitative data measured on a nominal measurement scale – different in nature / identity but have **equal** importance: e.g. the difference between palm oil, rubber and forest.

### Nominal Data: Point Symbols

-  airport
-  bench mark
-  capitol
-  church
-  mine
-  school
-  town




SLC 4 (P3)

### Nominal Data: Lines

- road 
- river 
- county boundary 
- utility cable 

SLC 4 (P6)

### Nominal Data: Areas

-  Grassland
-  Submerged marsh
-  Census Regions

SLC 3 (P3)

## Ordinance data

Qualitative information with clear element of order, though not quantity determined: e.g. difference between highway, primary road, track.

### Ordinal Data: Point Symbols

a. relationship coded by size  
b. relationship coded by color  
c. relationship coded by size and color.

SLC #10

### Ordinal Data: Line Symbols

Line Weight:

Line Style:

Line Color:

Combinations of Lines:

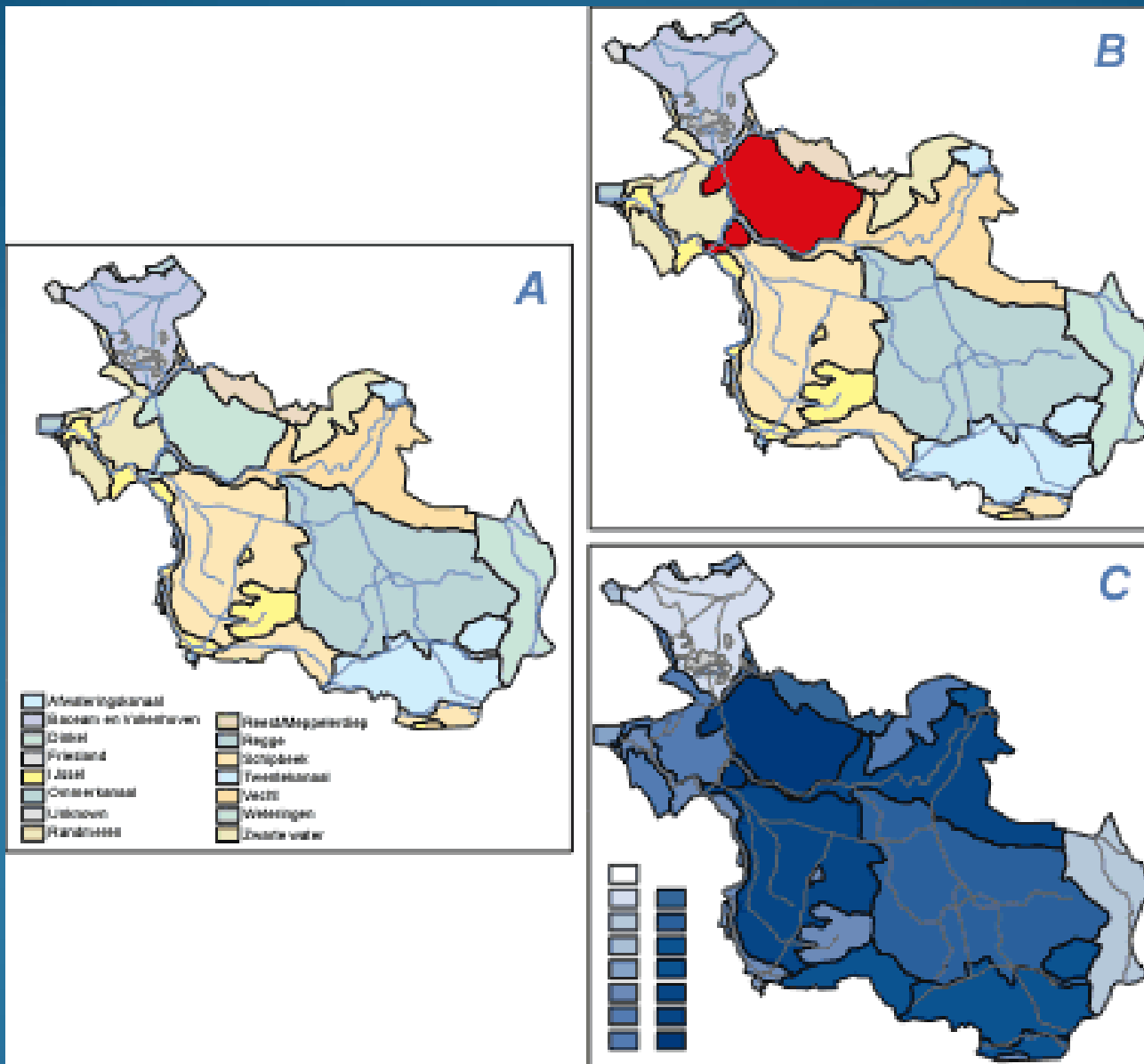
SLC #95

### Ordinal Data: Areas

Examples using color and fill patterns to indicate quantitative differences between areas.

SLC #96

# Mapping qualities: application of graphic variable



- **Quantitative nature**

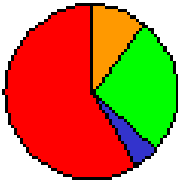
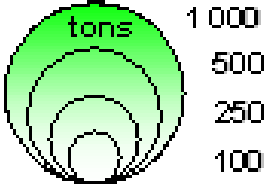
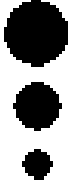
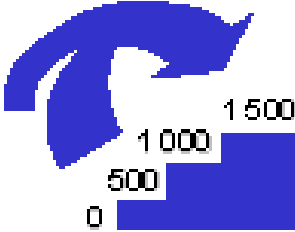




### Interval

Ranking of data and the interval between the data is quantitatively determine but the zero point is arbitrary. e.g. temperature, year.

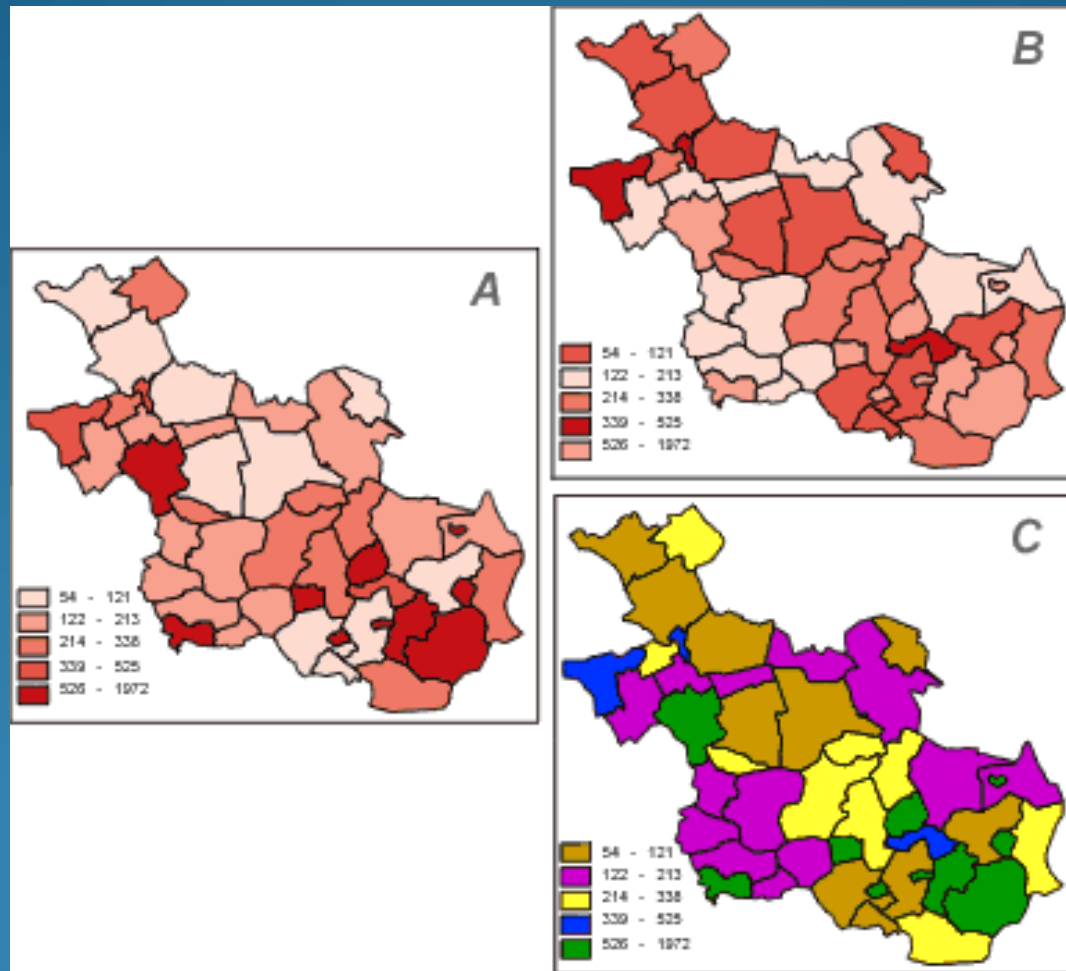
### Ratio

Data ranked on a quantitative scale using an absolute zero point e.g. distance, elevation above MSL, weight.

