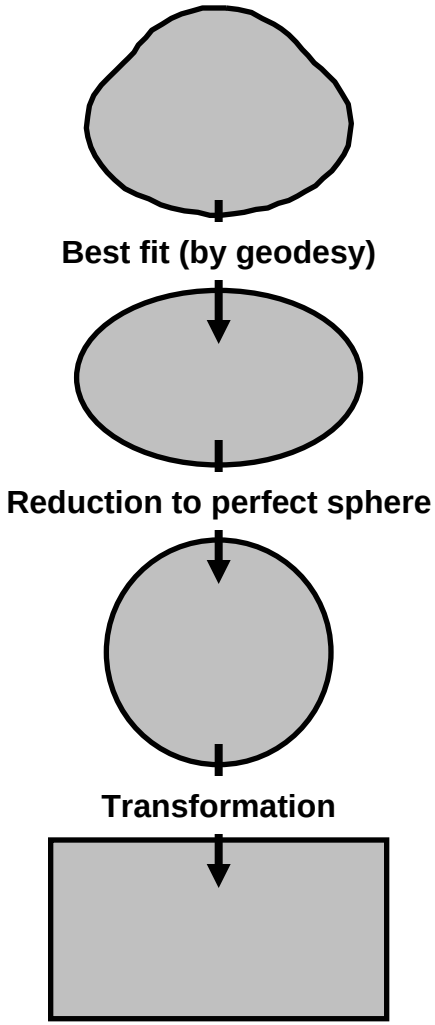
The Map Projection Process

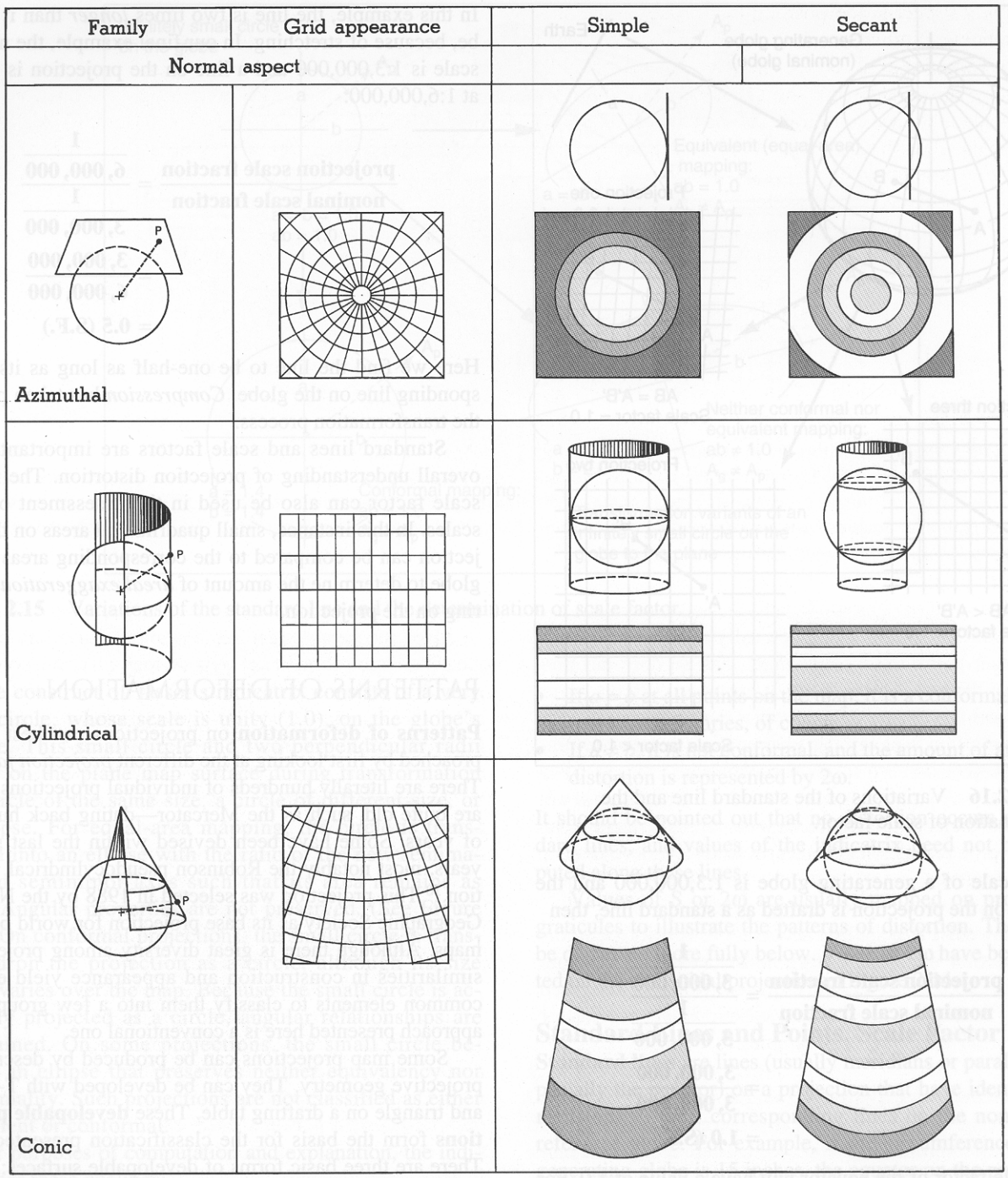


Earth (geoid)

Reference ellipsoid

Generating globe

Map projection



Projection Families and Patterns of Deformation

Source: Dent, (1999)

Summary

● = Yes
○ = Partly

Projection	Type	Properties: Conformal	Equal area	Equidistant	True direction	Perspective	Compromise	Straight rhumbs
Globe	Sphere	●	●	●	●			
Mercator	Cylindrical	●			○			●
Transverse Mercator	Cylindrical	●						
Oblique Mercator	Cylindrical	●						
Space Oblique Mercator	Cylindrical	●						
Miller Cylindrical	Cylindrical						●	
Robinson	Pseudocylindrical						●	
Sinusoidal Equal Area	Pseudocylindrical		●	○				
Orthographic	Azimuthal				○	●		
Stereographic	Azimuthal	●			○	●		
Gnomonic	Azimuthal				○	●		
Azimuthal Equidistant	Azimuthal			○	○			
Lambert Azimuthal Equal Area	Azimuthal		●		○			
Albers Equal Area Conic	Conic		●					
Lambert Conformal Conic	Conic	●			○			
Equidistant Conic (Simple Conic)	Conic			○				
Polyconic	Conic			○			●	
Bipolar Oblique Conic Conformal	Conic	●						

All above projections (except Robinson) are explained in detail in *Map Projections—A Working Manual*, John P. Snyder, Geological Survey Professional Paper 1395 (Washington: USGPO, 1987, 383 pp.)

Source: Dent, (1999)

Summary

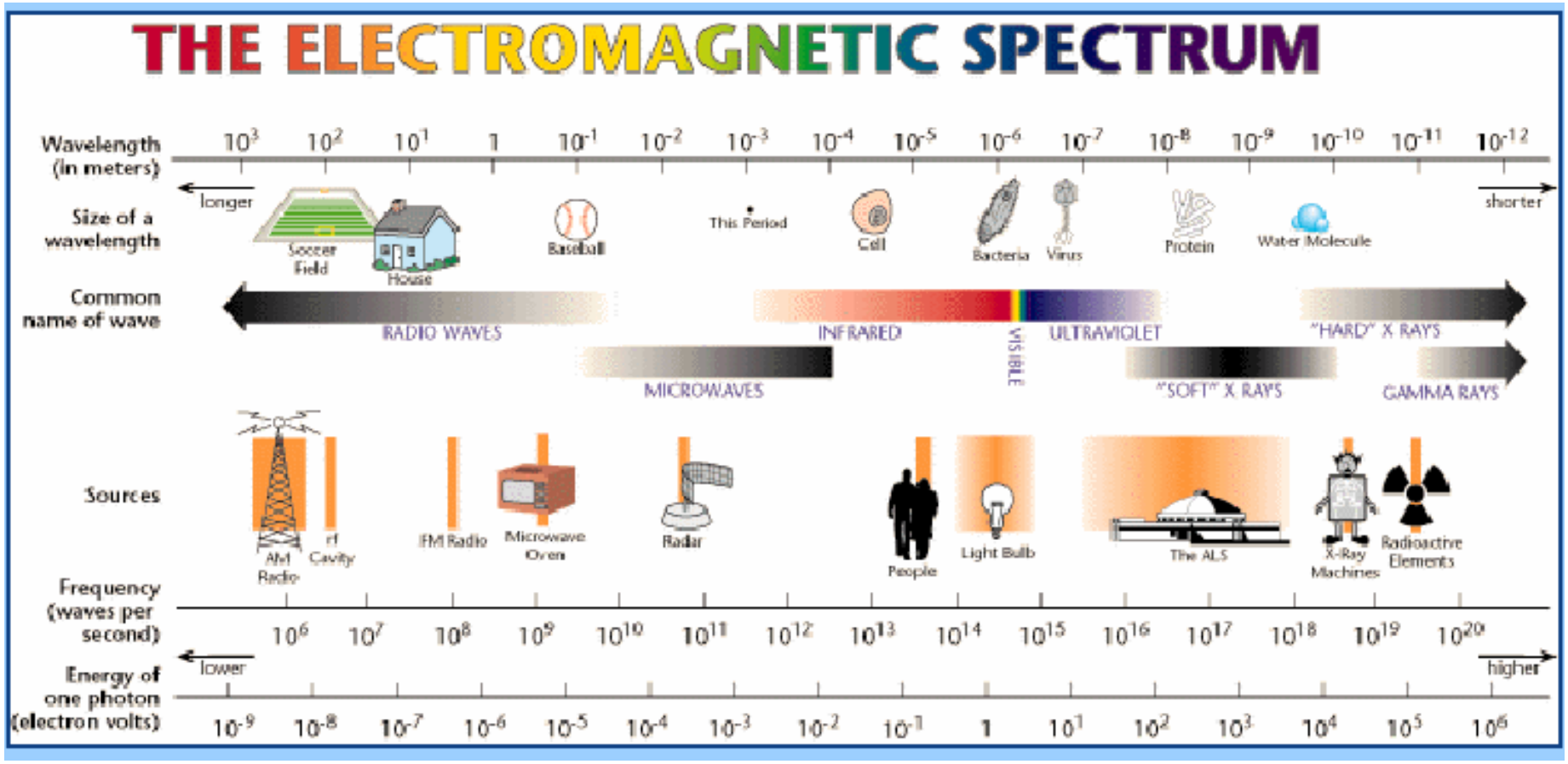
● = Yes
○ = Partly

Projection	Suitable for Mapping: World	Hemisphere	Continent/Ocean	Region/Sea	Medium Scale	Large Scale	General Use: Topographic Maps	Geological Maps	Thematic Maps	Presentations	Navigation	USGS Maps
Globe	●								●	●		
Mercator	○			●			●	●			●	●
Transverse Mercator			●	●	●	●	●	●				●
Oblique Mercator			●	●	●	●	●					●
Space Oblique Mercator						●	●					●
Miller Cylindrical	●								●			●
Robinson	●								●	●		
Sinusoidal Equal Area	●		●						●			●
Orthographic		○										●
Stereographic		●	●	●	●	●	●	●			●	●
Gnomonic				○						●	●	
Azimuthal Equidistant	○	●	●	●		○	●					●
Lambert Azimuthal Equal Area		●	●	●					●	●		●
Albers Equal Area Conic			●	●	●				●	●		●
Lambert Conformal Conic			●	●	●	●	●	●		●	●	●
Equidistant Conic (Simple Conic)			●	●								
Polyconic					○	○	●					●
Bipolar Oblique Conic Conformal			●					●				●

All above projections (except Robinson) are
detail in *Map Projections—A Working Manu*
Snyder, Geological Survey Professional Pa
(Washington: USGPO, 1987, 383 pp.)

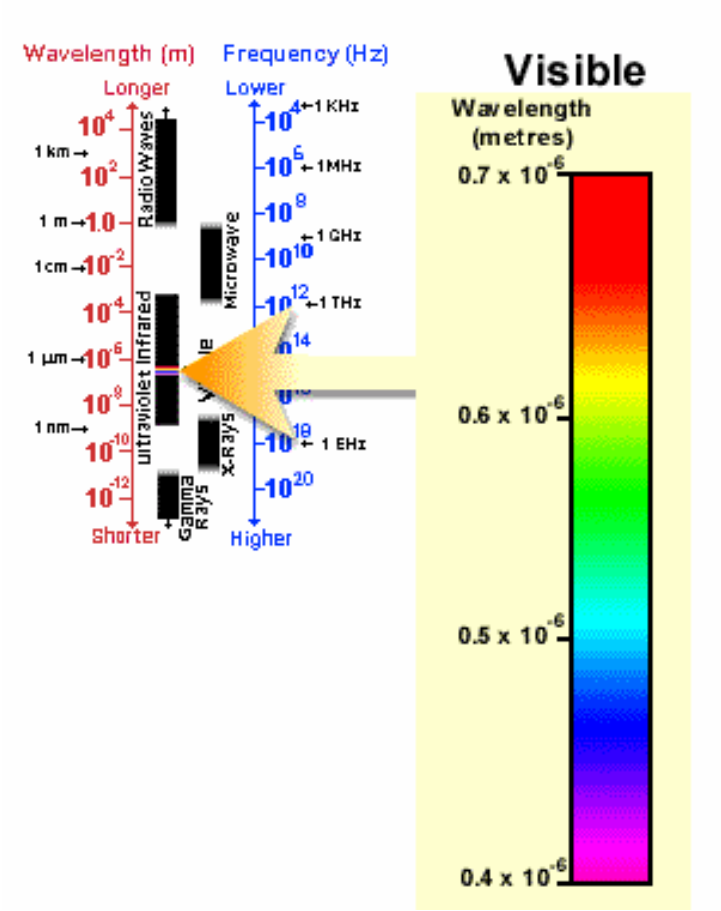
Source: Dent, (1999)

