

Information Graphics for Actuaries

Garrett Bradford
Cartographer / GIS Analyst

Sheri L. Scott, FCAS, MAAA
Principal and Consulting Actuary

2015 CAS Ratemaking and Product
Management Seminar
Addison, TX
March 10, 2015

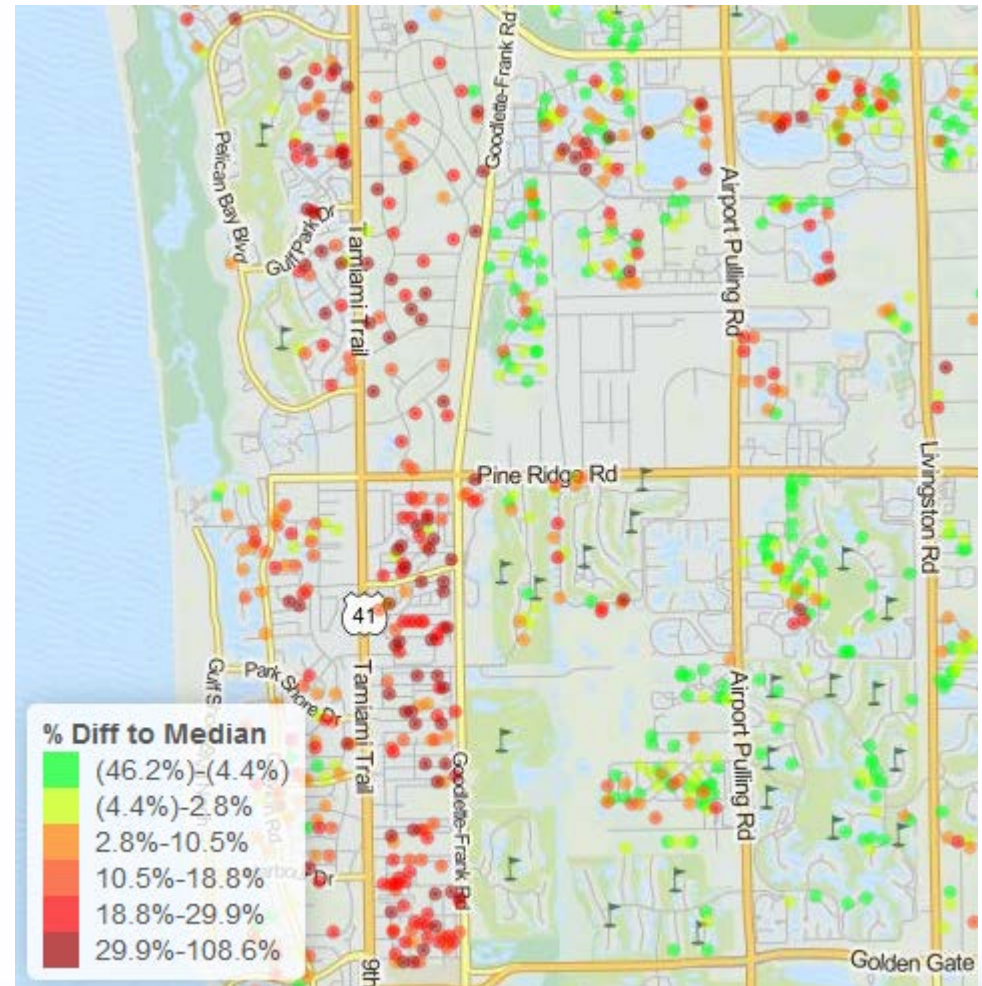


Outline

- What is data visualization?
- Why is it important?
- Picking your platform
- Principles of data visualization
- Guide to creating graphics
- Mapping considerations
- Case studies

Data Visualization

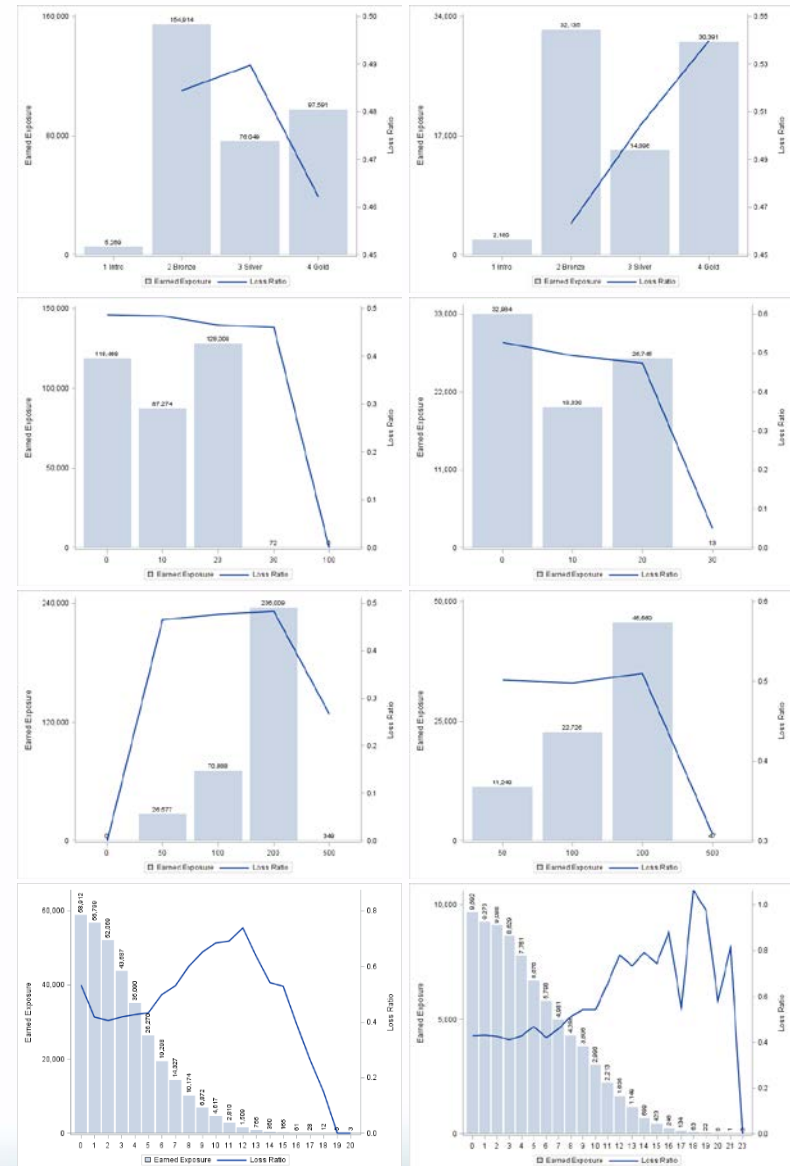
- Graphical representation of data
- Examples:
 - Tables
 - Bar charts
 - Scatter plots
- Both an art and a science



Source: Pixel
<http://milliman.com/pixel>

Data Visualization

- Just a substitute for tables?
 - Efficiency
 - New perspectives
- Used in every step of the analysis
 - Data exploration
 - Data modeling/review
 - Validation of results
 - Presentation of findings



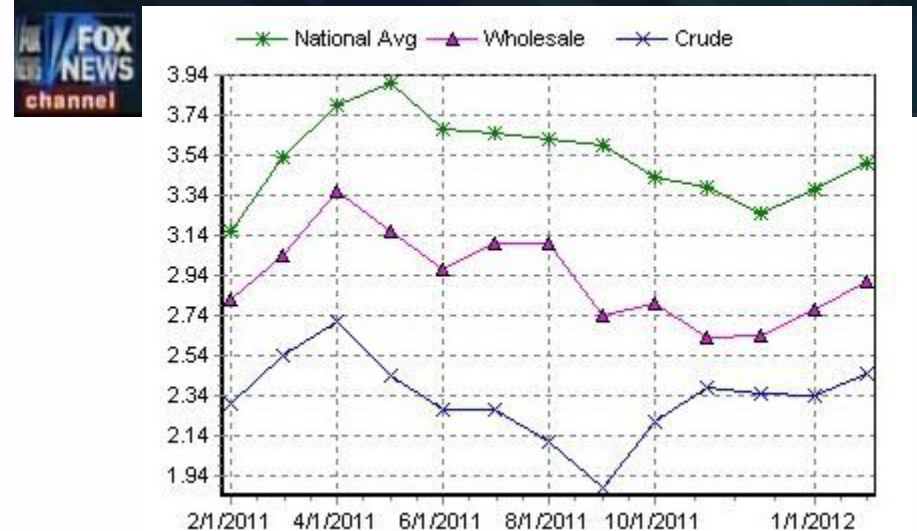
Earned Exposure and Loss Ratio by rating variable