### Interval and Ratio Data

<p><b>Point</b></p>	<p><b>Election results</b> % of votes</p> 	<p><b>Mineral production</b></p> 	<p><b>Populated places</b></p>  <p>50 - 80 10 - 49 1 - 9</p>
<p><b>Line</b></p>	<p><b>Roads: load capacity</b></p> <p>over 10 tons</p> <hr style="border: 2px solid red;"/> <p>5 - 10 tons</p> <hr style="border: 1px solid red;"/>	<p><b>Stream flow</b></p> 	<p><b>Elevation</b></p> 
<p><b>Area</b></p>	<p><b>Precipitation</b></p>  <p>25 20 15 10 0 cm.</p>	<p><b>Elevation</b></p>  <p>400 metres 300 200 100 0 sea level</p>	<p><b>Population density</b></p> <p>Persons / km<sup>2</sup></p>  <p>50 - 80 10 - 49 1 - 9</p>

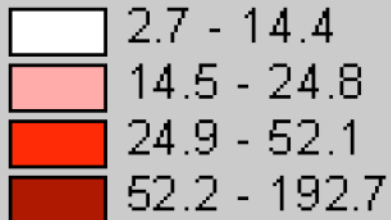
## Mapping Quantities: application of graphic variable





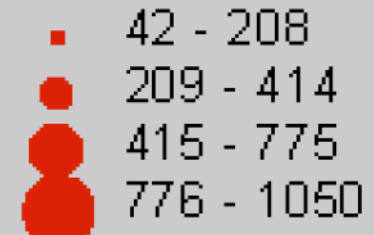
# Quantitative vs. Qualitative

## Pop. Density



**Quantitative:**  
Logical progression  
from low to high.

## Population

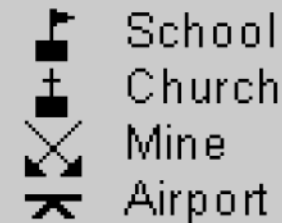


## Tree Species



**Qualitative:**  
No ranking implied.  
Differ only in type.

## Points of Interest



# Scale

- Map content depends on scale.
- Ability to zoom in and out → scale changes.
- Ideal scale (scale range) to be based on the density and accuracy of map detail.
- Need of scale bar.
- Default scale for a default display size → define map content and required accuracy.

# Accuracy

**Positional accuracy** required by the nature of the spatial data to be displayed.

- Absolute positional accuracy less important.
- Relative positional accuracy shall be maintained.

**Semantic accuracy:** related to data symbolisation and presentation.

Depends on selection of graphic variables and their variations.

Simple, easily recognisable and self explanatory symbol to be used.

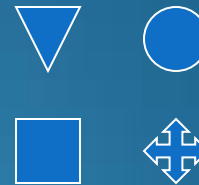
If not, legend is needed.

# Symbol

Wide variety of symbols developed to portray different kinds of information

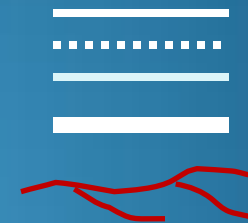
- **Point Symbols**

Represent location and characteristic of features of small territorial extent in relation to map scale



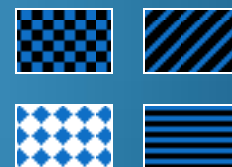
- **Line Symbols**

represent linear features



- **Area Symbols**

Represent features of considerable area extent in relation to scale



# Point symbol

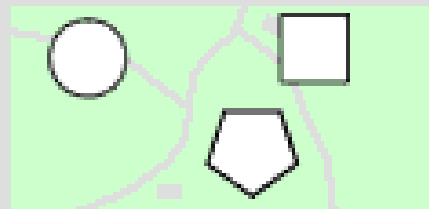
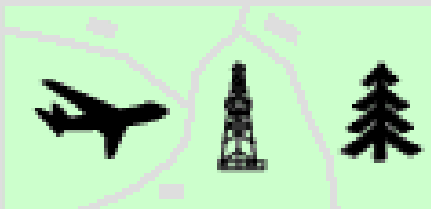
Point symbols:

Pictorial

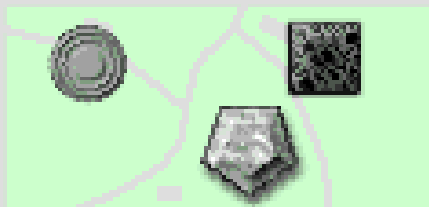
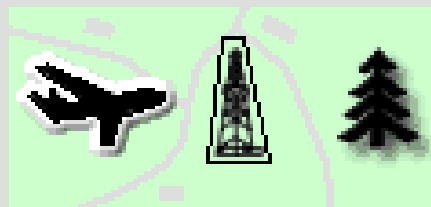
Geometric

