Using ‘rmapshaper’ to Modify Boundary Files for Use in Linked Micromap Plots

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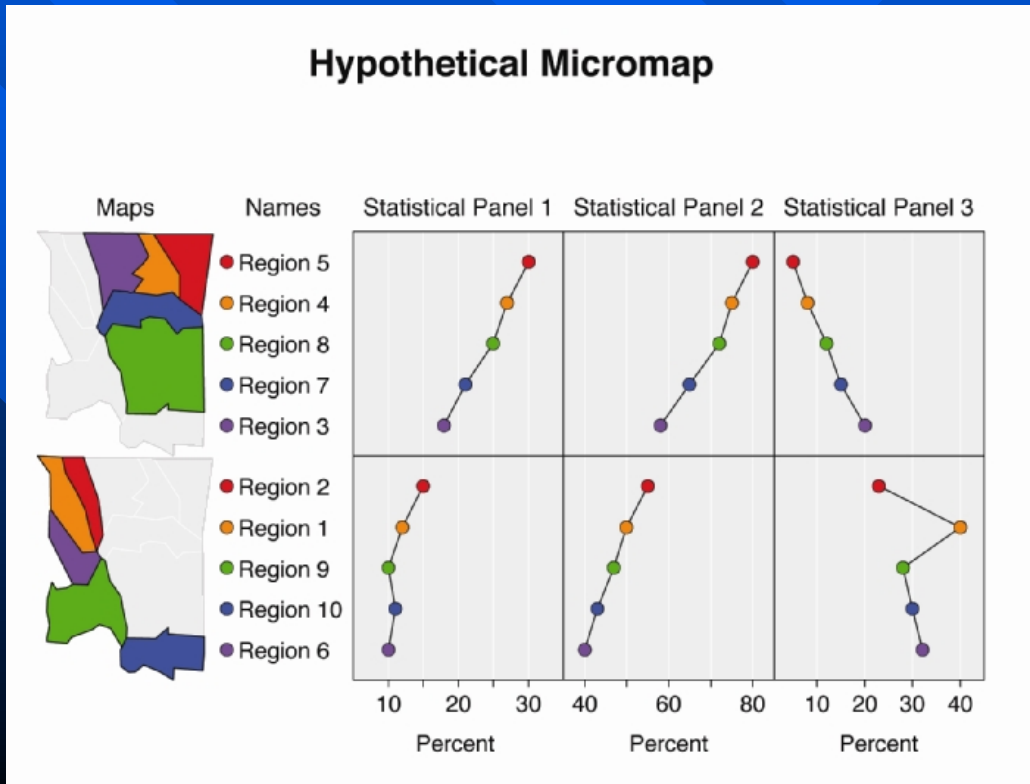
Concept of Micromaps

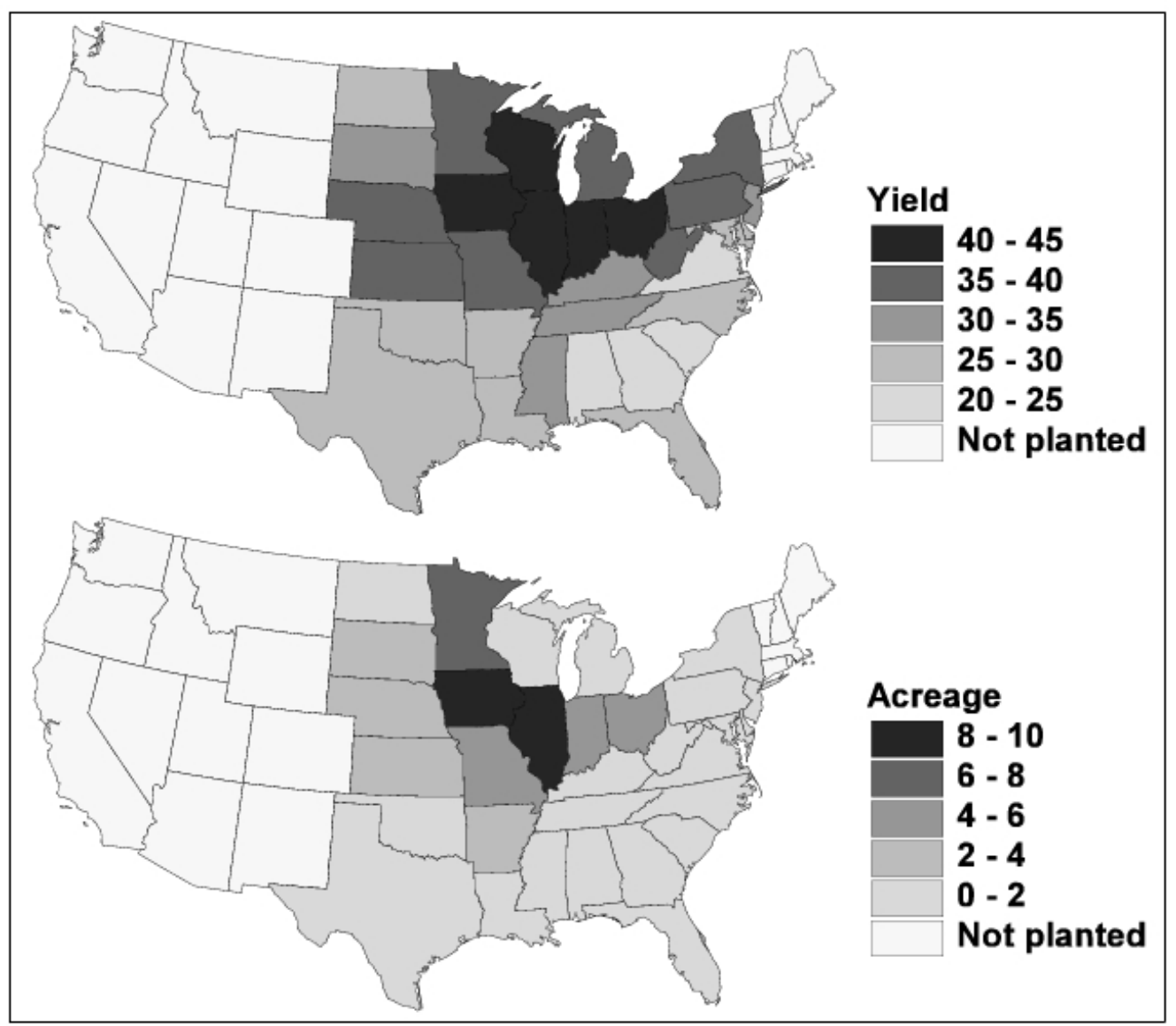
- Link of row-labeled univariate (or multivariate) statistical summaries to corresponding geographical region
- Focus on statistical display and not on maps
- Useful for
  - environmental data
  - agricultural data
  - medical data
  - public health data
  - economical data