Finding the Right Tool

- Desktop Applications
 - Excel, ArcGIS, Tableau*
- Coded solutions
 - Matlab, R, SAS, Python
- Web Applications
 - Tableau*, Google Chart Tools, Leaflet, ColorBrewer
 - Milliman Pixel

Basic Principles

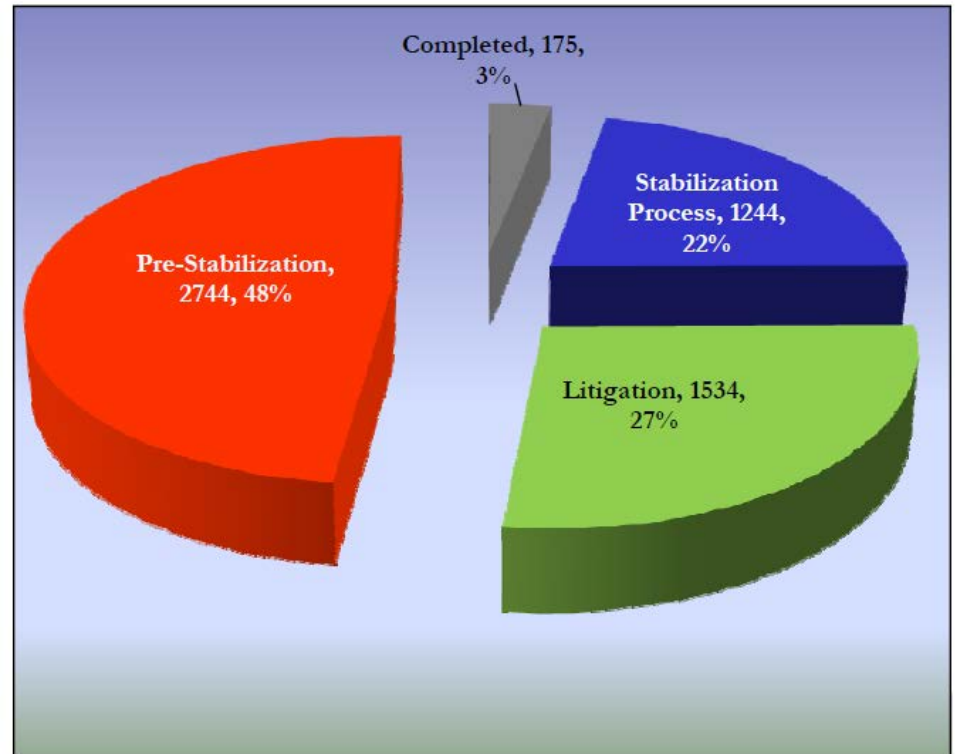
- Honesty
- Remove junk / ink
- Revise, revise, revise



Source: Fox News, *America's Newsroom*, 2/20/12
AAA Daily Fuel Gauge Report, 2/21/12
via *Media Matters* (www.mediamatters.org)

Basic Principles

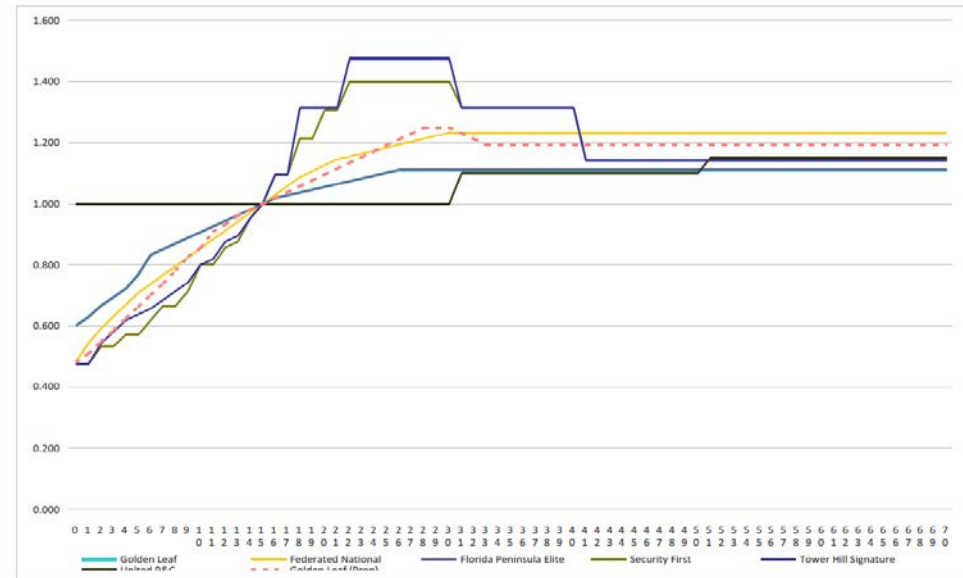
- **Honesty**
- **Remove junk / ink**
- **Revise, revise, revise**



Source: "Distribution of Sinkhole Pending Inventory"
Citizens Property Insurance Company, Florida Rate Filing #14-17638

Basic Principles

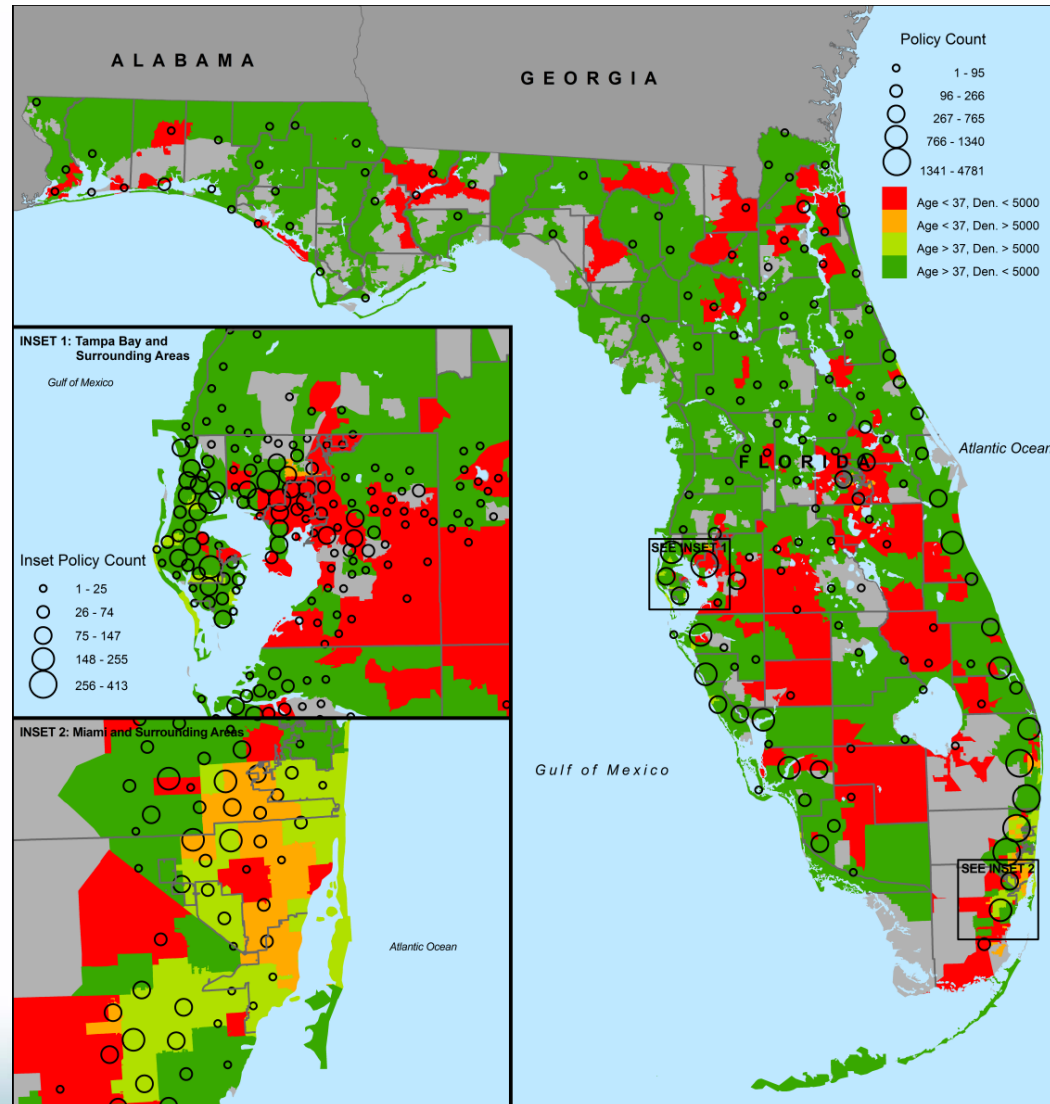
- Honesty
- Remove junk / ink
- **Revise, revise, revise**