(Alpha) Numerical

Static maps:  
*view only*



Static maps:  
*inter-active*



- Easy to understand
- Qualitative data
- Should have same visual impact

- To be in legend
- Easy to create
- Size : quantitative
- Color : qualitative

- To be in legend
- Numbers / letters
- Must be legible

## Line symbol



"Conventional" line symbols

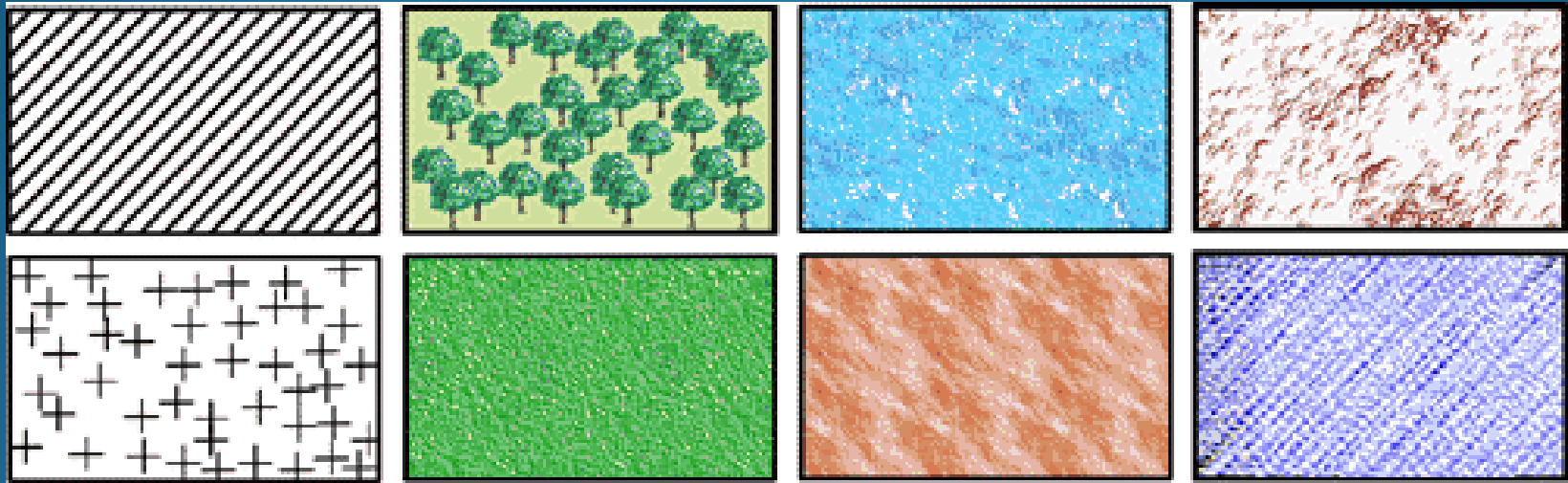


Web "art" line symbols

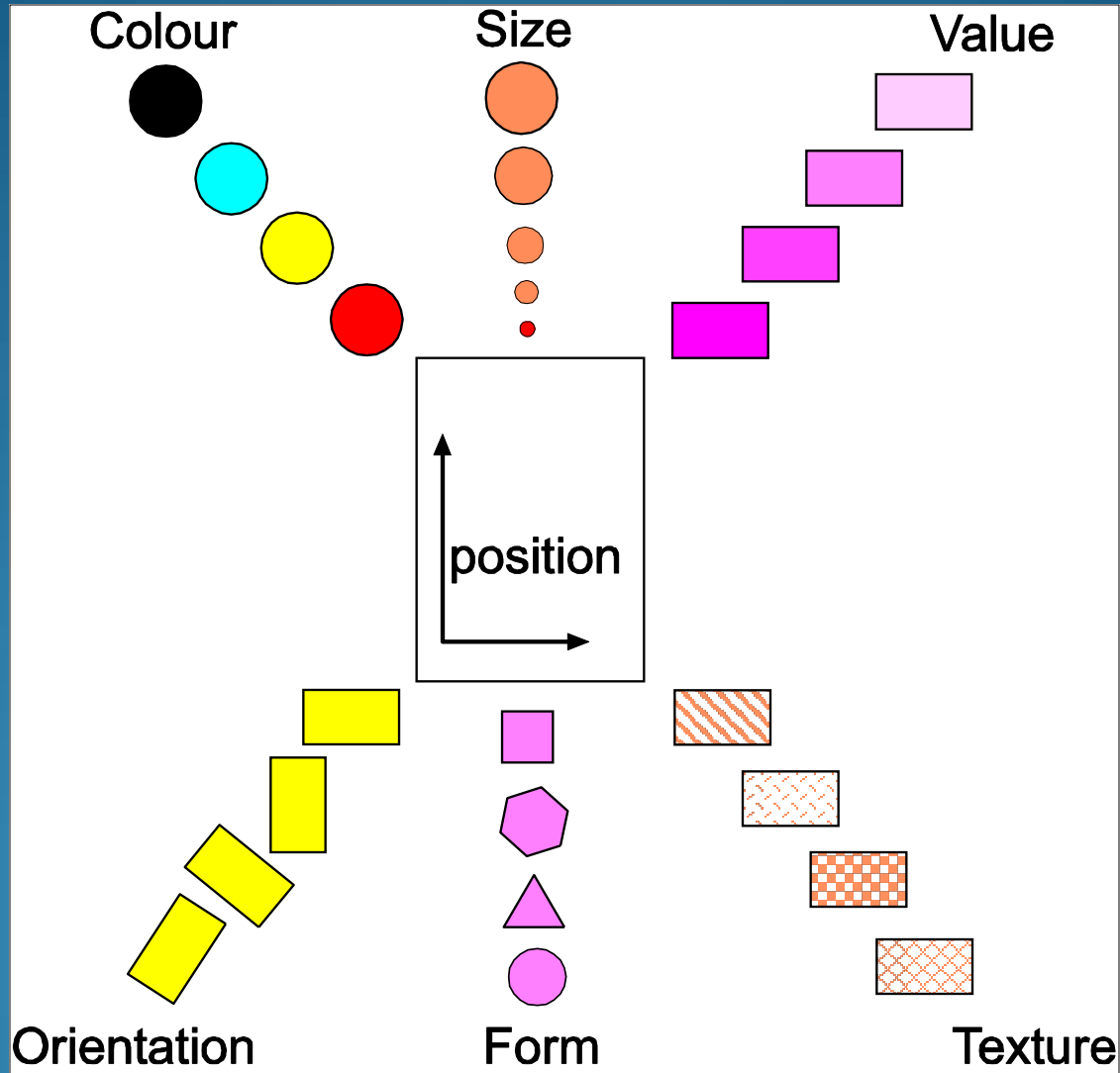


Flowline symbols

## Area symbol

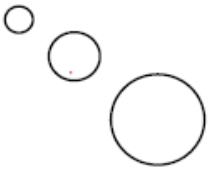

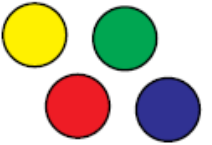
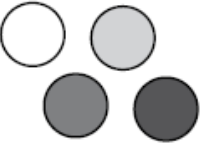
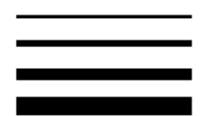



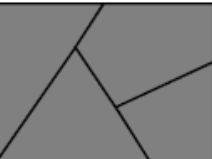




# The visual variable





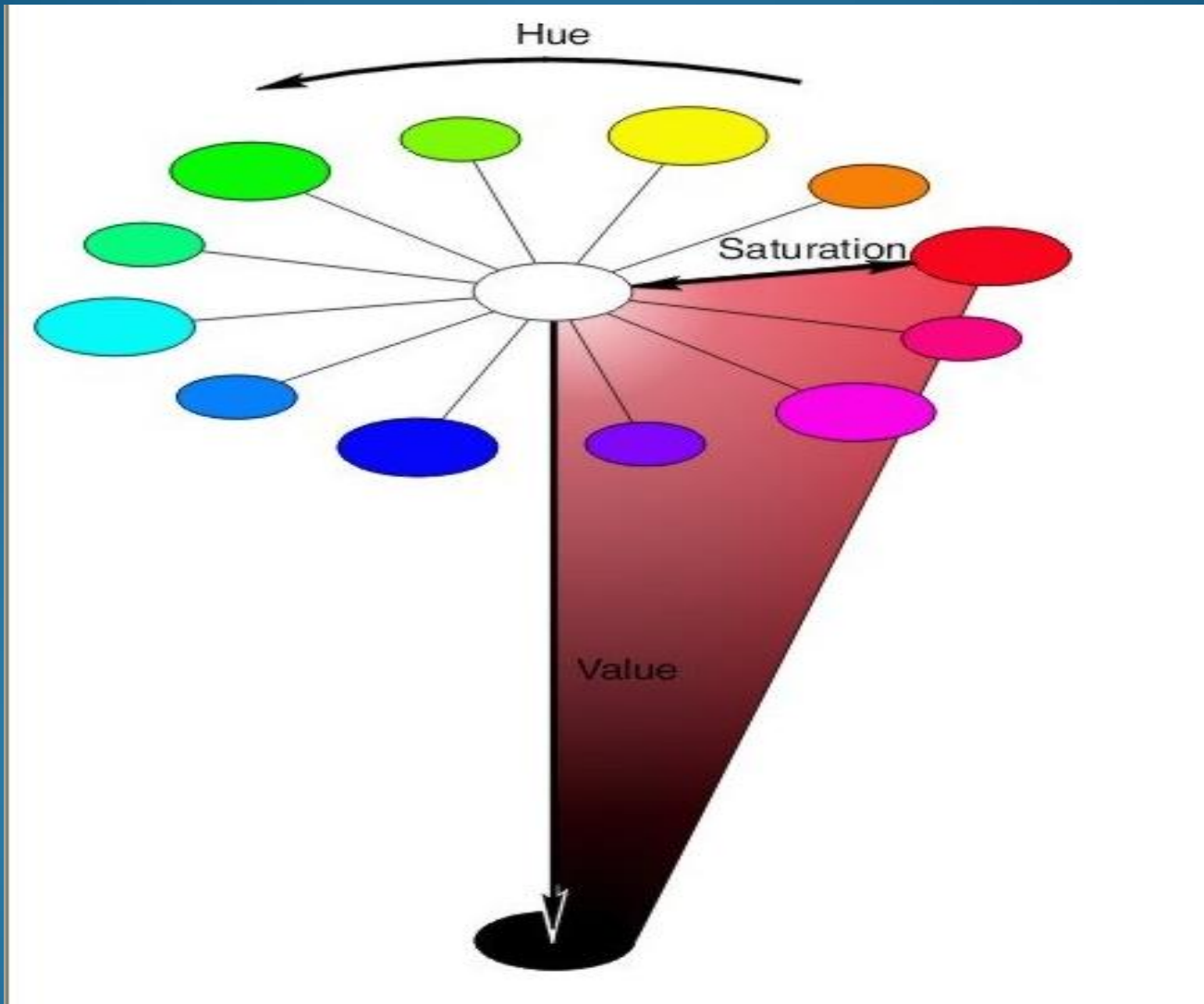
...cont.

	Size	Shape	Pattern	Hue	Value
Point					
Line					
Area					

# Colour

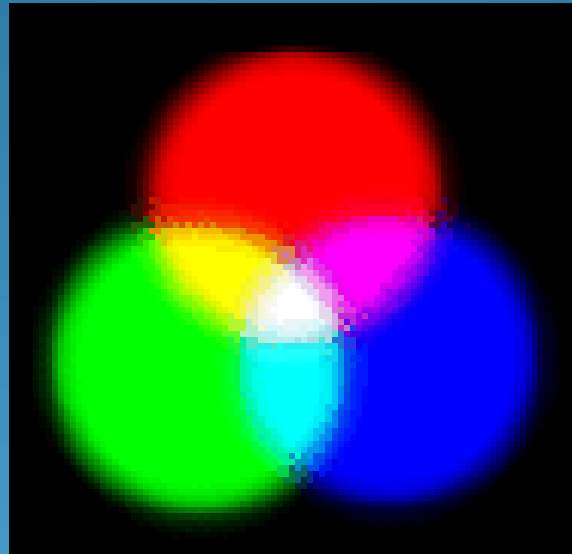
- The human brain requires a sense of order or it will reject whatever it sees.
- If too many colours are used, the viewer will become visually confused and will reject the image.
- If not enough colour is used, boredom results.
- Marketing psychologists state:
  - colour accounts for 60% of the acceptance or rejection of what a person sees.
  - a lasting impression is made within ninety seconds.
- Focus in design:
  - ✓ Aesthetics: draw the eye to the most important areas
  - ✓ Optical effects: increase readability and minimize optical fatigue.
  - ✓ Symbolism: communicate powerful symbolism.
  - ✓ Technological: the right combination create an overall logic.

