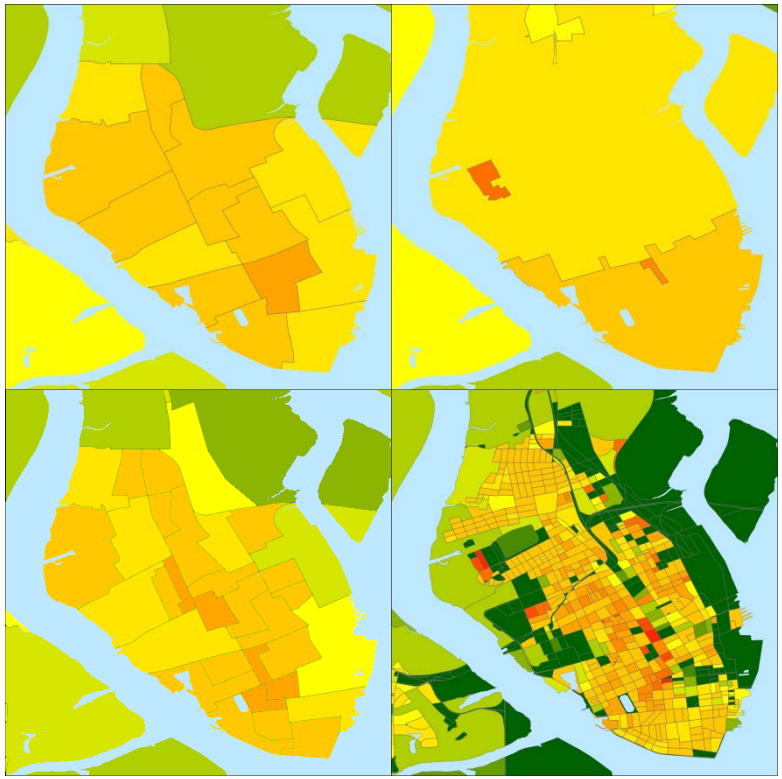
Mapping Census Data for Insurers



Demystifying External Data: Where to Get It and How to Map It
2015 CAS Ratemaking and Product Management Seminar
Addison, TX
March 10, 2015

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I. Visualization and Mapping

II. Introduction to Census Data

III. Examples of How to Use

IV. Case-Study

   A. Marketing a new High-Value HO Program

V. Closing / Questions

Visualization and Mapping: Why maps?

- Risk and exposures vary geographically
- New patterns revealed that cannot be seen with tables and charts
- Quick analysis of large volumes of data

Visualization and Mapping: Why maps?

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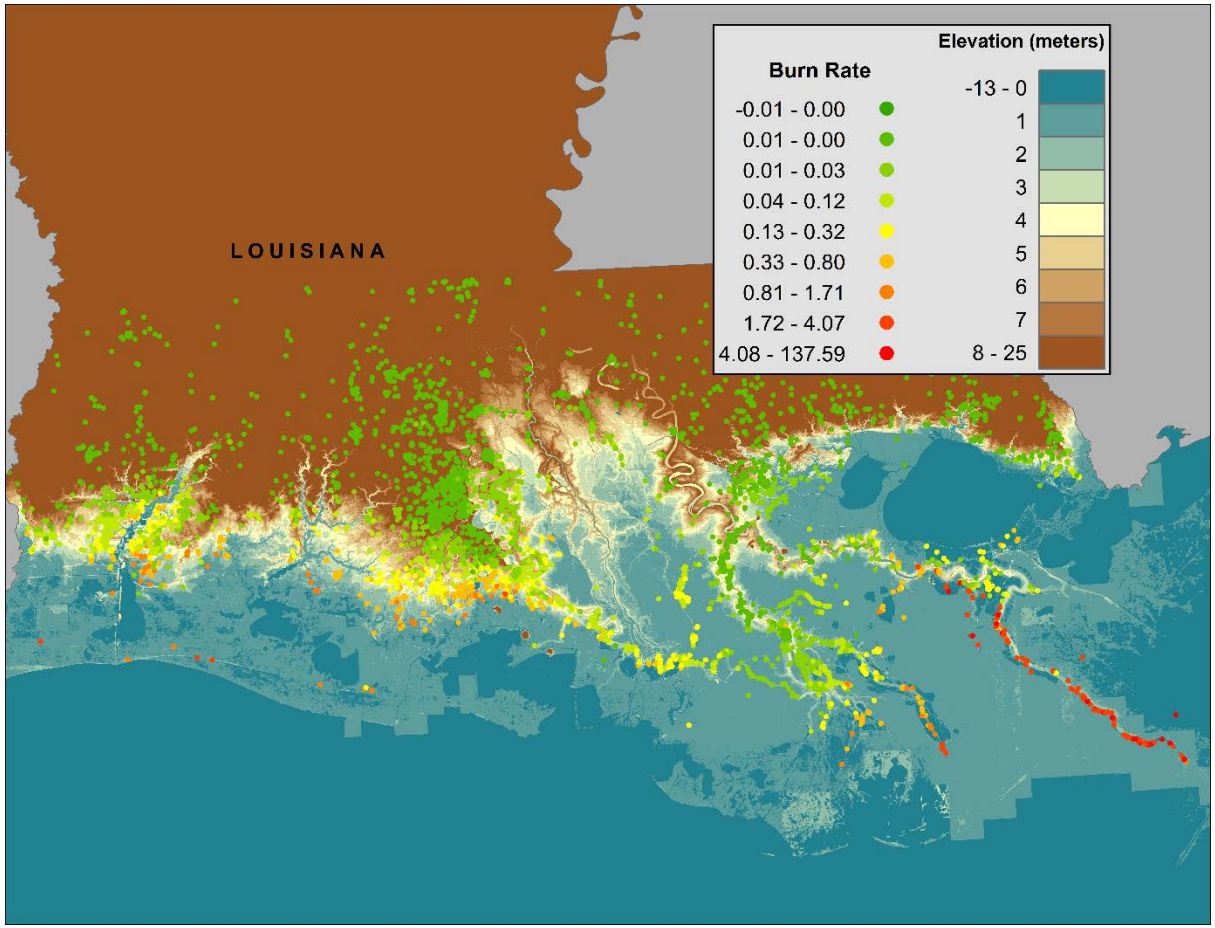

Burn rate is defined as expected annual average loss per $1,000 of Homeowners Coverage A

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Visualization and Mapping: Why maps?

