

# Map Design

Lecture #11 | GEOG 510  
GIS & Spatial Analysis in Public Health  
Varun Goel

# Overview

- Decisions, decisions, decisions
- Symbolization
- Color
- Design principles
- Maps vs figures
- In-class mapping exercise!

# Mapping in a GIS

- Mapping for others
  - Main purpose is to communicate geographic information
    - Focus on design/presentation in order to create an output that effectively communicates the information

# Decisions in Map Creation

- Information to be presented
  - Selection, generalization, simplification, exaggeration
- Symbolization of information
  - Selecting symbols based on thematic content, including color
- Design and layout of map display
  - Creating an aesthetically pleasing display

# Selective Content

- Selecting features and attributes to include in display
  - Determined by the specific objective of the thematic map
- Choosing the appropriate extent
  - What geographic region is most important

# Symbolization

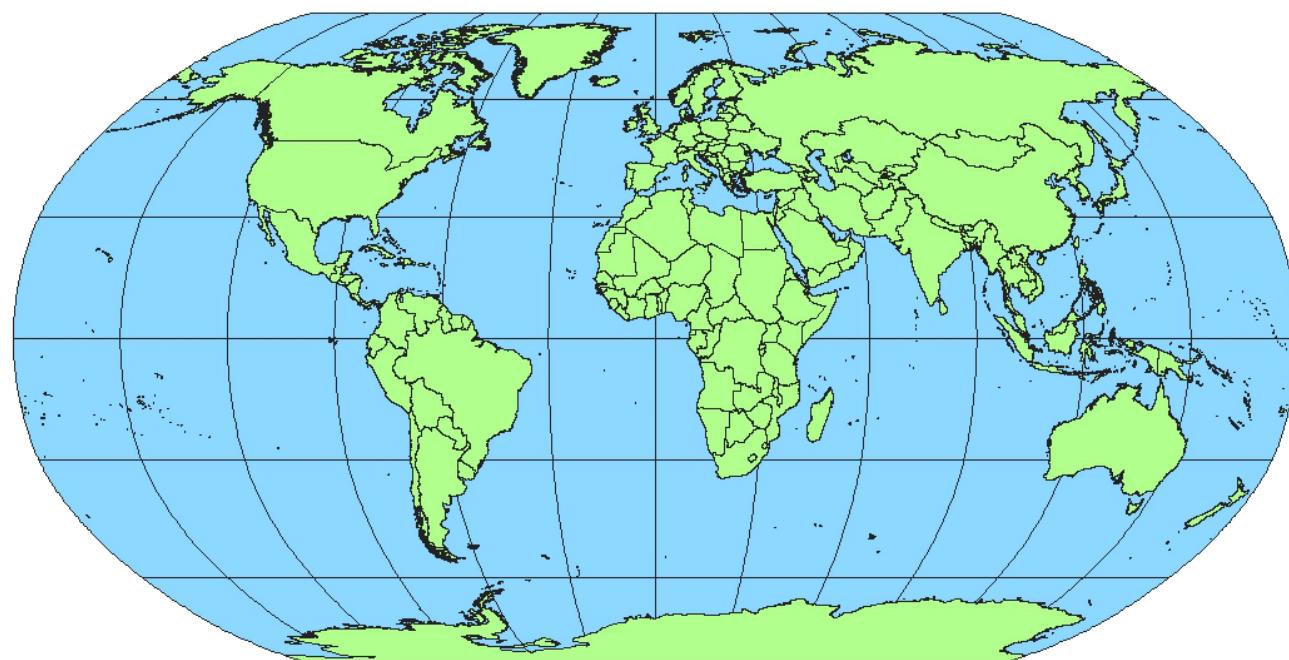
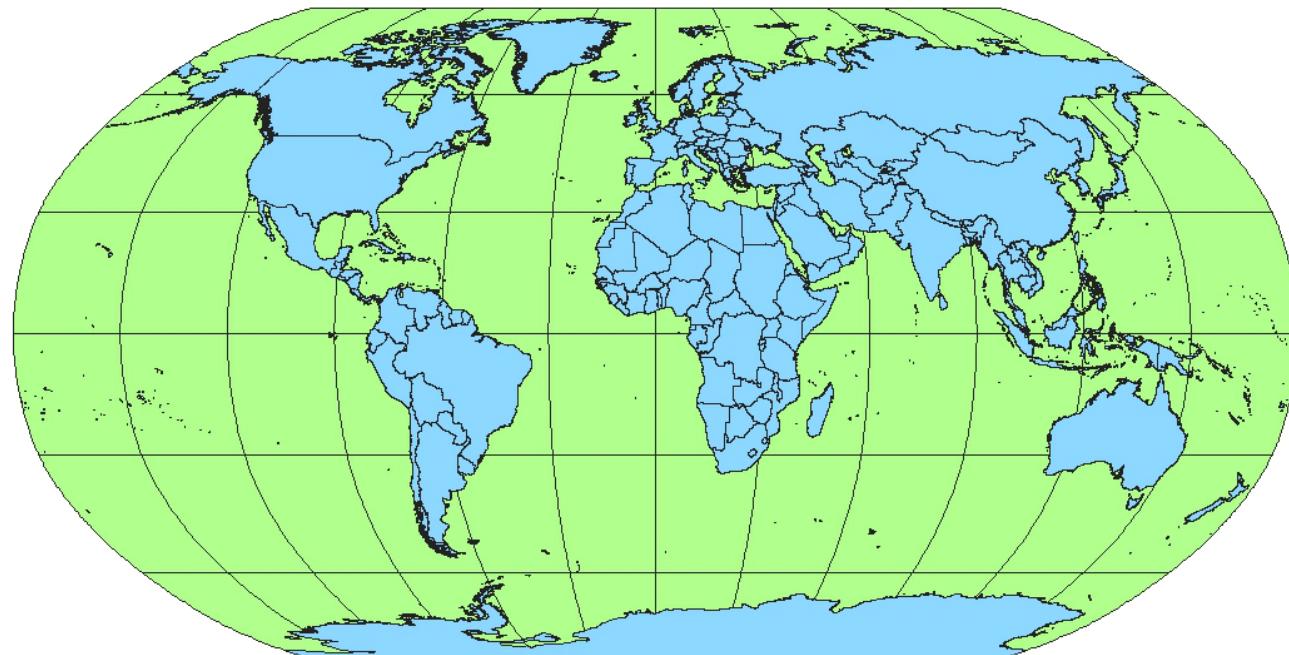
- Symbols are chosen to portray information selectively
- Basic spatial features serve as surrogates for real world objects or events
  - Points (e.g. trees), lines (e.g., roads), and areas (e.g., counties)
- Attribute values can be portrayed by varying several symbol characteristics
  - i.e., what?, how much?, how many?, how big?, etc.

# Symbol Characteristics

Feature Type	Visual Variable			Feature Type	Visual Variable			
	Shape	Orientation	Color Hue		Size	Pattern Texture	Color Lightness	Color Saturation
Point	 Spring  House  Tower	 Live Tree  Dead Tree	 Live Tree  Dead Tree	Point	 Small  Medium  Large	 Coarse  Fine	 Low  Dark	 Low  High
Line	 National Border  Trail  Section Line	 Asphalt Road  Concrete Road	 National Border  State Border	Line	 Low  Medium  High	 Low  Medium  High	 Low  Medium  High	 Low  Medium  High
Area	 Gravel  Sand	 Orchard  Field Crop	 Land  Water	Area	 Low  Medium  High	 High  Medium  Low	 High  Medium  Low	 High  Medium  Low

# Color Conventions

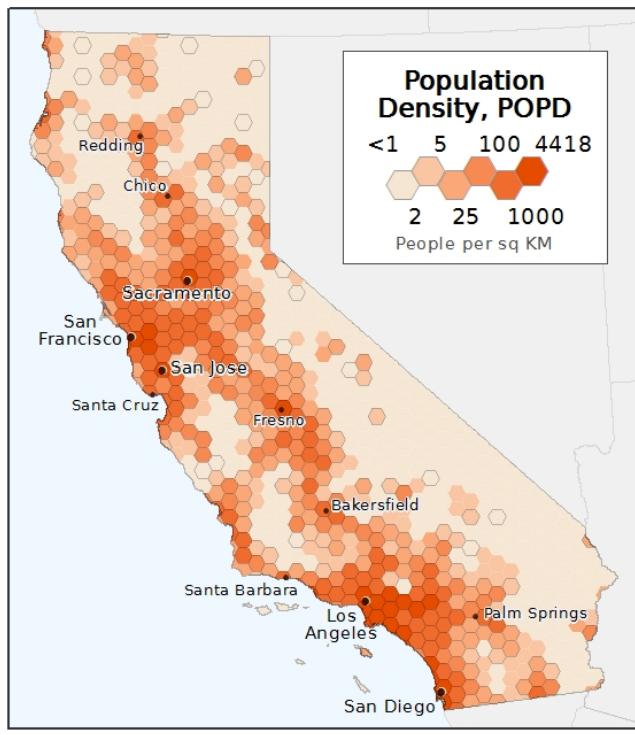
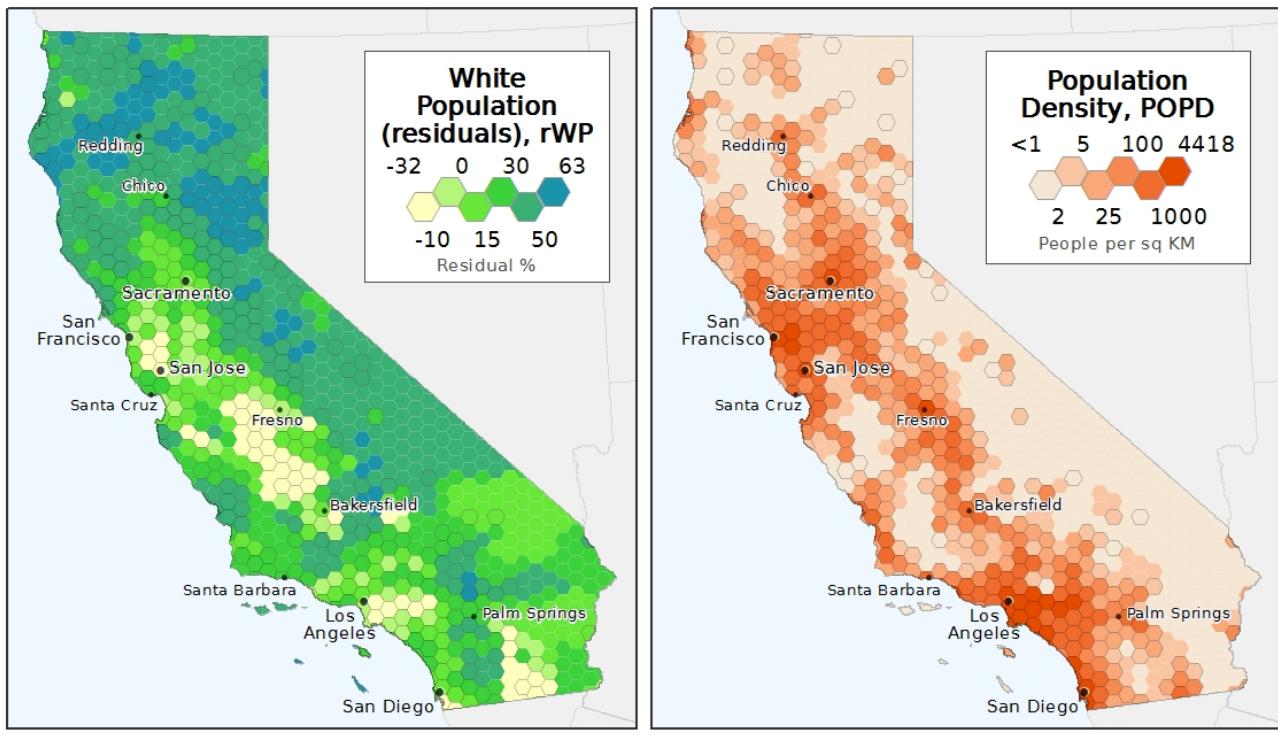
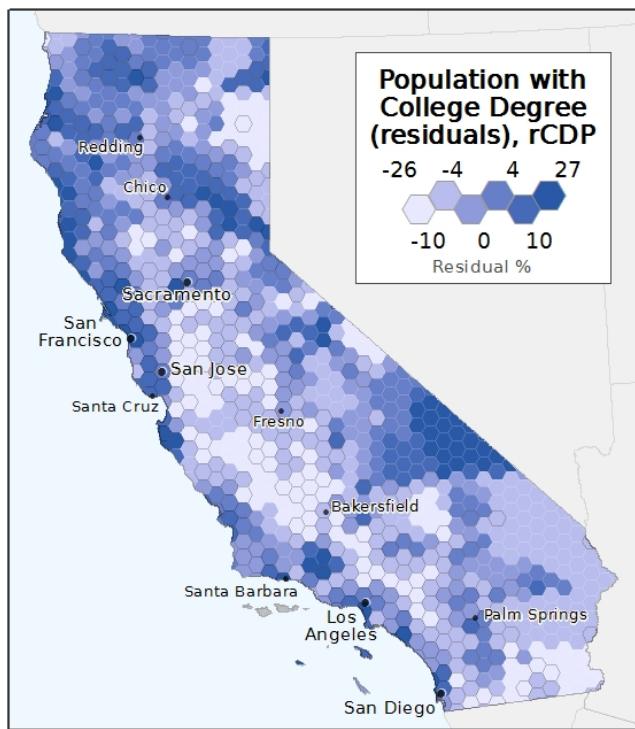
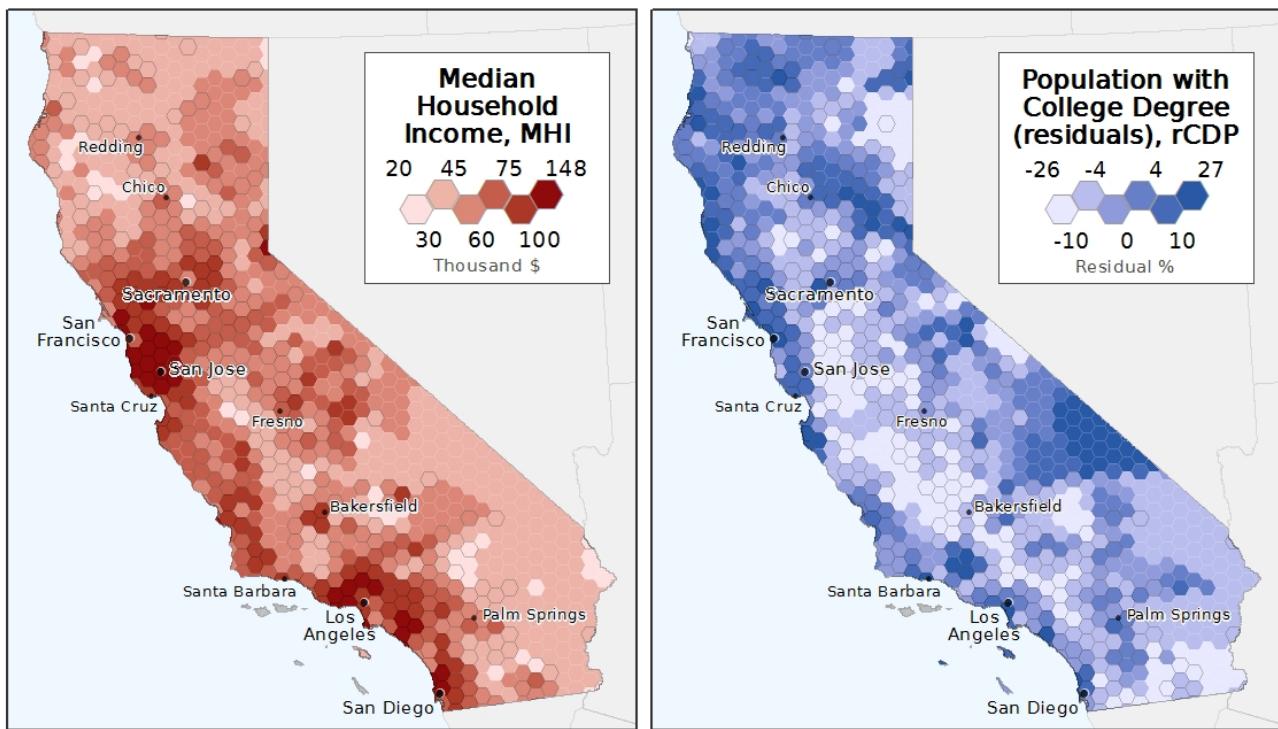
- Specific colors work well for specific physical features
  - e.g., blue for water, green for vegetation, brown for ground or soil
- Specific colors also work well for representing values
  - e.g., red for negative values and blue or green for positive values