## Colour : Hue, Saturation & Value



## Additive Colour

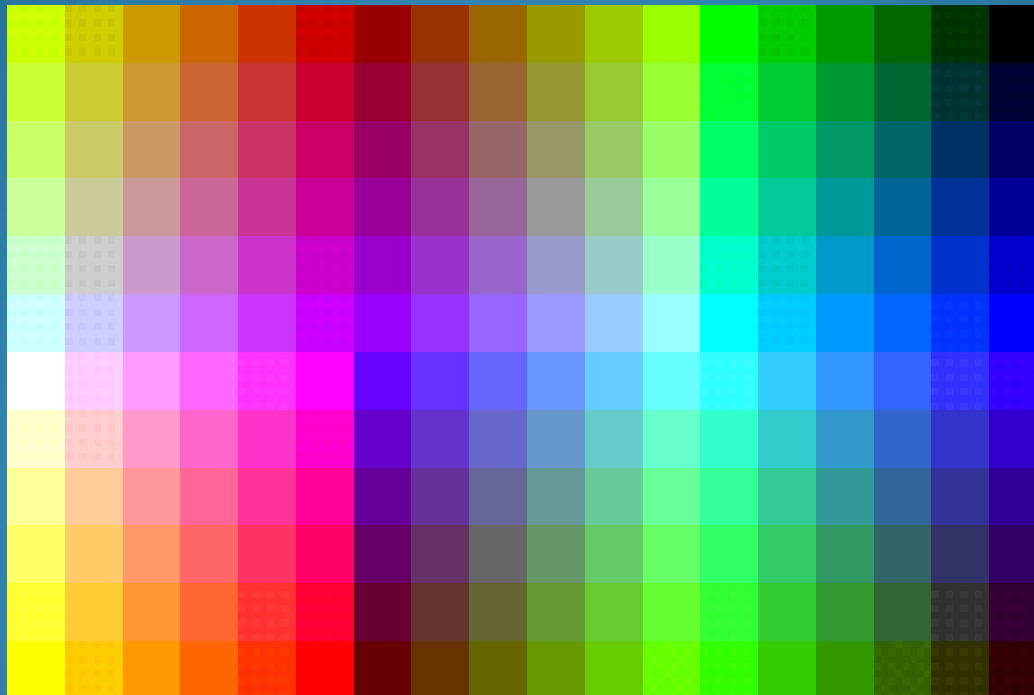
Computers create colours based on a special set of 3 primary colours: Red, Green, and Blue (RGB). So does your television. If you go up close to your TV, (put your eye right on top of the screen) you will see little dots of red green and blue. In computers and television, light transmissions are creating the colour. Red and green mix to create yellow.



This is called "**Additive Colour**" and is completely different from how colours are mixed in the tangible world of paints and pigments.

...cont.

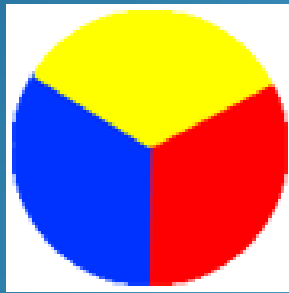
Although most colour computers have a capacity for at least 256 colours, only 216 colours are common to all computers. Newer computers are equipped with 64 thousand colours (16-bit) and the highest quality systems deliver 16.7 million colours (24-bit). However, approximately 10% of all computers are limited to 256 colours (8-bit). If we intend to address universal accesibility, this is the **216 web-safe colour palette**.



- Preferred  
image format :
- JPEG
  - GIF

## Subtractive Color

When we mix red and green paint, we get muddy browns. This is "**Subtractive Colour**" and is based on the primaries, red, yellow, and blue (or blue-based/**Cyan**, yellow-based/**Yellow** red-based/**Magenta**). Let's take a look at the color below and analyze the processes it passed through before it reached your eyes.



Primary Colors



Secondary Colors



Tertiary Colors

## Some facts about colour

### Yellow

Yellow is an eye irritant -

- babies cry more in yellow rooms.
- husbands and wives fight more in yellow kitchens.
- opera singers throw more tantrums in yellow dressing rooms .

### Red

A company which markets red contact lenses for chickens (at 20 cents a pair), points to medical studies showing that chickens seeing red during the day are happier and eat less food. A spokesperson said the lenses will improve world egg-laying productivity by \$600 million a year.

### Blue

Blue is an appetite suppressant . Weight loss plans suggest putting your food on a blue plate, put a blue light in your refrigerator, or dye your food blue! A little black will make it a double whammy!

# Text and placements

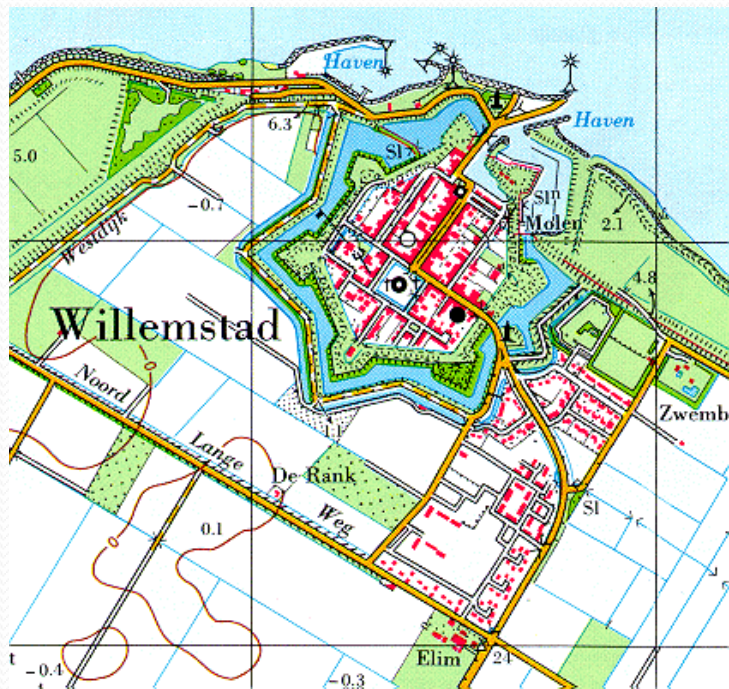
- Text expresses information such as geographical names, height values, etc.
- Should be legible: no overlapping
- Applications:
  - Outside map face; title legend, scale line, grid, etc
  - Within map face; geonames, symbols.
- Text to be rasterised should not be < 10 point.
- Anti-aliasing

ORDINAL	High	Capital/lower case OVERIJSSEL	Corps (size) OVERIJSSEL	Value <b>OVERIJSSEL</b>	Grey value OVERIJSSEL
	Low	Overijssel	OVERIJSSEL	OVERIJSSEL	OVERIJSSEL
NOMINAL	Colour	Lower case/ small caps OVERIJSSEL OVERIJSSEL	Type family <b>OVERIJSSEL</b> OVERIJSSEL	Roman/italic Overijssel <i>Overijssel</i>	