History of Micromaps

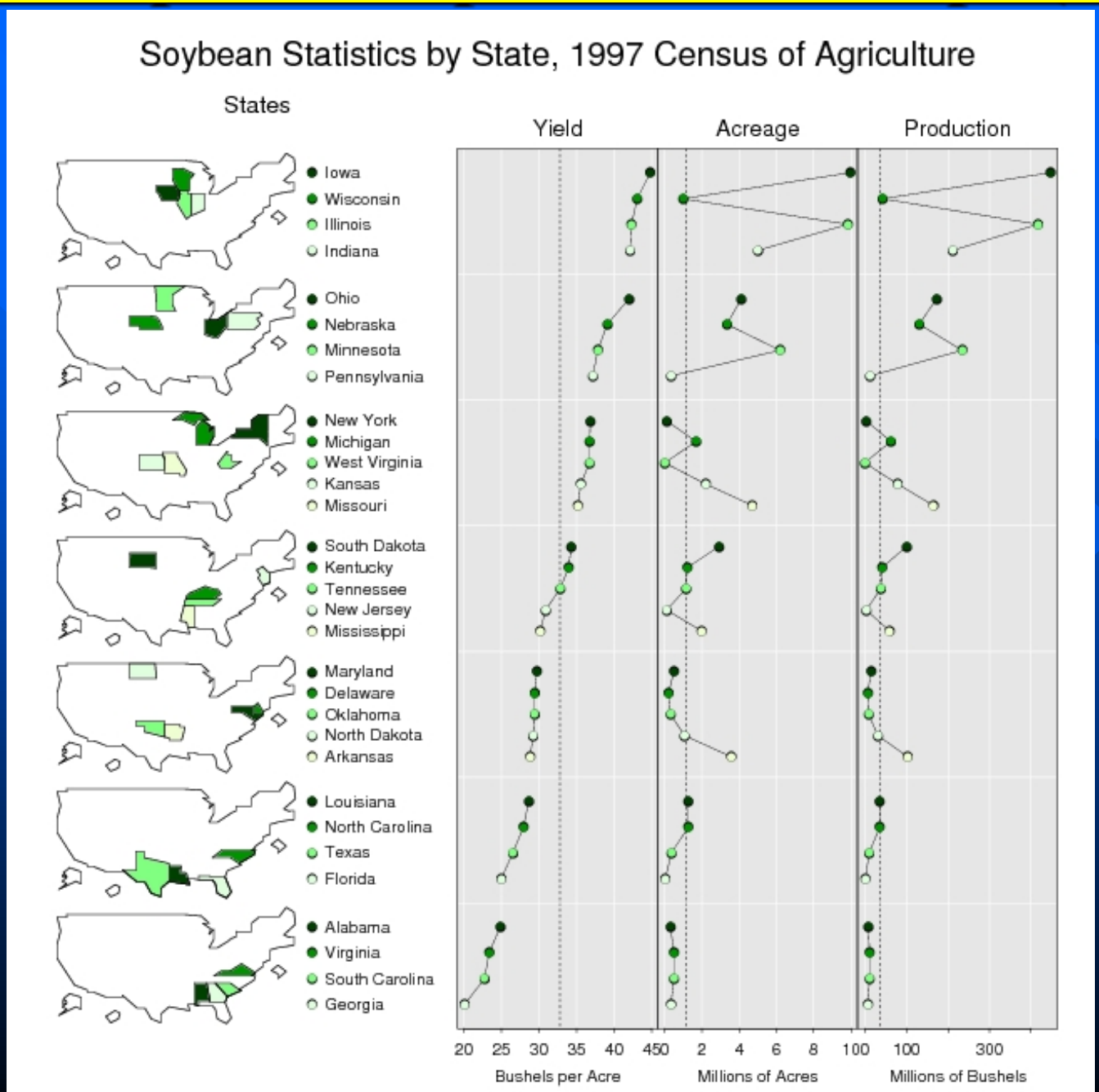
- First presented at the 1996 American Statistical Association's annual meeting (Olsen, Carr, Courbois, Pierson)
- Initial references:
  - Carr, Pierson (1996)
  - Carr et al. (1998)