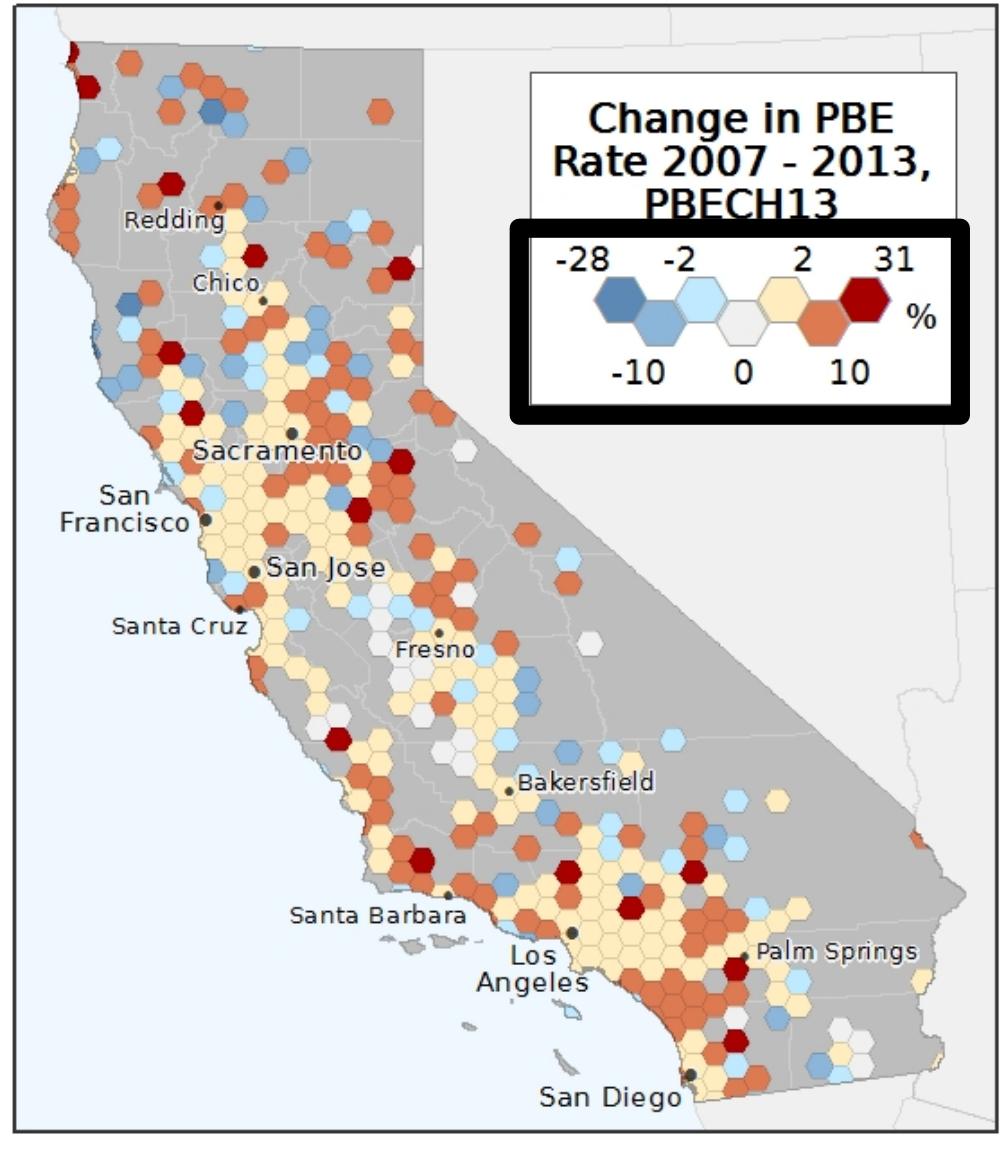
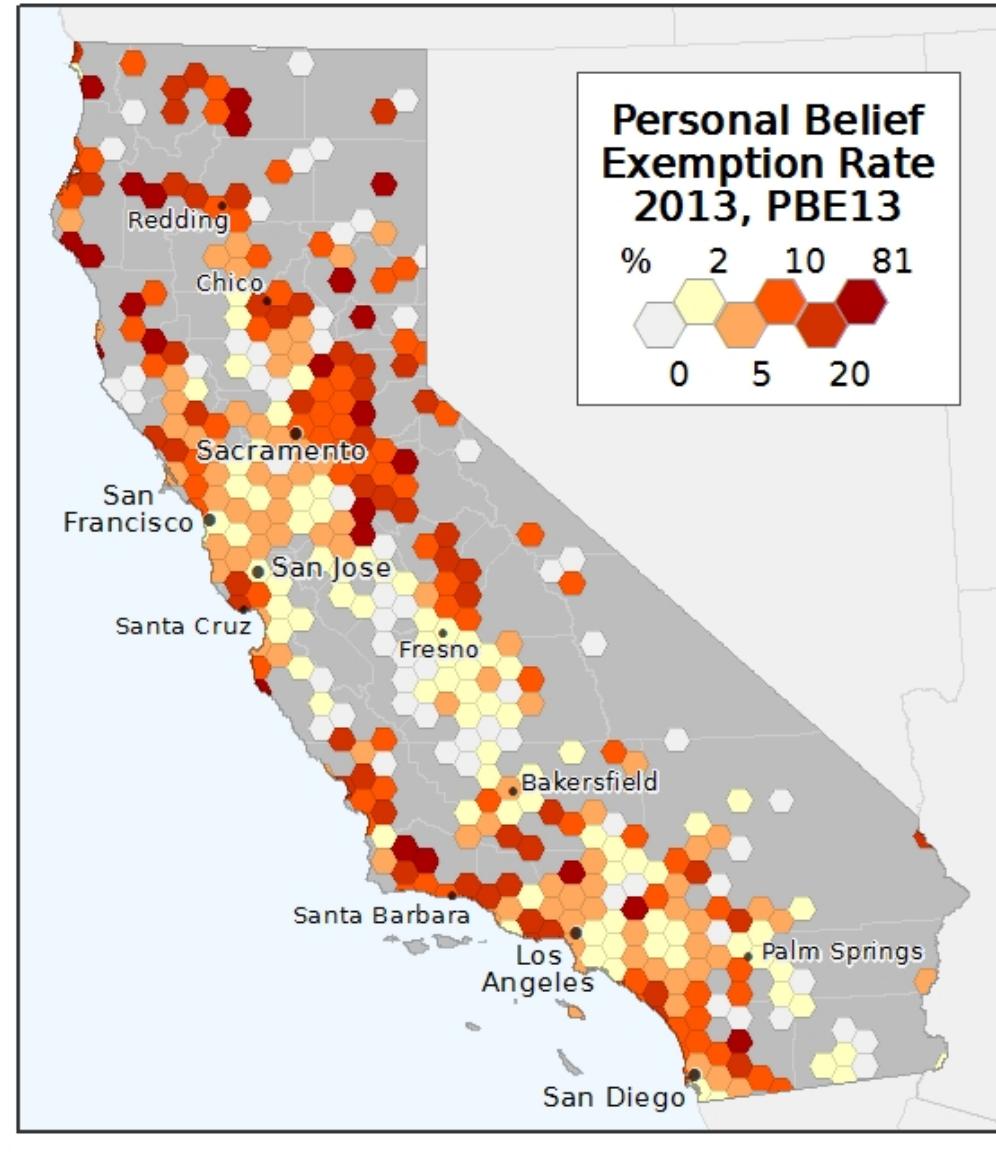


# Colors and Quantity

- Color Ramps (value sequences)
  - Most useful for ordinal, interval/ratio variables
  - Use diverging colors, if the variable range has a “true” center
- Blended hue sequences that suggest quantity
  - Spectrum of cool to warm colors
  - Partial spectrum or blending of hues
  - Elevation sequence (blue to green to brown to white)





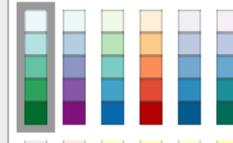
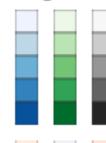


ColorBrewer: Color Advice for ... +

colorbrewer2.org

Number of data classes: 3 i

Nature of your data: i  
 sequential  diverging  qualitative

Pick a color scheme:  
 Multi-hue:   
 Single hue: 