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- **New patterns revealed that cannot be seen with tables and charts**
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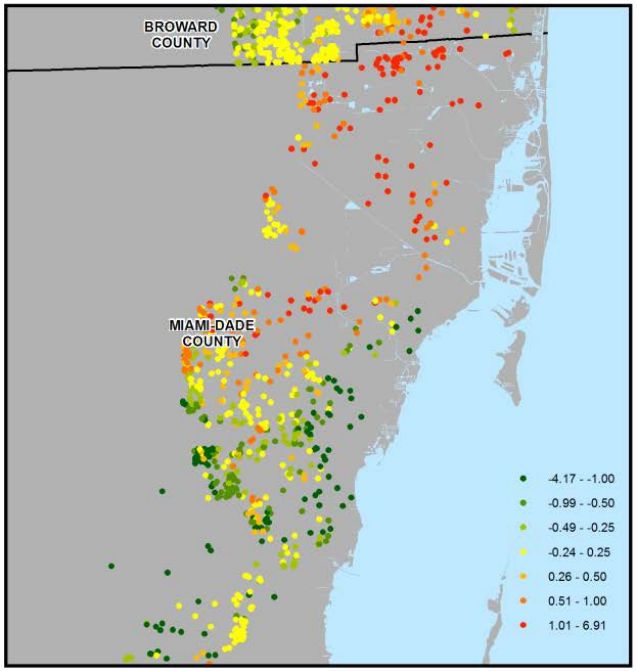
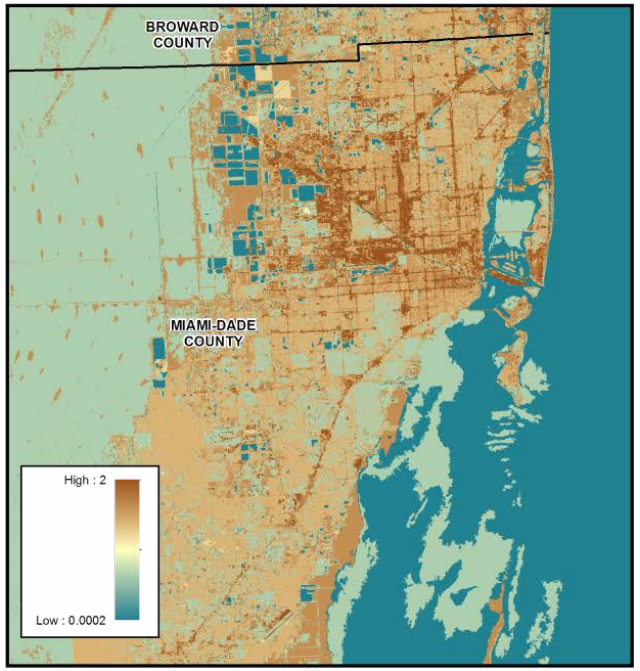


Prediction error for modelled hurricane loss



Surface roughness based on land cover

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Visualization and Mapping: Why maps?

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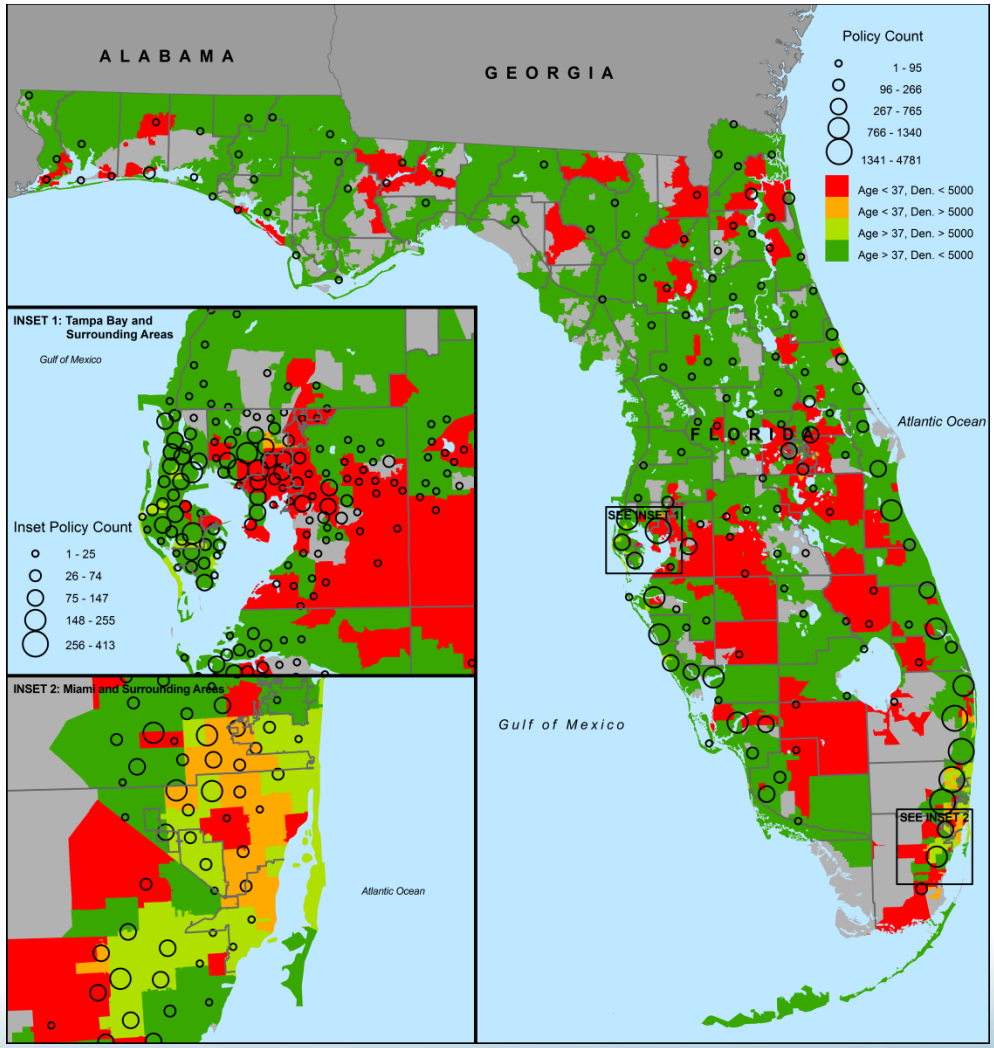