The Electromagnetic Spectrum



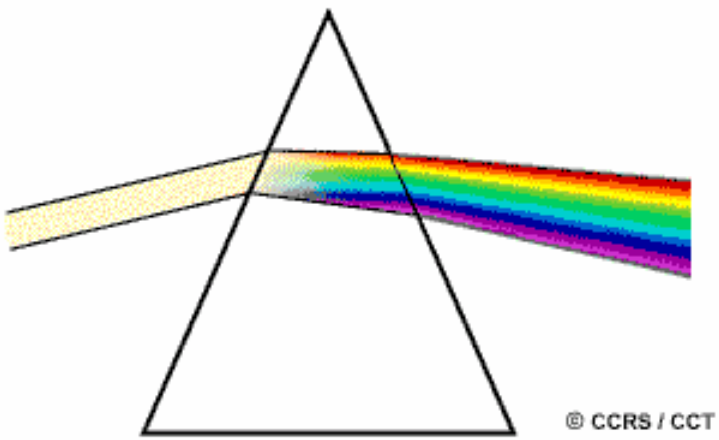
Source: http://www.electro-optical.com/bb_rad/emspect.htm

The Colors of the Visible Portion of the Electromagnetic Spectrum I



Source:
http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_3_e.html

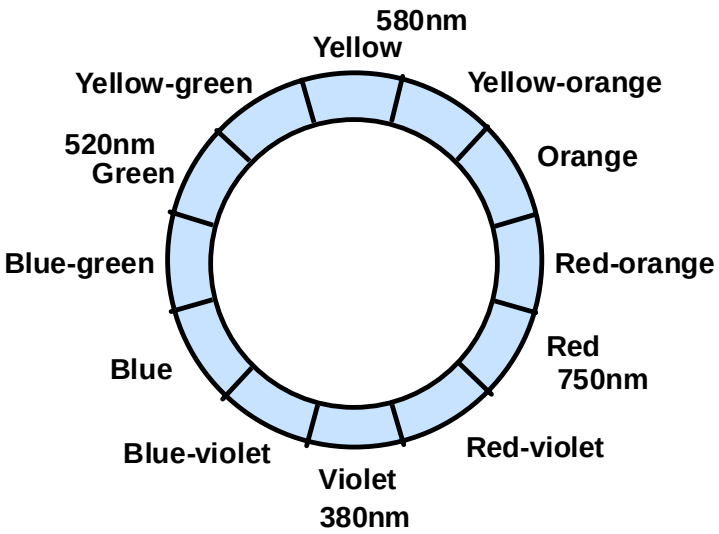
The Colors of the Visible Portion of the Electromagnetic Spectrum II

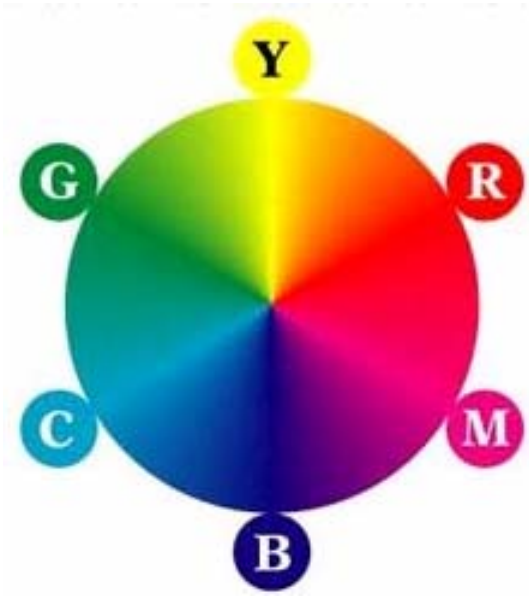


- **Violet:** 400 - 446 nanometers
- **Blue:** 446 - 500 nanometers
- **Green:** 500 - 578 nanometers
- **Yellow:** 578 - 592 nanometers
- **Orange:** 592 - 620 nanometers
- **Red:** 620 - 700 nanometers

Source:
http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_3_e.html

Color Wheel and Complementary Colors

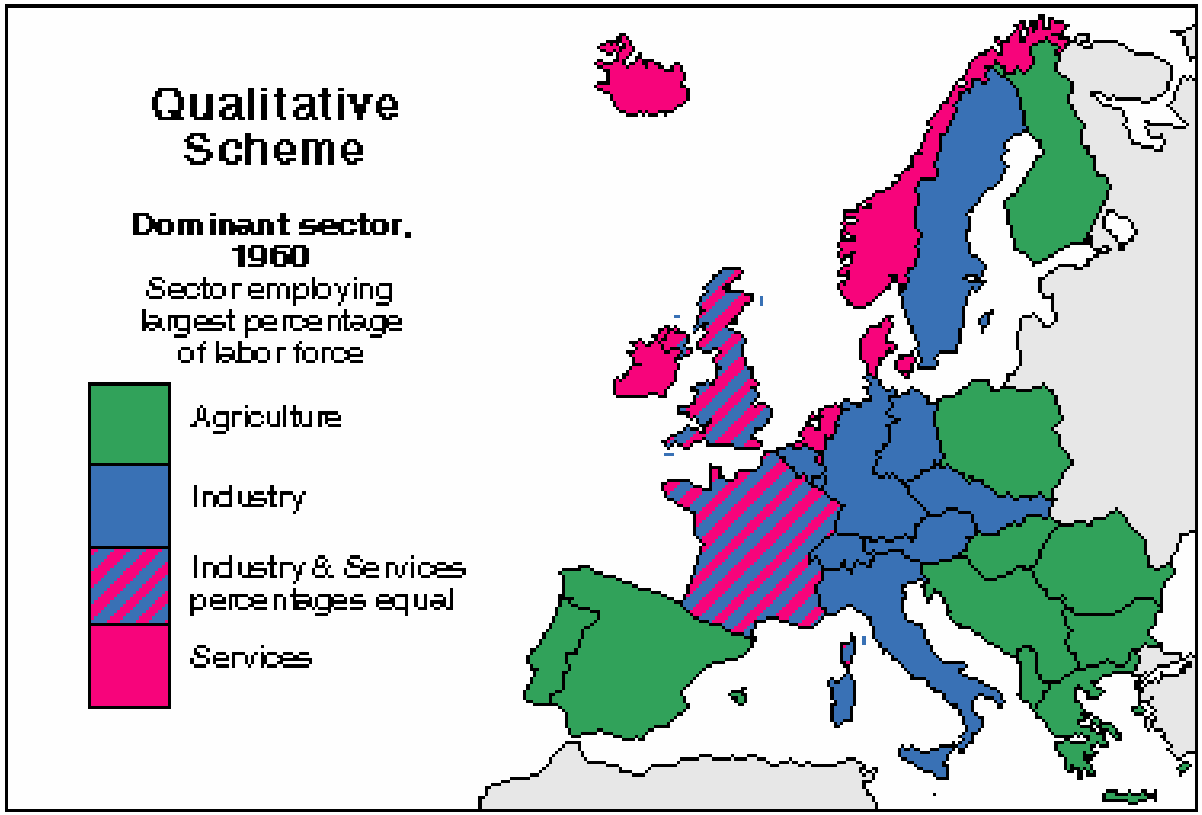




Additive primaries:
R = red
B = blue
G = green

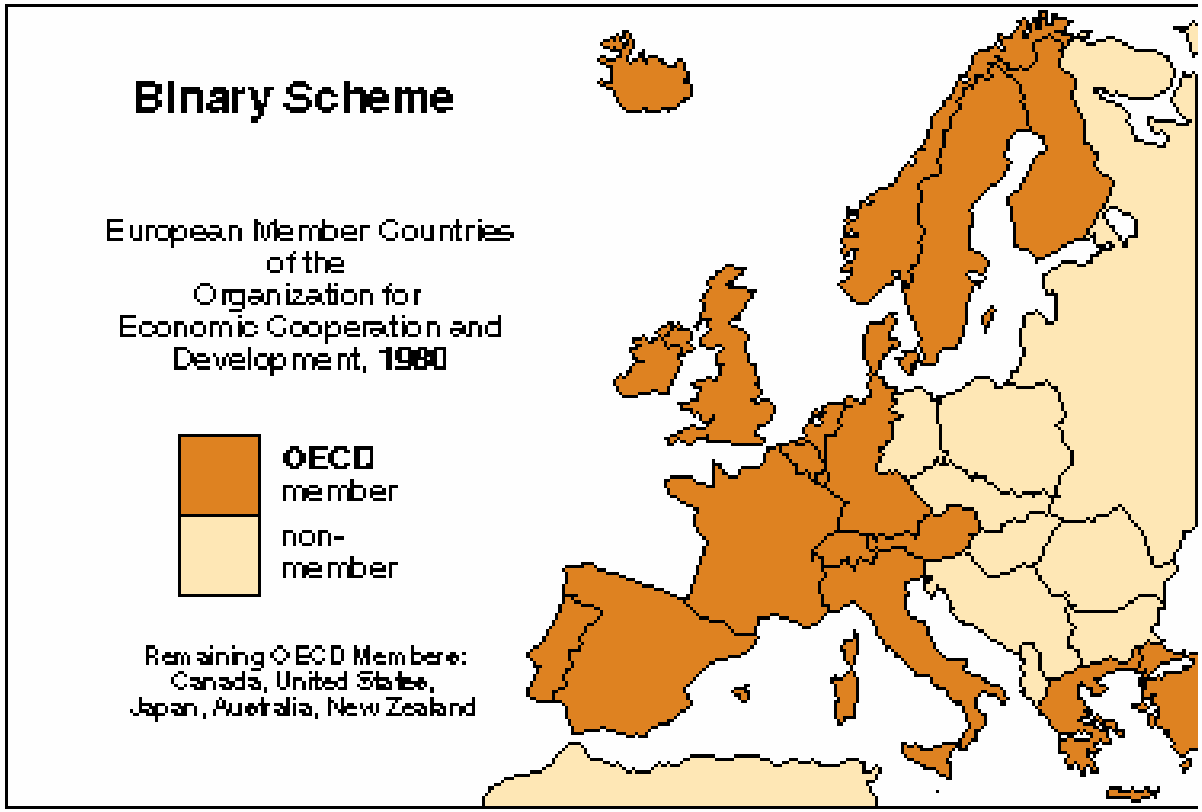
Secondary subtractive:
Y = yellow
M = magenta
C = cyan

Qualitative Color Scheme



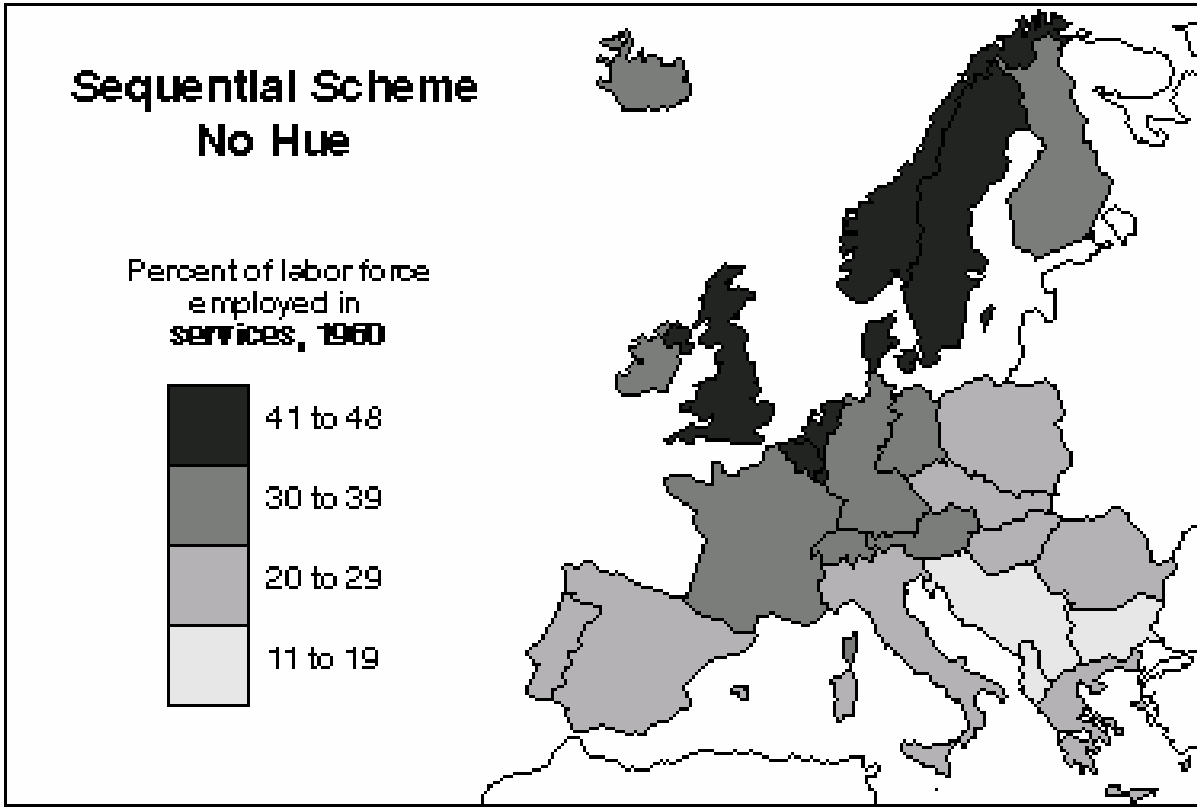
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Binary Color Scheme