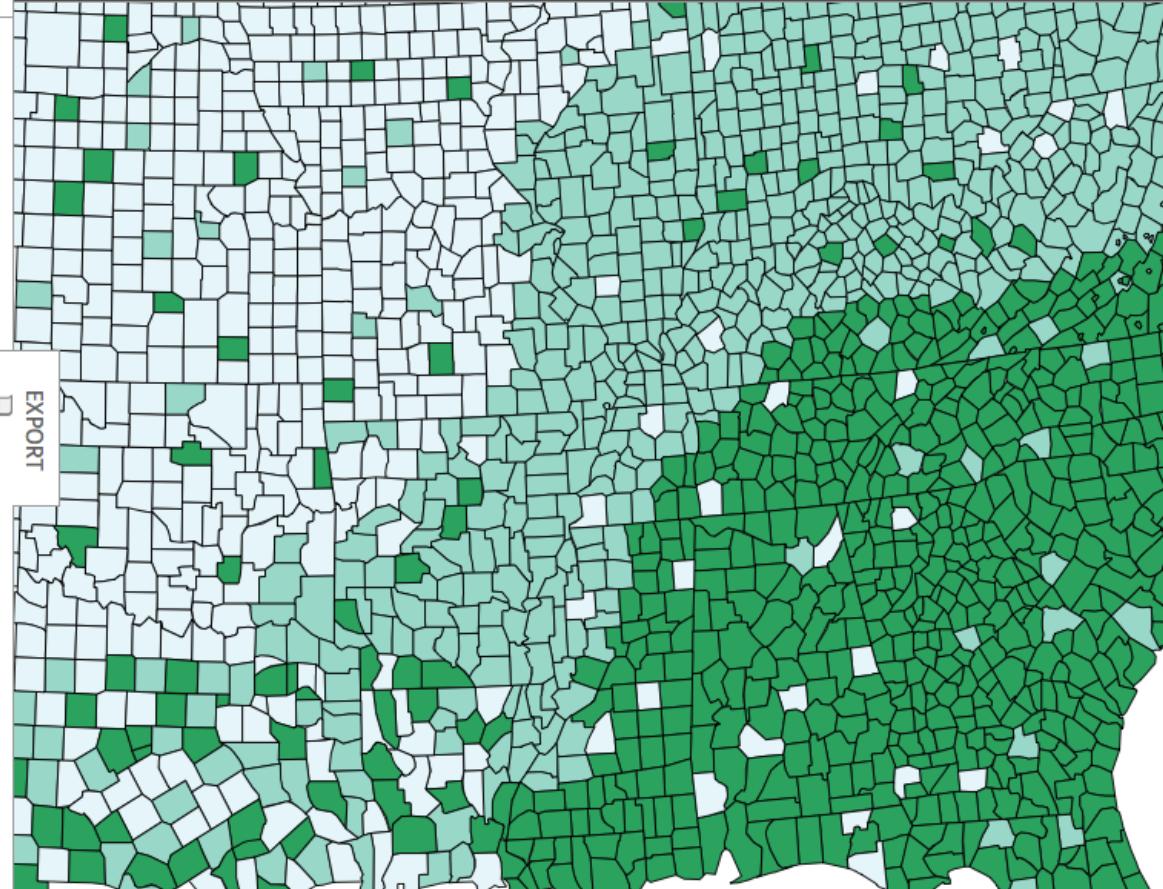
Only show: i  
 colorblind safe  
 print friendly  
 photocopy safe

Context: i  
 roads  
 cities  
 borders

Background: i  
 solid color   
 terrain  
 color transparency

3-class BuGn  
    
 HEX   
 #e5f5f9  
 #99d8c9  
 #2ca25f

EXPORT



© Cynthia Brewer, Mark Harrower and The Pennsylvania State University  
[Support](#)  
[Back to Flash version](#)  
[Back to ColorBrewer 1.0](#)

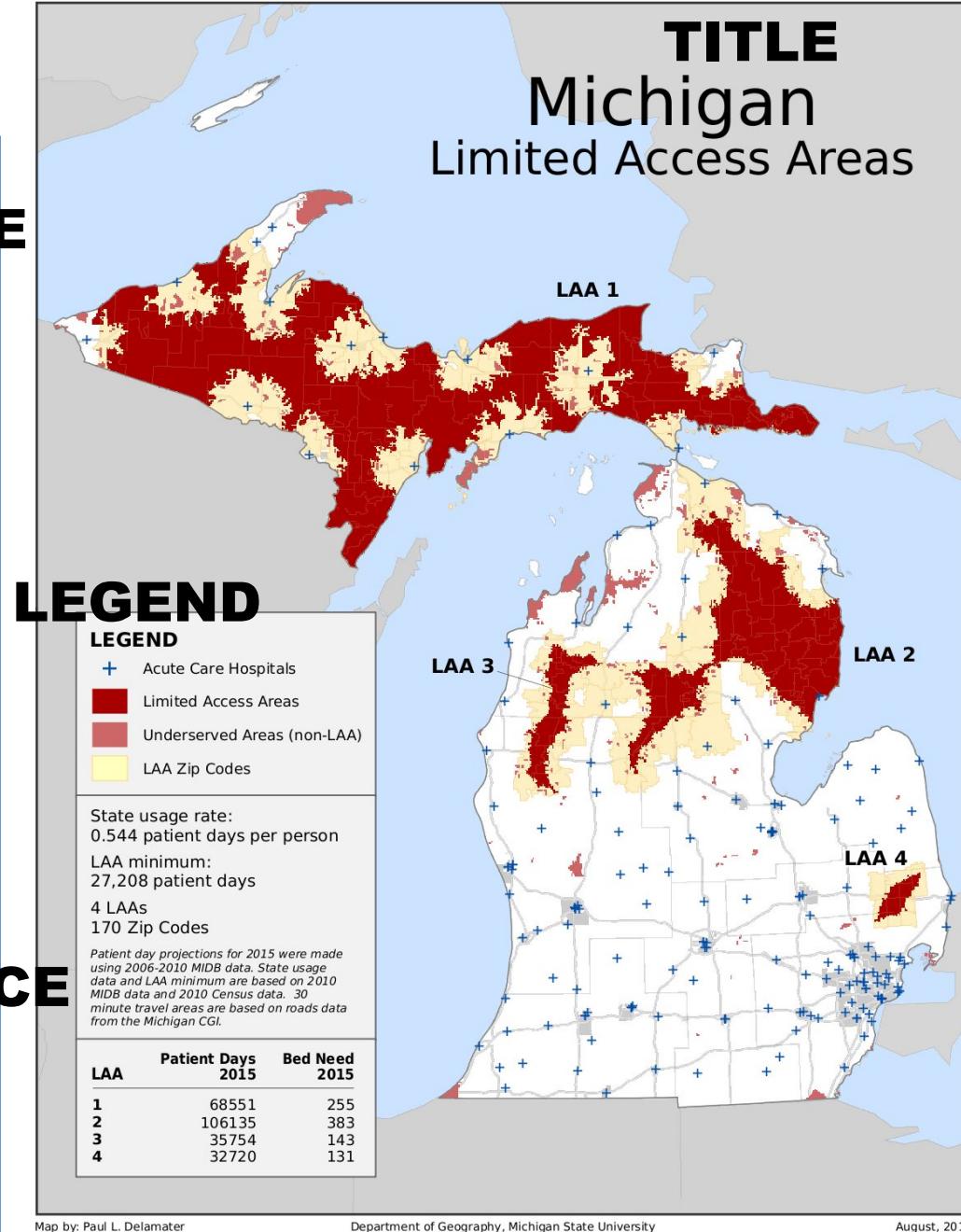
axismaps

Cynthia Brewer, Pennsylvania State University– <http://colorbrewer2.org>

# Map Elements

- Title: Identifies the map's content
- Legend: Relates symbols to their meaning
- Inset/Locator: Shows relative location of map
- North Arrow: Points “north”
- Information Sources: Allows users to evaluate map suitability
- Scale: Defines the relationship between distance on map and ground

**NEATLINE**



**SOURCE**

**AUTHOR**

**AGENCY**

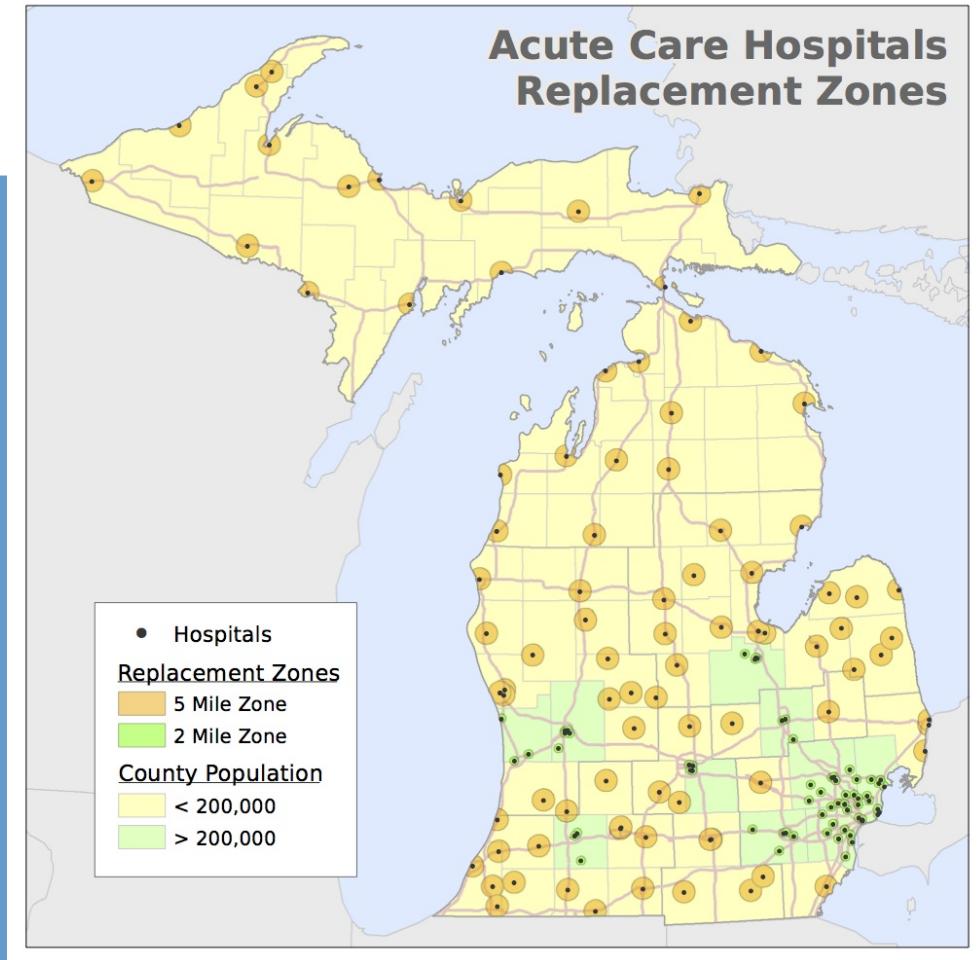
**DATE**

# Design Principles

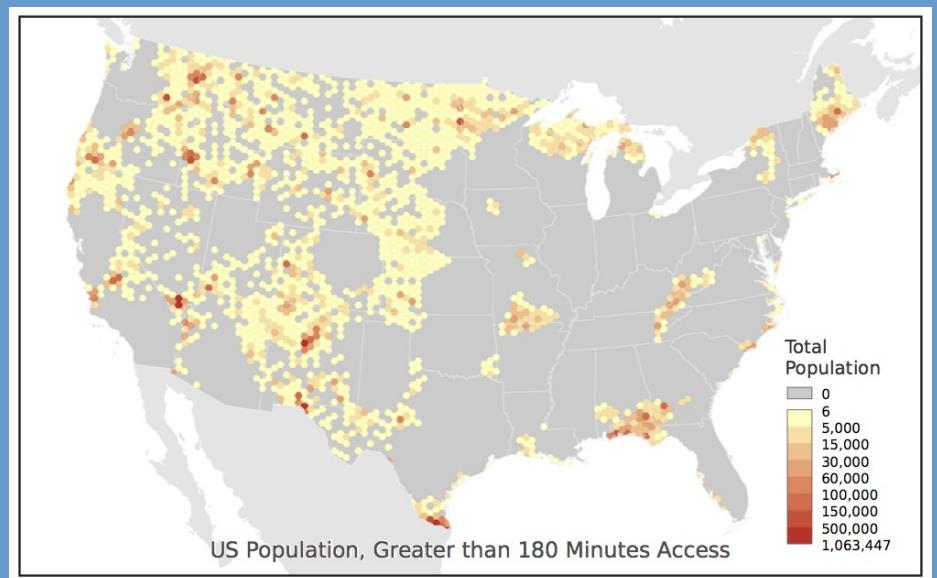
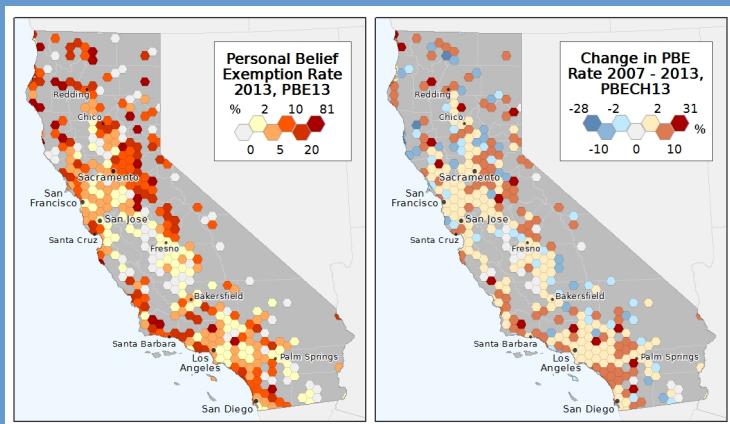
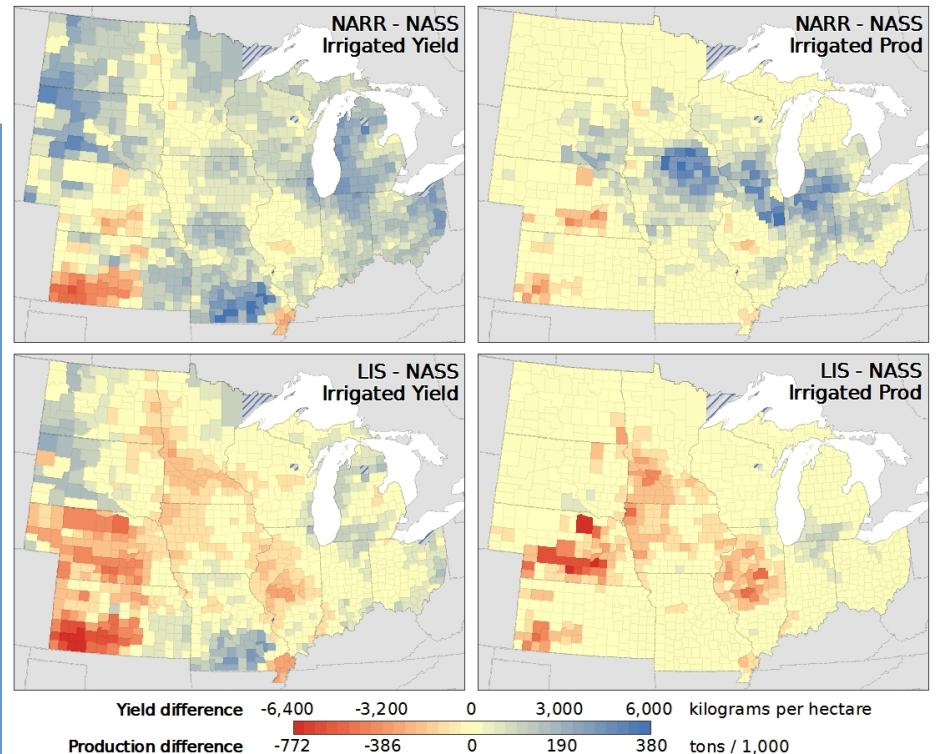
- Balance
- Hierarchy
- Figure-Ground
- Legibility