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Introduction to Census Data: Products

- Decennial Census (every 10 years)
  - Count of population and housing
  - Short form questionnaire (2000 vs. 2010)
  - Technical Documentation

    https://www.census.gov/prod/cen2010/doc/sf1.pdf
- American Community Survey (ACS)
  - "*an ongoing statistical survey that samples a small percentage of the population every year*"
  - 1-year, 2-year, 3-year, and 5-years estimates and margin of error
  - Technical Documentation

    http://www2.census.gov/acs2012_3yr/summaryfile/ACS_2010-2012_SF_Tech_Doc.pdf

Introduction to Census Data: Geography

- Provides framework for survey design, sample selection, data collection, tabulation, and dissemination

- TIGER Products
  - GIS data layers based on Census geographies
  - Available in a variety of formats (.shp/.gdb/.kml)

    https://www.census.gov/geo/maps-data/data/tiger.html

"Geography provides meaning and context to statistical data"

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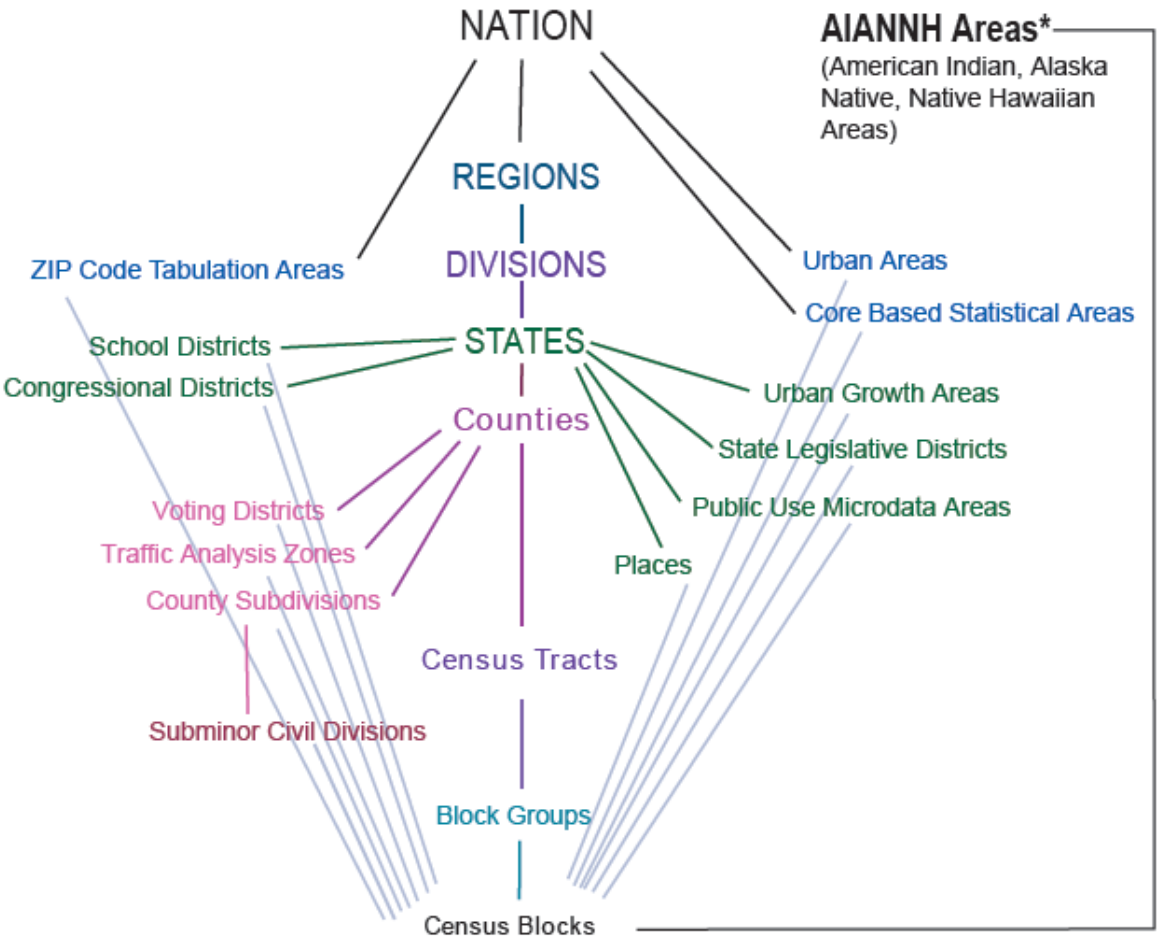
Introduction to Census Data: Geography



Source: U.S. Census Bureau (https://www.census.gov/geo/reference/)

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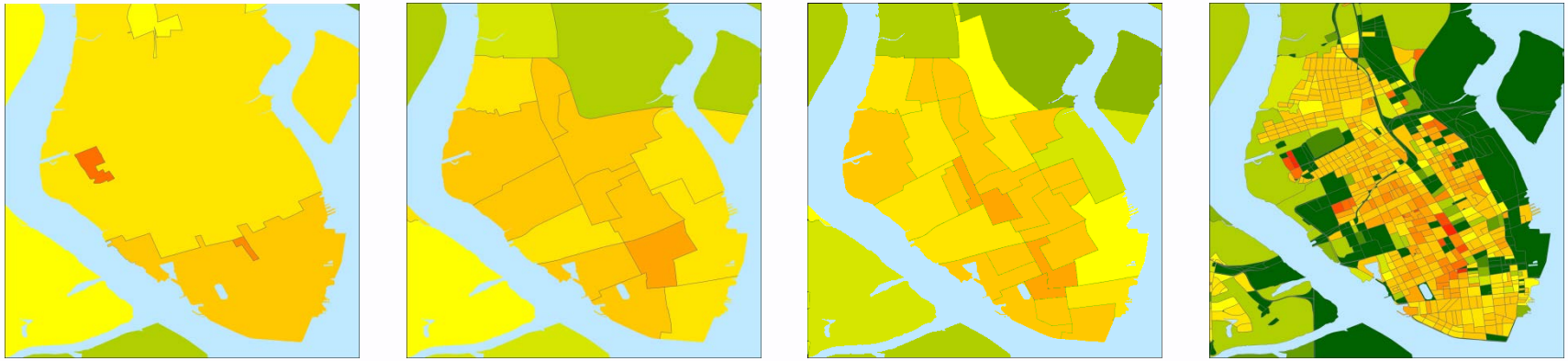
Introduction to Census Data: Geography