Choropleth Maps vs Micromaps (1)



From: Symanzik & Carr (2008)

Choropleth Maps vs Micromaps (2)



From:
Symanzik &
Carr (2008)

Limitations of Choropleth Maps

1) Some map regions can be too small to effectively show color
2) Converting a continuous variable into a variable with a few ordered values results in an immediate loss of information
3) Difficult to show more than one variable in a choropleth map

Basic Examples of Linked Micromap Plots

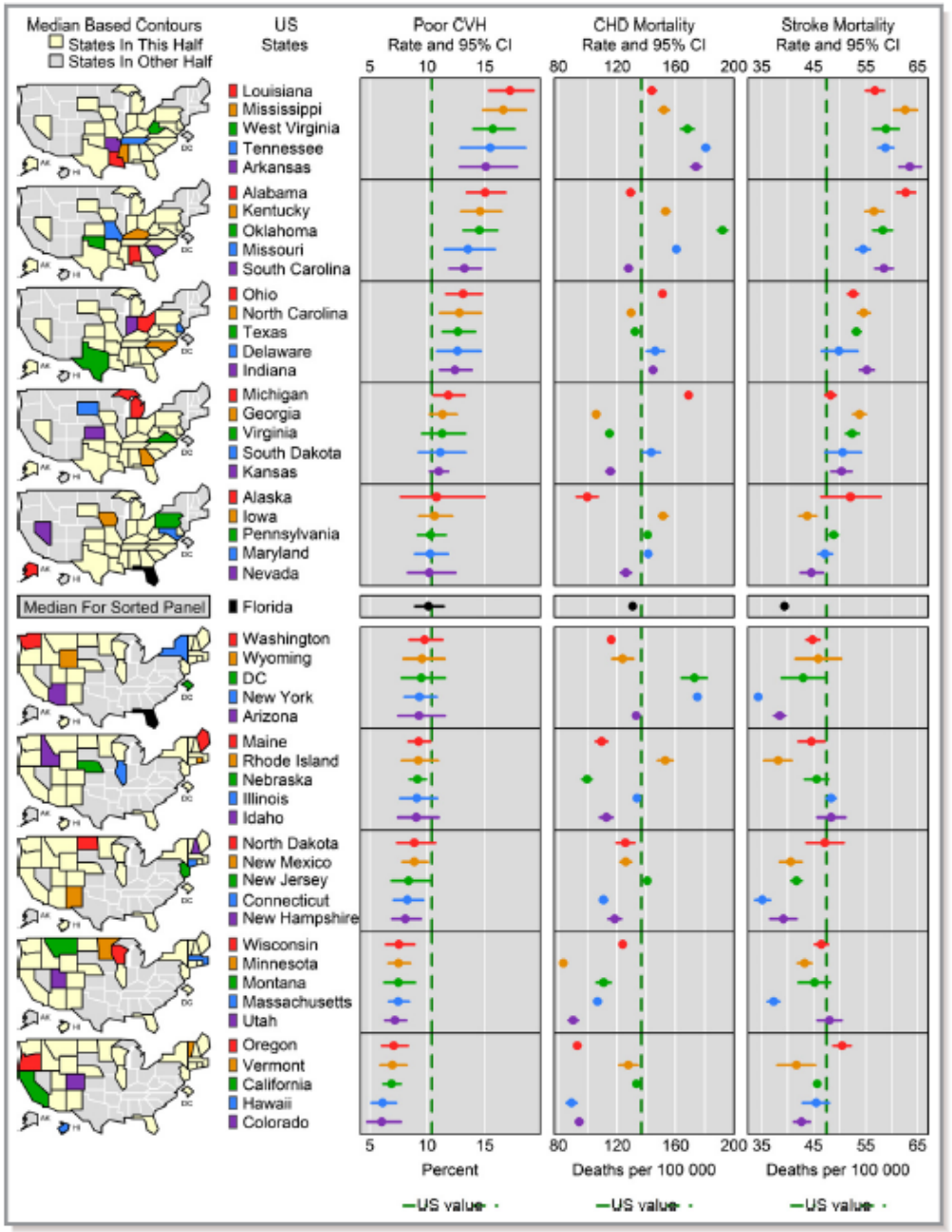
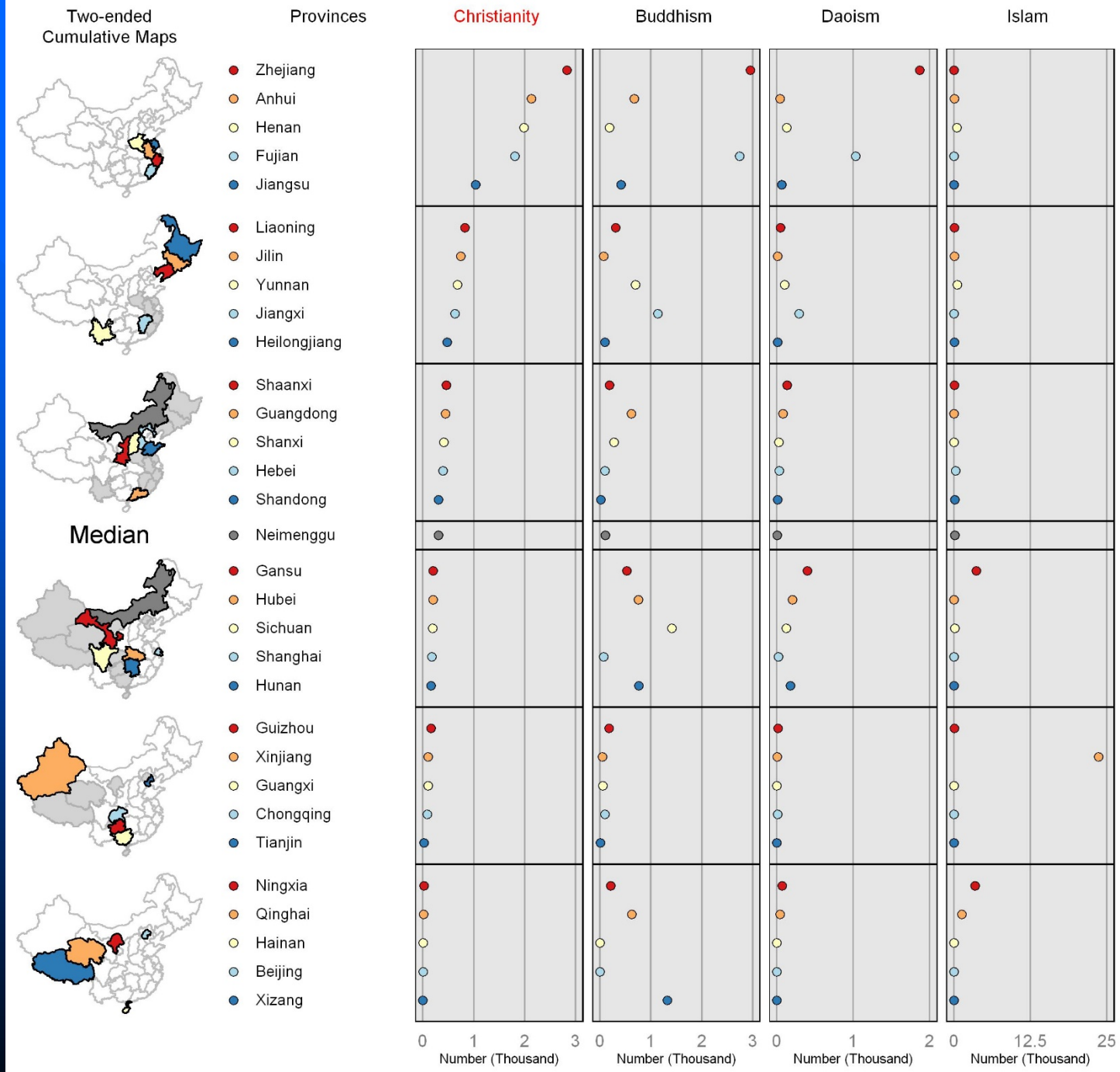