# Balance

- Experiment with placement of all map elements on the page
- Be sure that the map itself is as large as possible
- No single layout is correct or incorrect, but properly balanced layouts minimize blank space while making efficient use of space to convey information
- Prioritize information by size

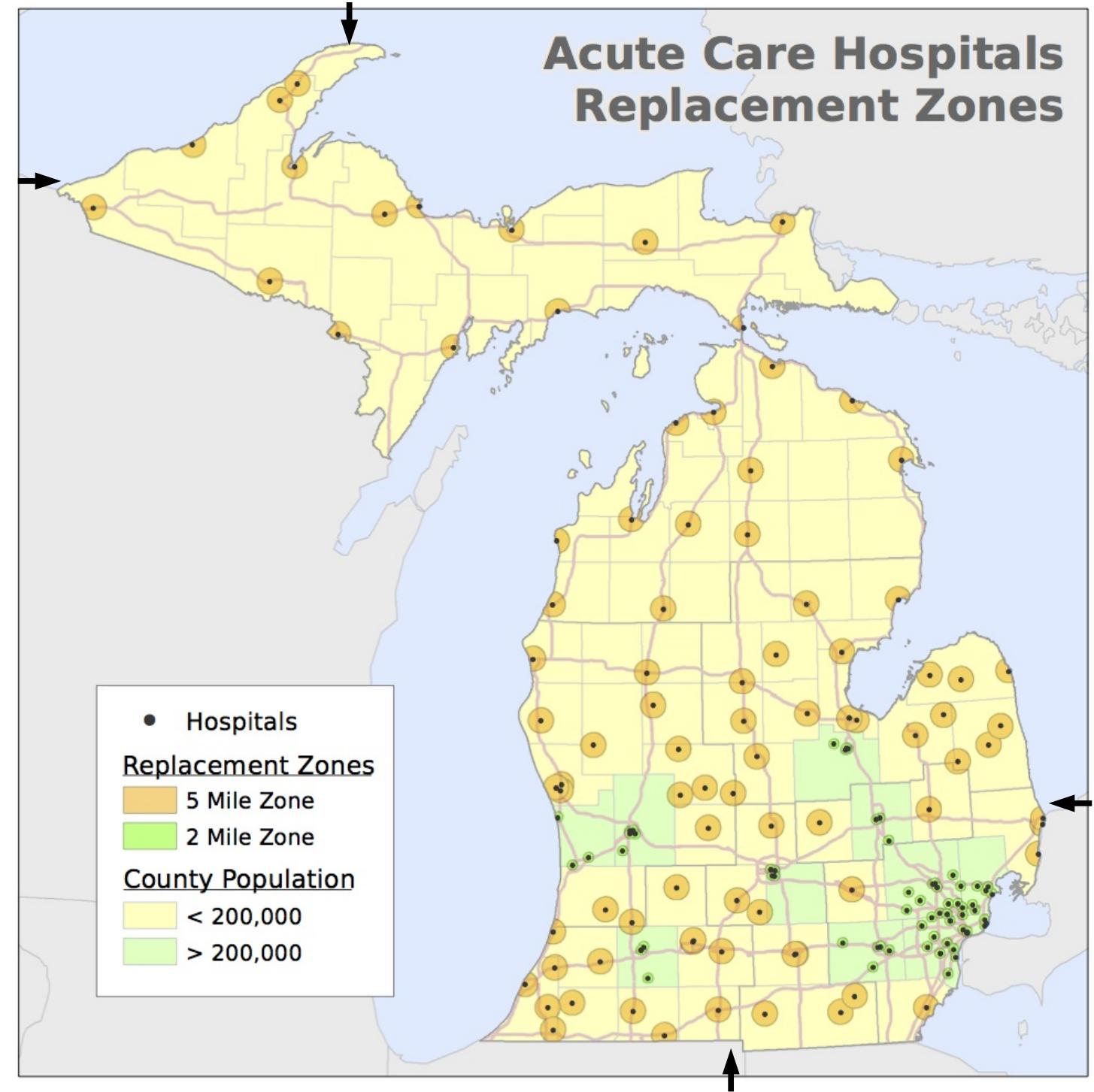


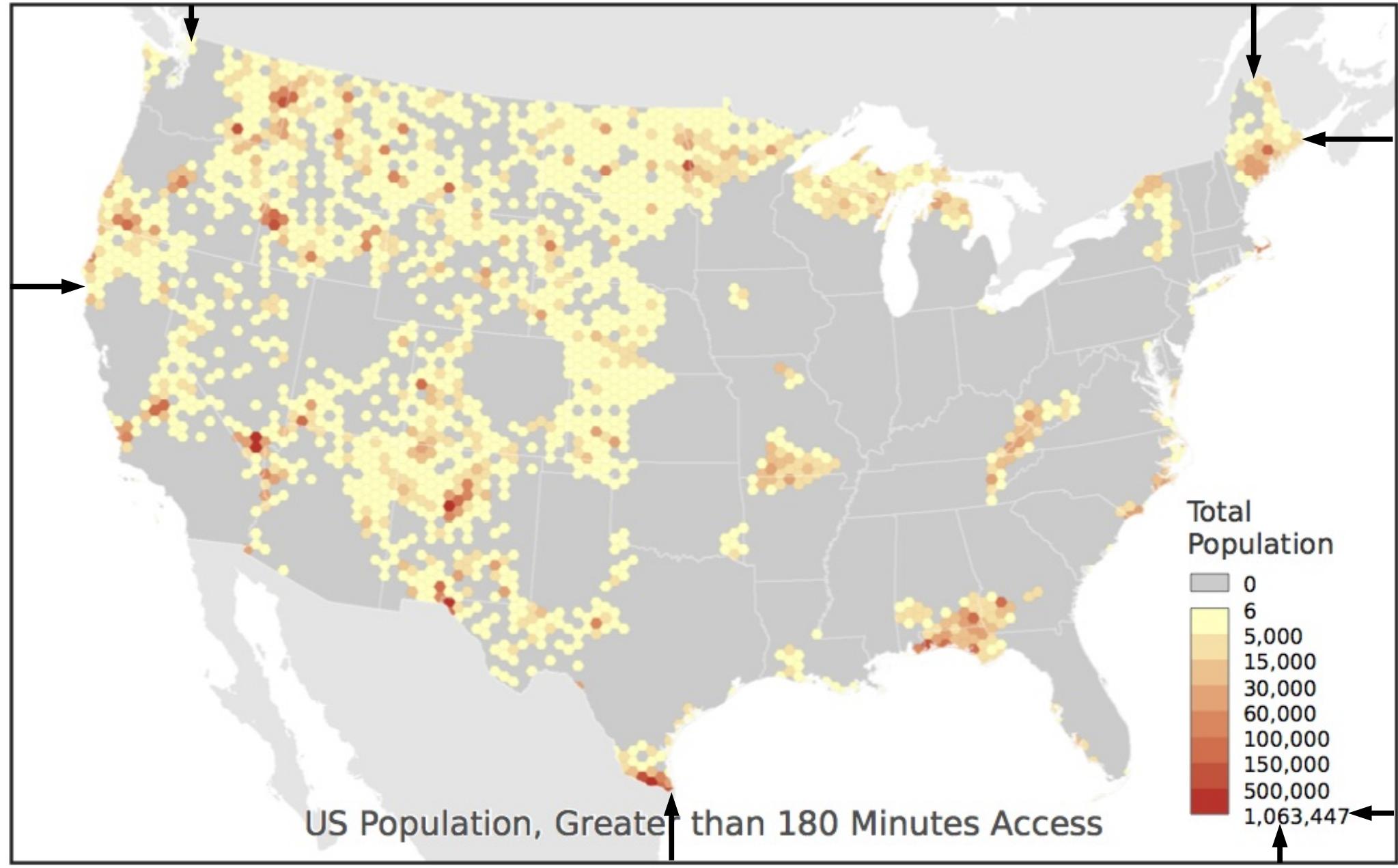
Mean Annual Yield and Production Difference, 1981 - 2012

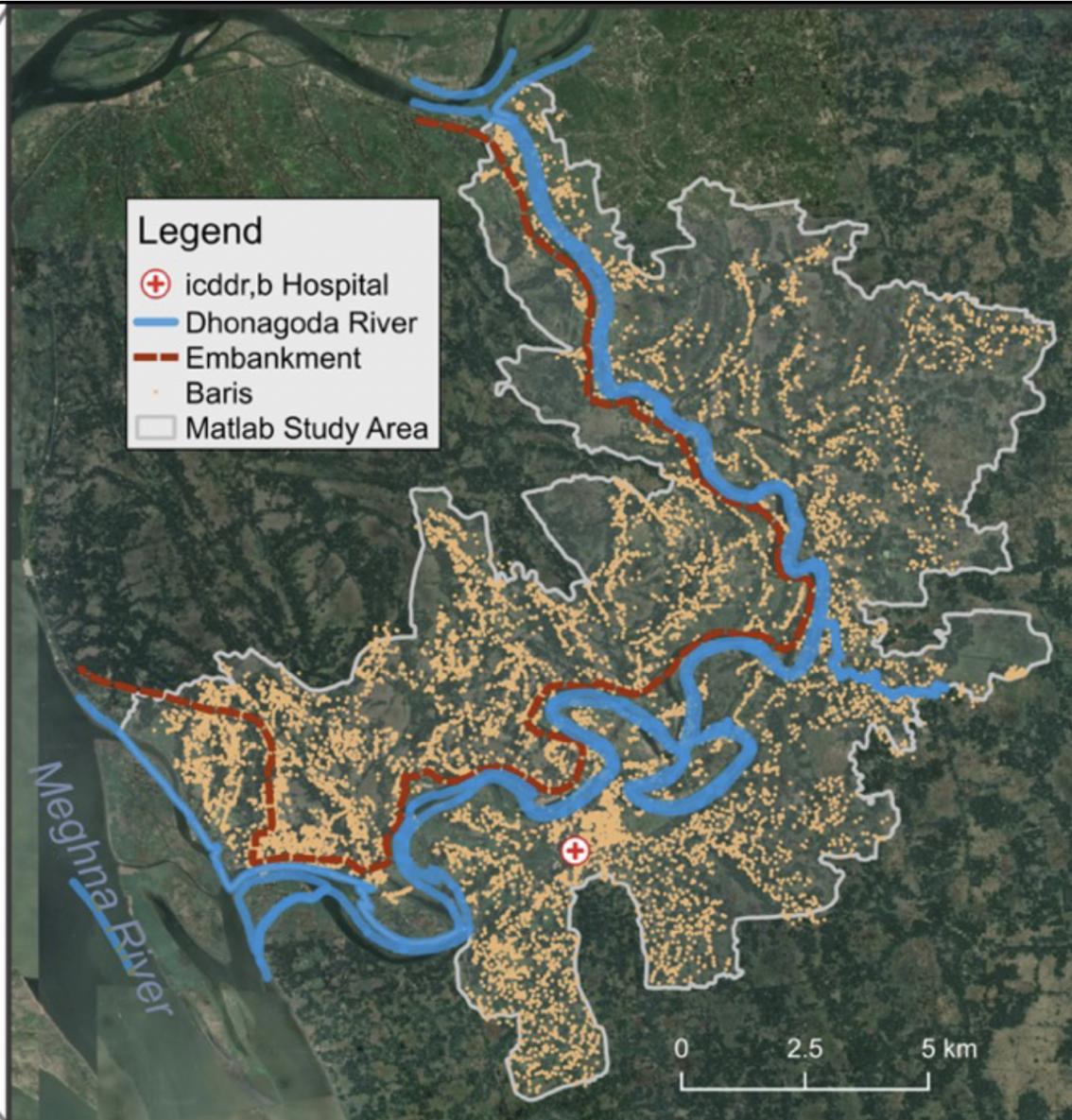
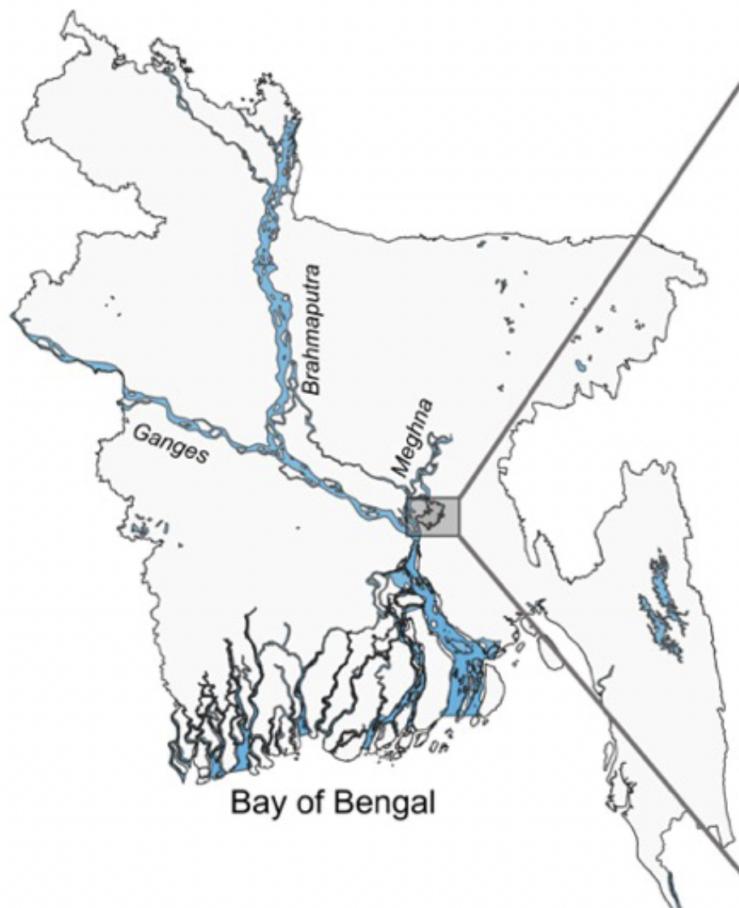