- Determining what geography is right for your analysis
- Modifiable areal unit problem (MAUP):

"*The areal units (zonal objects) used in many geographical studies are arbitrary, modifiable, and subject to the whims and fancies of whoever is doing, or did, the aggregating*" (Openshaw, 1983)



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

Introduction to Census Data: Where to get data

- FactFinder (http://factfinder2.census.gov/)
  - Easiest for novice users (but not fool proof)
  - Good for quick, single variable downloads

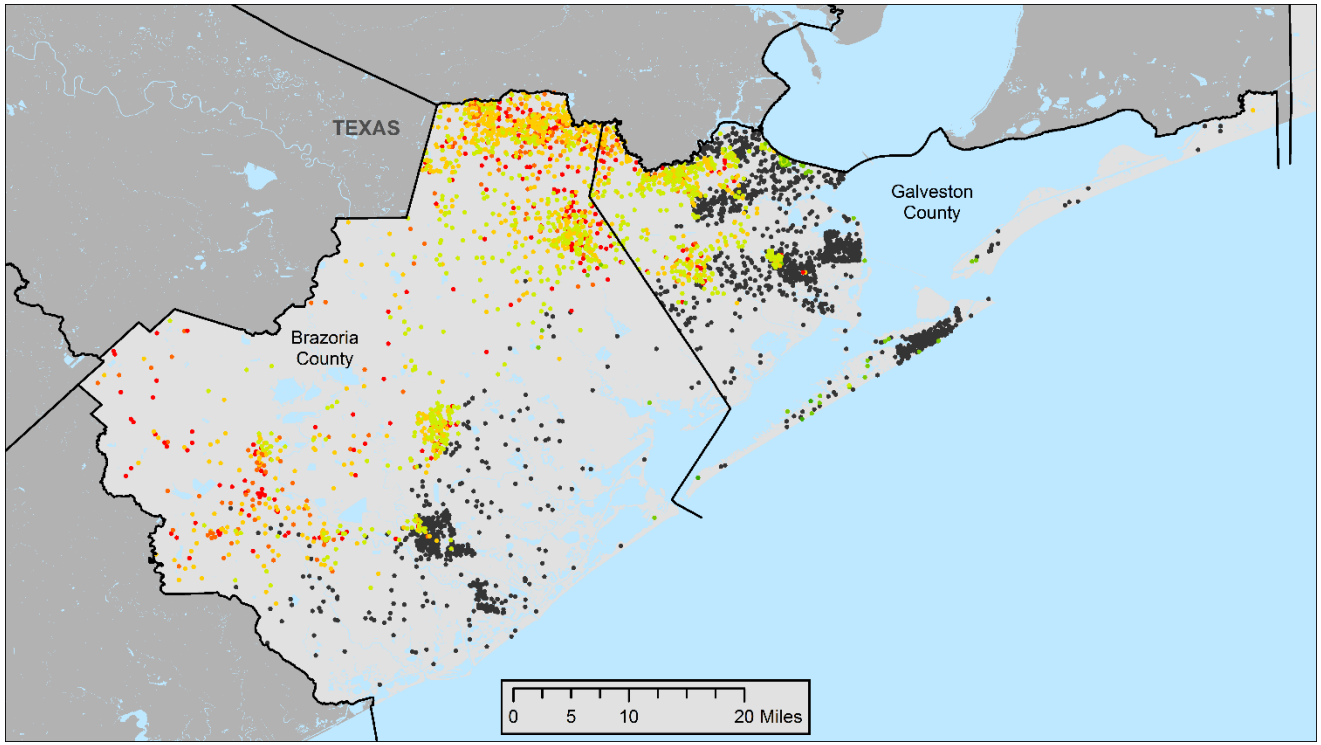
- Via FTP (ftp://ftp.census.gov/)
  - Experienced users
  - Access to bulk dataset by state/nationwide
  - User tools
    - SAS Code
    - Excel Data Retrieval Tool

Examples of How to Use

- Notional locations
- Additional variables for segmentation analysis
- Marketing

Examples of How to Use

- Notional locations



Points represents notional homeowners locations with policy characteristics and geographic location based on distributions derived from ACS and Census data.

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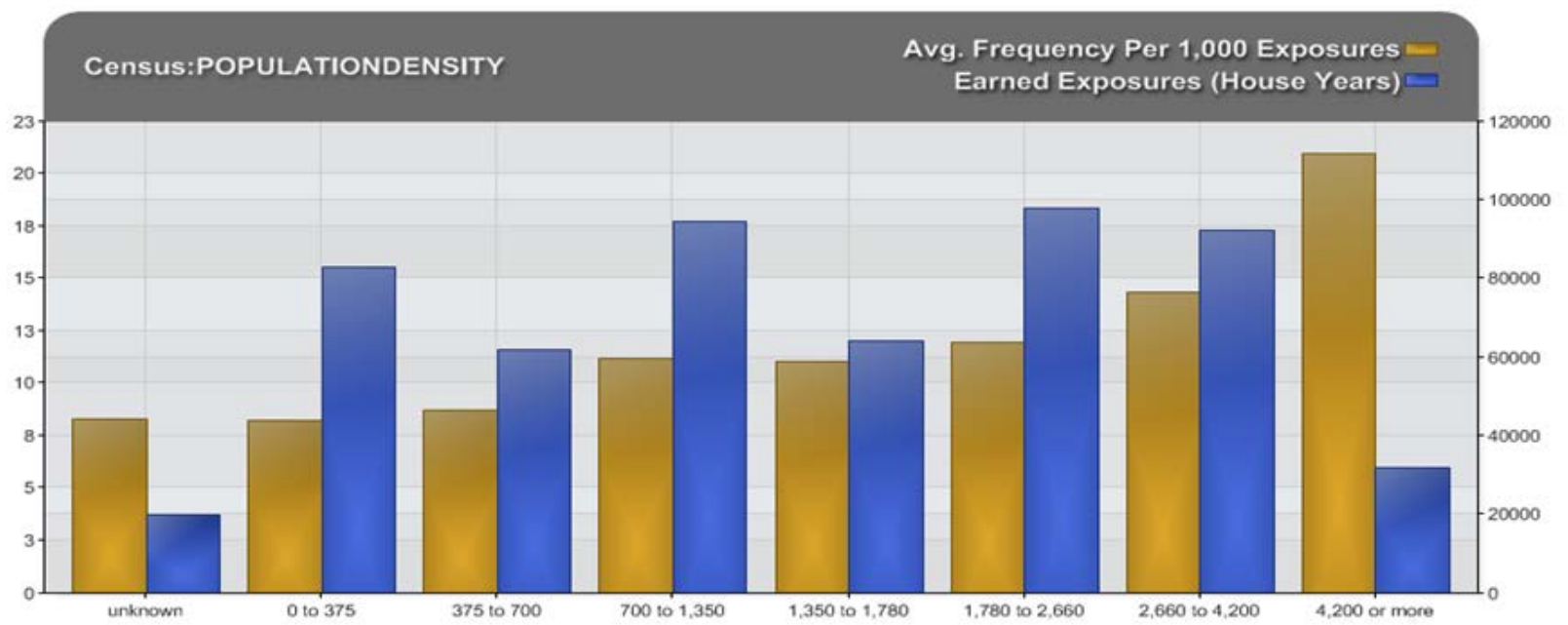
Examples of How to Use