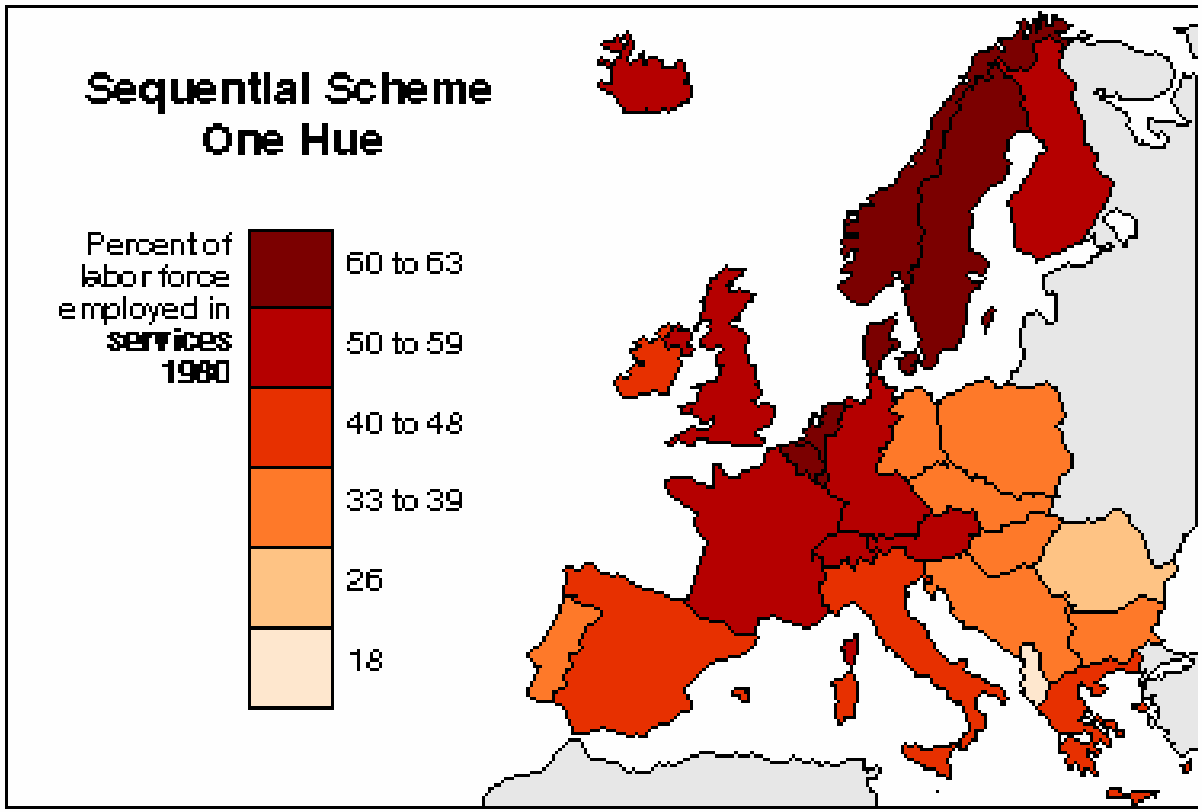
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Sequential Color Scheme I



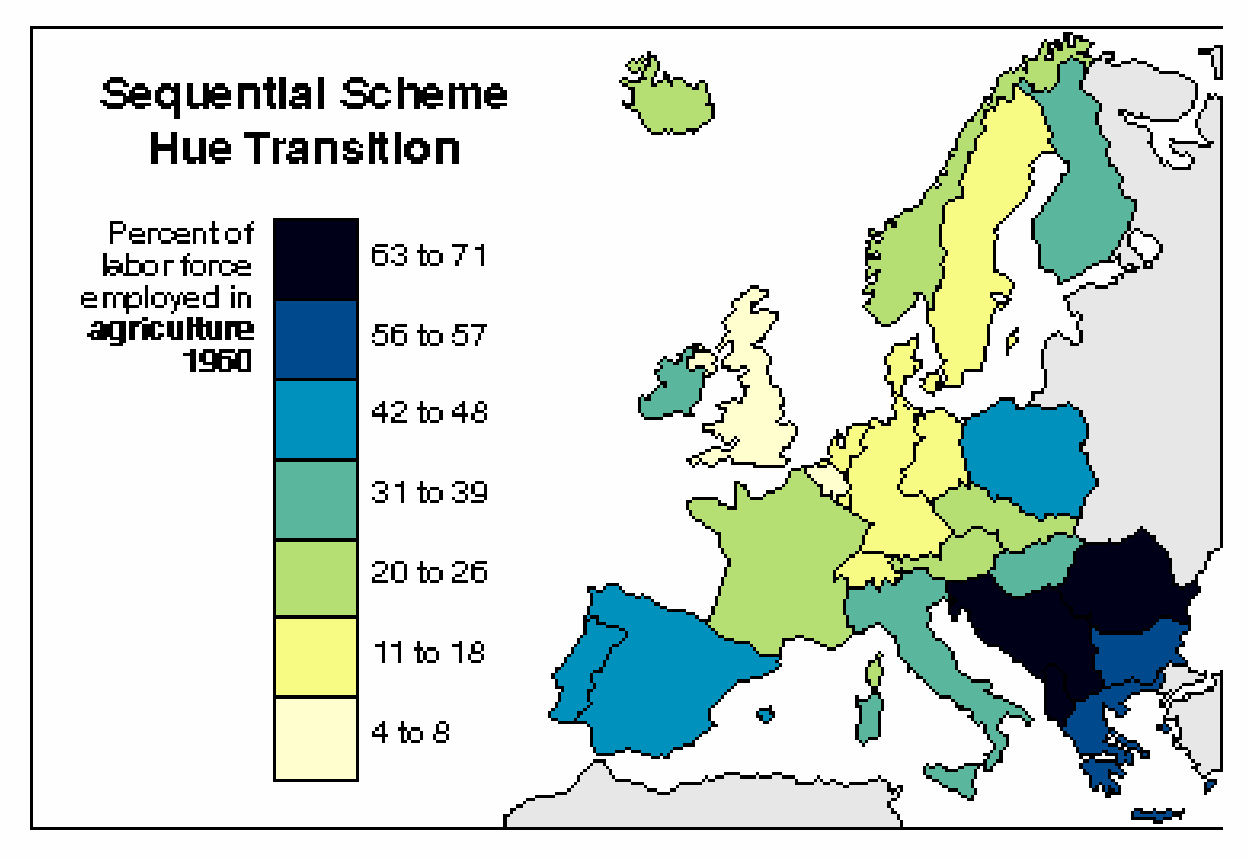
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Sequential Color Scheme II



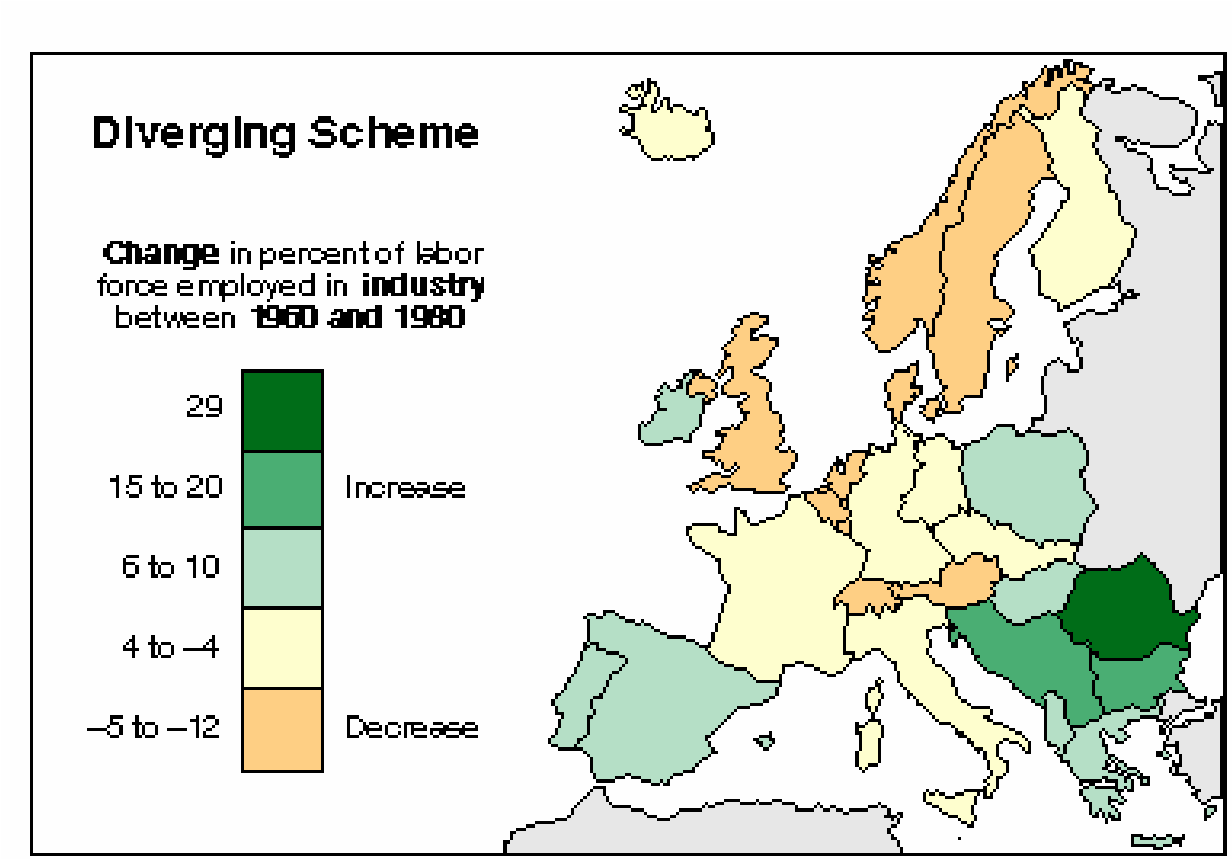
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Sequential Color Scheme III



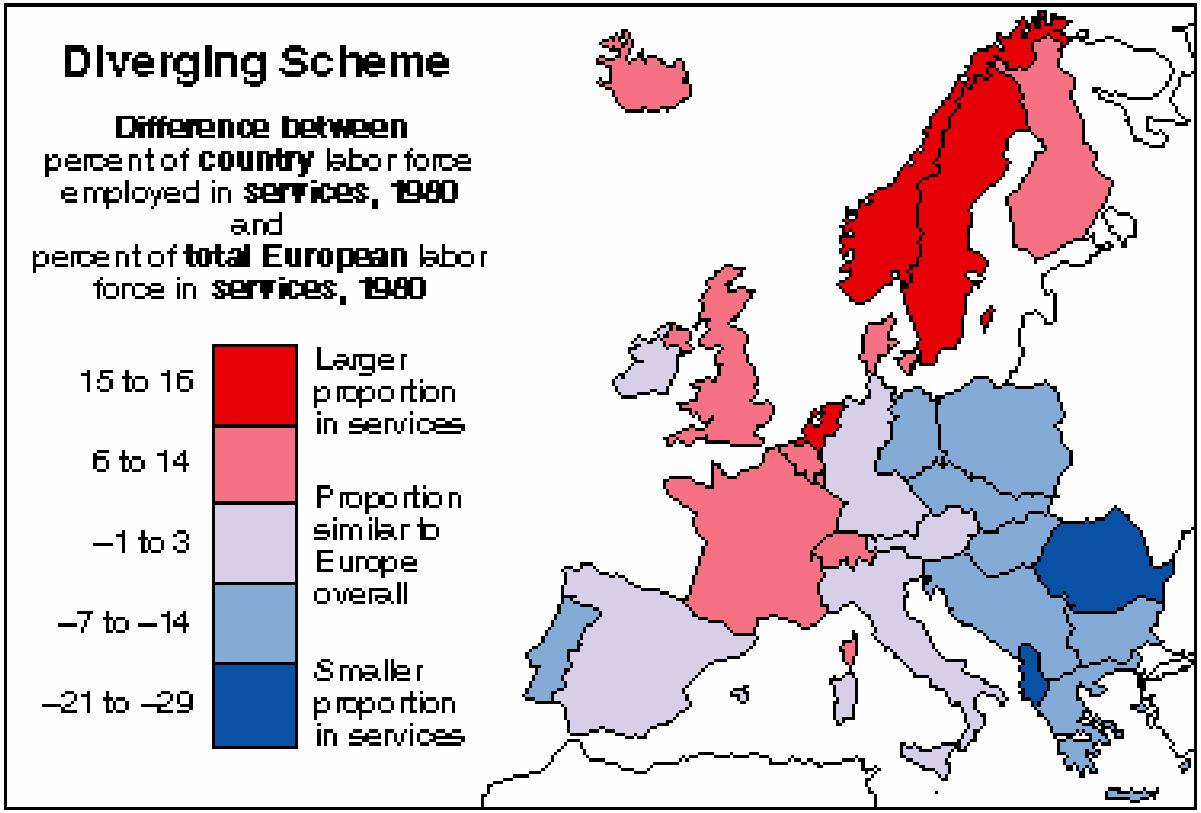
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Diverging Color Scheme



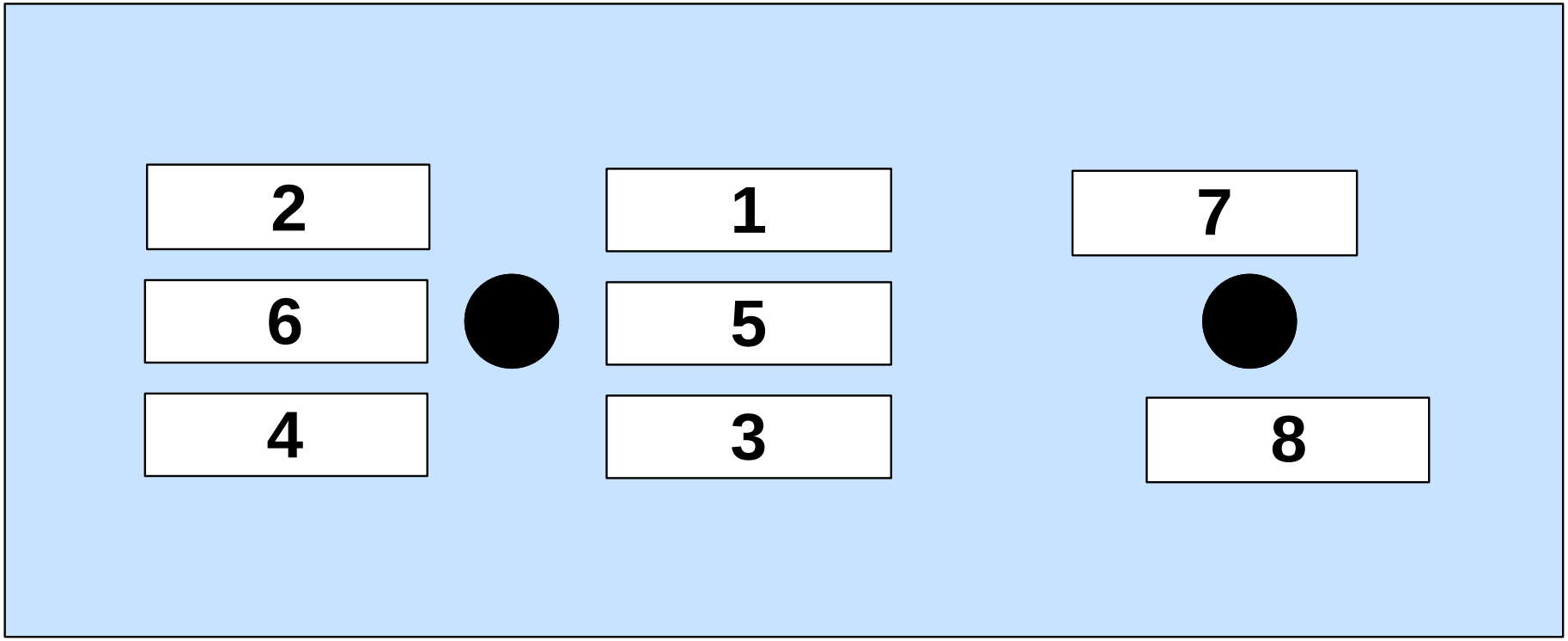
Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Diverging Color Scheme



Source: http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html

Point Symbol Labeling



Source: Dent, (1999)

Introduction to Mapping

Michael Leitner

ESRI /FEMA Hazard Awareness Site - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.esri.com/hazards/makemap.html

PAWS Google Firefox Plug-in FAQ

Related Sites

- FEMA Web Site
- ESRI Web Site
- State EM Sites

Hazard Info

- HAZUS-MH
- Disasters
- Mitigation
- Flood Insurance
- Floods Next 24 hrs.
- Fire Administration

GIS Info

- What is GIS?
- Public Safety GIS
- GIS Jumpstation
- GIS for Schools
- GIS Training Online

Make Online Hazard Map

To generate an online hazard map your area of interest, simply enter the information requested below. For more information about the map data, please visit the Frequently Asked Questions page.