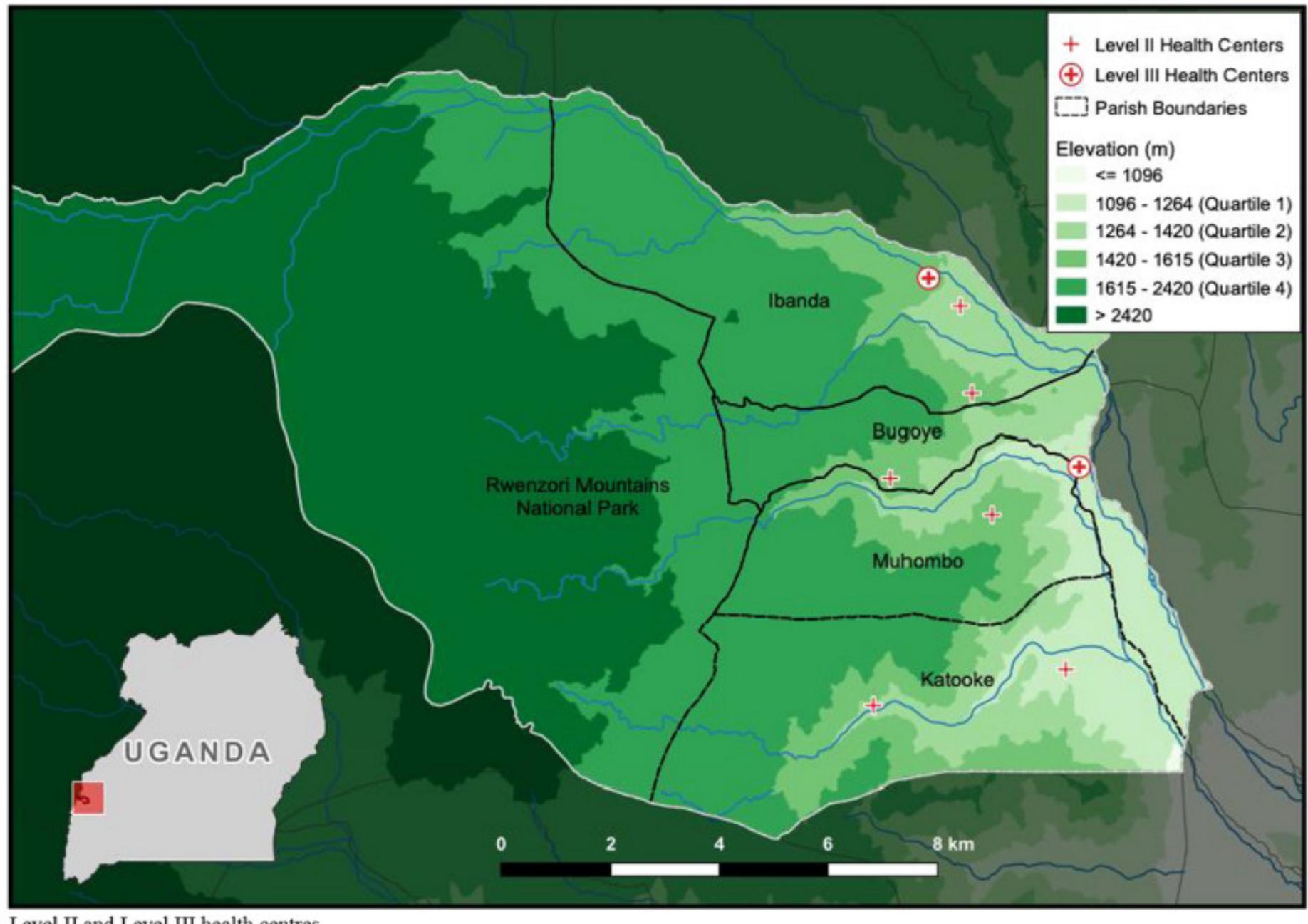
Use combination  
of Zoom and Pan  
tools to position  
the study area or  
area of interest  
within the frame

Make study area  
as large as  
possible within  
the neatline  
bounds, allowing  
for other  
elements



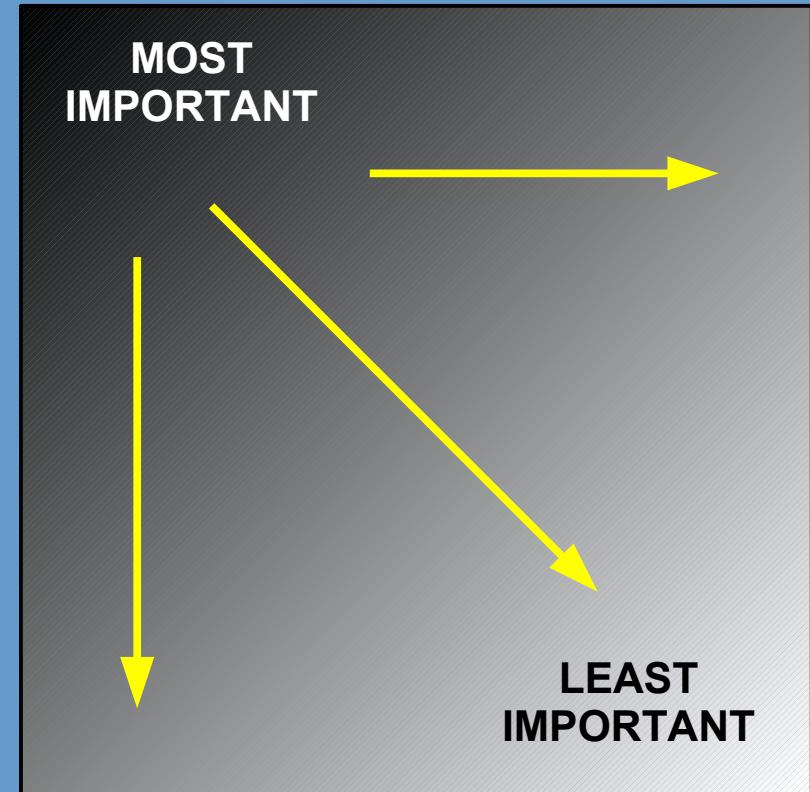






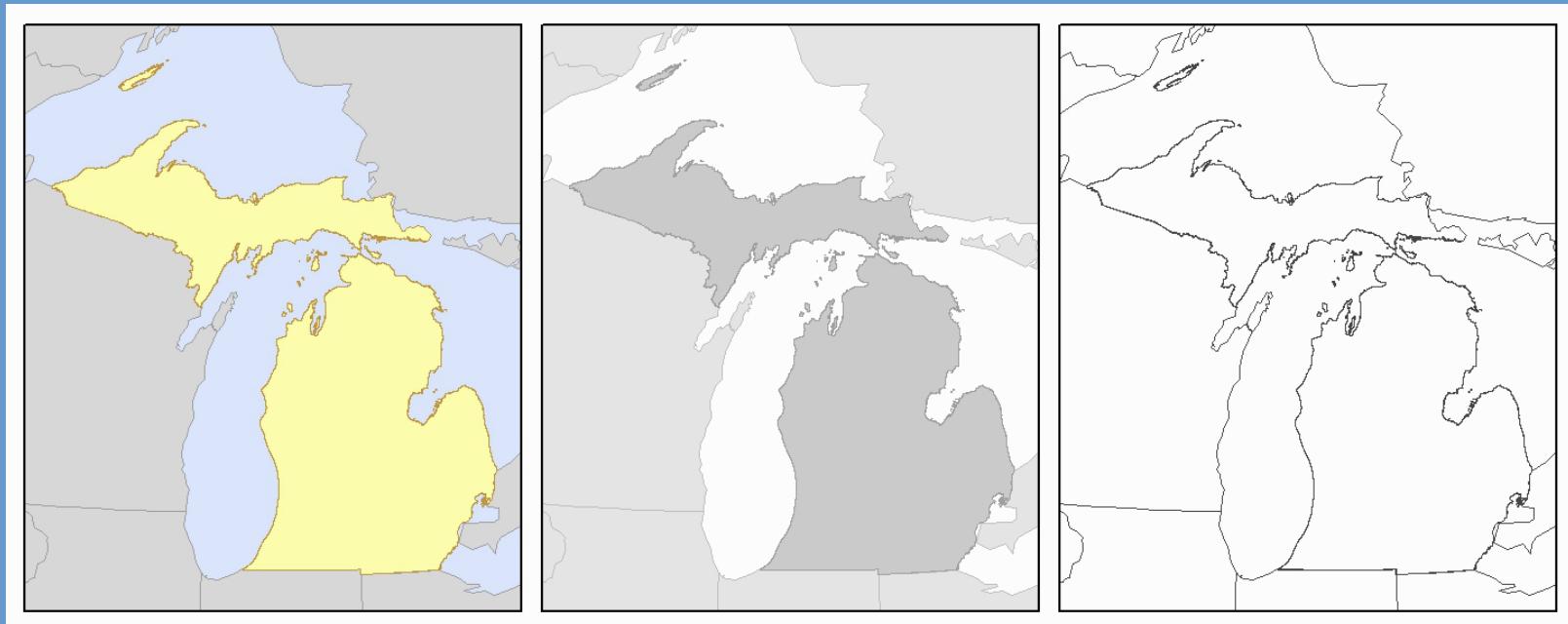
# Hierarchy

- Relative importance of information should be clear
- Placement can be one way to indicate importance of information
- Roughly, top left tends to receive more attention from map readers



# Figure-Ground

- Be clear about what is the information to be highlighted and what is the background
- Use contrast and color to highlight the important information against a less-important background