# Generalisation

- Changes that are necessary when reducing the map scale



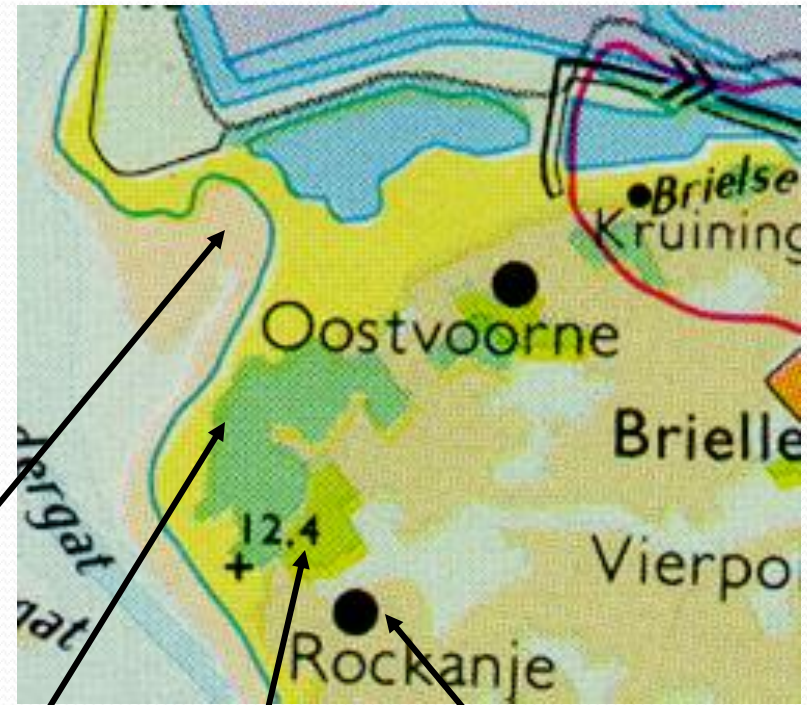
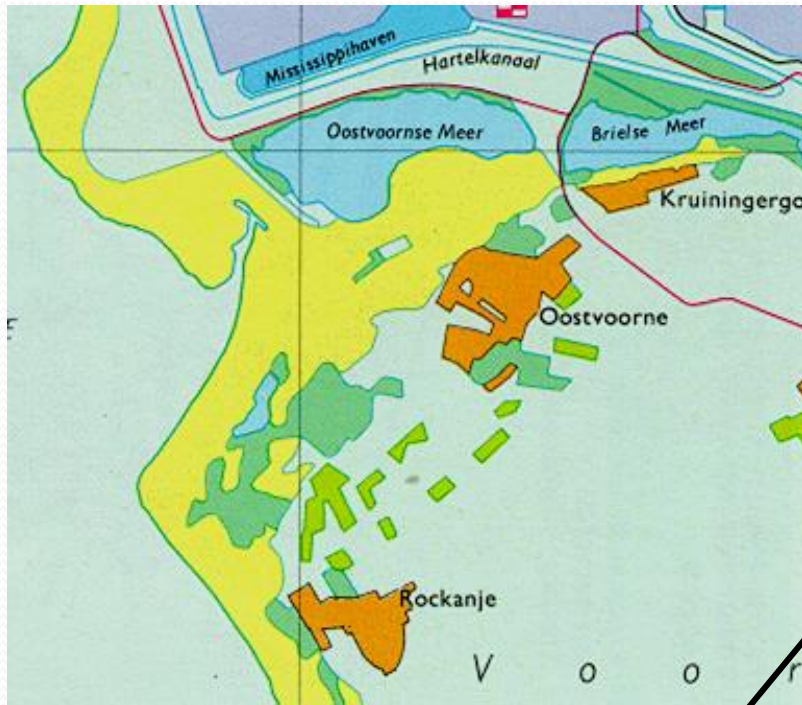
1 : 25.000



1 : 50.000



1 : 50.000 enlarged

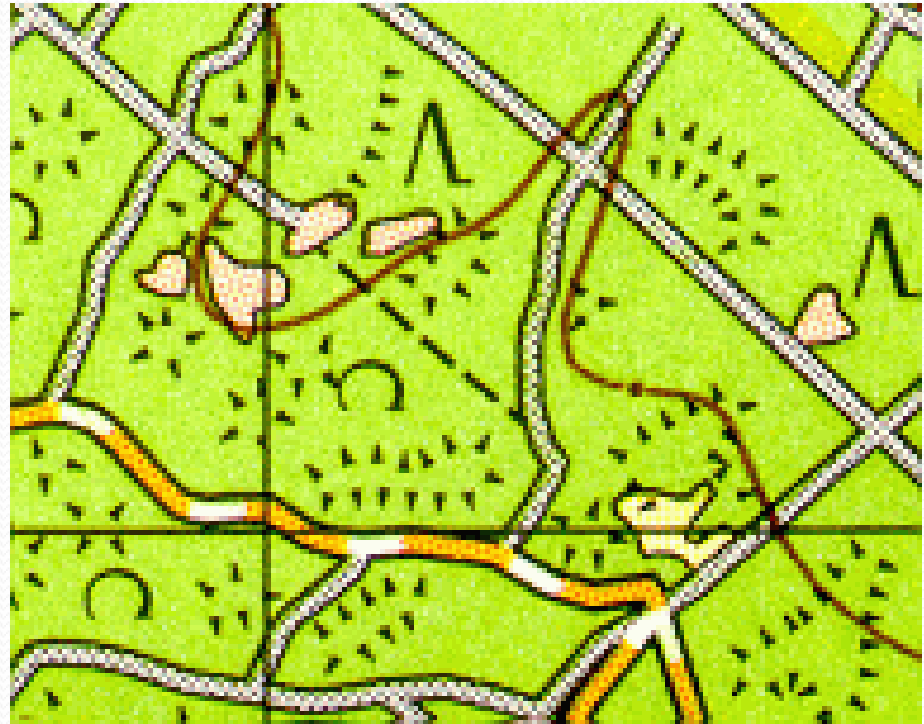
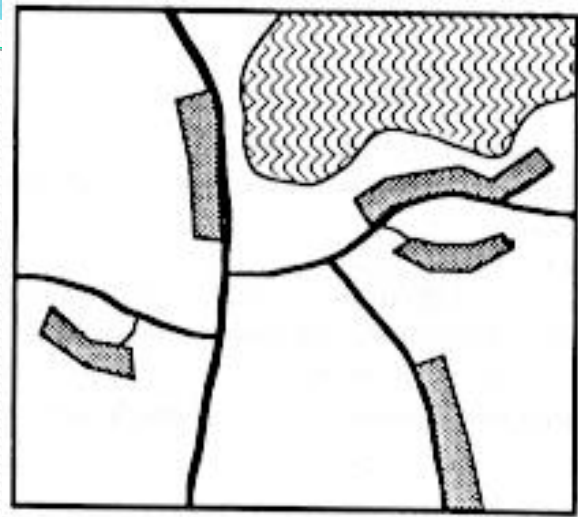
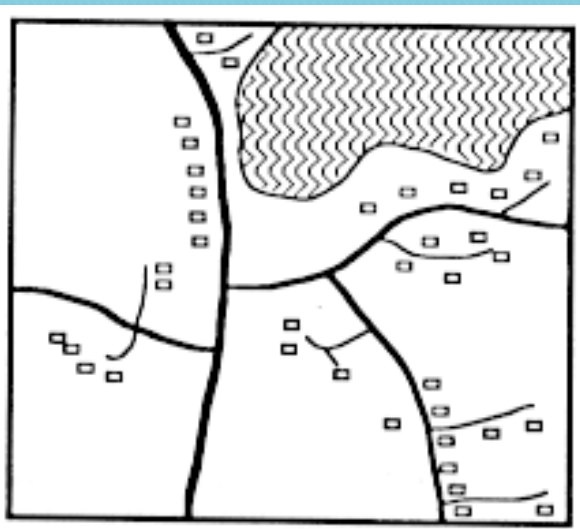


simplification

elimination

aggregation (of polygons)

point conversion  
(symbolisation)

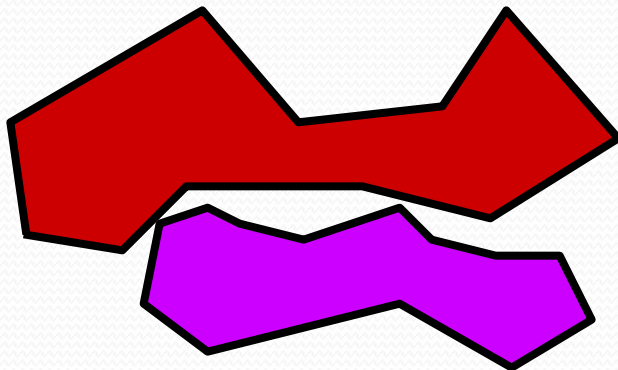


# Reasons for generalization

- Less crowdedness, distracting detail on the map
- Improve visibility of objects that would become too small
- Better visualisation through symbolisation
- Moving to avoid visual collisions

# Need for generalisation

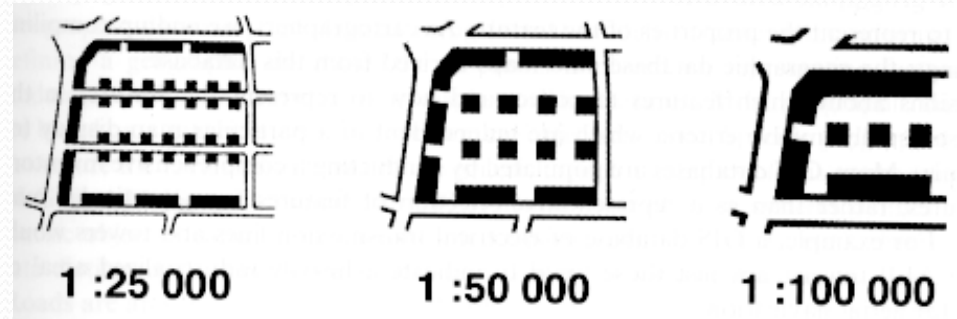
- Imperceptibility (too small)
- Coalescence (visual collision, too close)
- Congestion (too crowded, too much detail)
- Consistency preservation