Source: "Distribution of Sinkhole Pending Inventory"
Citizens Property Insurance Company, Florida Rate Filing #14-17638

Guide to Creating Graphics

- Show your data
- Induce thinking about substance
- Avoid distortion
- Many numbers/small space
- Make large datasets coherent
- Encourage eye-to-eye comparison
- Show multiple levels of detail
- Have a clear purpose
- Integrate statistical and verbal descriptions of data



Guide to Creating Graphics

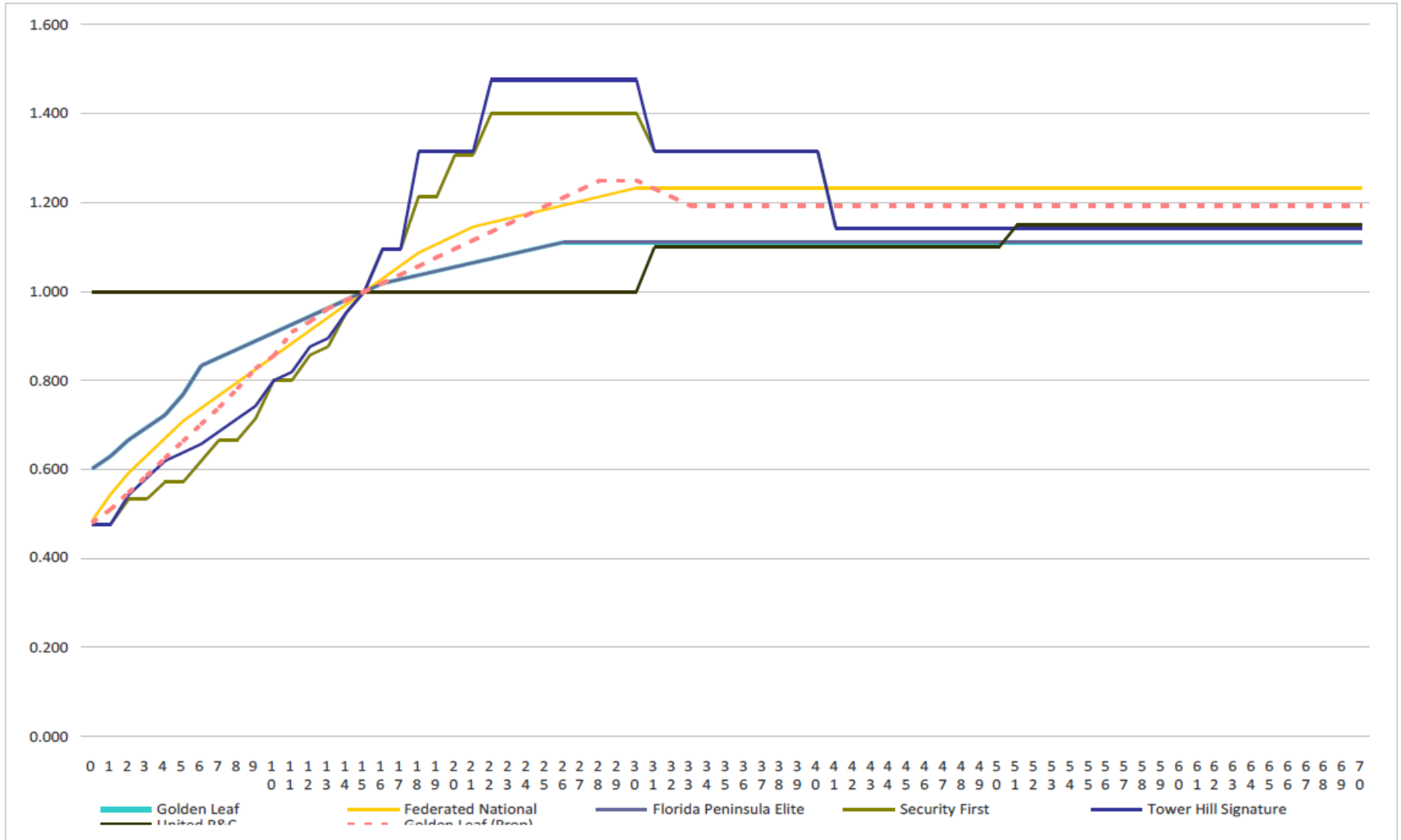
Do's

- Heading 2pt > body
- Not too small
- Simple font
- Data range = 2/3 y-axis
- Direct labeling
- Sort data in meaningful way
- Max 3-4 lines per chart

Don'ts

- Heavy gridlines
- 3D bars
- Pie charts
- Let type oppress graphics
 - No ALL CAPS or **bold** / *italic*
- Multi-color for no reason
- Awkward increments (3,6,9...)

What's Wrong With This Picture?