- Additional variables for segmentation analysis



From an AOP Segmentation Analysis: Higher frequency of water claims found with increasing population density.

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Case Study: High Value Homeowners

- Goal:
  - Identify mass affluent target market for new high-value Homeowners product
- Input data:
  - 2007-2011 ACS 5-Year Estimates
  - 2000 Decennial Census
  - 2010 Decennial Census
- Geography:
  - Illinois Zip Code Tabulation Areas (ZCTA)

Case Study: High Value Homeowners

- Step 1: Select desired attributes from available fields
- Step 2: Calculate any derived attributes
- Step 3: Visualization of selected attributes
- Step 4: Final selections

Case Study: Selected Attributes (Page 1 of 3)

Variable	Census Table ID	Census Product
Total Number of Owner Occupied Housing Units - 2000	H084	2000 SF3
Number of Owner Occupied Housing Units with Value b/t $500k and $750k - 2000	H084	2000 SF3
Number of Owner Occupied Housing Units with Value b/t $750k and $1m - 2000	H084	2000 SF3
Number of Owner Occupied Housing Units with Value Greater Than $1m - 2000	H084	2000 SF3
Number of Housing Units	H2	2010 SF1
Number of Housing Units Inside Urbanized Areas	H2	2010 SF1
Number of Housing Units Inside Urban Clusters	H2	2010 SF1
Number of Housing Units in Rural Areas	H2	2010 SF1
Median Value of Owner Occupied Units	B25077	ACS 2011 5-year
Median Rent of Renter Occupied Units	B25064	ACS 2011 5-year
Total Number of Occupied Housing Units	B25003	ACS 2011 5-year
Total Number of Owner Occupied Housing Units	B25003	ACS 2011 5-year
Total Number of Renter Occupied Housing Units	B25003	ACS 2011 5-year
Total Number of Housing Units	B25024	ACS 2011 5-year
Number of Single Unit Detached Housing Units	B25024	ACS 2011 5-year
Total Number of Single Unit Attached Housing Units	B25024	ACS 2011 5-year
Total Number of 2 Unit Housing Units	B25024	ACS 2011 5-year
Total Number of 3-4 Unit Housing Units	B25024	ACS 2011 5-year

Case Study: Selected Attributes (Page 2 of 3)

Variable	Census Table ID	Census Product
Total Number of 5-9 Unit Housing Units	B25024	ACS 2011 5-year
Total Number of 10-19 Unit Housing Units	B25024	ACS 2011 5-year
Total Number of 20-49 Housing Units	B25024	ACS 2011 5-year
Total Number of 50 or more Housing Units	B25024	ACS 2011 5-year
Total Number of Mobile Housing Units	B25024	ACS 2011 5-year
Total Number of Boat, RV, or Van Housing Units	B25024	ACS 2011 5-year
Number of Households	B19001	ACS 2011 5-year
Number of Households with income b/t 150k and 200k	B19001	ACS 2011 5-year
Number of Households with income greater than 200k	B19001	ACS 2011 5-year
Number of Households with 2 Vehicles	B08201	ACS 2011 5-year
Number of Households with 3 Vehicles	B08201	ACS 2011 5-year
Number of Households with 4 or more vehicles	B08201	ACS 2011 5-year
Aggregate Number of Vehicles Available	B25046	ACS 2011 5-year
Median Household Income	B19013	ACS 2011 5-year
Mean Household Income	S1902	ACS 2011 5-year

Case Study: Selected Attributes (Page 3 of 3)

Variable	Census Table ID	Census Product
Per Capita Income	B19301	ACS 2011 5-year
Percentage of Population 25 and Older with a Bachelors Degree or Higher	S1501	ACS 2011 5-year
Number of Owner Occupied Housing Units with Value b/t $500k and $750k	B25075	ACS 2011 5-year
Number of Owner Occupied Housing Units with Value b/t $750k and $1m	B25075	ACS 2011 5-year
Number of Owner Occupied Housing Units with Value Greater Than $1m	B25075	ACS 2011 5-year
Number of Housing Units Classified as seasonal, recreational, or occasional use	B25004	ACS 2011 5-year

Case Study: Derived Attributes

Variable
Percentage of Occupied Housing Units - Owner Occupied
Percentage of Occupied Housing Units - Renter Occupied
Number of Households with income greater than 150k
Percentage of Households with Income Greater Than $150k
Number of Households with 2 or more vehicles
Percentage of Households with 2 or more vehicles
Vehicles Per Household
Number of Owner Occupied Housing Units with Value Greater Than $500k
Percentage of Owner Occupied Housing Units with Value Greater Than $500k
Number of Owner Occupied Housing Units with Value Greater Than $500k - 2000
Percentage of Owner Occupied Housing Units with Value Greater Than $500k - 2000
Percent Change in Number of Owner Occupied Housing Units with Value Greater Than $500k - 2000
Percentage of Total Housing Units Classified as seasonal, recreational, or occasional use