Figure. Linked micromap plot showing age-adjusted prevalence of poor cardiovascular health (CVH) and mortality rates for coronary heart disease (CHD) and stroke by state in 2011. The green lines show the national average (ie, mean) of the prevalence of poor CVH (10.4%), the CHD mortality rate (136.6 per 100 000), and the stroke mortality rate (47.5 per 100 000). Florida (black color) highlights the median of poor CVH among the states and the District of Columbia. AK indicates Alaska; DC, District of Columbia; HI, Hawaii.

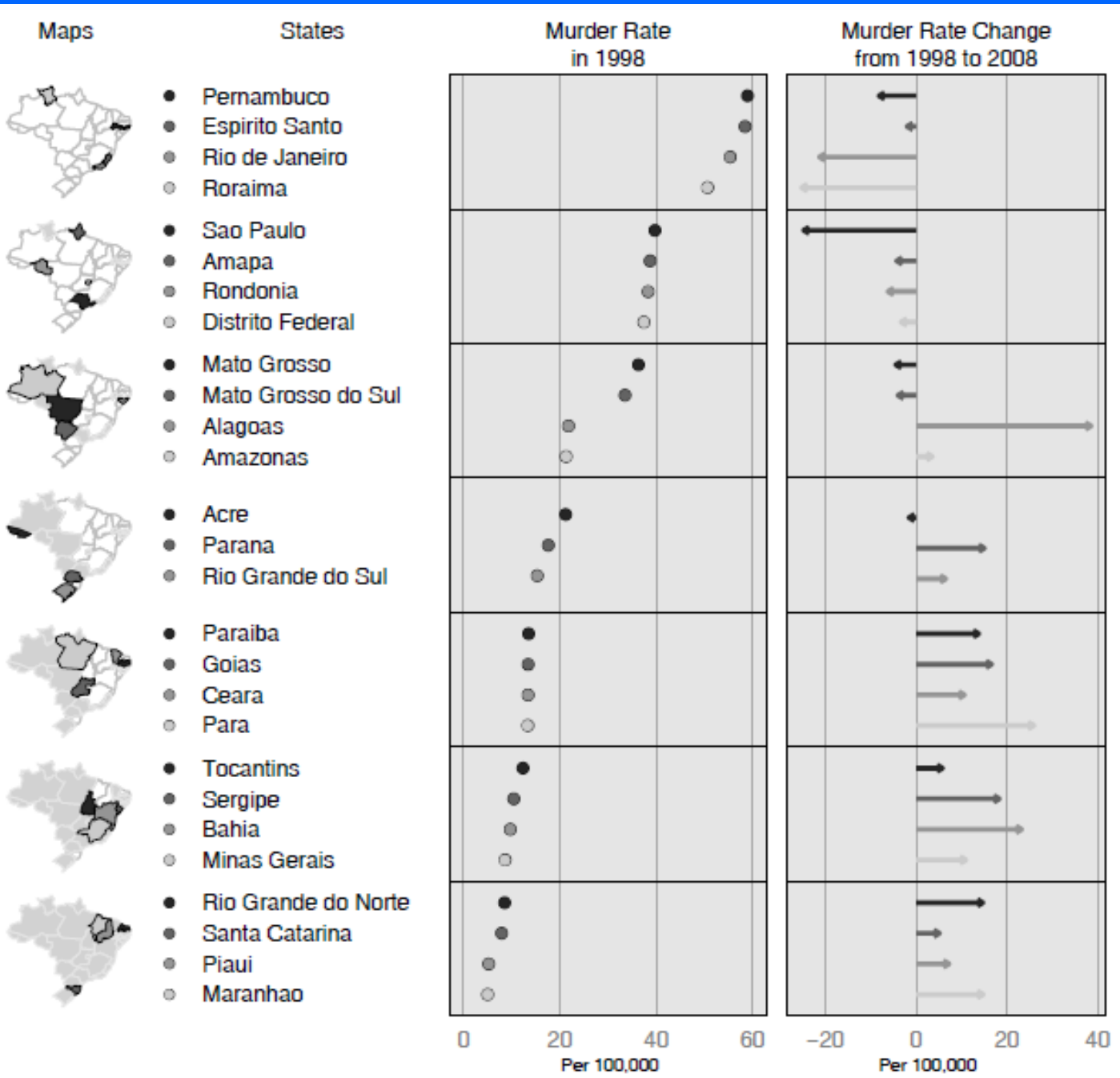
From: Gebreab et al. (2015)

China



From: Symanzik et al. (2016)

Brazil



From:
Symanzik et al.
(2014)

Shapefile Modifications & Micromap Construction

Micromaps in R

- Two recently developed R Packages:
  - "micromap": general purpose; can handle arbitrary shapefiles from Geographic Information Systems (GIS)
  - "micromapST": focus on the 50 U.S. states

Shapefile Modifications

- Modification of existing shapefiles
  - Simplification of boundaries (via Douglas-Peucker 1973 algorithm)
  - Removal of tiny islands
  - Enlarging small areas such as capital regions, e.g, Washington DC in the United States
  - Shifting and resizing (enlarging or shrinking) regions that are far away from the main area, e.g., Alaska or Hawaii in the United States
  - Can be done in R, but tedious to do in the past!!!

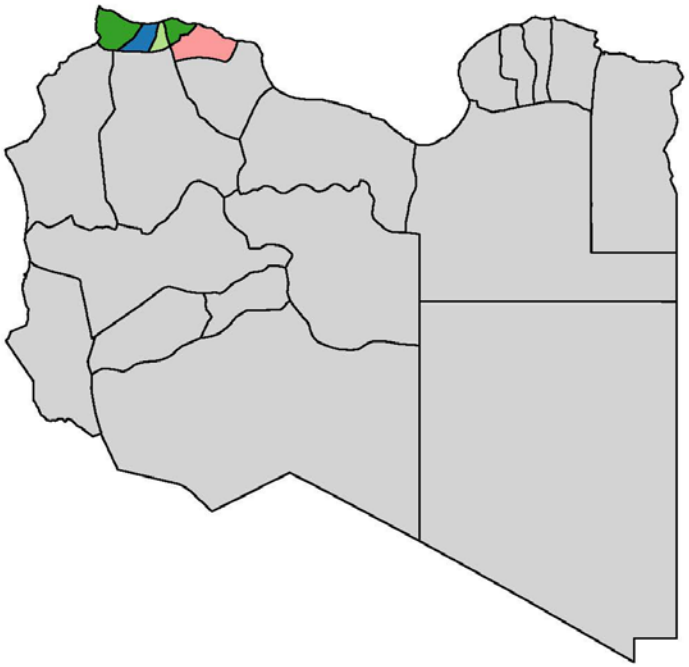
Simplification via Mapshaper and "rmapshaper"