1. Select Area of Interest

City: Baton Rouge **State:** LA

2. Select Type of Hazard Map

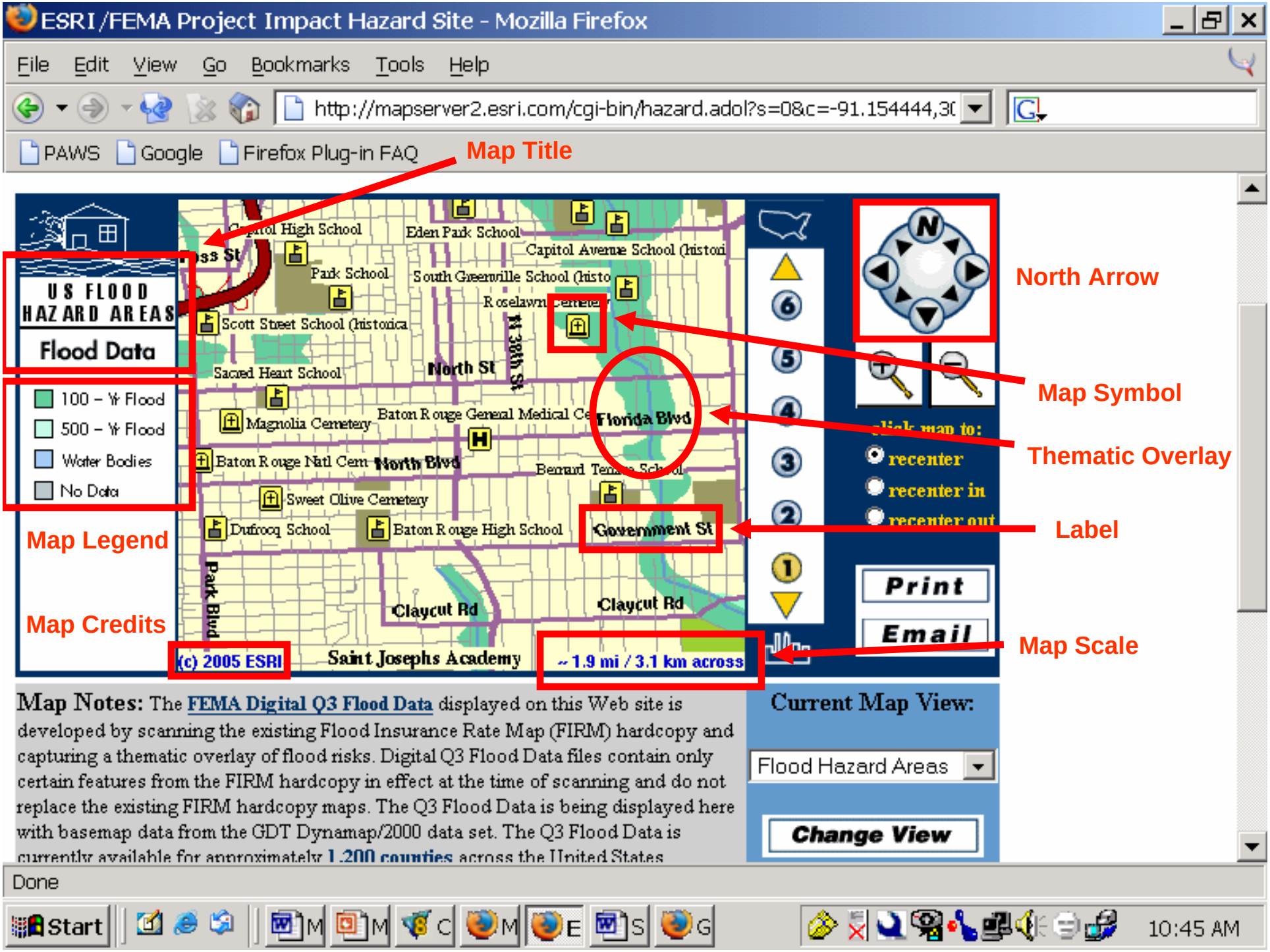
Flood Hazard Areas

3. Make the Map!

Return to Home Page

Done

Start M... M... C... M... E... S... 5:08 PM


ESRI/FEMA Project Impact Hazard Site - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://mapserver2.esri.com/cgi-bin/hazard.adol?s=0&c=-91.154444,3(
PAWS Google Firefox Plug-in FAQ
Map Title
US FLOOD HAZARD AREAS
Flood Data
100 – Yr Flood
500 – Yr Flood
Water Bodies
No Data
Map Legend
Map Credits
Capitol High School
Eden Park School
Capitol Avenue School (histori
Park School
South Greenville School (histo
Roselawn Cemetery
Scott Street School (historica
Sacred Heart School
North St
N 38th St
Magnolia Cemetery
Baton Rouge General Medical Ce
Florida Blvd
Baton Rouge Natl Cem
North Blvd
Bernard Terrace School
Sweet Olive Cemetery
Dufrocq School
Baton Rouge High School
Government St
Park Blvd
Claycut Rd
Claycut Rd
(c) 2005 ESRI
Saint Josephs Academy
~1.9 mi / 3.1 km across
N
click map to:
recenter
recenter in
recenter out
Print
Email
North Arrow
Map Symbol
Thematic Overlay
Label
Map Scale
Map Notes: The FEMA Digital Q3 Flood Data displayed on this Web site is developed by scanning the existing Flood Insurance Rate Map (FIRM) hardcopy and capturing a thematic overlay of flood risks. Digital Q3 Flood Data files contain only certain features from the FIRM hardcopy in effect at the time of scanning and do not replace the existing FIRM hardcopy maps. The Q3 Flood Data is being displayed here with basemap data from the GDT Dynamap/2000 data set. The Q3 Flood Data is currently available for approximately 1,200 counties across the United States
Current Map View:
Flood Hazard Areas
Change View
Done
Start
10:45 AM

Definition of a map

A map is a graphic representation of the milieu (Robinson and Petchenik, 1976).

Milieu is used broadly to include all aspects of the cultural and physical environment.

This definition includes mental abstractions that are not physically present on the geographical landscape.

Elements of a Map I

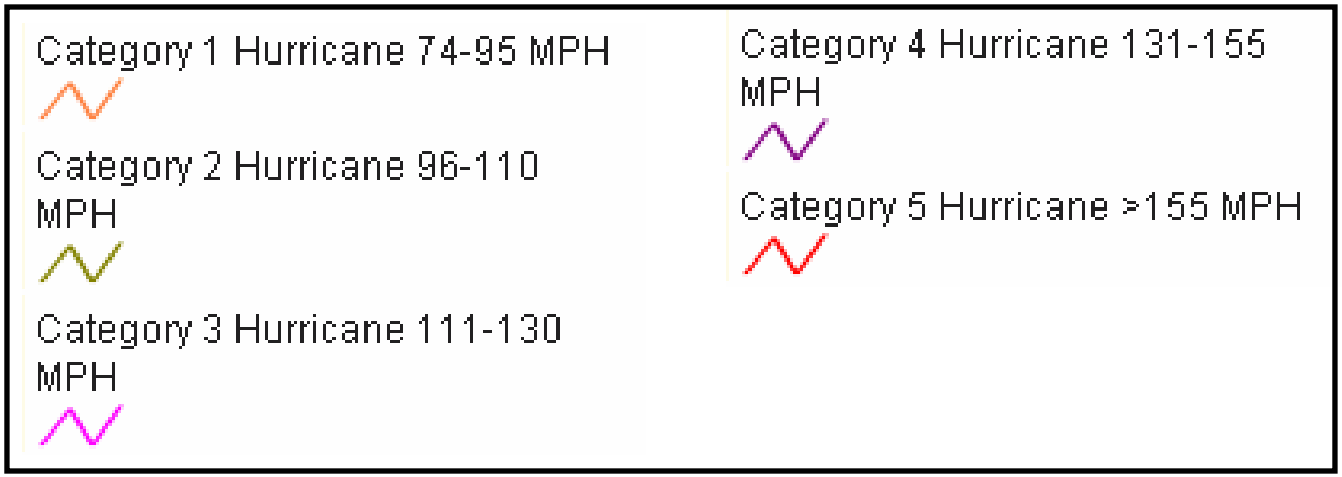
Title: STRENGTH OF HURRICANES AND LOCATION OF HURRICANE TRACKS IN LOUISIANA SINCE 1970

Mapped Area: Includes the map itself

Credits:

- Who compiled the map?
- When was the map compiled?
- Which data sources were used?
- Which data collection methods were applied?

Legend:

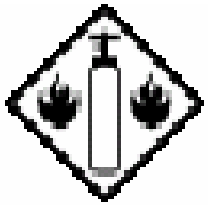


Elements of a Map II

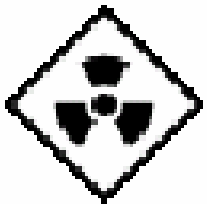
North Arrow: (

Symbols:

Fire Incident



Flammable Gas



Radioactive Material

Volcanic Eruption

Scale: Numerical 1:100,000

Graphical

Map Frame: Encloses the mapped area.

Map Projection: A systematic representation of a round body such as the Earth on a flat (plane) surface.

Map Scale I

Scale selection

Large	Map Scale	Small
Small	Mapped earth area	Large
More	Information detail	Less
	Symbolization	
Less generalized		More generalized

Adopted from: Dent (1999)

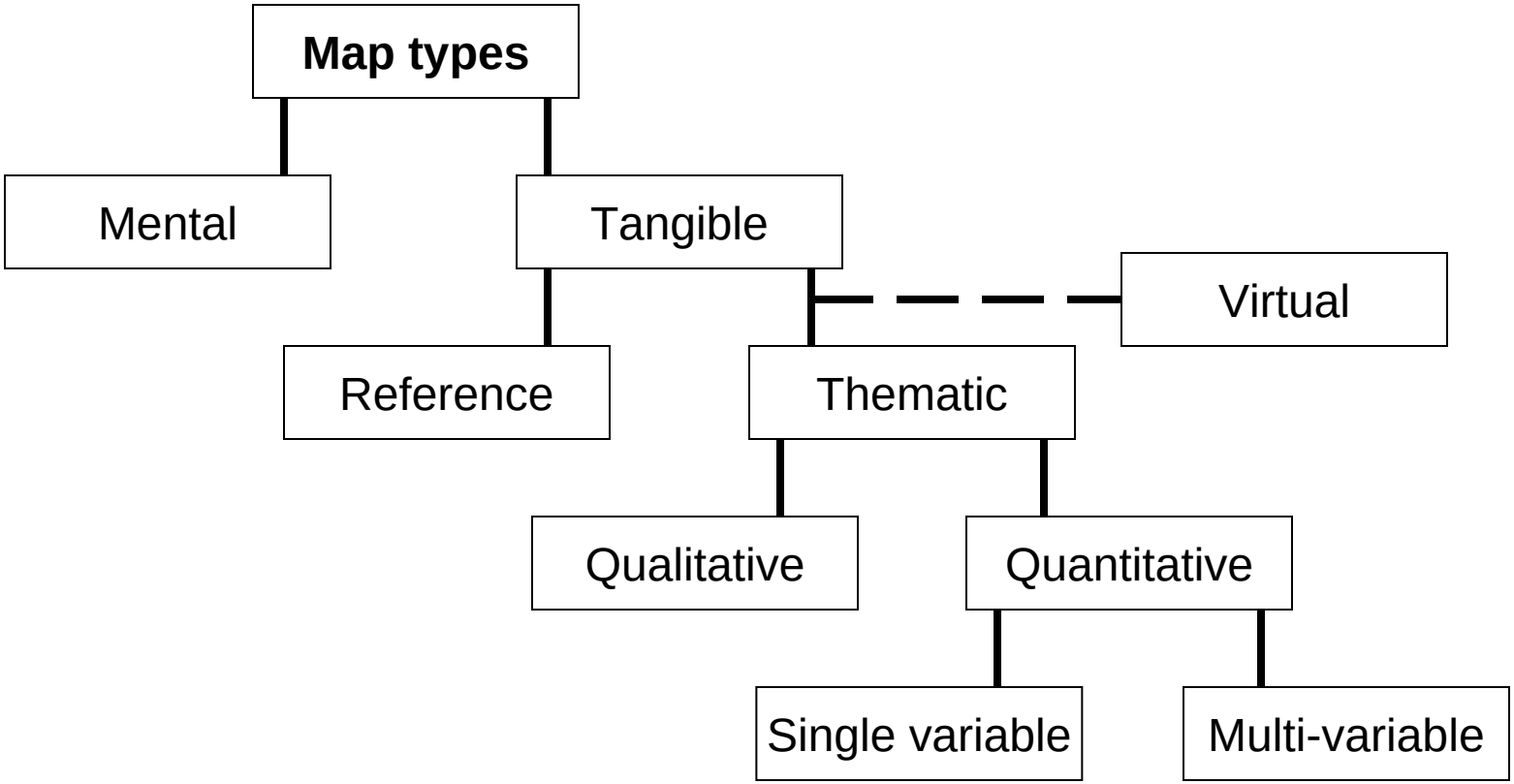
Map Scale II

Large map scale: 1:24,000 and larger; an example is the 7.5-minute, 1:24,000-scale quadrangle map series from the USGS

Medium map scale: Scale ranges between 1:24,000 and 1:30mio; examples area USGS 1:100,000-scale and 1:250,000-scale maps