Case Study: Mapping the data

- Desktop GIS solutions
  - ESRI's ArcMap
  - GRASS GIS
  - QGIS

- Online tools
  - Census Data Mapper (beta, limited data)

    http://tigerweb.geo.census.gov/datamapper/map.html
  - Social Explorer

    http://www.socialexplorer.com

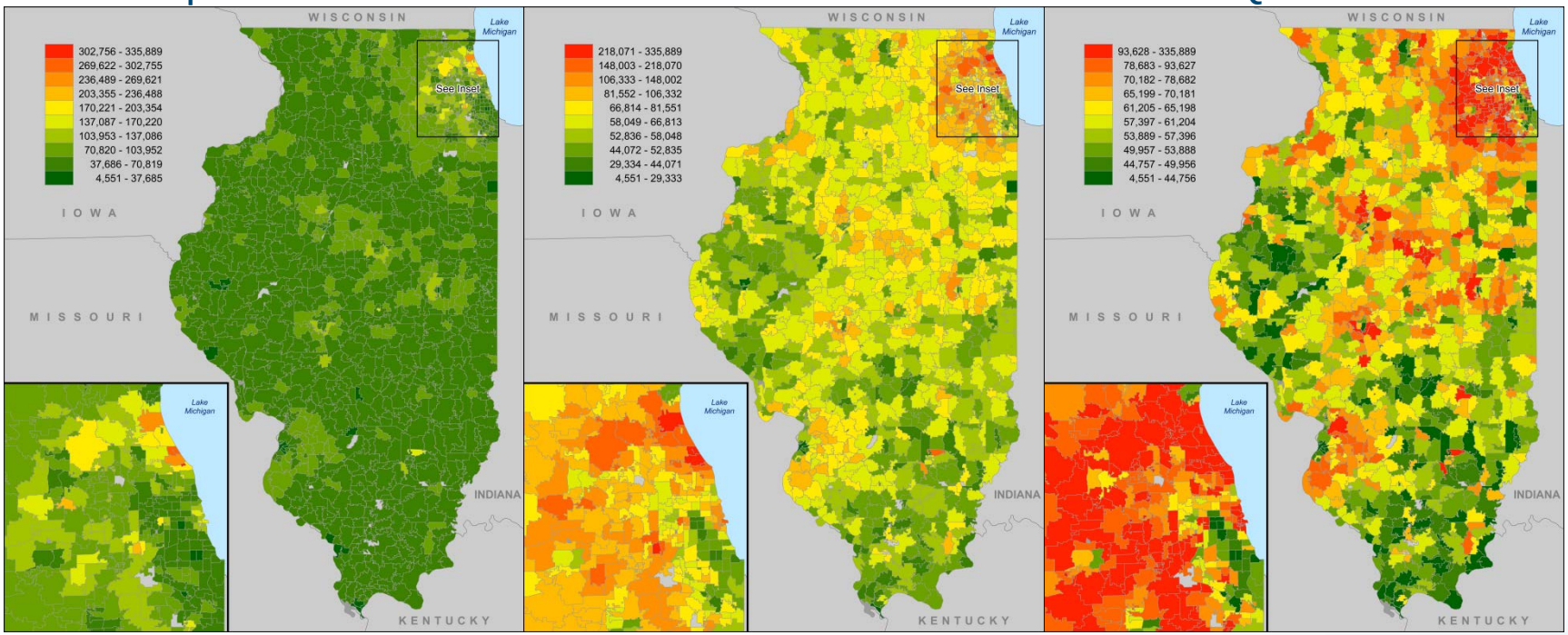
Case Study: Mapping the data

- Mapping considerations
  - Choice of breaks for choropleths
  - Normalization of areal data

Case Study: Mapping the data

- Mapping considerations
  - **Choice of breaks for choropleths**

Equal Interval | Geometrical | Quantile



Median Household Income by ZCTA using three different color scales.

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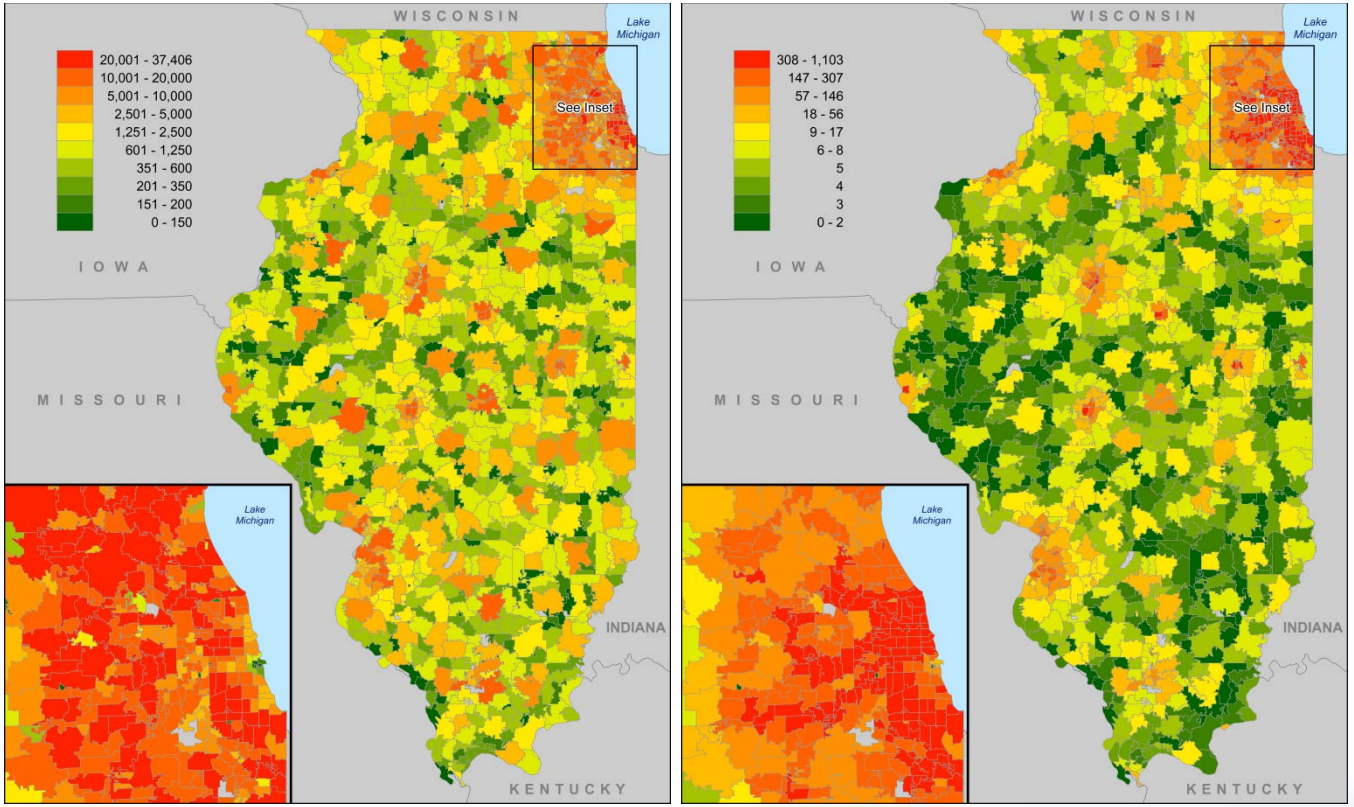
Case Study: Mapping the data

- 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.