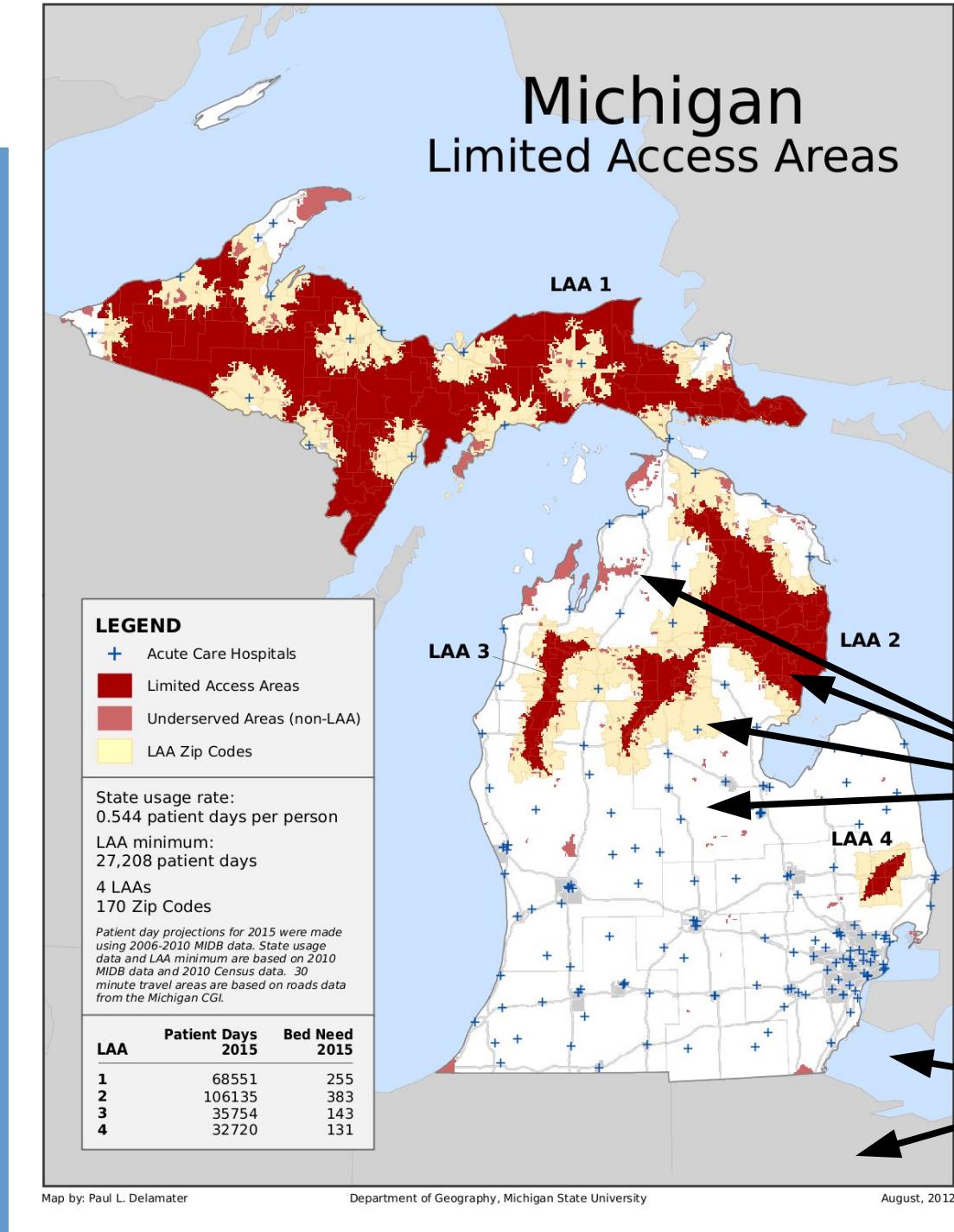
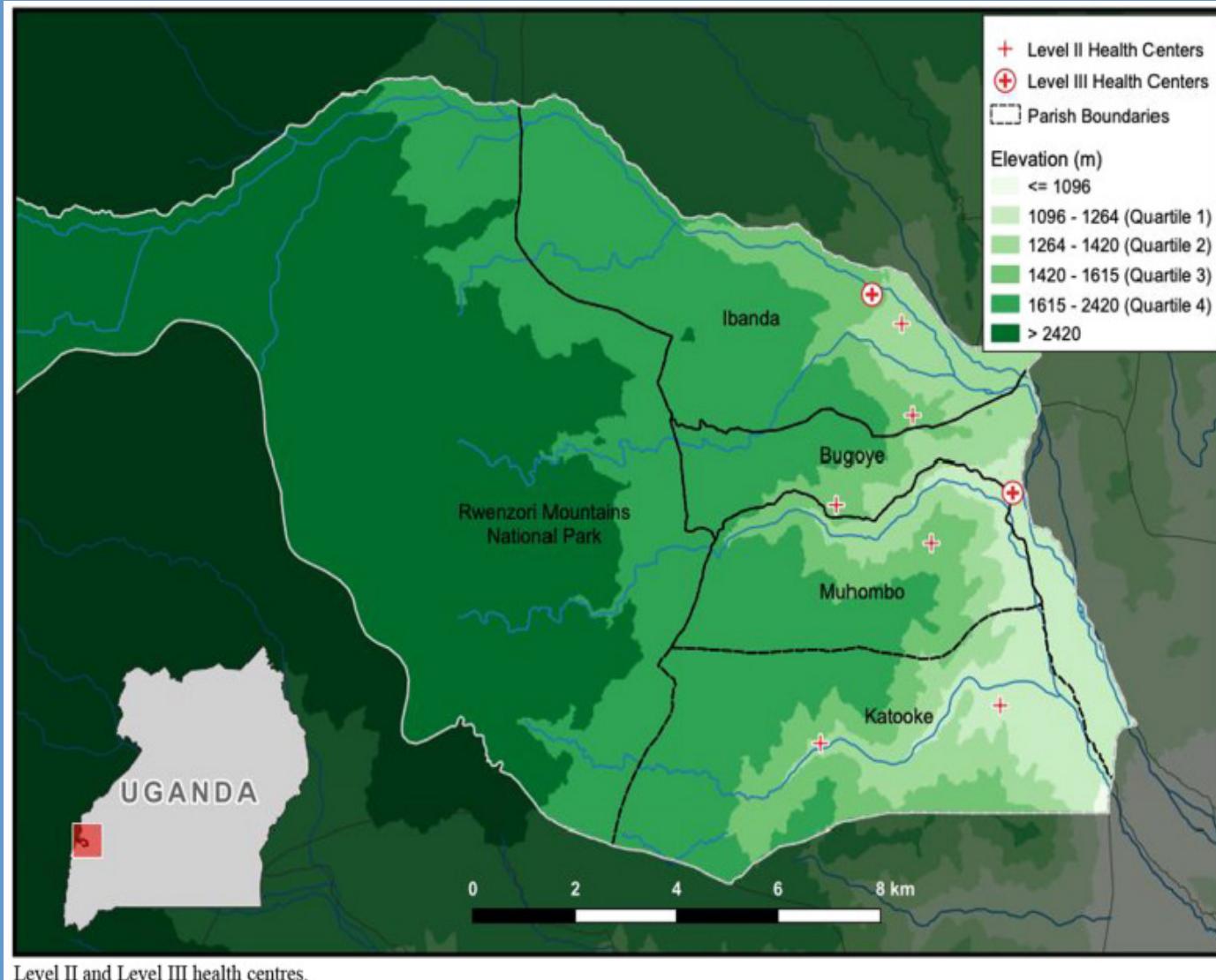


Figure colors

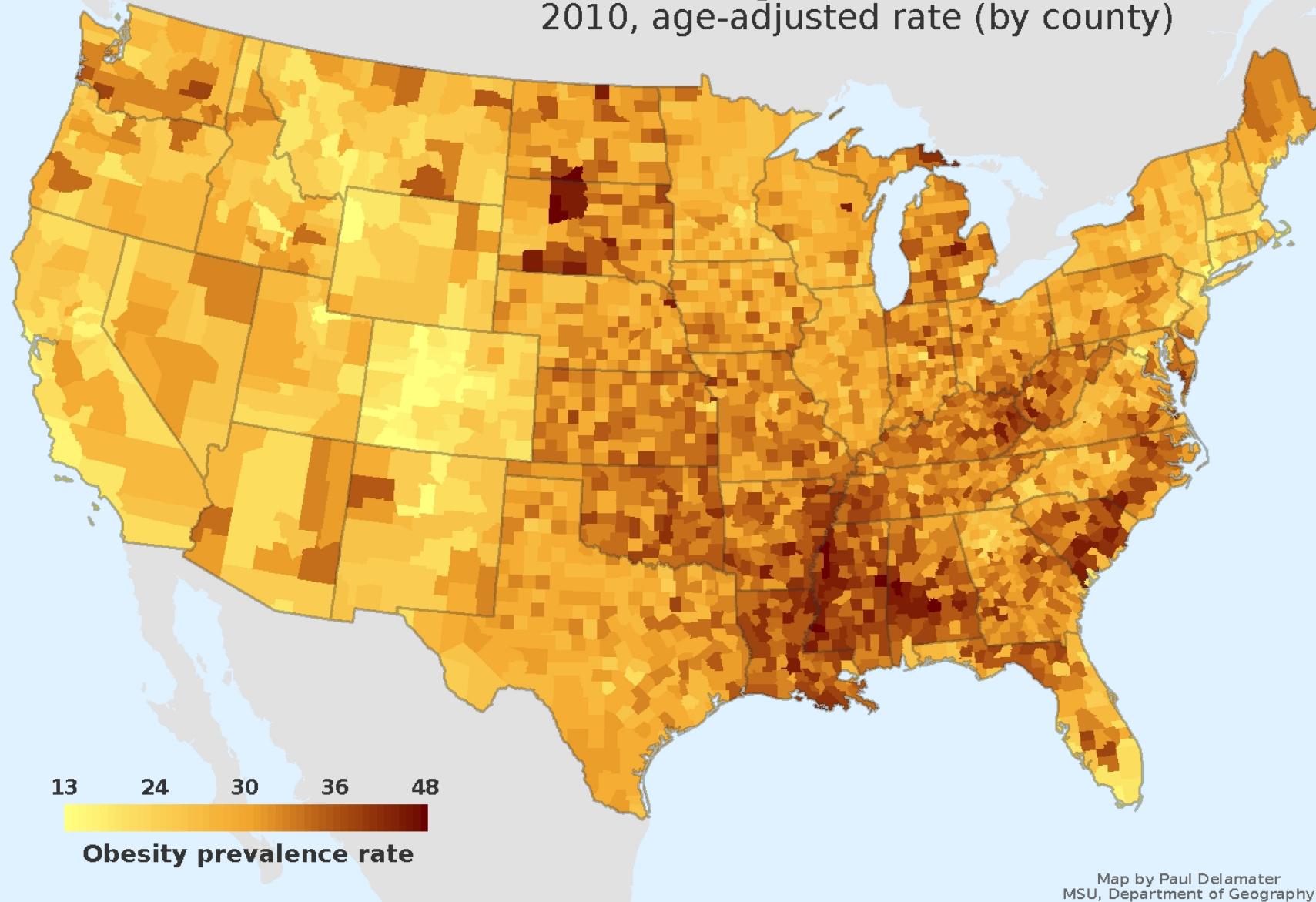
Ground colors

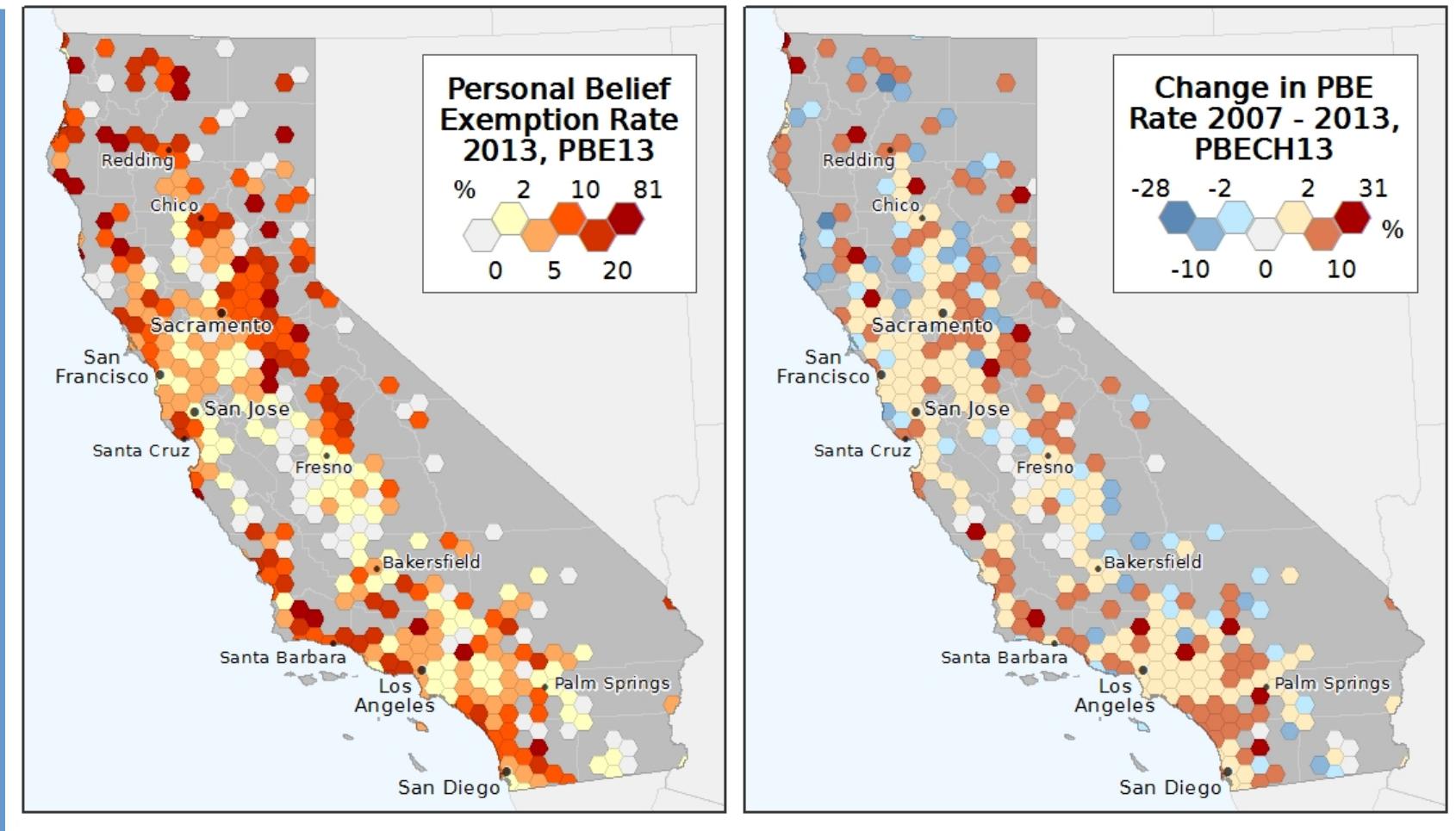
the colors  
and colors



# Obesity Prevalence

2010, age-adjusted rate (by county)