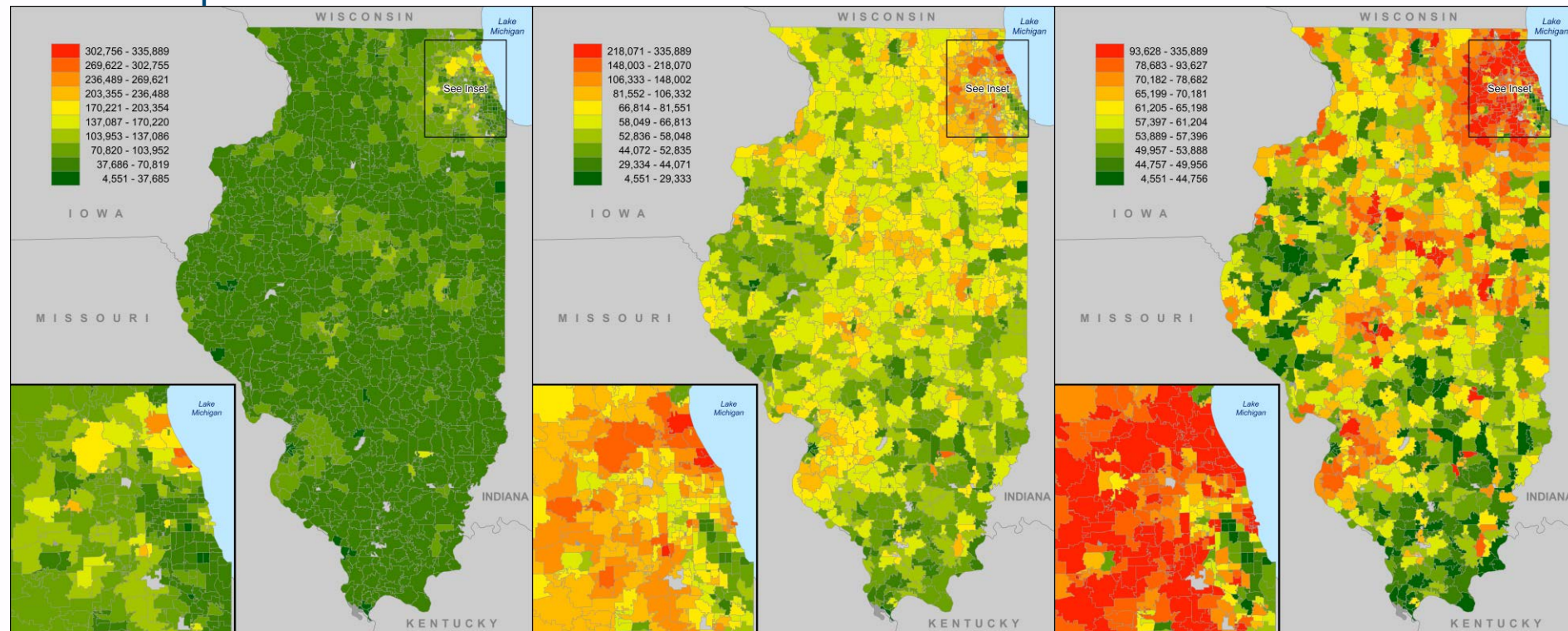
Mapping Considerations

Choosing breaks for choropleths

Equal Interval

Geometrical

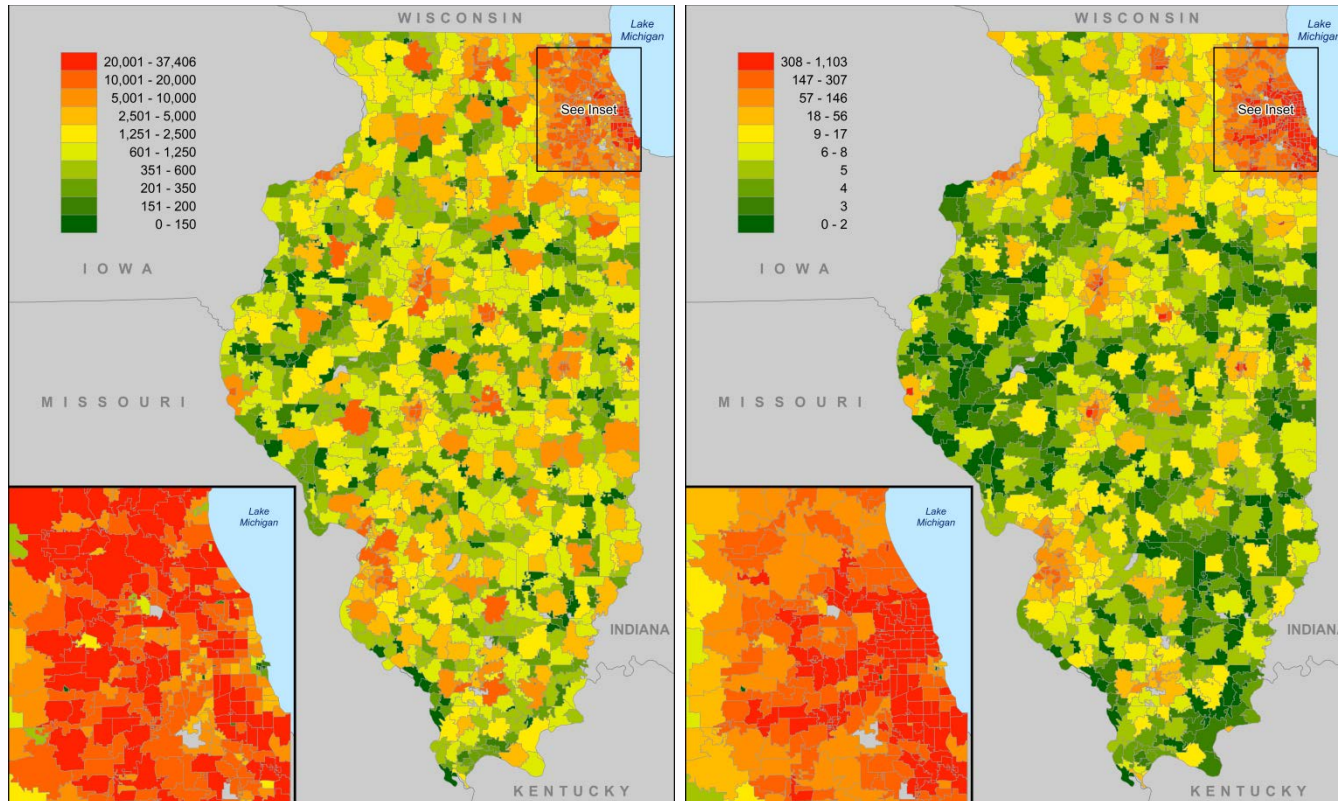
Quantile



Median Household Income by ZCTA using three different color scales.

Mapping Considerations

Normalization of areal data

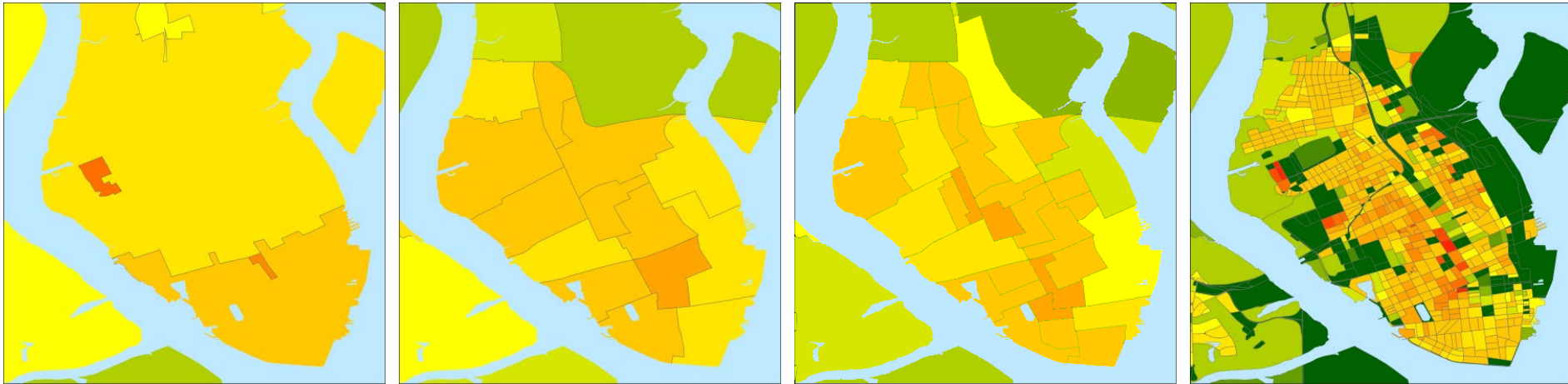


Number of Single-Unit Detached Housing-Units by ZCTA shown with raw counts on left and per sq. km on right.

Mapping Considerations

Modifiable areal unit problem (MAUP)

- What geography is right for your analysis?