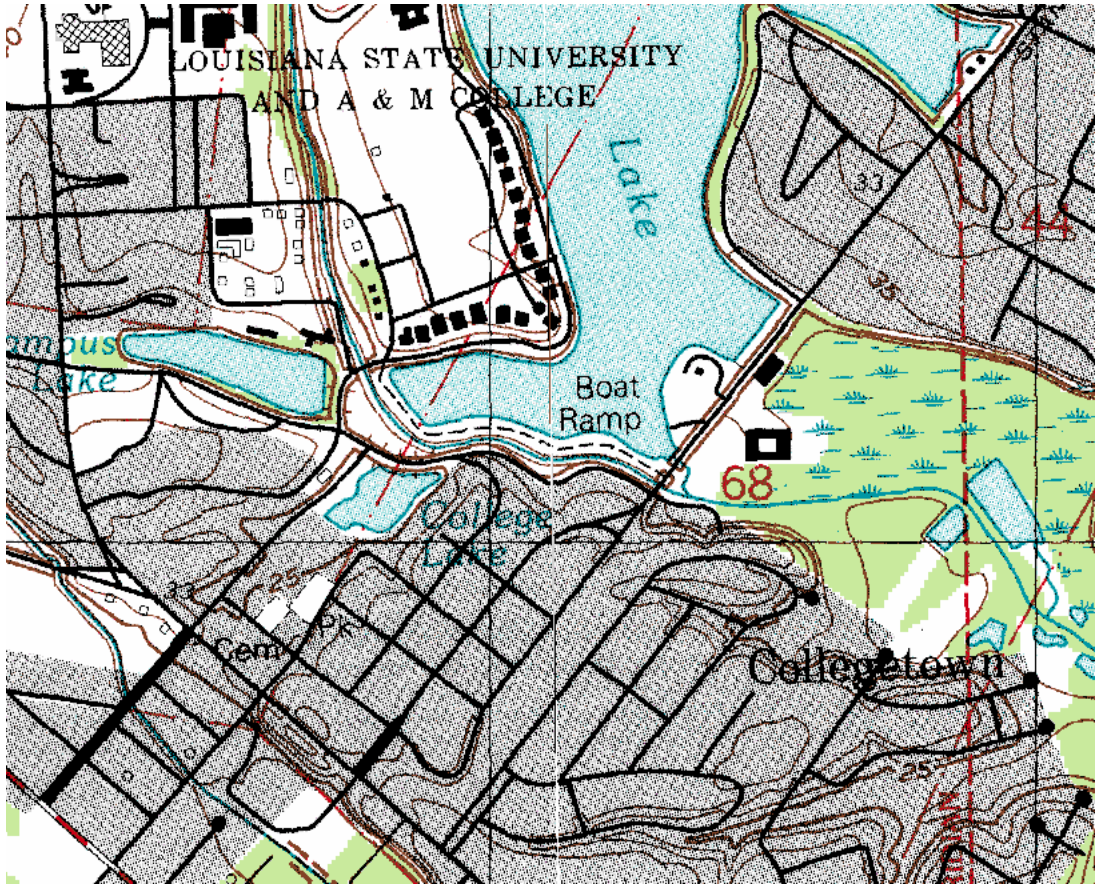
Small map scale: 1:30mio and smaller; an example is a map of the world

Classification of Maps



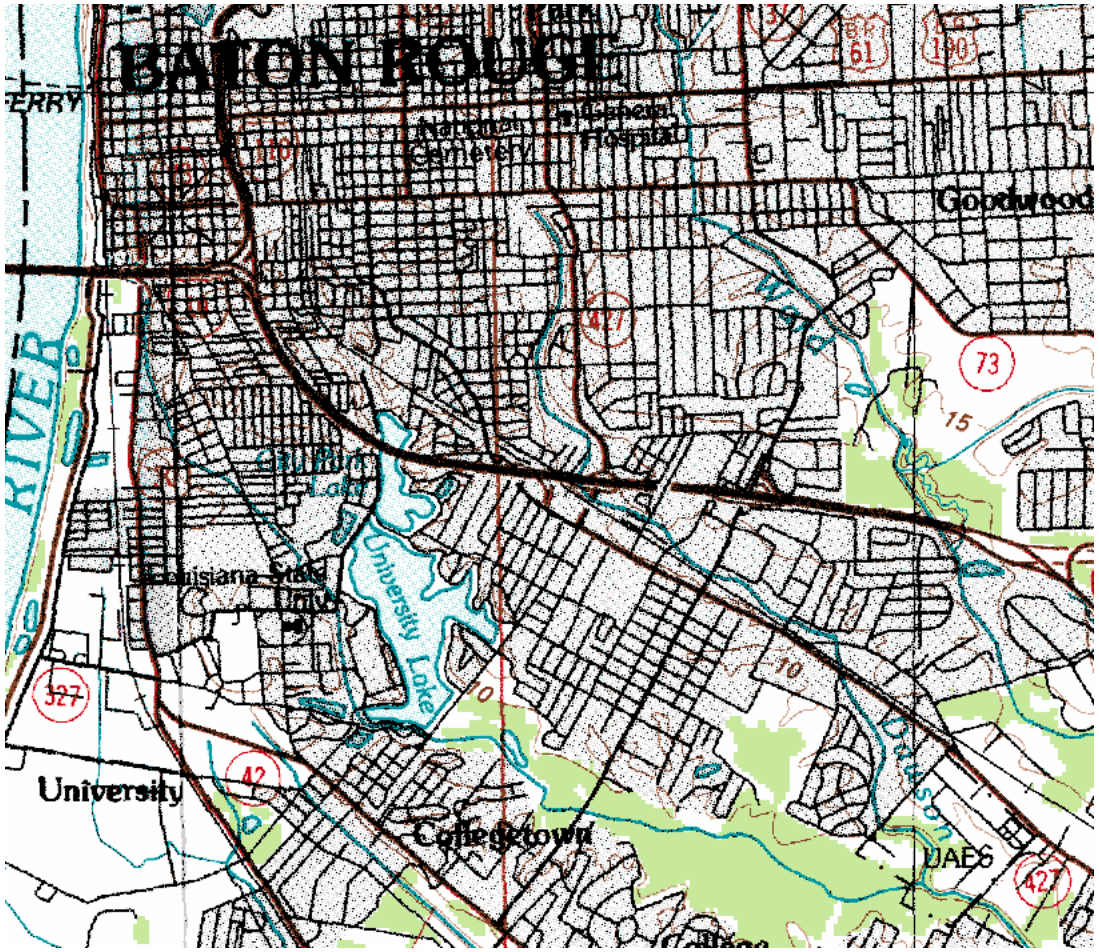
Adopted from: Dent (1999)

Digital Raster Graphics (DRG) of USGS 7.5 Minute Map



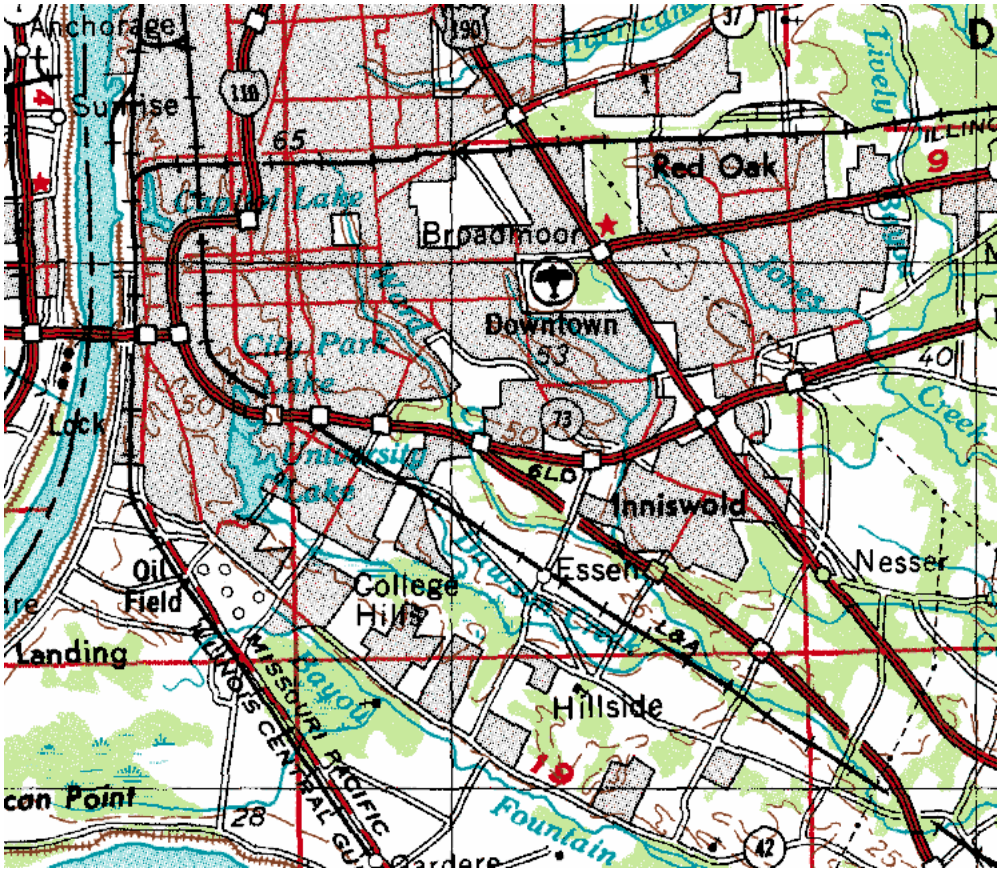
Source: http://erg.usgs.gov/isb/pubs/booklets/usgsmaps/usgsmaps.html

Digital Raster Graphics (DRG) of USGS 100,000-Scale Map



Source: http://atlas.lsu.edu

Digital Raster Graphics (DRG) of USGS 250,000-Scale Map



Source: http://atlas.lsu.edu

USGS Orthophotomap

Part of "Callao Quadrangle, Utah," 1972, 1:24,000, 7.5-minute orthophotomap, Lambert conformal conic projection, 22 x 27 inches.

Source: http://erg.usgs.gov/isb/pubs/booklets/usgsmaps/usgsmaps.html

USGS Orthophotoquad

Part of "Lewes, Delaware," quadrangle, 1980, 1:25,000, orthophotoquad, Universal Transverse Mercator projection, 22 x 27 inches.

Source: http://erg.usgs.gov/isb/pubs/booklets/usgsmaps/usgsmaps.html

Louisiana Oil Spill Coordinator's Office (LOSCO) Digital Orthophoto Quarter Quadrangle

Part of “SE quadrant of Baton Rouge West Quadrangle, LA,” 1998, 3.75 minute color infrared (CIR) orthophoto, Universal Transverse Mercator projection, UTM Zone 15 NAD83.

Source: http://atlas.lsu.edu

USGS High-Resolution 1500-meter Orthoimage

USGS high-resolution 1500-meter orthoimage (part of 133 Urban Areas – Baton Rouge, LA Area). Natural color orthoimage at 0.3-meter pixel resolution (approximately 1-foot), 2002, Universal Transverse Mercator, Zone 15, NAD 1983.

Source: USGS

USGS Shaded Relief Map

Part of the "Grand Canyon National Park and Vicinity, Arizona," shaded-relief edition of 1972, 1:62,500, polyconic projection.

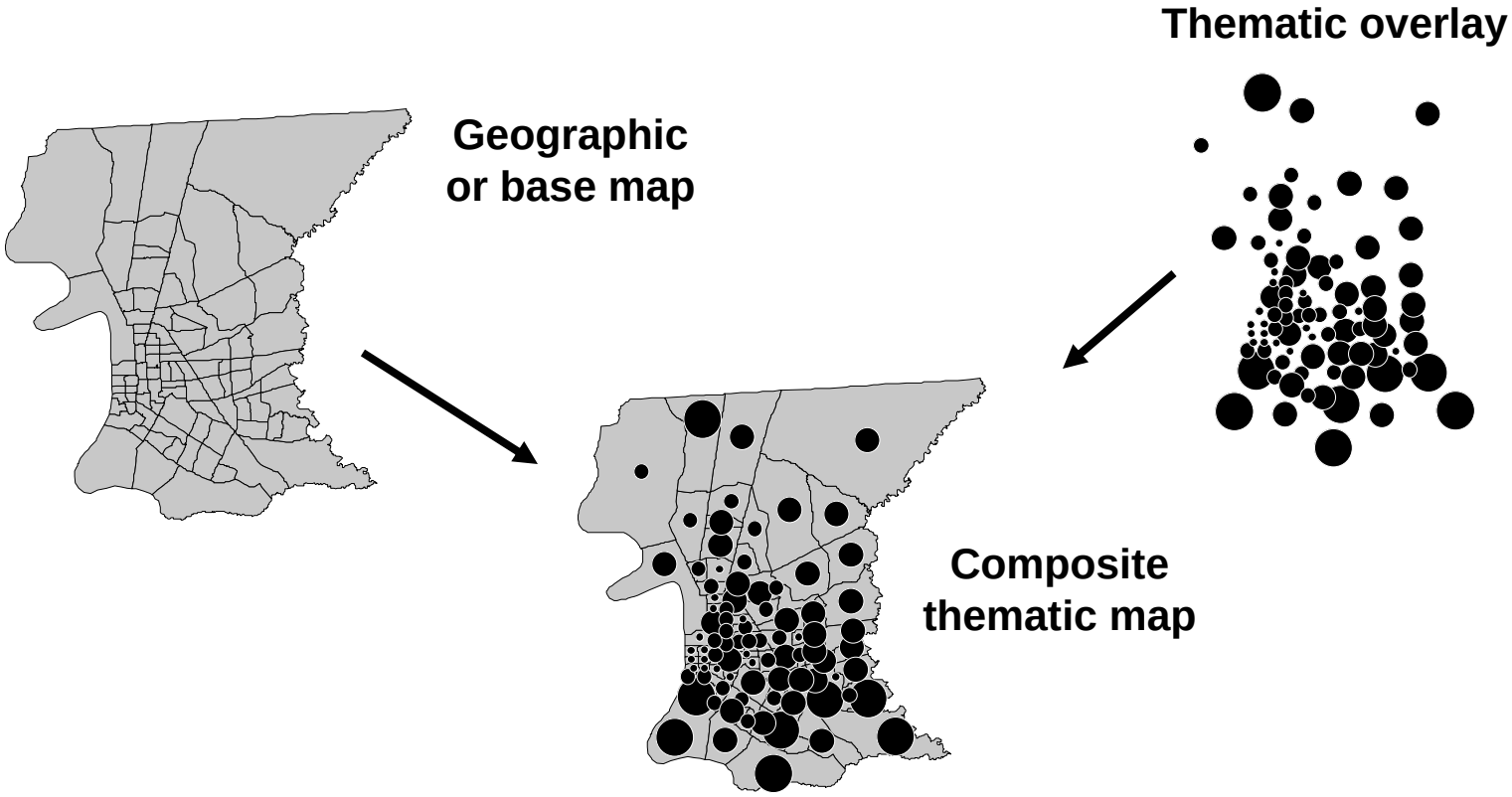
Source: http://erg.usgs.gov/isb/pubs/booklets/usgsmaps/usgsmaps.html