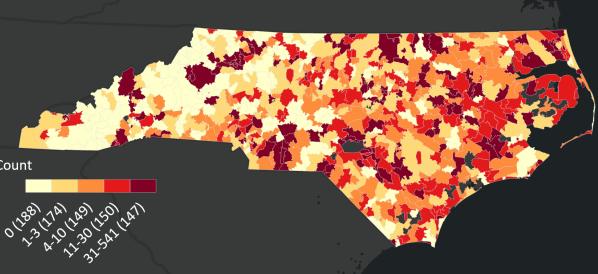


## NC Heatwave Events by ZCTA, 2010-2020

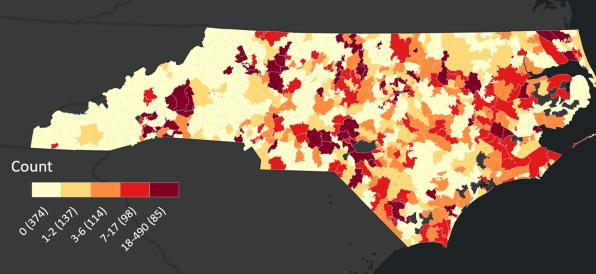
0 50 100 200 Miles



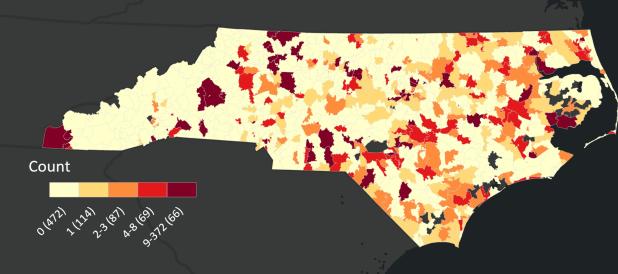
2-Day 90%



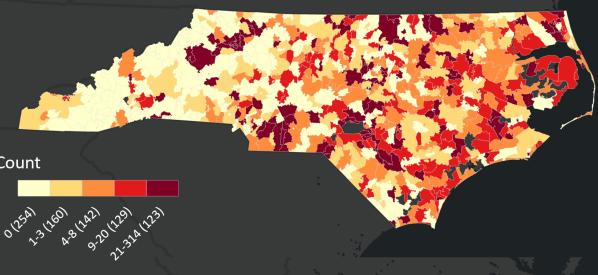
3-Day 90%



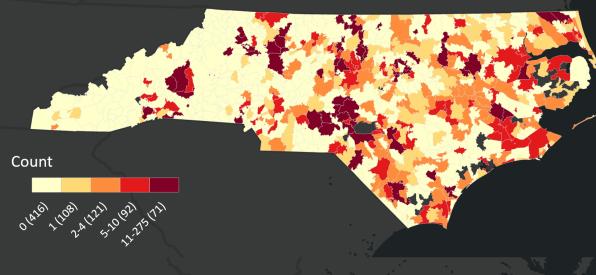
4-Day 90%



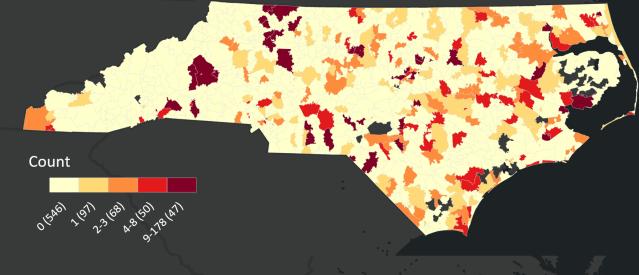
2-Day 95%



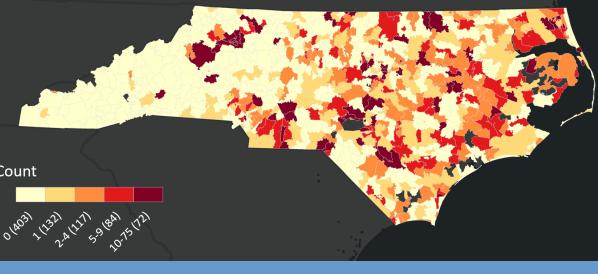
3-Day 95%



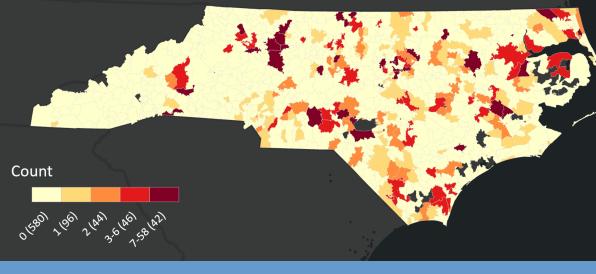
4-Day 95%



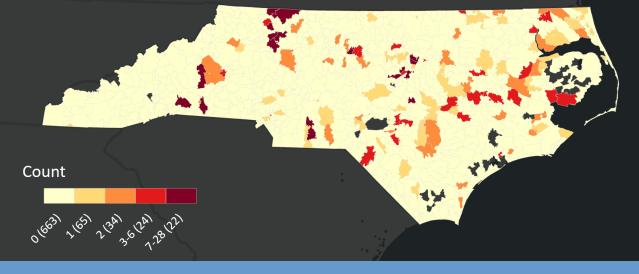
2-Day 99%



3-Day 99%



4-Day 99%



# Legibility

- Less is more
  - Be sure that everything on the map is necessary and that it communicates as effectively as possible
- Be sure that fonts are not too large or small
  - Use a common font (or only two) throughout
    - Stay away from
      - *Comic Sans, Calligraphy/script, Handwriting, Superbold, etc.*

# Figures/Maps

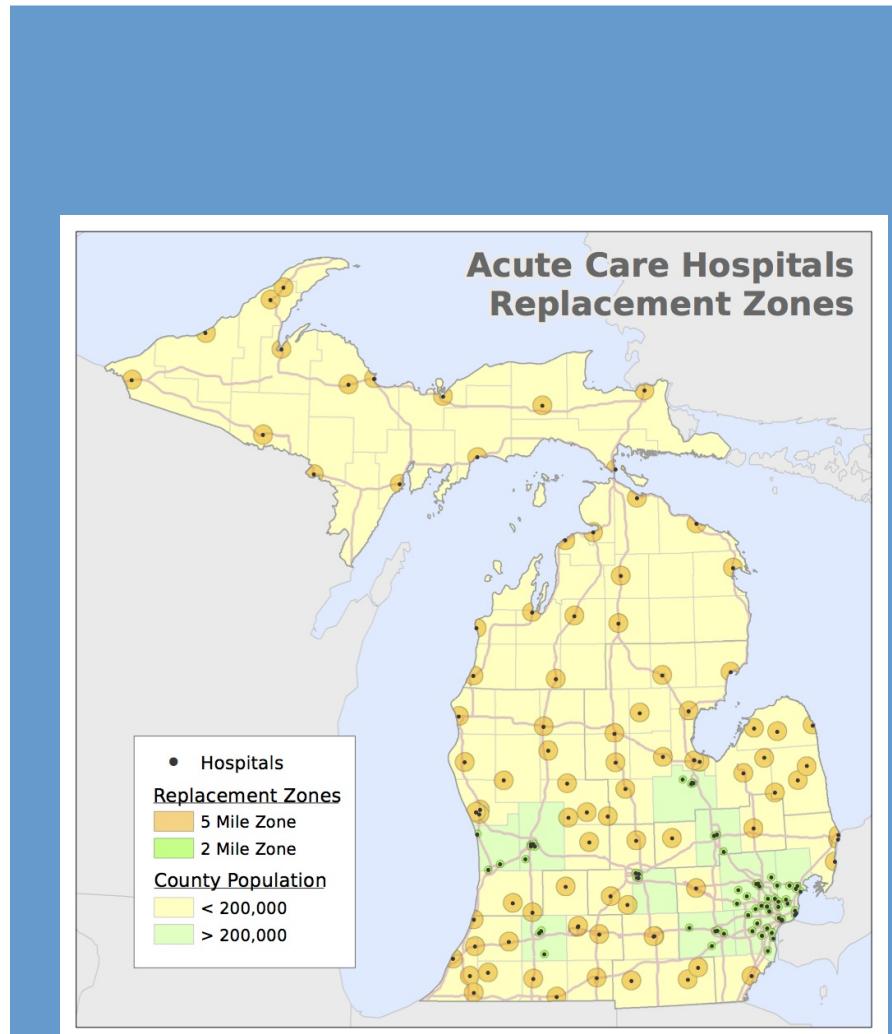
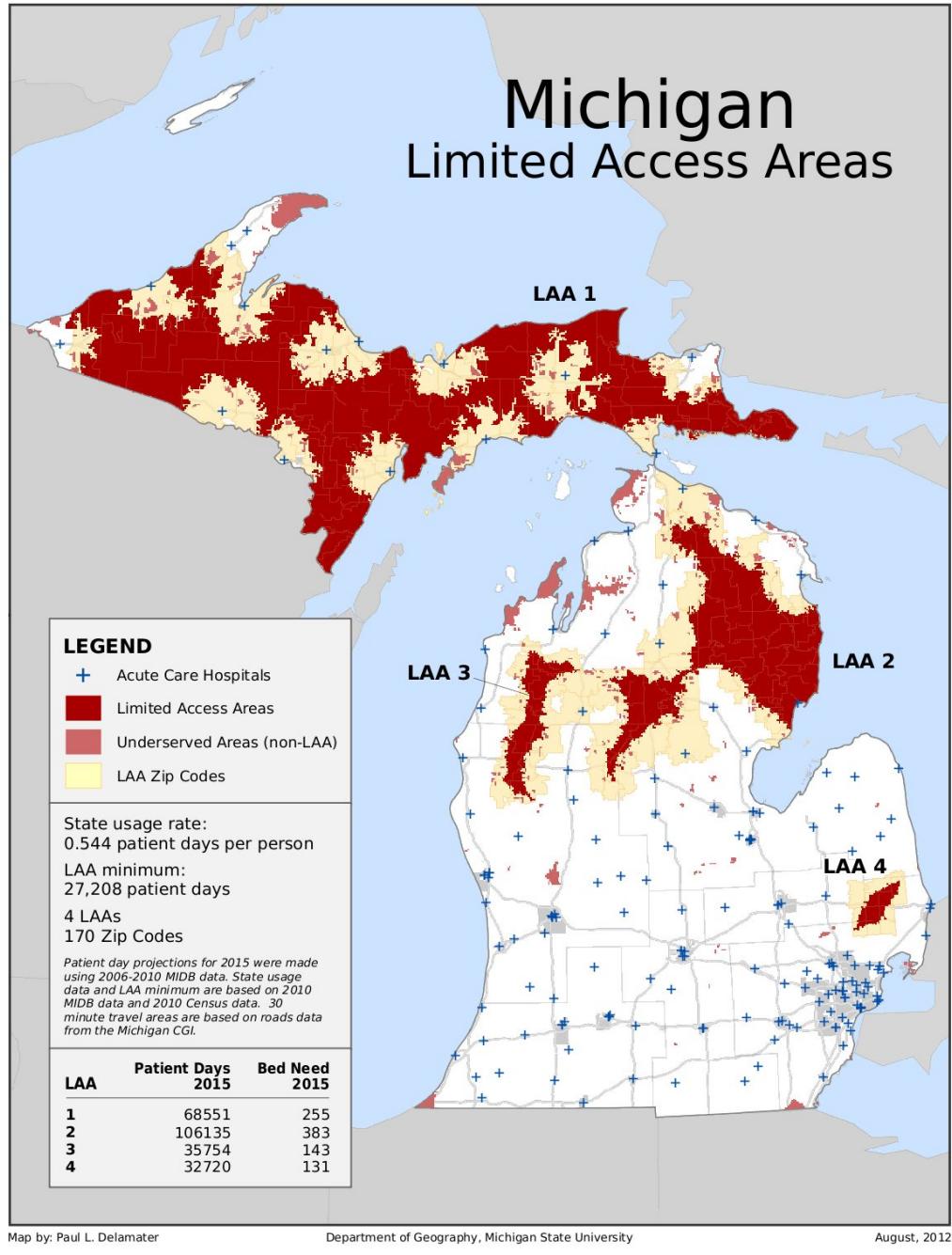
- Maps
  - Stand alone
    - Limited additional content or context
- Figures
  - Maps that are include in a publication, report, etc
    - Map is part of a larger document