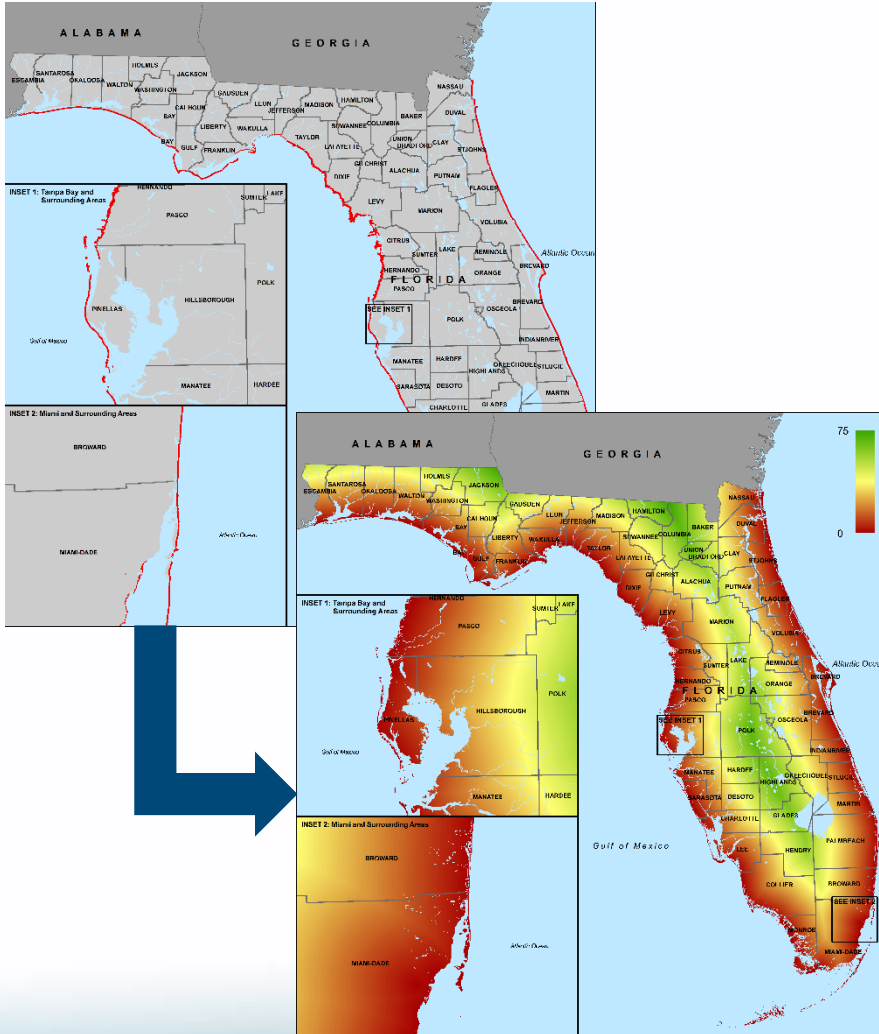


Population density in Charleston, SC plotted using (left-to-right) ZIP Code Tabulation Areas (ZCTAs), Census Tracts, Block Groups, and Blocks.