USGS Topographic-Bathymetric Map

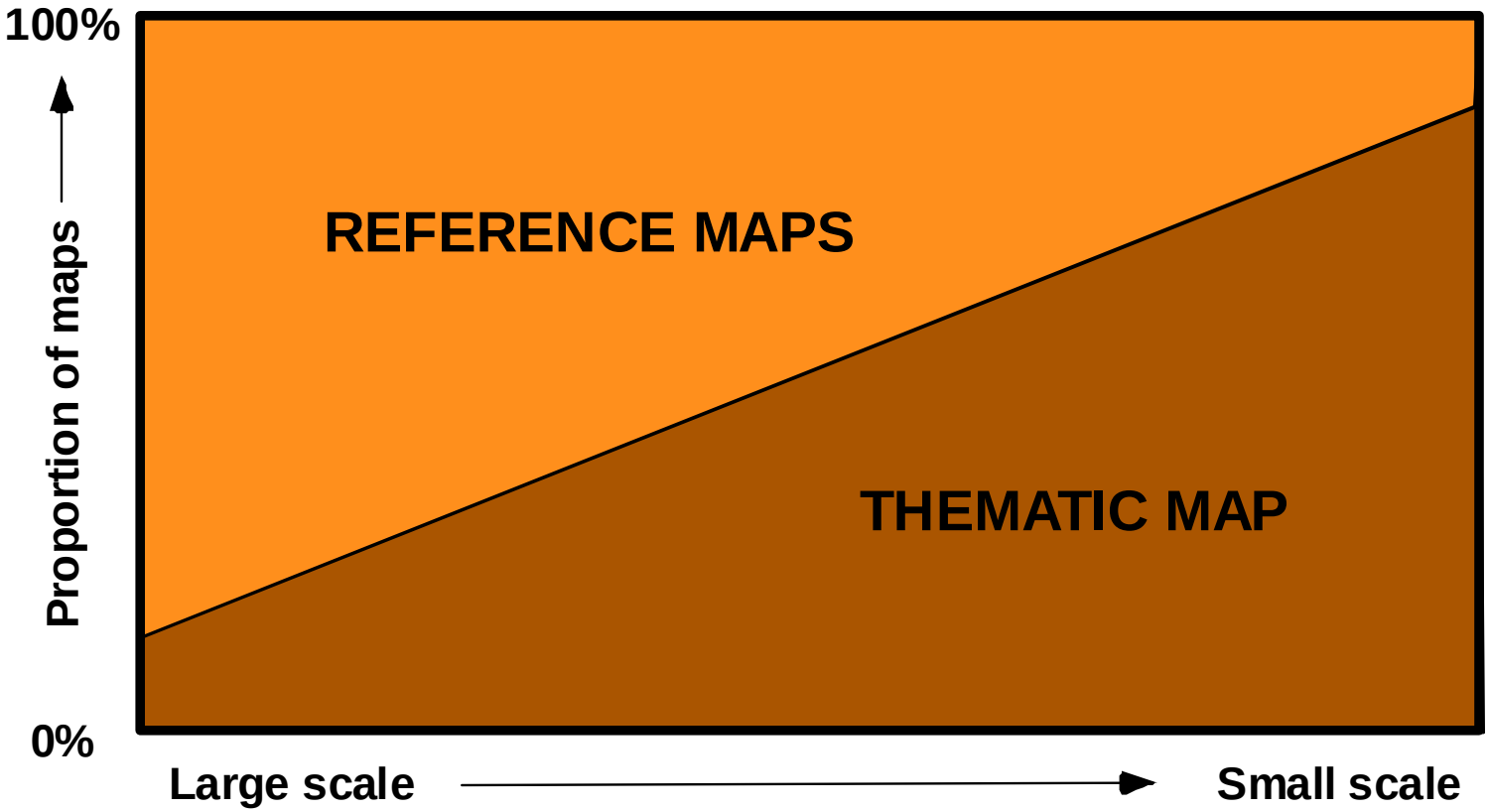
Part of the topographic-bathymetric map "Kedges Straits, Maryland," quadrangle, 1972, bathymetry added 1987, by the USGS and the National Ocean Survey, 1:24,000, Lambert conformal conic projection.

Source: http://erg.usgs.gov/isb/pubs/booklets/usgsmaps/usgsmaps.html

The Two Components of a Thematic Map

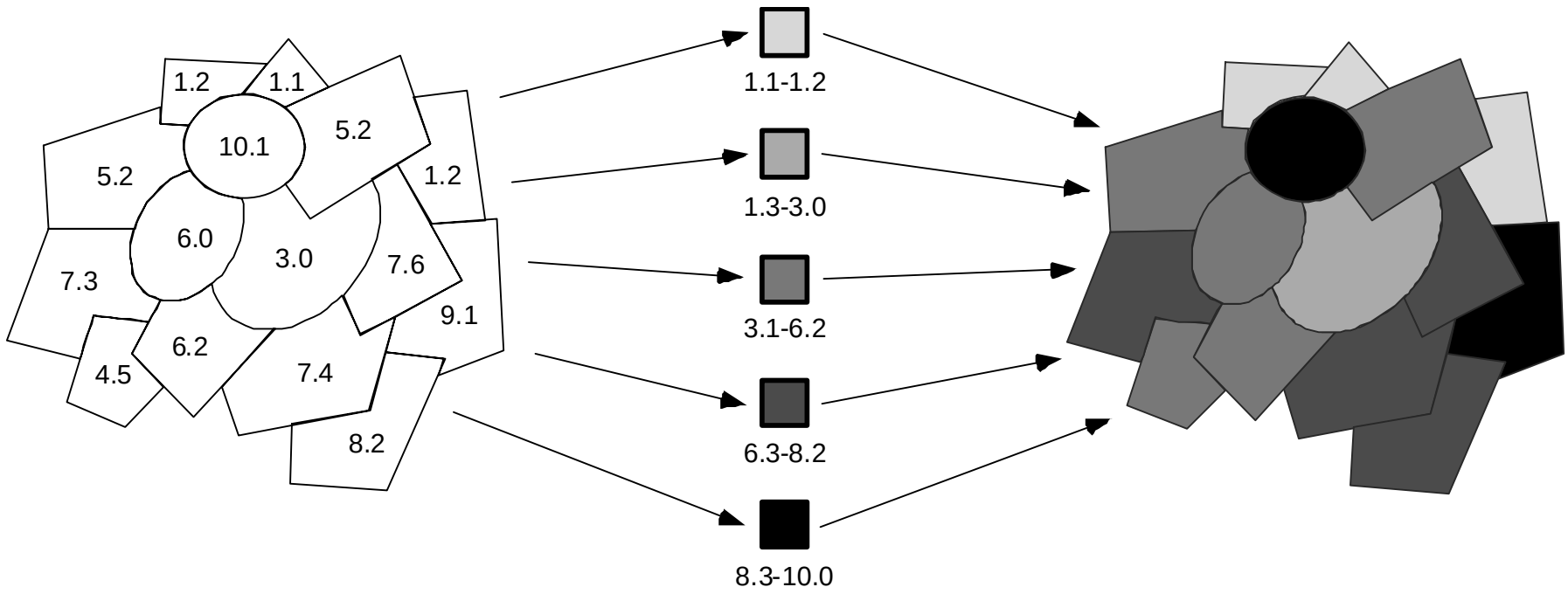


Relationship Between Type of Map and Map Scale



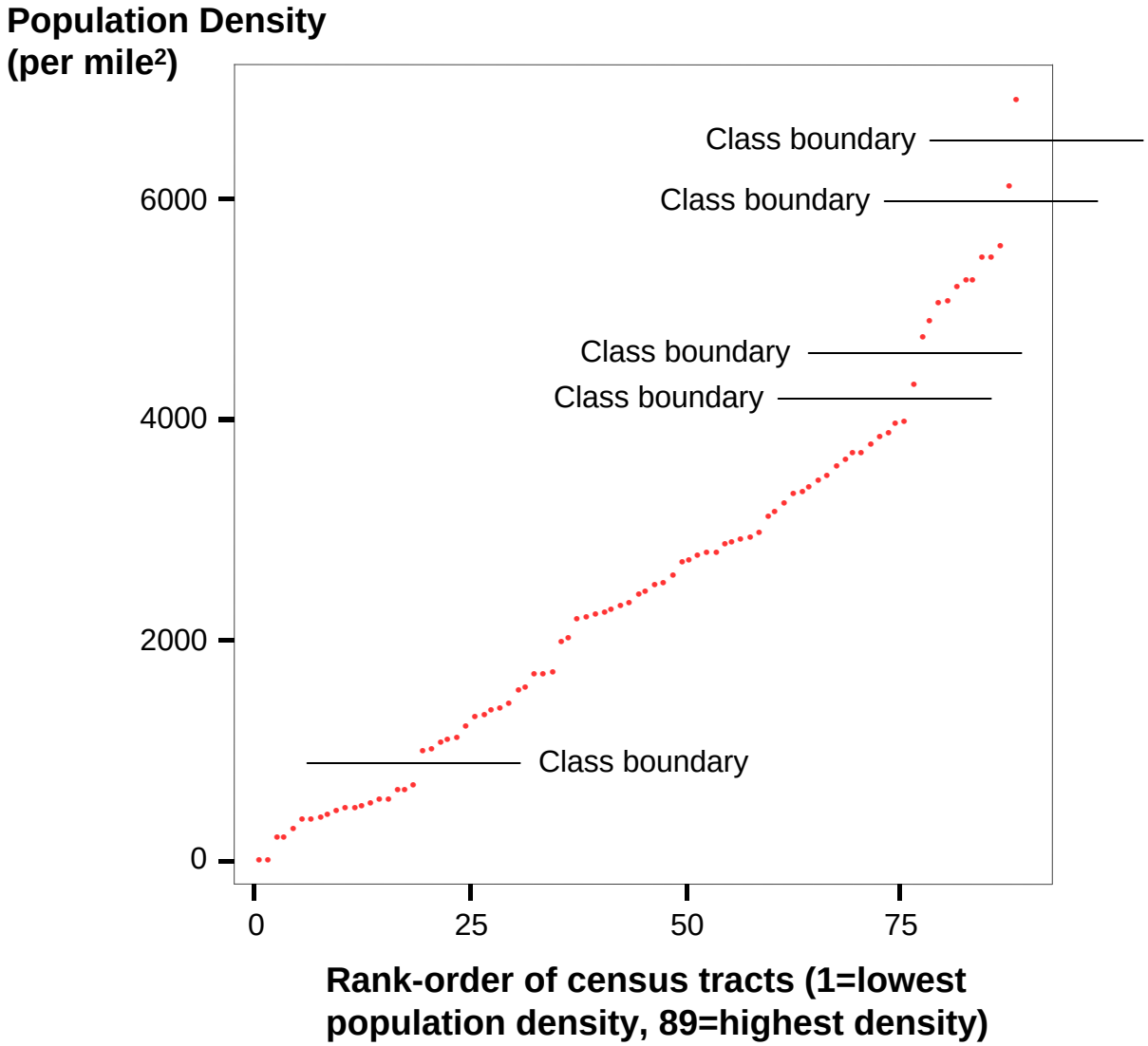
Adopted from: Dent (1999)

The Choropleth Technique

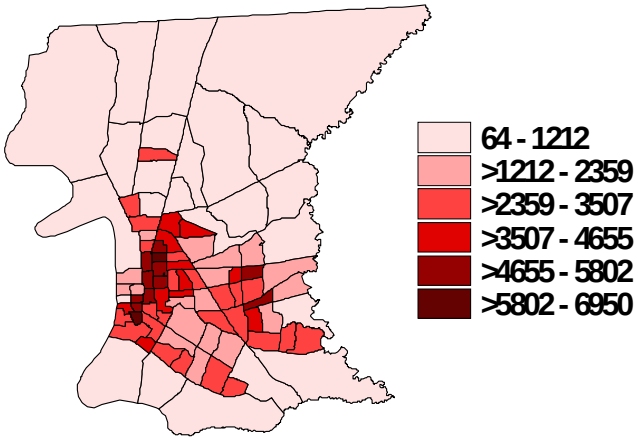


Data map **Symbol scheme** **Choropleth map**

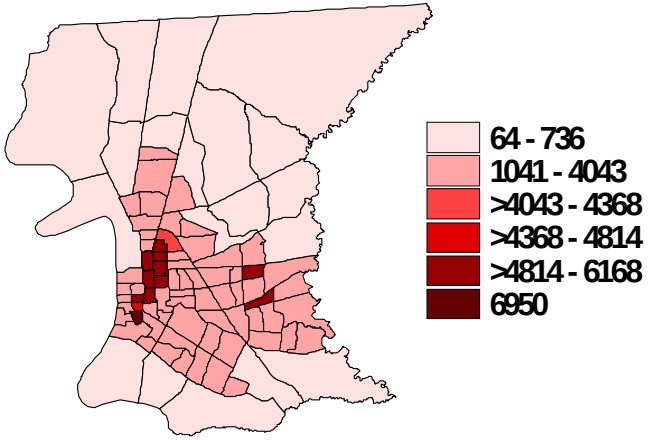
Natural Breaks Classification Method (6 Classes)



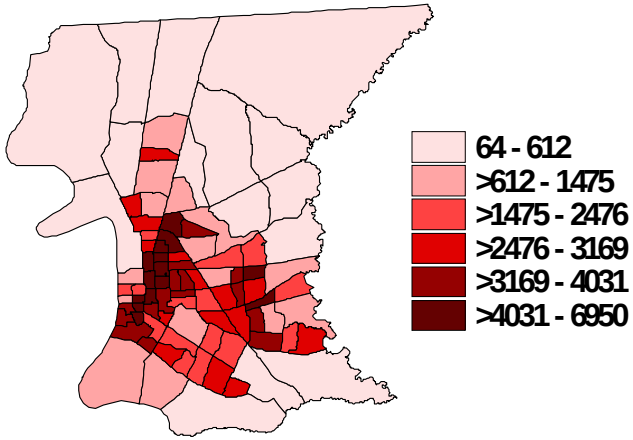
Data Mapped with Four Different Classification Methods (6 Classes)