# Means: the operators

- Selection/elimination
- Displacement
- Shape change
- Aggregation
- Dissolution
- Reclassification

- Typification

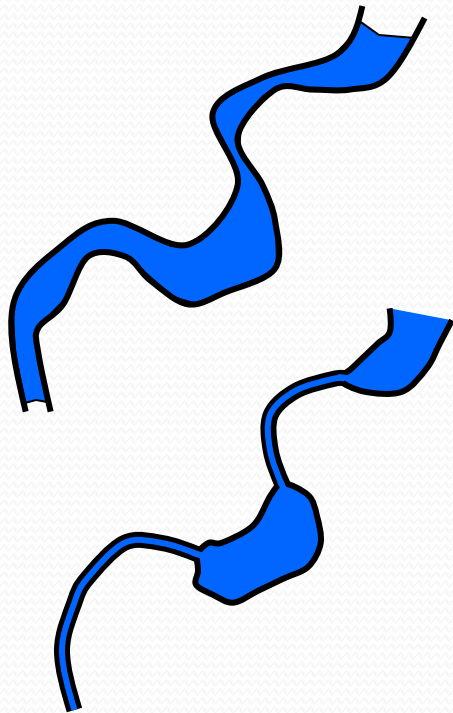


- Exaggeration
- Point, line, area conversion

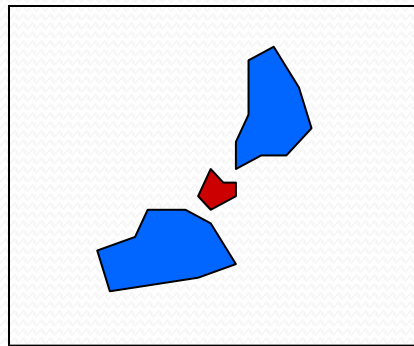
*deciduous forest, coniferous forest → forest*

*Municipality boundaries → province boundaries*

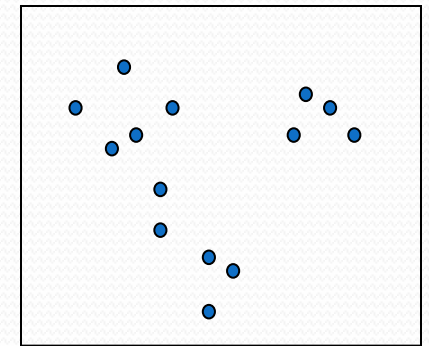
# Operators: more examples



Partial line conversion



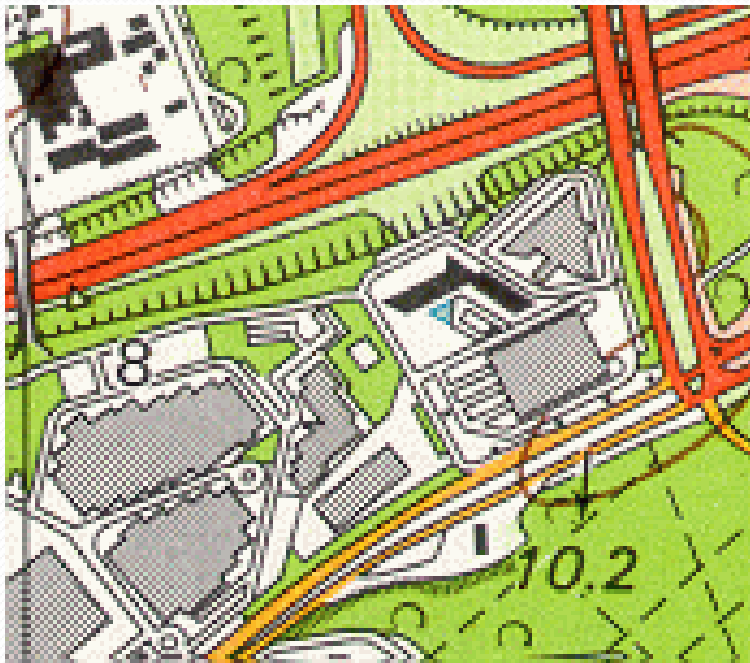
Exaggeration  
(enlargement)



Point-to-area  
conversion

# Shape change buildings

- Requirement to preserve axis-parallelity and character



Topo 1 : 25.000



Topo 1 : 50.000



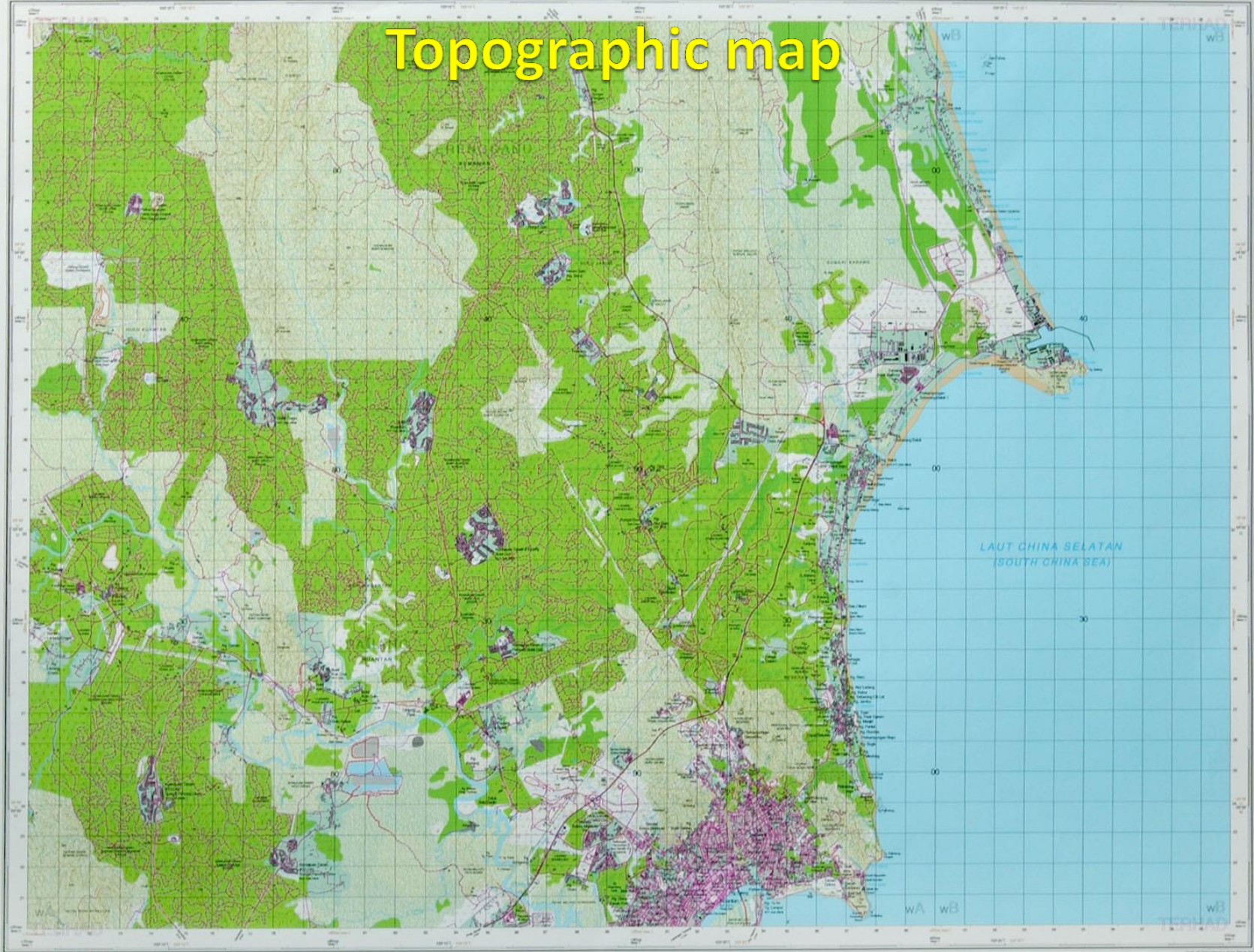
# Types of Maps

- **Large scale map**
  - Planimetric maps
  - Cadastral maps, etc.
- **Topographic map**
  - Shows shape and elevation of terrain. Published in series.
- **Thematic map**
  - Maps with specific themes eg. vegetation, land use, transportation, etc
- **Navigation oriented map**
  - Nautical charts
  - Aeronautical charts