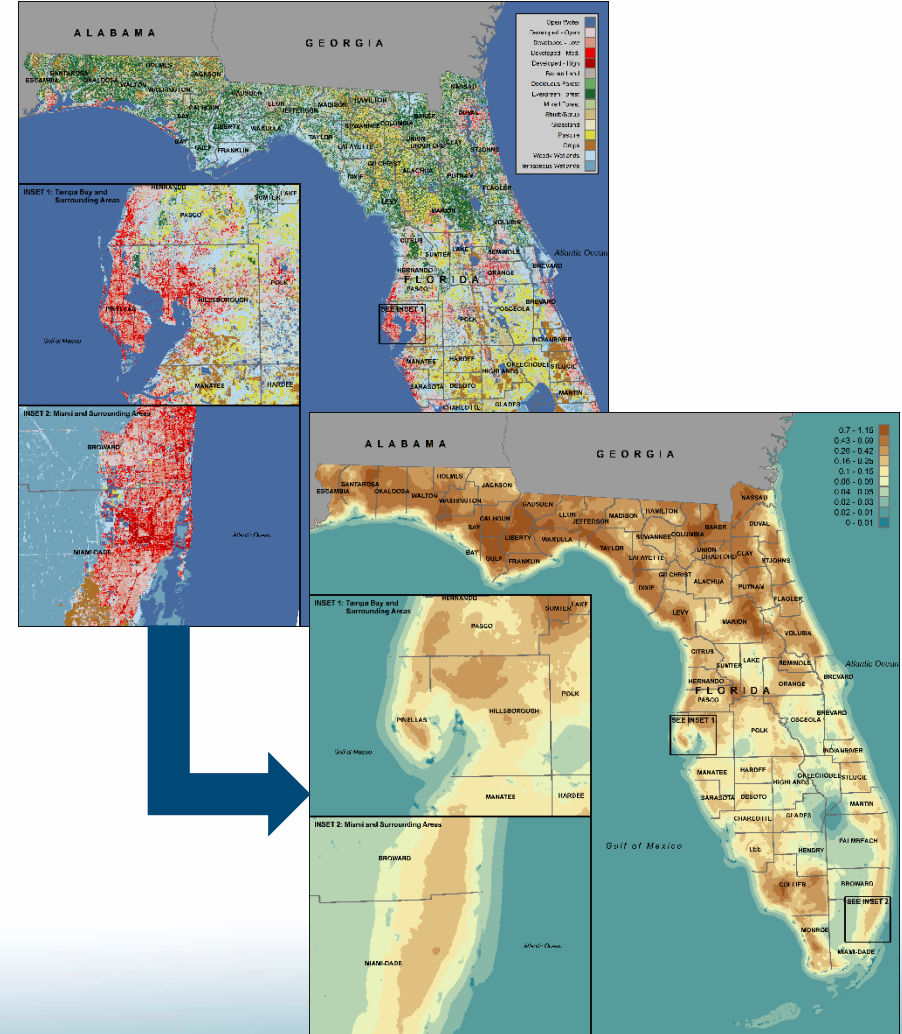
Case Studies

Case Study: Visualizing Hurricane Risk

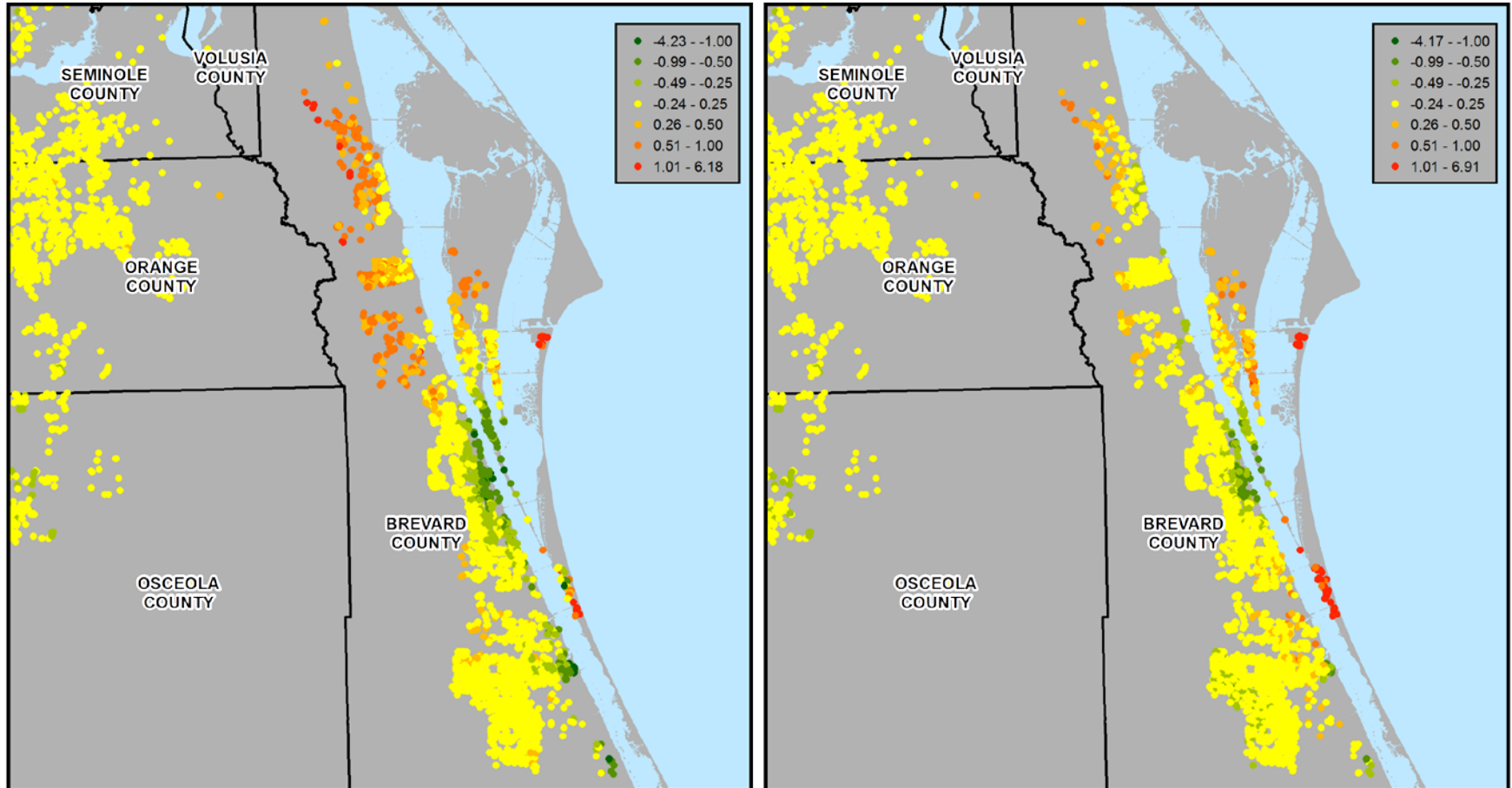
Coastline and Distance to Coast



Land Cover and Surface Roughness

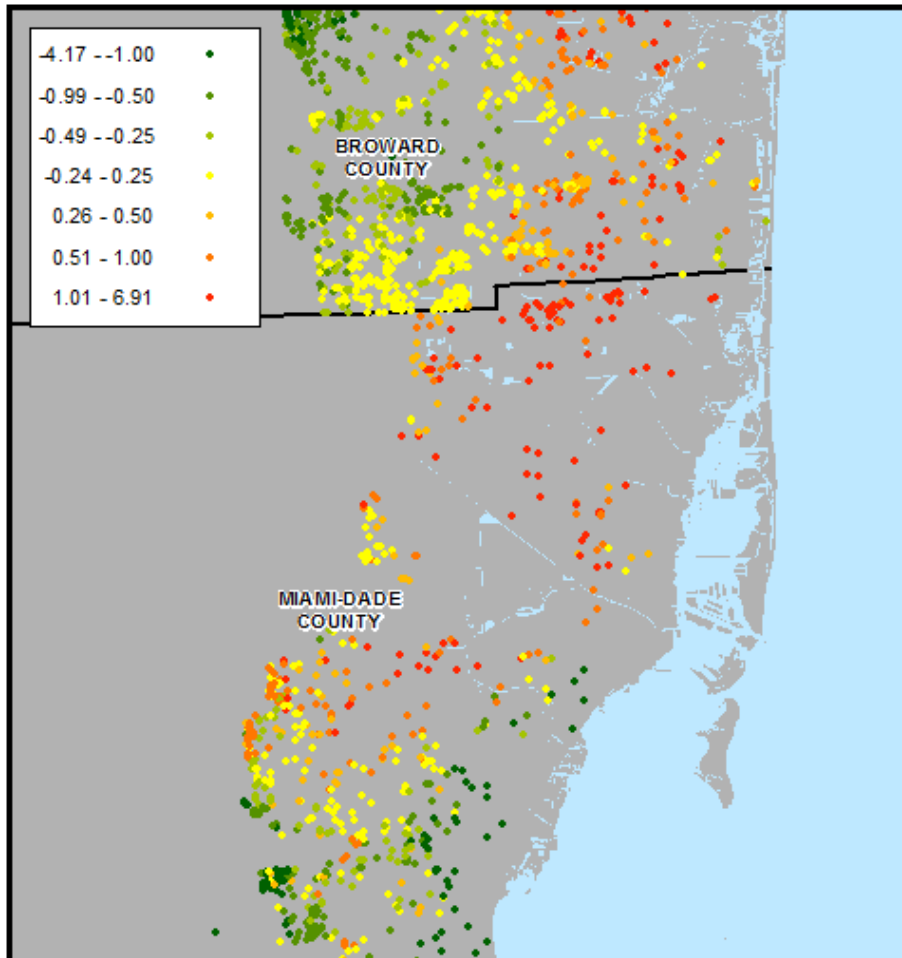


Case Study: Visualizing Hurricane Risk

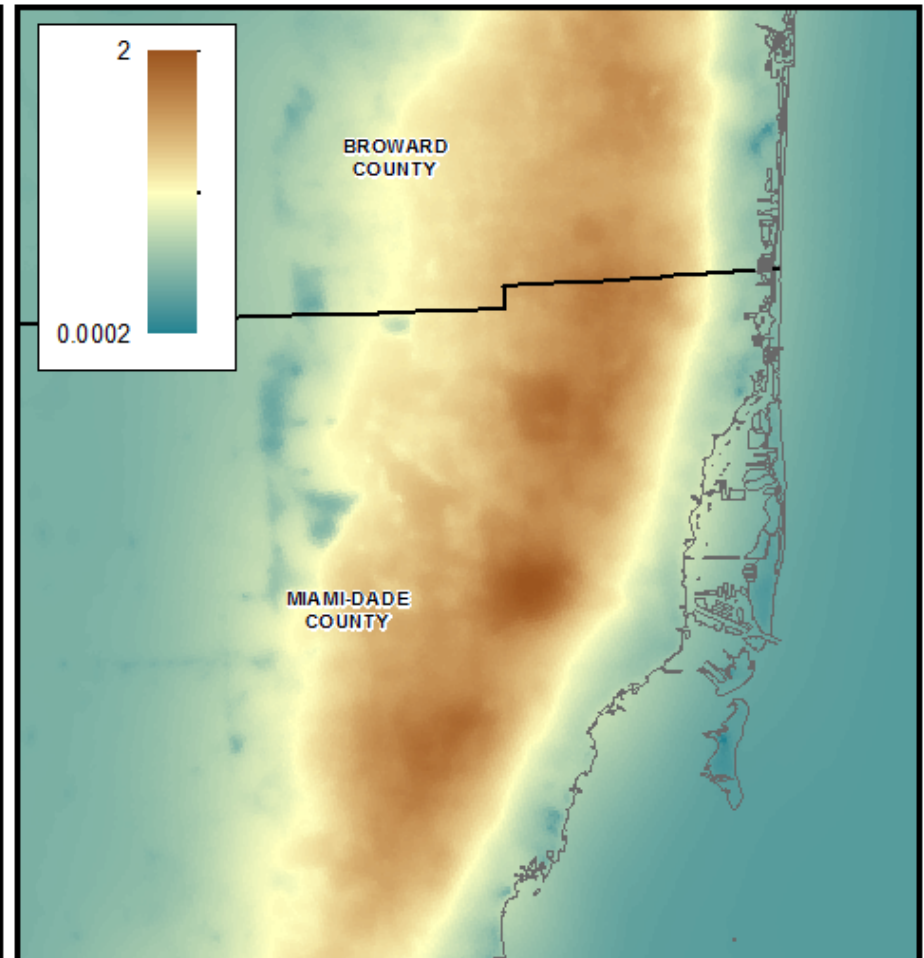


Comparison of Preliminary (left) and Revised (right) Model Error for Brevard County, FL