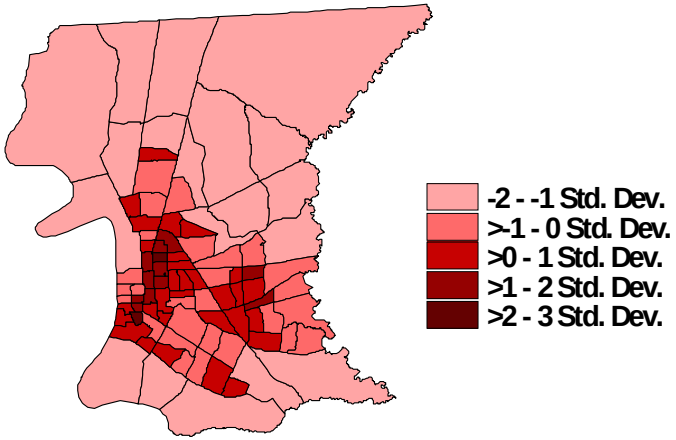
Equal steps



Natural breaks



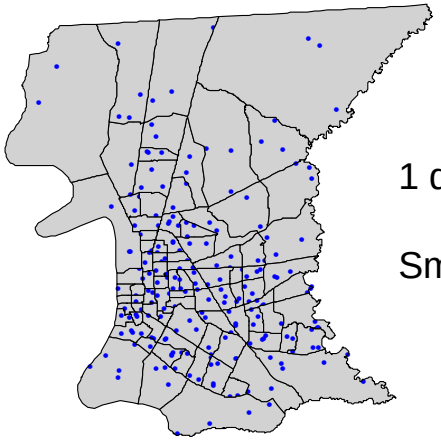
Quantiles (Sixtiles)



Standard deviations

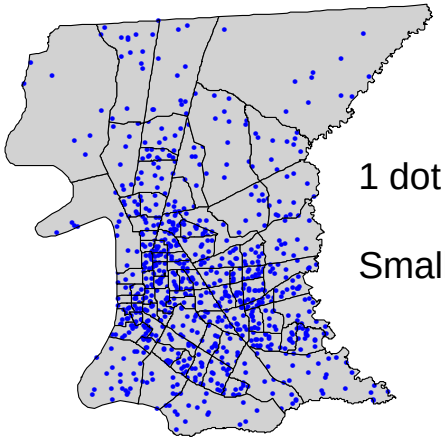
The Common Dot Map

Population Distribution in East Baton Rouge Parish



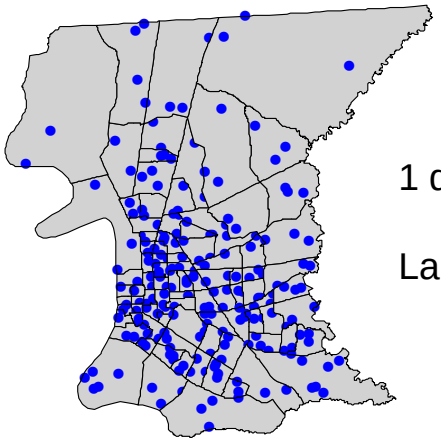
1 dot = 2,000 people

Small dot size



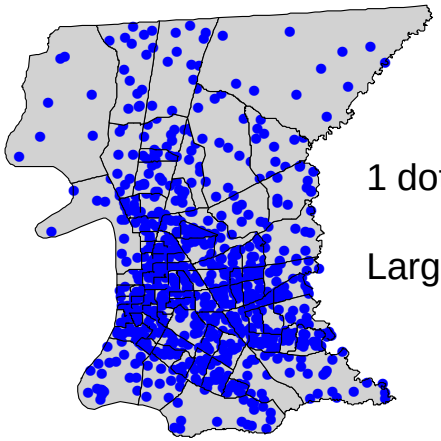
1 dot = 500 people

Small dot size



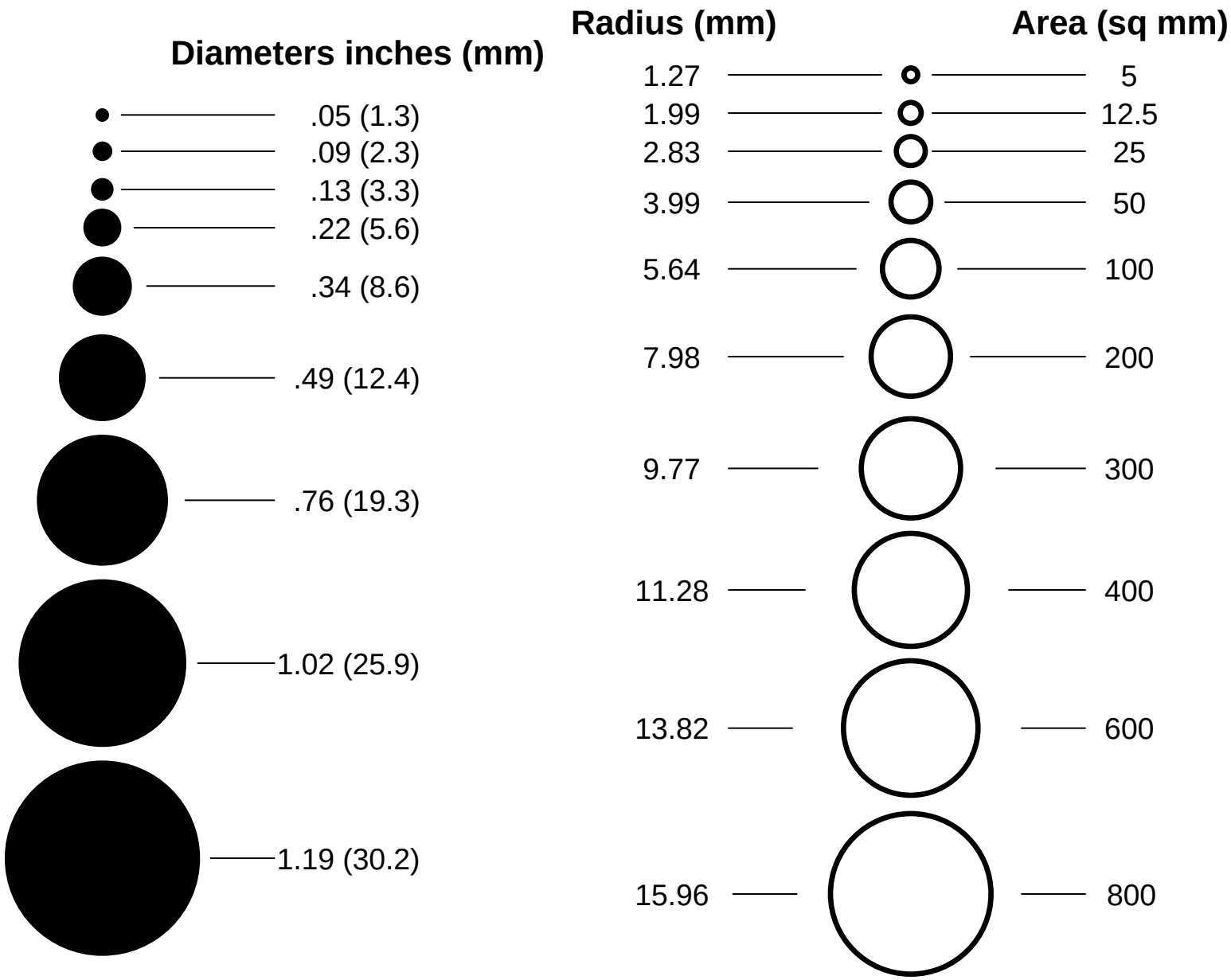
1 dot = 2,000 people

Large dot size



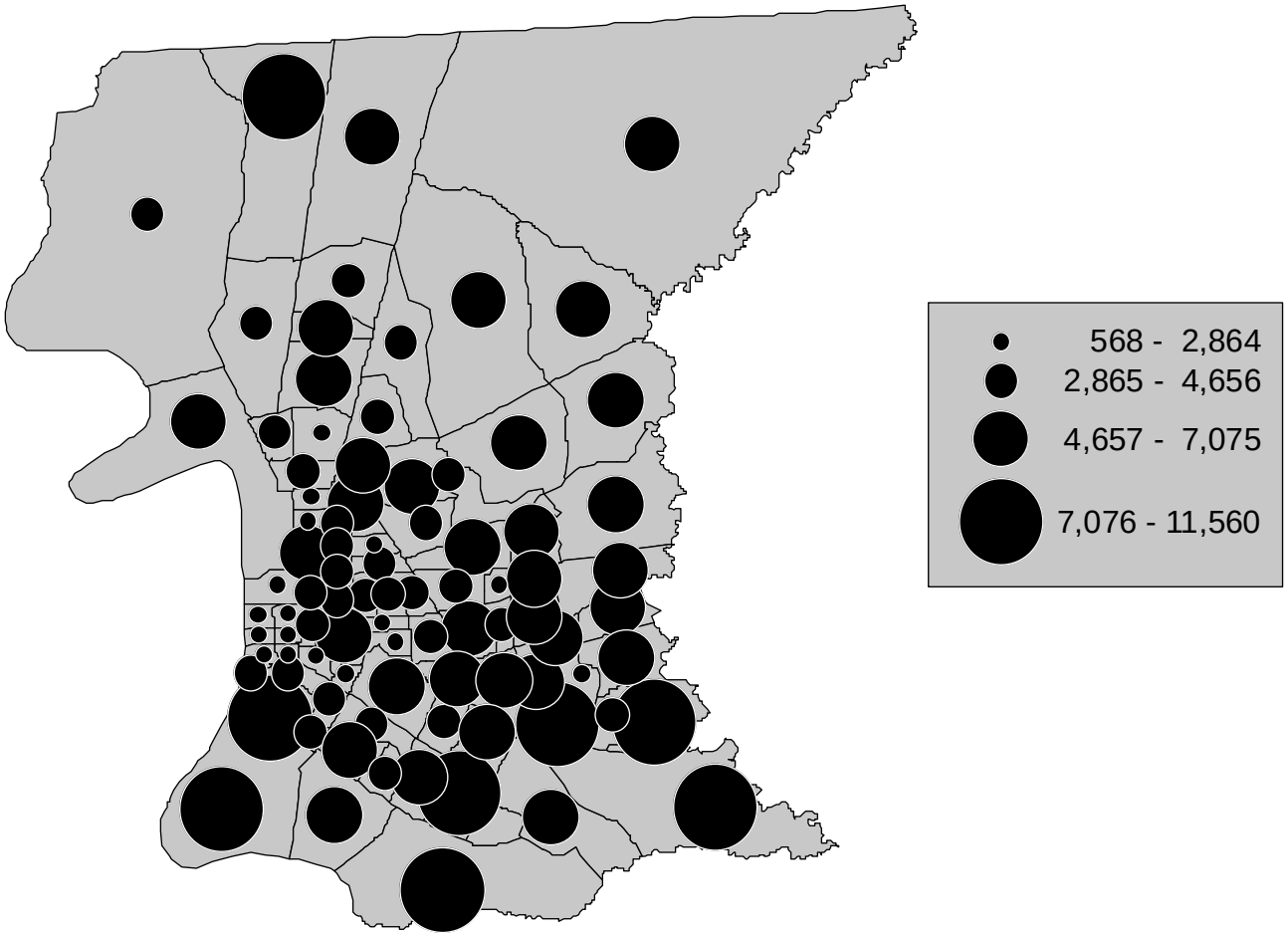
1 dot = 500 people

Large dot size

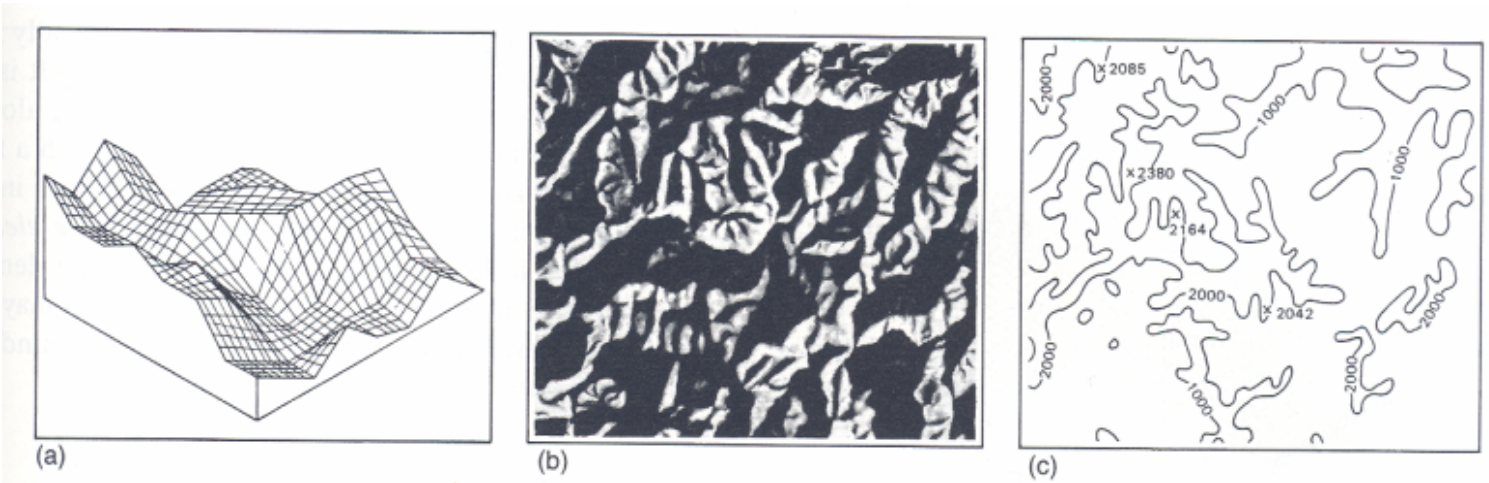


Two different sets of range-graded circles to use in proportional point symbol mapping. Any set containing three to six adjacent opaque circles (left) and no more than five adjacent transparent circles (right) may be used.