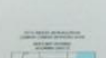
# Planimetric map



# Topographic map

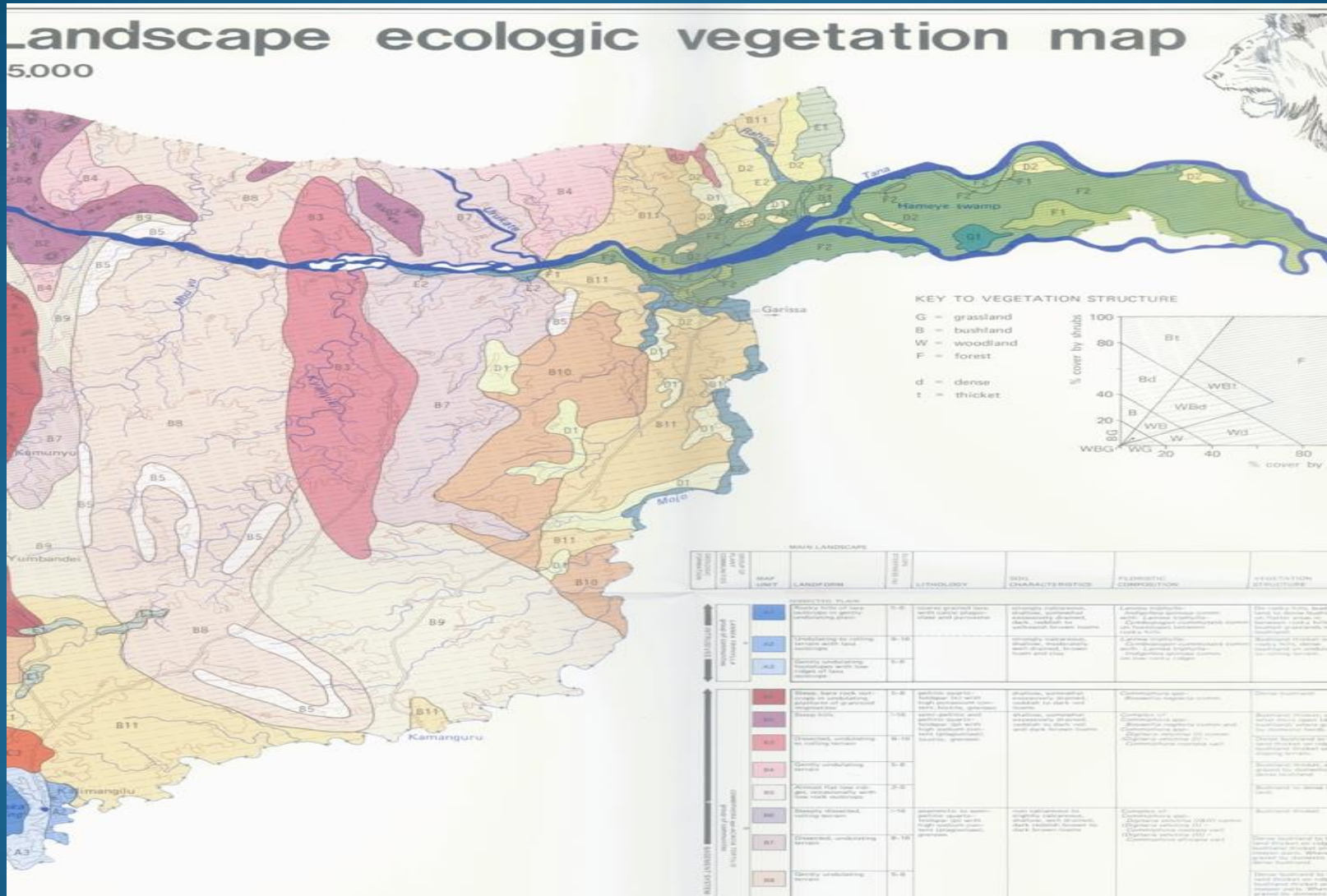


Revised and Progress (Penerbitan) Negara, Malaysia 2008  
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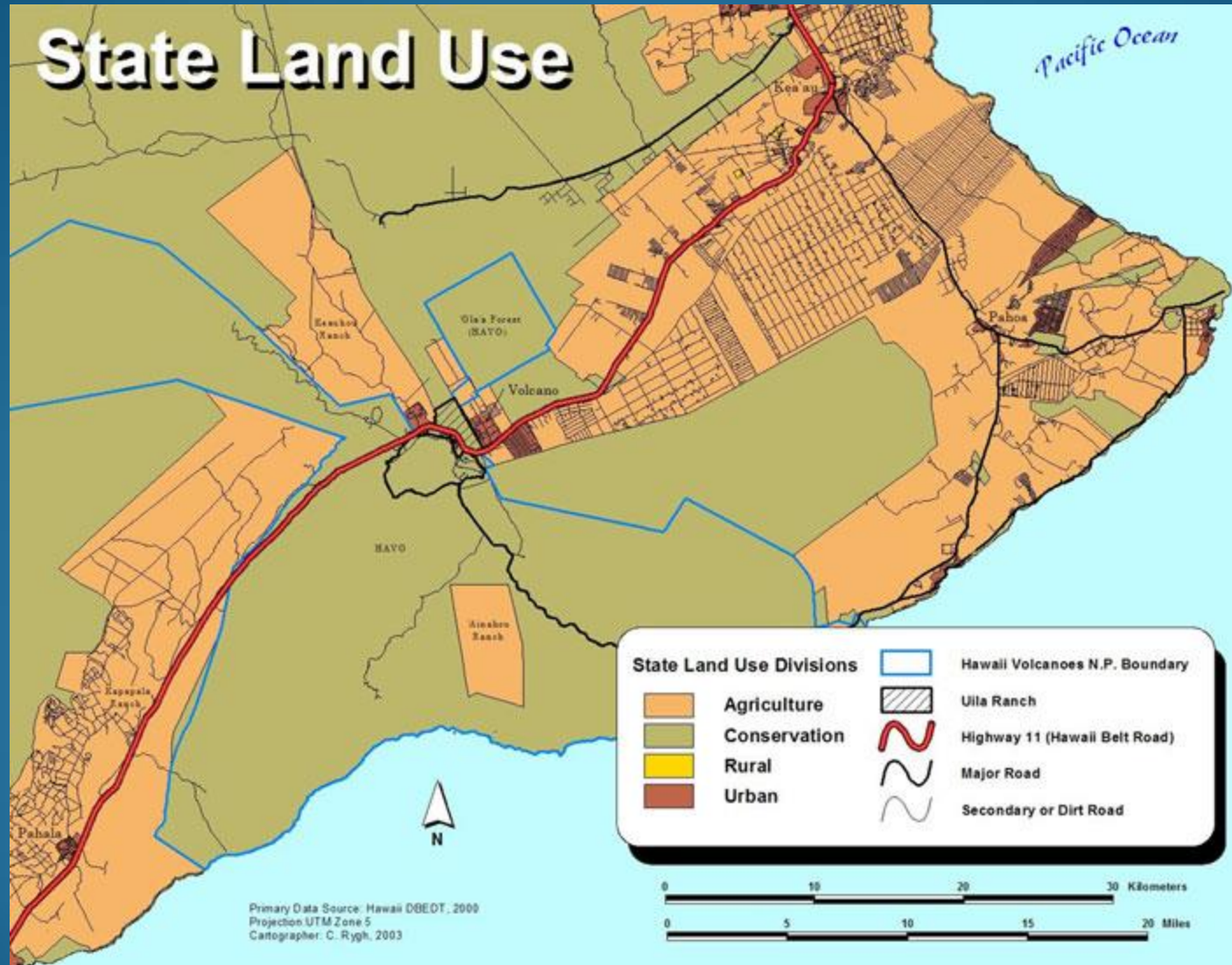