Case Study: Visualizing Hurricane Risk



Prediction error for modelled hurricane loss



Surface roughness based on land-use/land-cover

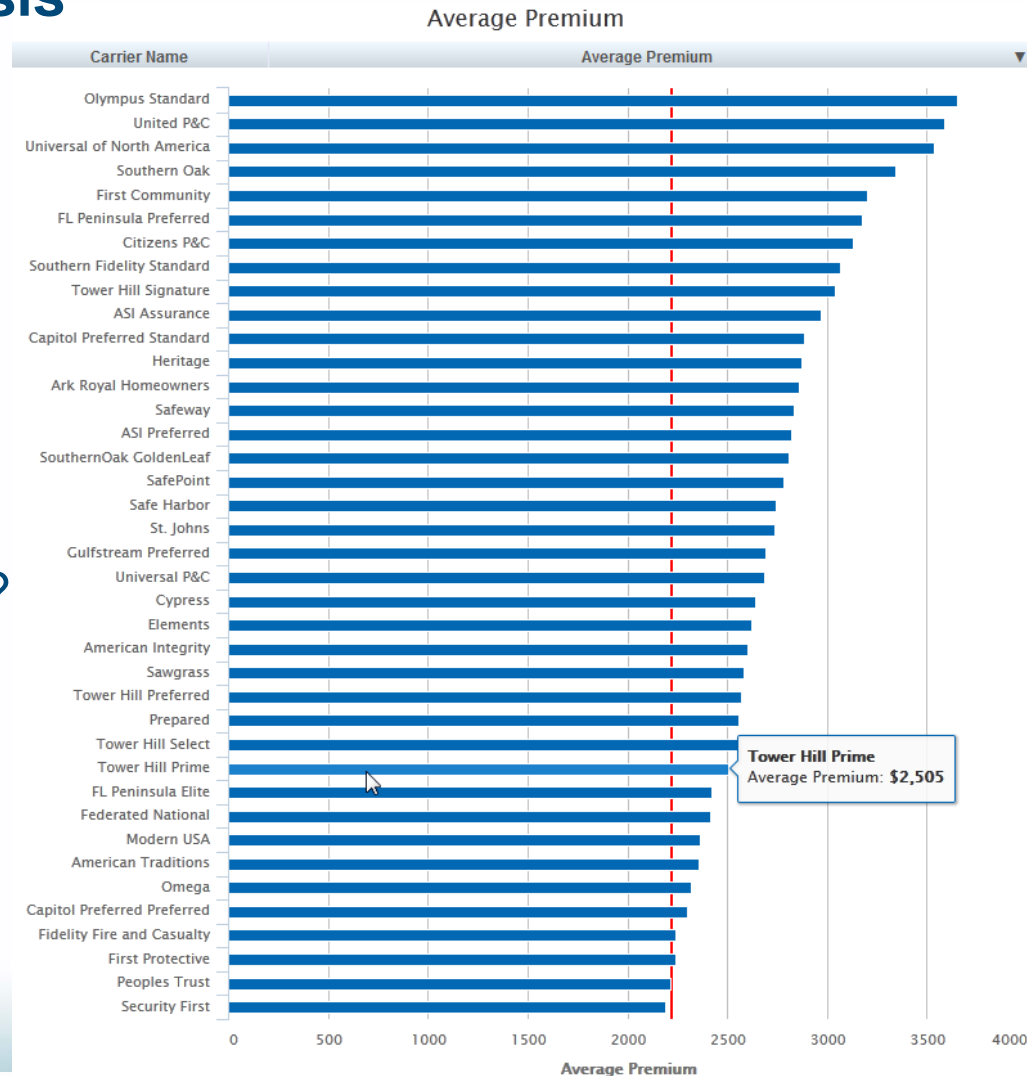
Case Study: Pixel

Competitive Premium Analysis

Using Horizontal Bar Charts

Online tool designed to explore your company's competitive position

- Who are your most significant competitors?
- What variables/segments might be mispriced versus the market?
- Where do you want to make competitive price adjustments, and how much should they be?
- What risk characteristics and/or segments should you target?

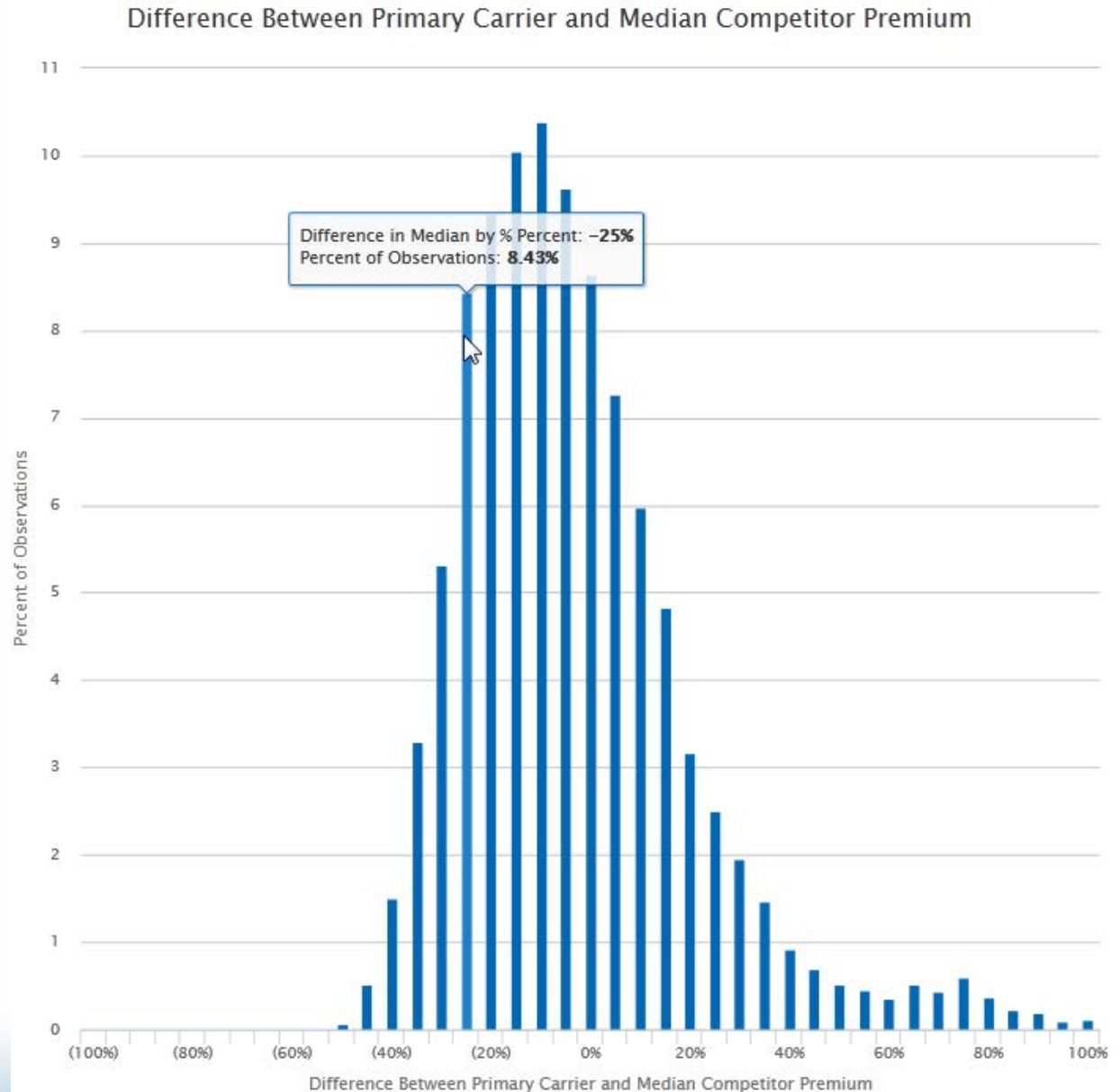


Pixel

Competitive Premium Analysis Using Histograms

How do I compare to the market?