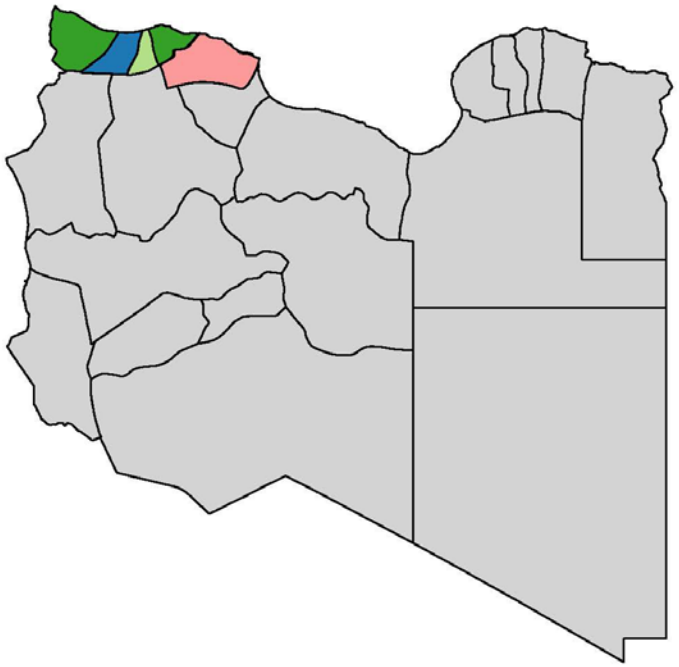
- Mapshaper (Harrower & Bloch, 2006):
  - Web-based tool for the simplification of shapefiles
- "rmapshaper" R Package (Teucher & Russell, 2018):
  - R wrapper for Mapshaper
  - Direct translation into R functions of some functionality
  - Remaining functionality can be obtained via console commands