The Proportional Symbol Map

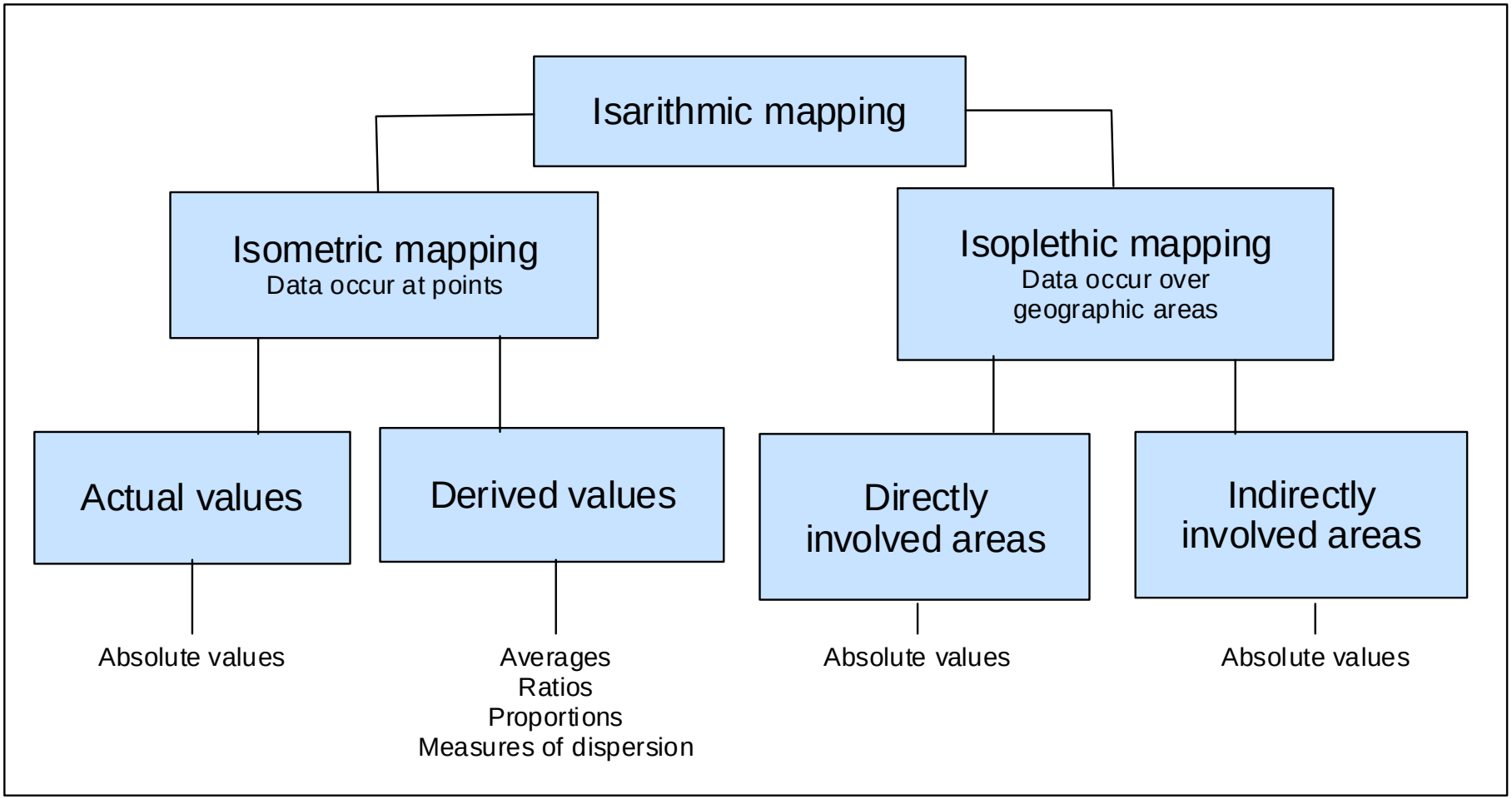


The Isarithmic Map



(a) Three-dimensional model bounded by a continuous surface;
(b) vertical shaded relief representation of three-dimensional model;
(c) planimetric representation of the three-dimensional model in form of an isarithmic map.
Source: Dent, (1999)

The Isarithmic Map



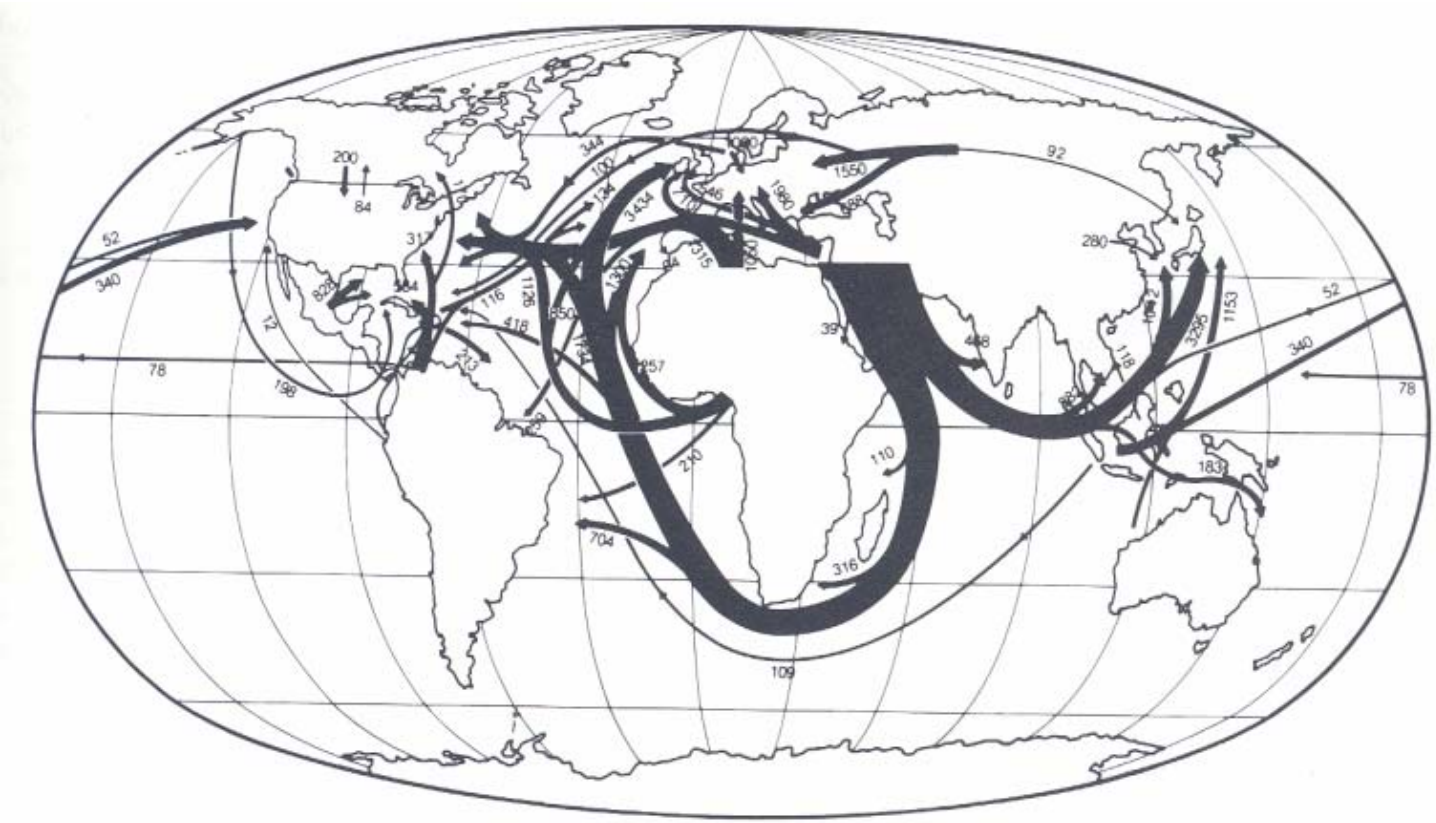
Adopted from: Dent (1999)

Isoline Names

Isobath……..Depth below a datum (e.g., mean sea level)
Isogonic line……..Magnetic declination
Isocline…….. Magnetic dip (inclination) or angle of slope
Isohypse (contour)…...Elevation above a datum (e.g., mean sea level)
Isodynamic line…… Intensity of the magnetic field
Isotherm…… Temperature
Isobar…… Atmospheric pressure
Isohyet…….. Precipitation
Isobront…… Occurrence of thunderstorms
Isanther…… Time of flowering of plants
Isoceph……..Cranial indices
Isochalz…… Frequency of hail storms
Isogene……..Density of a genus
Isospecie……...Density of a species
Isodyn…… Economic attraction
Isohydrodynam…….Potential water power
Isostalak……...Intensity of plankton precipitation
Isovapor……Vapor content in the air
Isodynam……. Traffic tension
Isophot……..Intensity of light on a surface
Isoneph……Degree of cloudiness
Isochrone……. Travel time from a given point
Isophene……. Date of beginning of a plant species entering a certain phenological phase
Isophectic…….Time of ice formation
Isotac…… Time of thawing
Isobase……Vertical earth movement
Isohemeric line… Minimum time of (freight) transportation
Isohel…… Average duration of sunshine in a specified time
Isodopane…… Cost of travel time

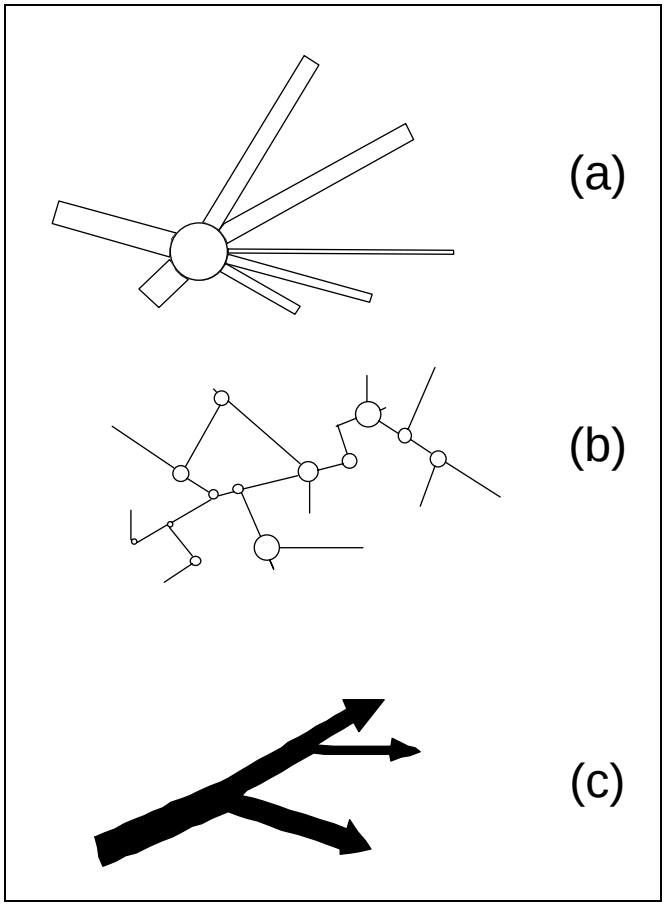
Source: Thrower, 1972

The Design of Flow Maps



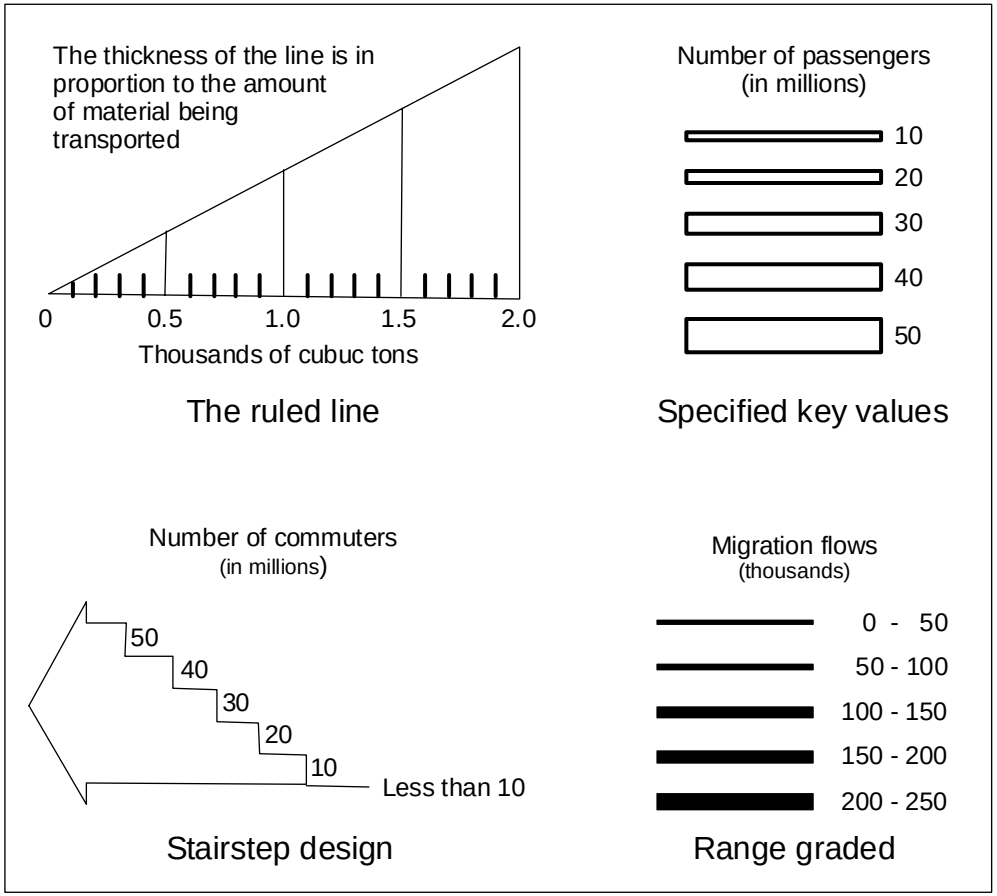
International crude oil flow, 1980 (thousand barrels per day).
Source: U.S. Department of Energy, Energy Information Administration, 1981 International Energy Annual.
Source: Dent, (1999)

Classification of Flow Maps



Classification of flow maps: (a) radial type, (b) network type, (c) distributive type;
Source: Dent, (1999)

Legend Designs for Flow Maps



Source: Dent, (1999)