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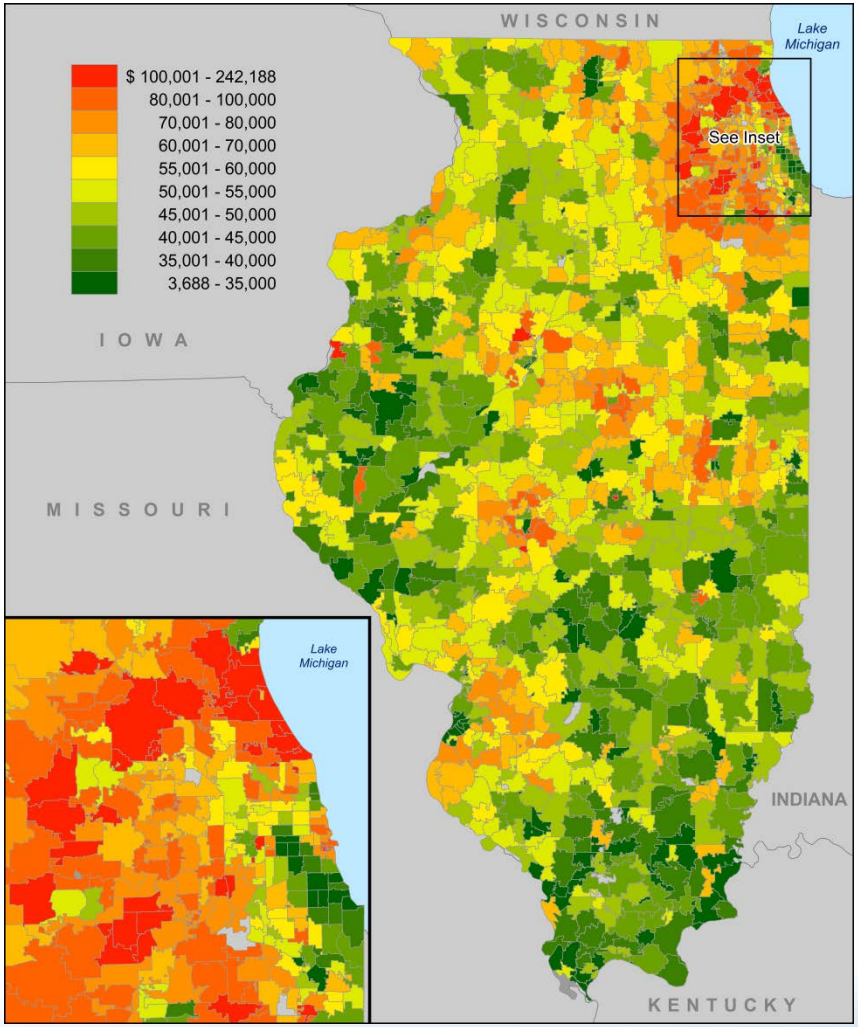
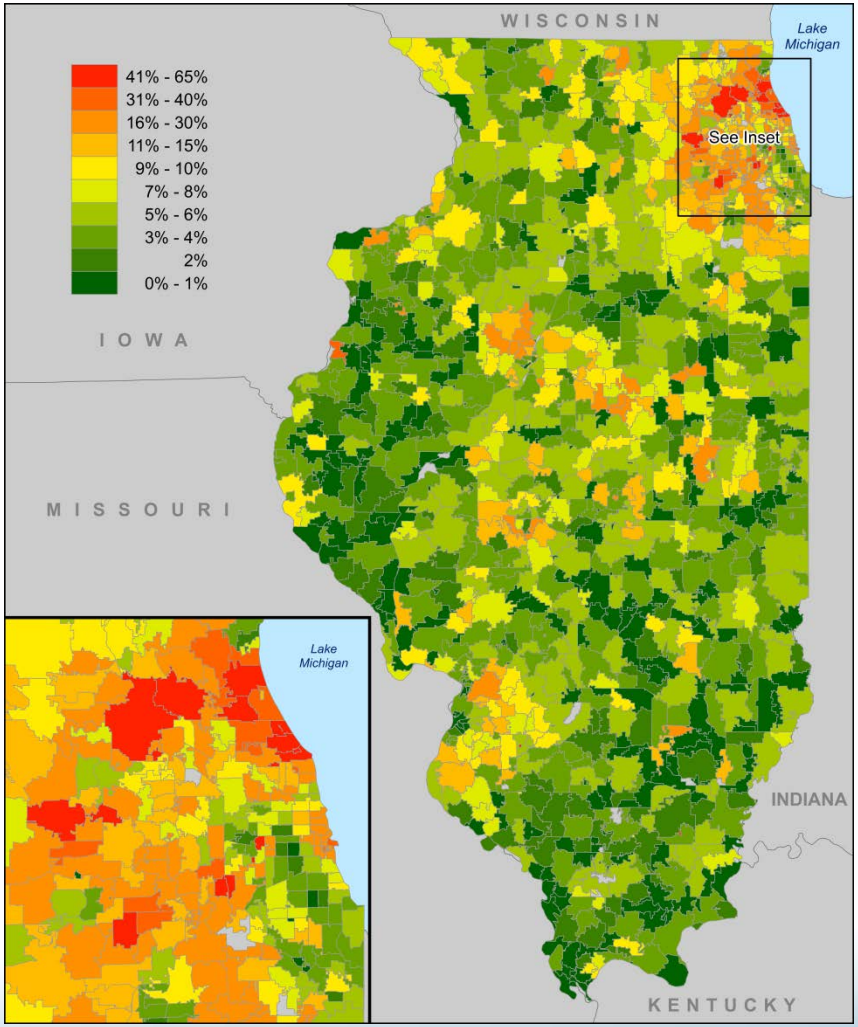
Median Household Income