Task 1: Thinning Boundaries

Mexico

Task 2: Resizing Regions





Libya

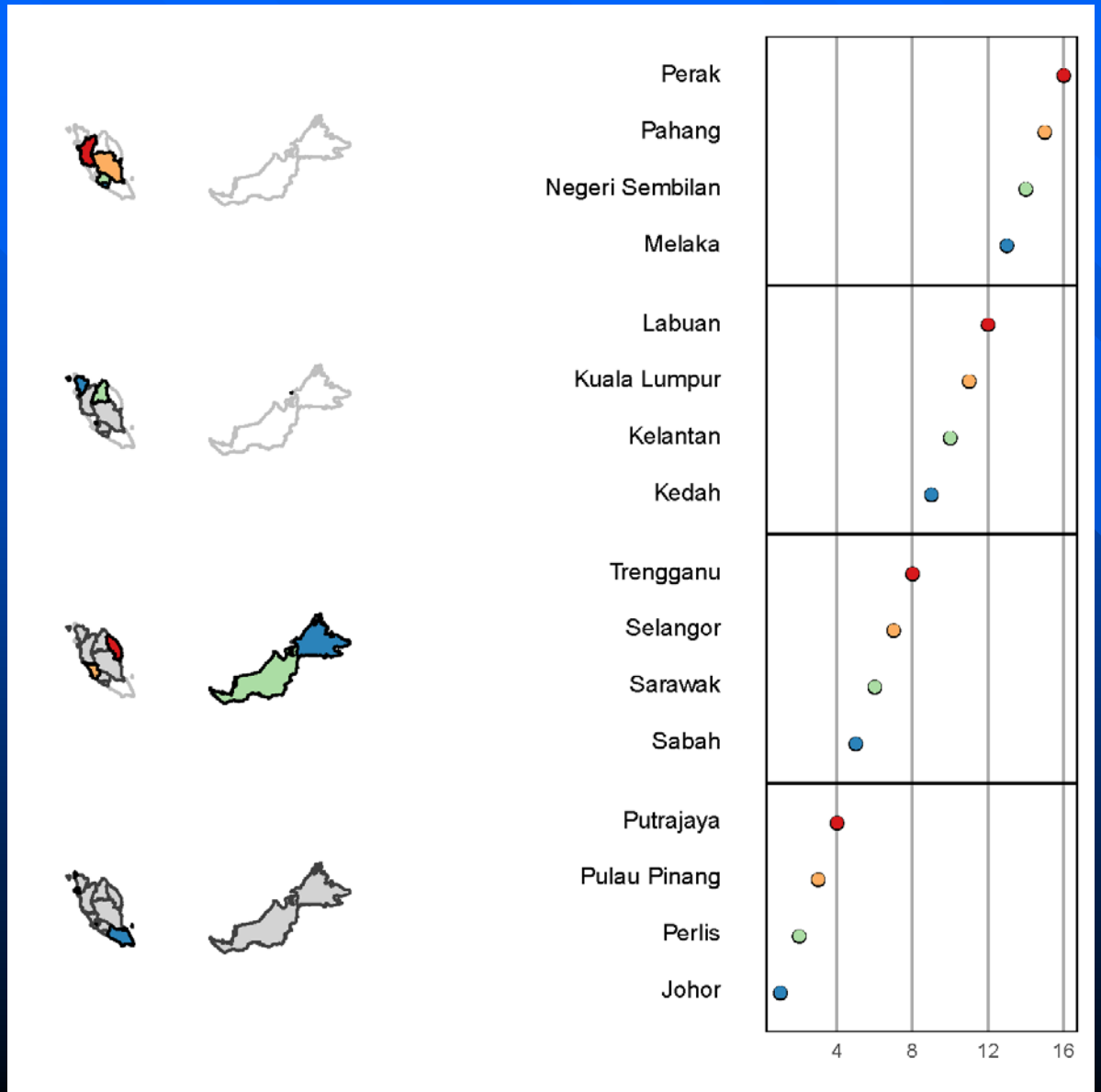
Task 3: Moving Regions

Spain: *Canary Islands*

Tasks 2 & 3: Moving & Resizing Regions

Benin: *Littoral*

Malaysia: Out-of-the Box



Malaysia: Shapefile Modification

Input Shapefile

Browse... 4 files

Upload complete

Upload Table

Browse... MYS_modi | Use Blank Table

Upload complete

Thinning Value

0.005 | Apply Thinning Level

Select Region

Putrajaya

Scale Value 6.5

Degree of Rotation 0

Longitudinal Shift 0.15

Latitudinal Shift -.1

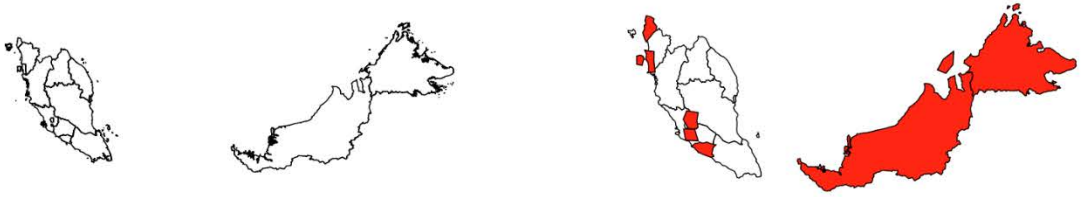
Add Command

Remove Row:

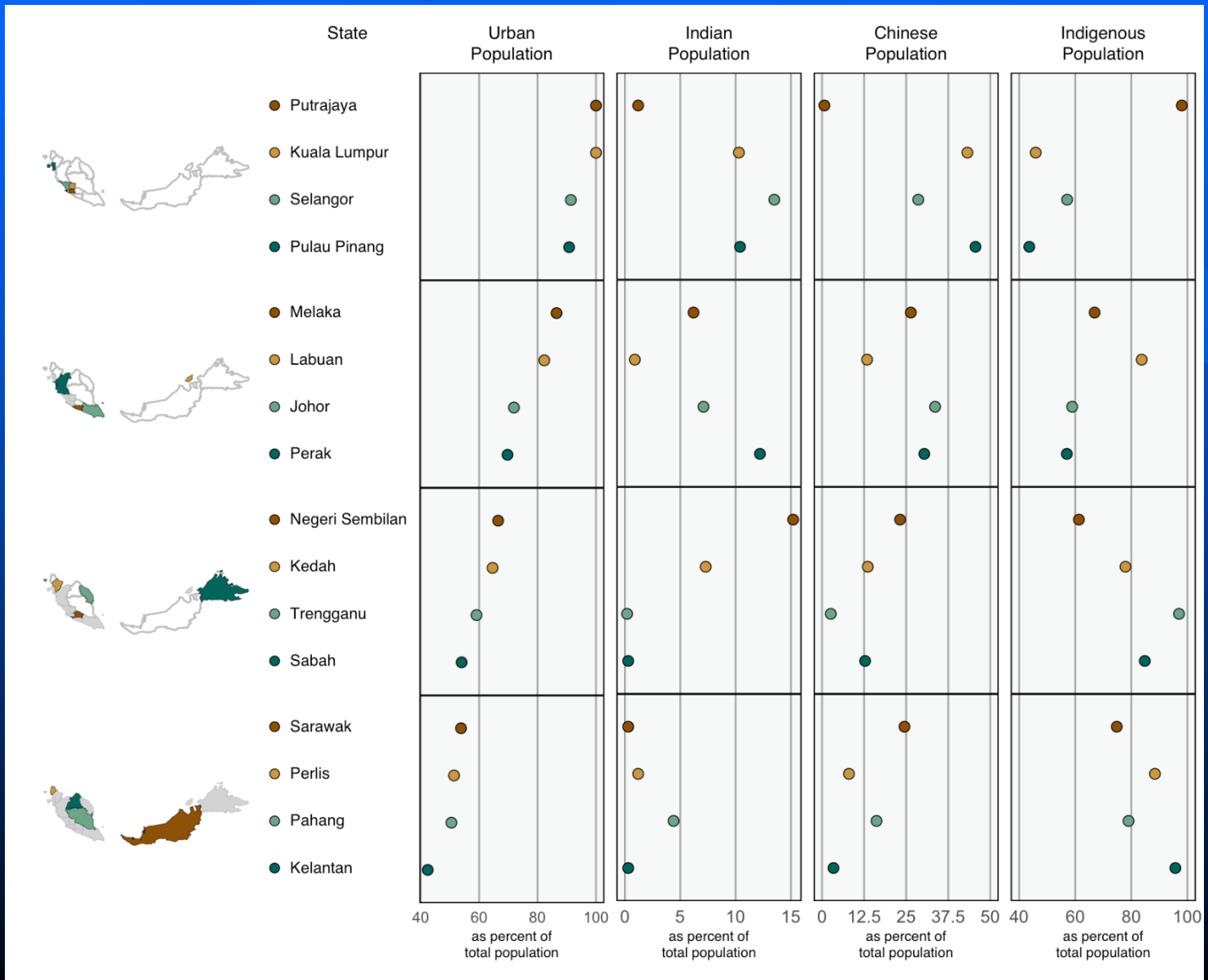
Remove Row | 1

Apply Modifications | Export Table

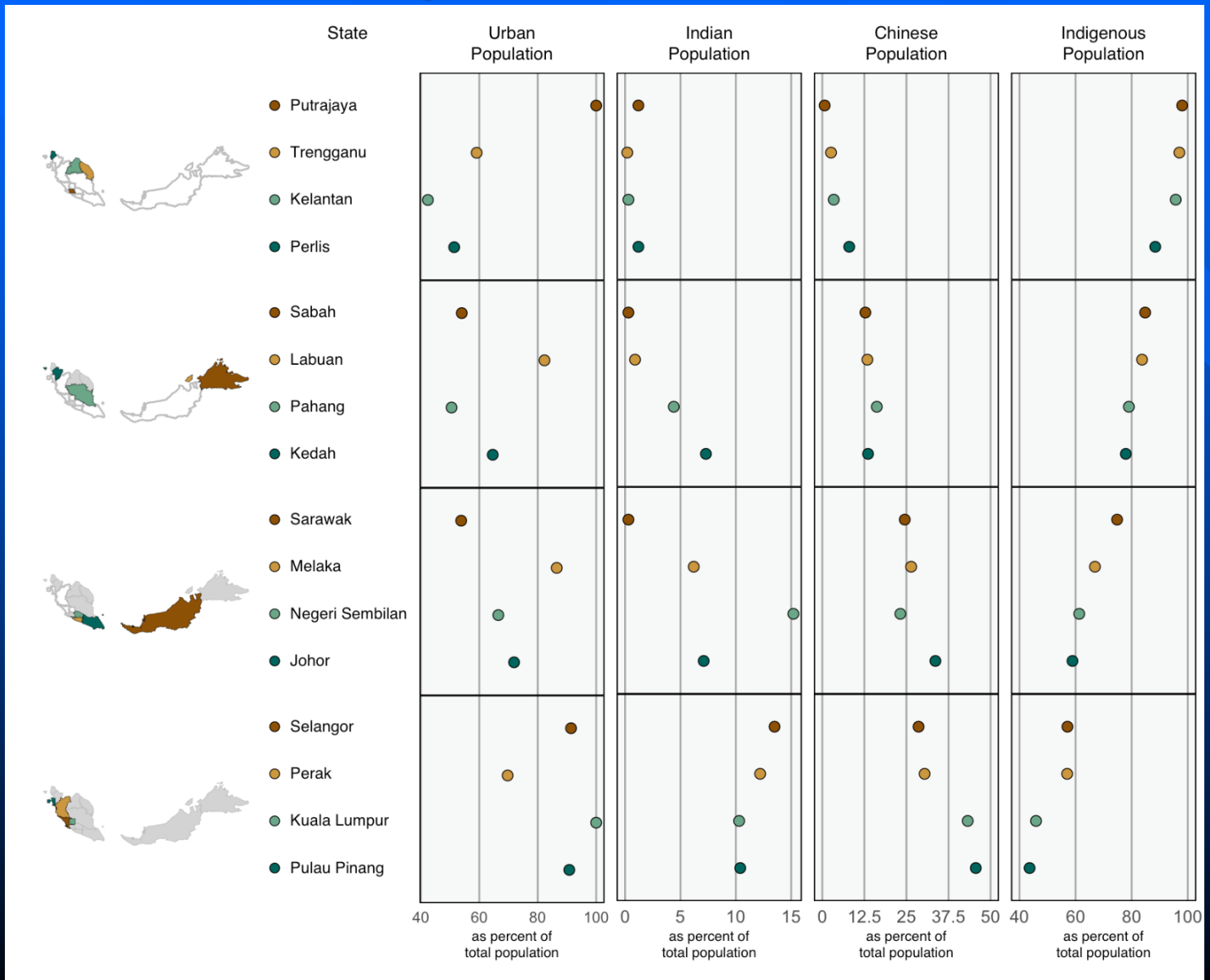
	Command	Region	V1	V2	V3	V4
1	simplify		0.005	NA	NA	NA
2	affine	Labuan	7	0	-4.5	0
3	affine	Melaka	1.4	0	0	0
4	affine	Kuala Lumpur	3.5	0	0.15	0.2
5	affine	Perlis	2	0	0.15	0
6	affine	Sarawak	1	0	-4	0
7	affine	Sabah	1	0	-4	0
8	affine	Pulau Pinang	1.75	0	-0.1	0
9	affine	Putrajaya	6.5	0	0.15	-0.1



Malaysia: Modified (1)



Malaysia: Modified (2)



Current / Future Work

- Finalization of recommendations for shapefile modifications for about 150 countries
- *LMshapemaker* R Package for the modification of shapefiles and shiny user interface to be finalized
- **Braden's MS Defense coming up in September!**
- **Challenge: What to do with Indonesia – Reshape ?!?**

From: https://en.wikipedia.org/wiki/Indonesia

From: https://bigthink.com/strange-maps/657-welcome-to-planet-voronoi-a-capital-place

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Questions ???

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