Symbol	Description
[Symbol]	1. Road
[Symbol]	2. High Road
[Symbol]	3. Railway
[Symbol]	4. Canal
[Symbol]	5. River
[Symbol]	6. Stream
[Symbol]	7. Lake
[Symbol]	8. Pond
[Symbol]	9. Swamp
[Symbol]	10. Forest
[Symbol]	11. Cultivated Land
[Symbol]	12. Urban Area
[Symbol]	13. Building
[Symbol]	14. Tower
[Symbol]	15. Monument
[Symbol]	16. Boundary
[Symbol]	17. Spot Height
[Symbol]	18. Contour
[Symbol]	19. Spot Elevation
[Symbol]	20. Spot Depression
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[Symbol]	22. Spot Contour Depression
[Symbol]	23. Spot Contour Elevation
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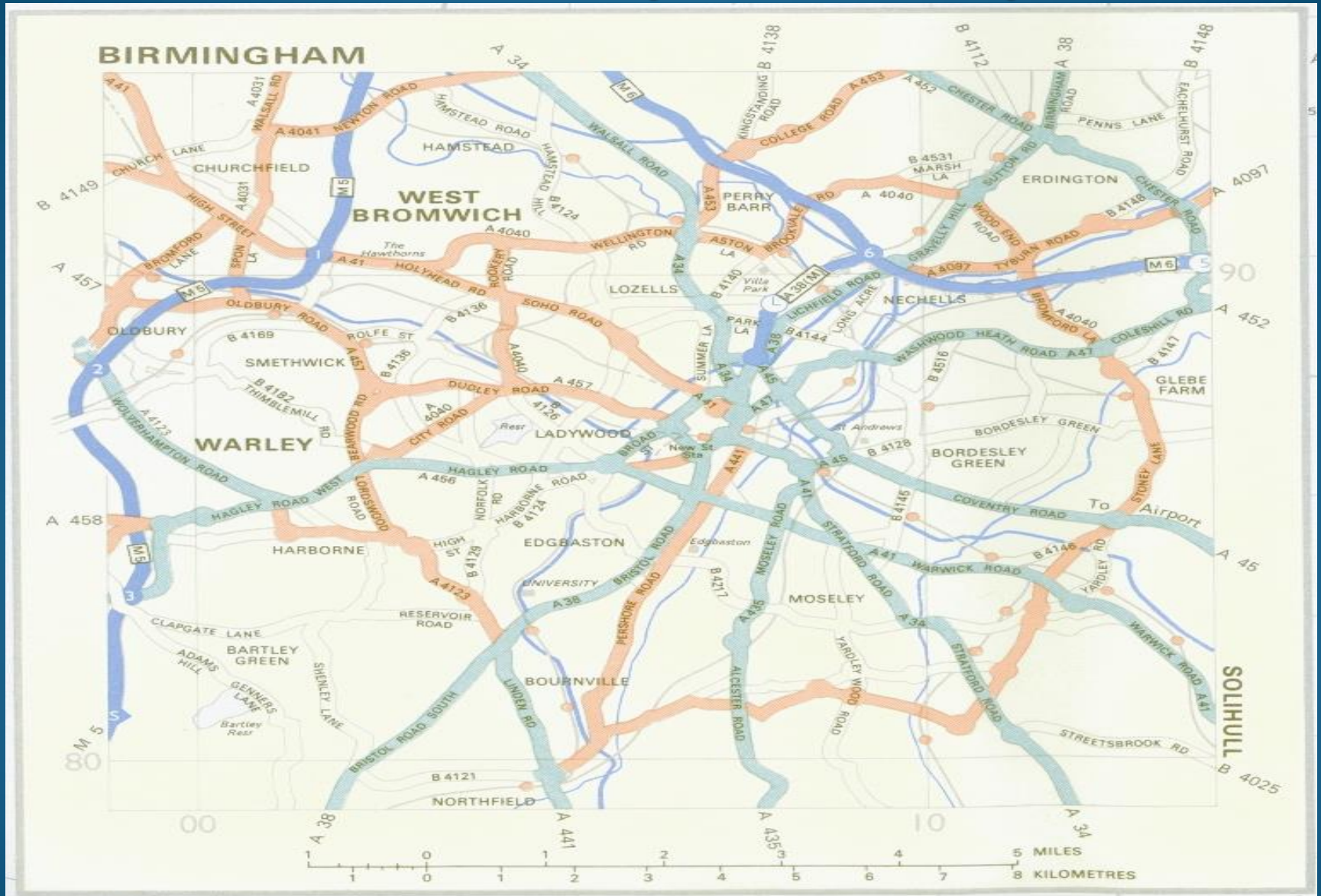
# Thematic map – Vegetation map



# Thematic map – Land use map



# Thematic map – Route map



# CONTOH PETA TERBITAN JUPEM

PETA ASIA TENGGARA DAN  
PASIFIK BARAT DAYA  
MAP OF ASIA SOUTH-EAST AND  
PACIFIC SOUTH-WEST

R 134



# PETA NEGERI (POLITIKAL) TERBITAN JUPEM

## PETA PEMERINTAHAN

POLITICAL MAP

SABAH

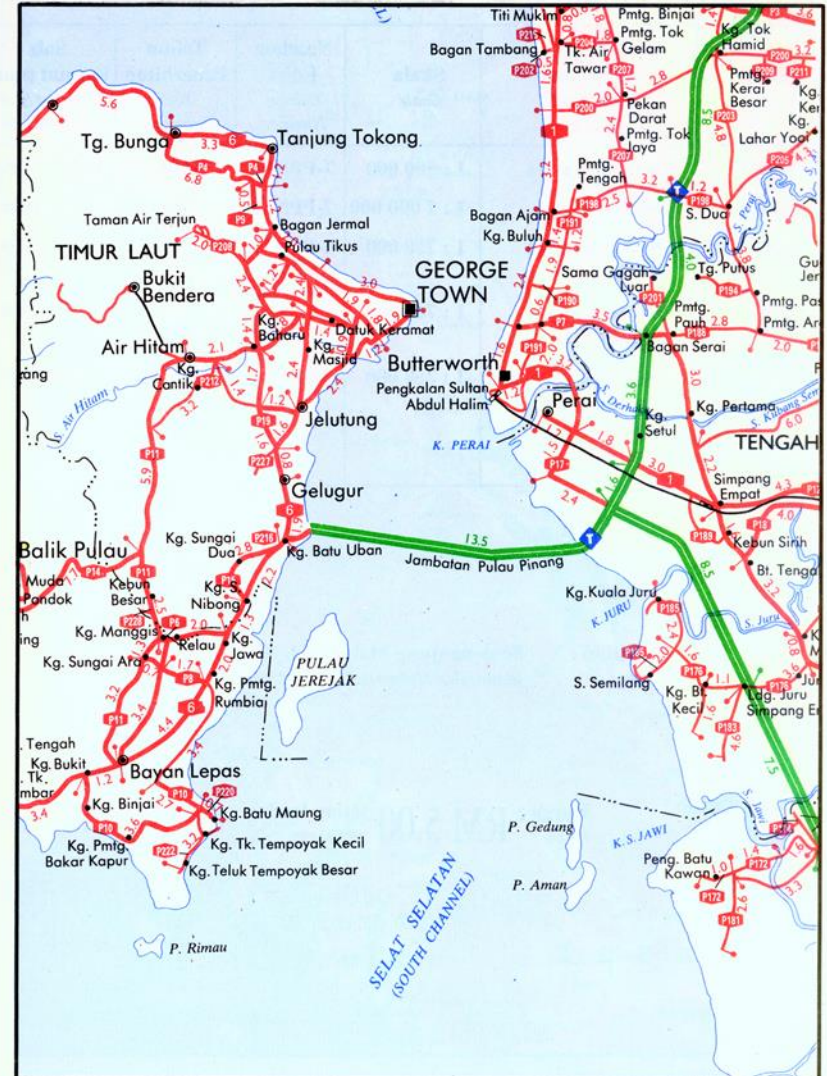
R 37





DI MALAYSIA  
ROAD MAPS OF STATES  
IN MALAYSIA

PULAU PINANG



PETA  
JALAN RAYA NEGERI  
TERBITAN JUPEM

# PETA JALAN RAYA SEMENANJUNG MALAYSIA TERBITAN JUPEM

## PETA JALAN RAYA SEMENANJUNG MALAYSIA ROAD MAP PENINSULAR MALAYSIA

R 96



Siri/Series

Skala/Scale

Nombor Edisi/Edition Number

Tahun Penerbitan/Year Published

Saiz Format (mm)/Format Size

Rampaian 96

1 : 1 000 000

2-PPNM

1984

140 x 220 (mm) dilipatkan

# PETA FIZIKAL TERBITAN JUPEM

PHYSICAL MAP

SEMENANJUNG MALAYSIA

L 4010



# PETA DIGITAL: eMap

INDEKS

METADATA

BUTIRAN

CARIAN

INPUT



# PETA DIGITAL: Webmap

MYeMap - Windows Internet Explorer

http://www.mymap.jupem.gov.my/v1/framesetup.asp

File Edit View Favorites Tools Help

Google Search Share Check Translate AutoFill Sign In

MYeMap

Lebuhraya Beringkat Aklah (Ampang Kuala Lumpur)

Sg. Klang

Map Legend:

- PETA BANDAR**
  - Kuala Lumpur
- Legend**
- Display Order**
- Groups**
- PENGANGKUTAN**
- KEMUDAHAN AWAM**
  - Balai Polis
  - Balai Bomba
  - Pejabat Pos
  - Bank
  - Hentian Bas
  - Perpustakaan
  - Pasar
  - Dewan Serbaguna
  - Balairaya
- Tempat Ibadat**
  - Surau
  - Masjid
  - Gereja
  - Kuil
  - Tokong
  - Gurdwara
- KESTIHATAN**
  - Hospital
  - Klinik
- PENDIDIKAN**
  - Institusi Pengajian Tinggi
  - Kolej
  - Sekolah Menengah
  - Sekolah Rendah
  - Pra Sekolah
- KOMERSIAL**
- REKREASI**
- PETA ASAS**

400 m Scale 1: 5000 Hide Legend

MYeMap

**SEKIAN**

**TERIMA KASIH**