- View percent or dollar difference to competitor premiums

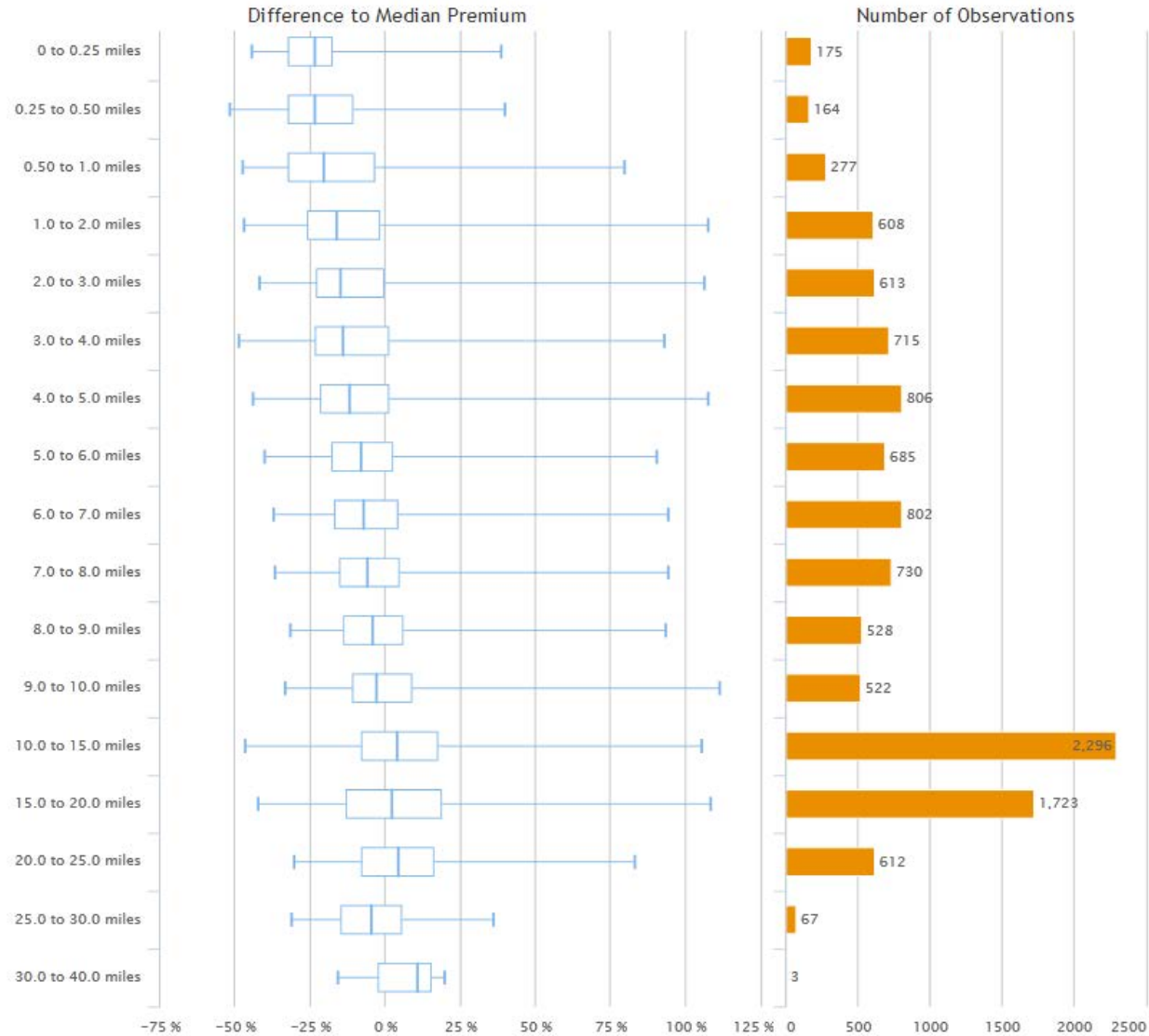


Pixel

Competitive Premium Analysis Using Box and Whisker Plots

Where am I most/least competitive?

- Summarize by rating variable

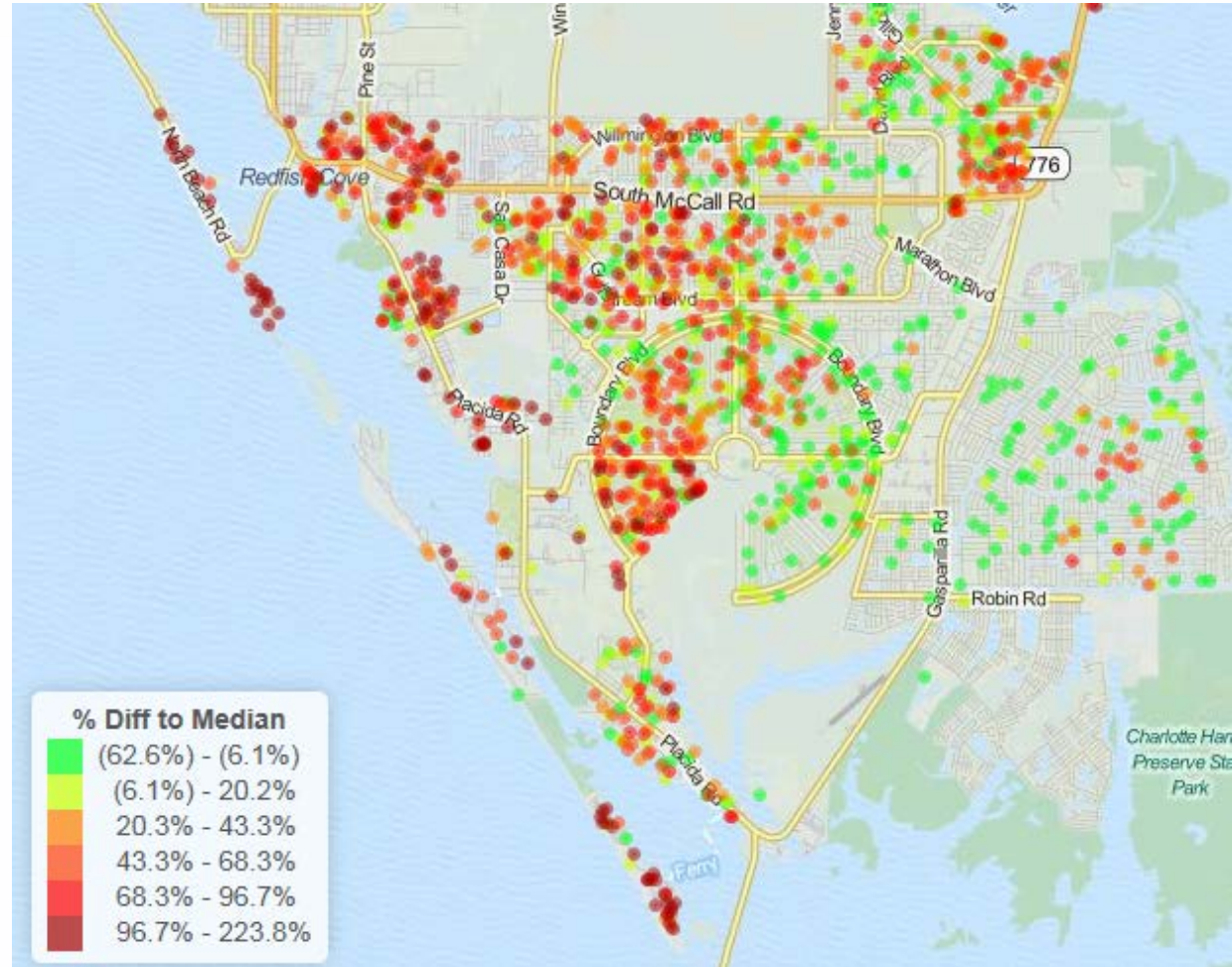


Pixel

Competitive Premium Analysis Using Location Level Point Maps

Where am I most/least competitive?

- Map by county, territory, zip code, or policy



Questions?

Contact Information:

Garrett Bradford
Cartographer / GIS Analyst
Milliman, Inc.
650 California Street, 17th Floor
San Francisco, CA 94108
garrett.bradford@milliman.com
(415) 394-3792

Sheri L. Scott
Principal & Consulting Actuary
Milliman, Inc.
650 California Street, 17th Floor
San Francisco, CA 94108
sheri.scott@milliman.com
(415) 394-3745