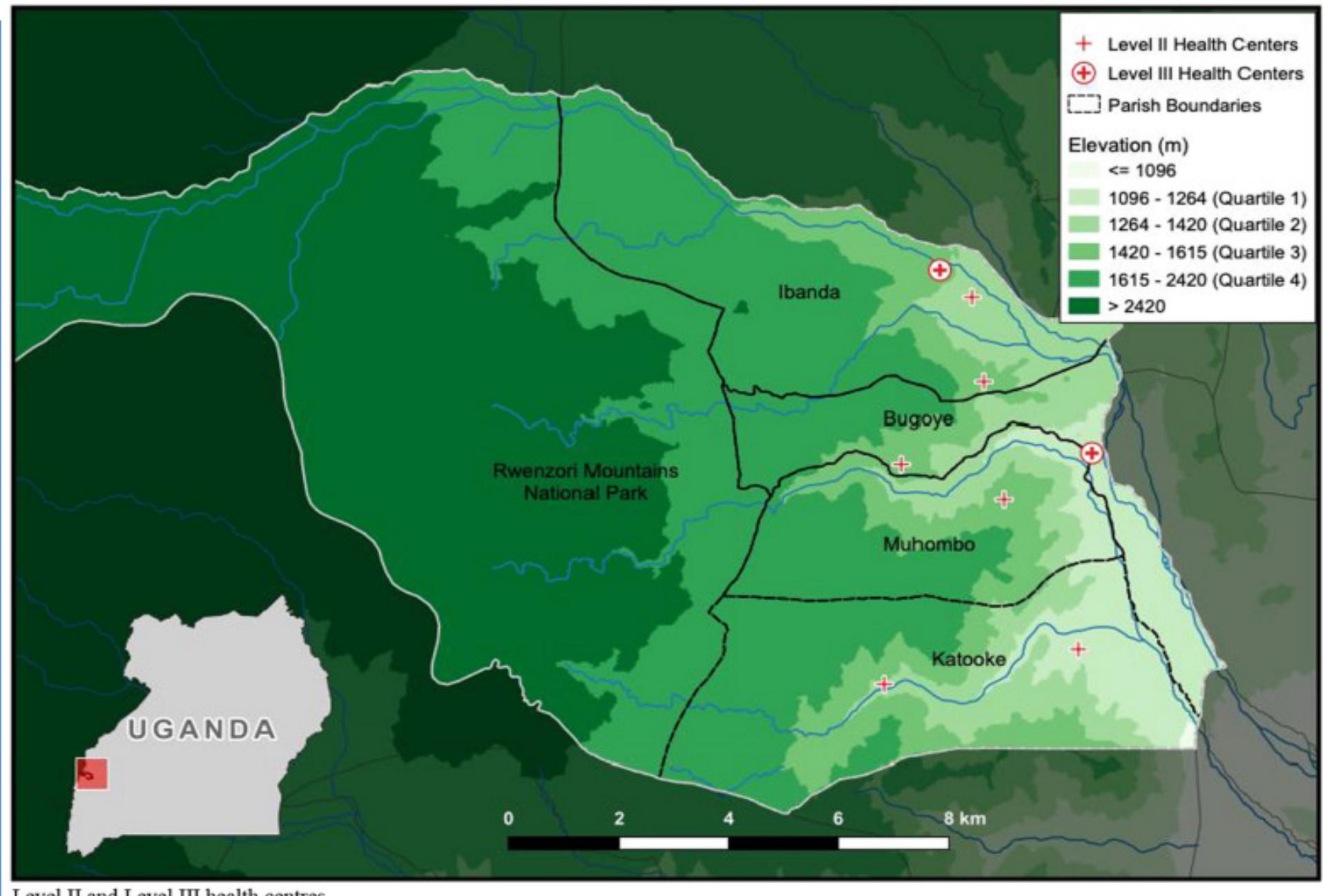
# Figures/Maps

- Maps (stand alone) and Figure maps are very different
  - Level of detail included in a Figure map
    - *Probably* not necessary
      - North arrow (unless N anywhere but up)
      - Inset
    - *Definitely* not necessary
      - Data source
      - Author

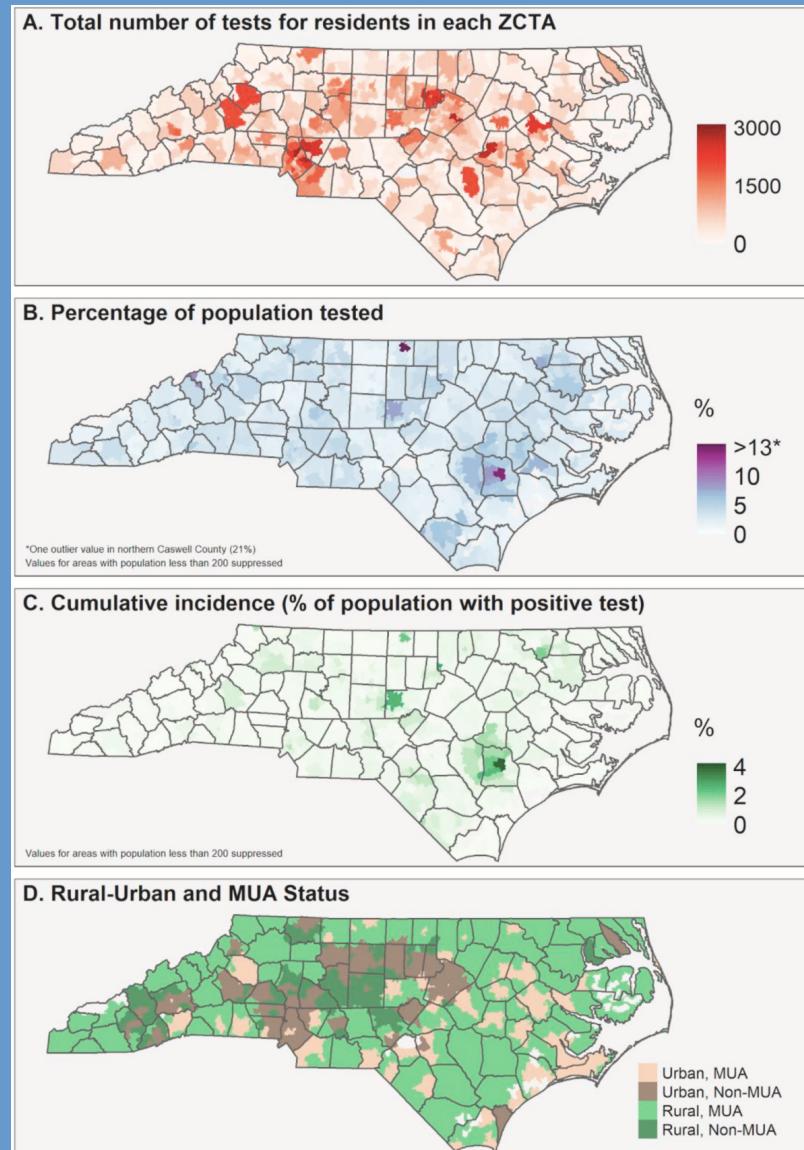
# Figures/Maps

- Maps (stand alone) and Figure maps are very different
  - Less is more in a Figure map
    - Thematic, not reference maps (generally)
      - Don't fill your maps with reference info or labeling, unless it is necessary, e.g., towns, counties, roads
    - Scale bar
      - If you used absolute "distance" in your analysis, then definitely yes





**Fig. 3. Intersections between race and age in COVID-19 testing and positivity.** Fig. S2 in the Supplement extends the findings of Fig. 3A and B by showing median ages of individuals tested and individuals testing positive among sub-groups stratified by race-ethnicity and rural-urban status or gender.



# Figures/Maps

- Should be created with the page layout and size of the journal in mind (when possible)
  - Text must be readable at the published page size
    - Text size (absolute minimum 7-8 pt)
    - No overlapping text
    - Stay away from things like auto-labels in QGIS
  - **Set the page size in QGIS!**

# Map Design

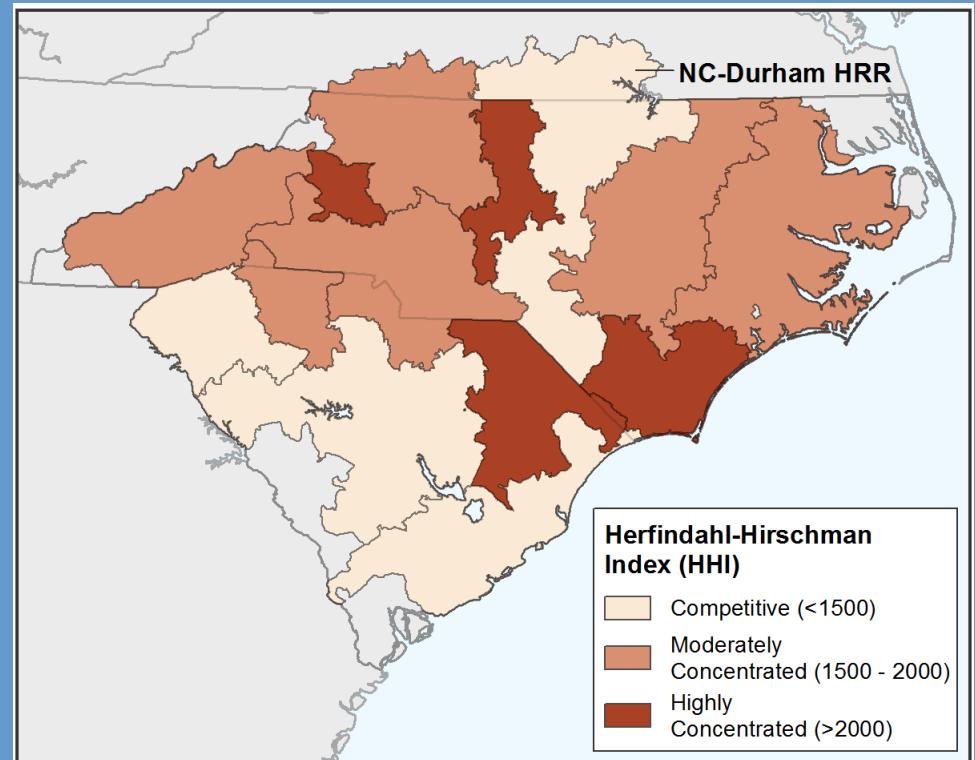
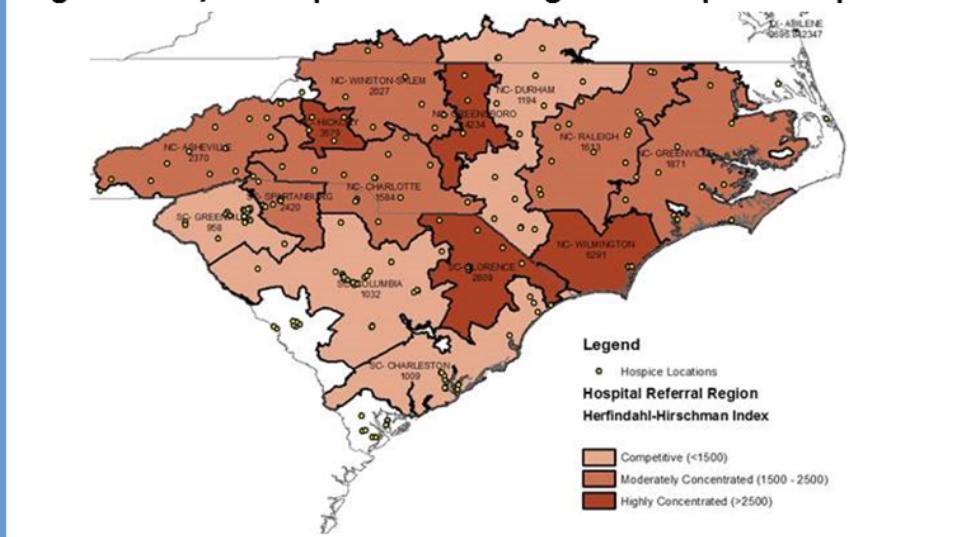
- It's the little things...
  - Background data
    - The dreaded "floating study area"
  - Legends!!
    - Default legends are awful
      - NO DEFAULT LAYER NAMES
      - Rounding of legend values
      - Units
      - Customize for your purpose (convert to graphics)

# Map Design

- It's the little things...
  - Be proactive in your design choices
    - Colors
      - Please avoid...
        - Diverging color schemes when the "middle" value has no meaning
        - Multicolor schemes for a single variable, unless assists in interpretation
      - Line weights
      - Fonts
        - Arial or Times New Roman
      - Title
      - Consistency
        - Make one map, then use as a template

# Map Design

Figure 1: NC/SC Hospital Referral Region & Hospice Competition



# Keywords

- Selective content
- Symbol characteristics
- Visual variables
- Color ramps
  - Diverging schemes
- Map elements
- Design principles
  - Balance, hierarchy, figure-ground, legibility
- Figures vs Maps
  - Page size
- Little things
  - Floating study area, layer names, legend rounding

# Wrap Up

- Next week
  - Query and Field Calculation; GIS Overlay, Distance, Buffer; Spatial Variation and Clustering
- Readings (next week)
  - C & M Chp 5