Percentage of Households with Income Greater Than $150k



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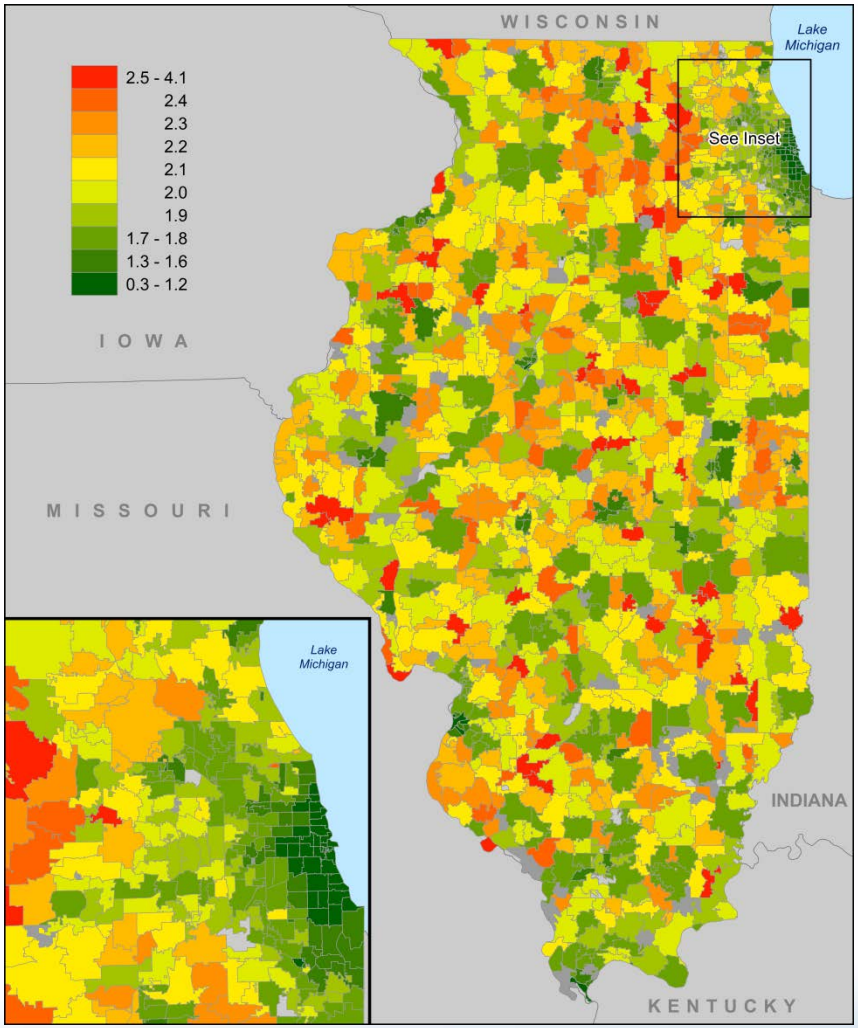
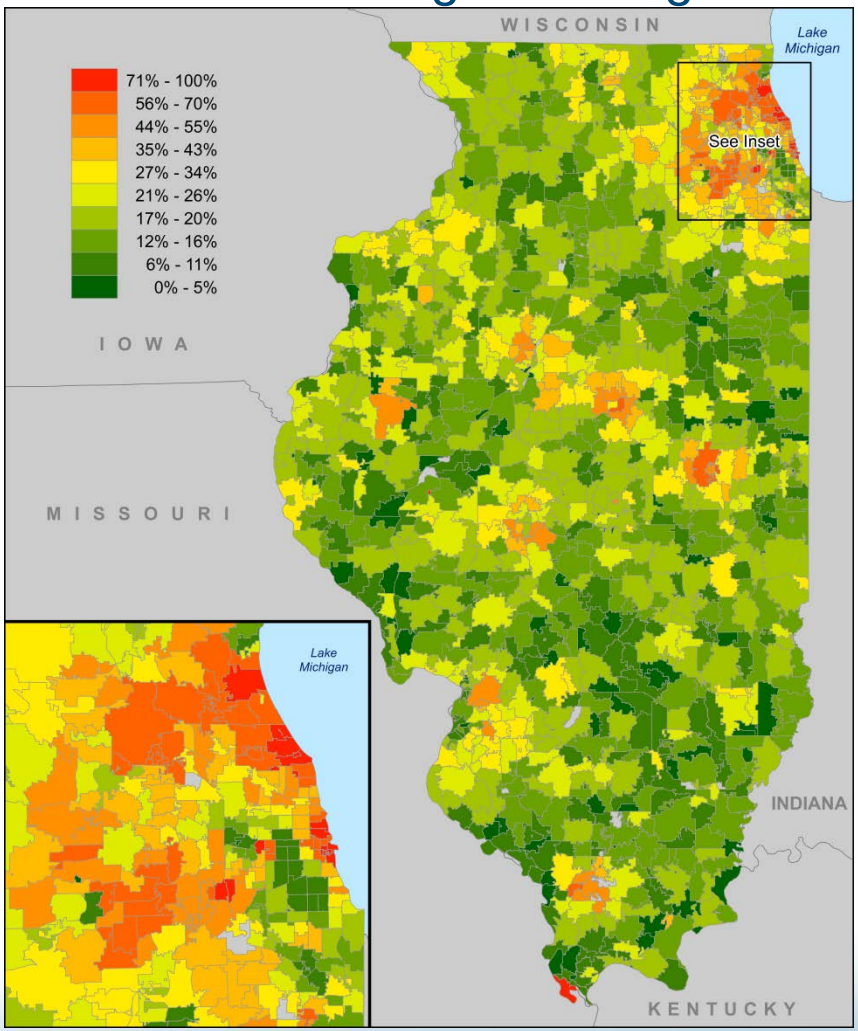
Vehicles Per Household



Percentage of Population with a Bachelors Degree or Higher



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Case Study: Selection Criteria

- Top 20 zip codes ranked by Number of Household with Home Value greater than $500k
  - Top 5 selected
  - For remainder, consider:
    - Percentage with Home Value > $500k
    - Growth in high value homes since 2000*
    - Degree of urbanization

Questions?

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