# making maps: basic applied gis (geographic information systems)

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this version: Saturday 3rd February, 2018 22:25

## outline

thematic (choropleth) maps

categorical vars, heatmaps, goog maps, geocoding

SQL/regexp and geo-processing/tools

tips and tricks!

pretty maps: illustrative examples [did on Tues:)]

references

## disclaimer; and about me

- it's videotaped
- our first faculty development workshop
- an experiment
- not 100% sure what I'm doing–help me out here!
-
- first, my research and maps (if overlap, can collaborate):
  - `https://sites.google.com/site/adamokuliczkozaryn/`
  - `https://sites.google.com/site/adamokuliczkozaryn/pubs/gesis3.pdf`
    note cross-border clustering; and map of ineq
  - `https://sites.google.com/site/adamokuliczkozaryn/pubs/rel_inn.pdf`
    West Coast and CA, TX and TX metros, North East

## introduce yourself, and:

- 1) what are you researching/analyzing?
- 2) what data are you using?
- 3) what do you expect from this workshop?

## what is there?

- GIS: Geographic Information Systems
  - Geographic: Cities, Roads, Rivers, Countries, etc
  - Information Systems: data, software, programming,
- GIS=CS(graphics, database/sys adm, coding)+geography
- geographic=geospatial=spatial

## past and future

- much of the gis has been (still is) done with ArcGIS/ArcMap
  - this is more of a dinosaur, however
- the future is open source software like qgis
- and internet companies like Google

# rules

- i'll go slowly as computer skills likely vary a lot!
- do interrupt and ask questions
- help your neighbor! [will see how it goes, may add Straso]
- many slides have refs as urls; at the end i list more refs
- communicate outside of the classroom:
  bother me, email everyone (emails in mass email)

## setup

- don't have much time: skip the intros
- we'll be mostly displaying data on maps using colors (thematic/choropleth)
- start simple: point-and-click in qgis [maybe: GeoDa, Py]
- start with my examples; Q&A tomorrow, and transition to your data: in a day or two you'll be presenting your maps!

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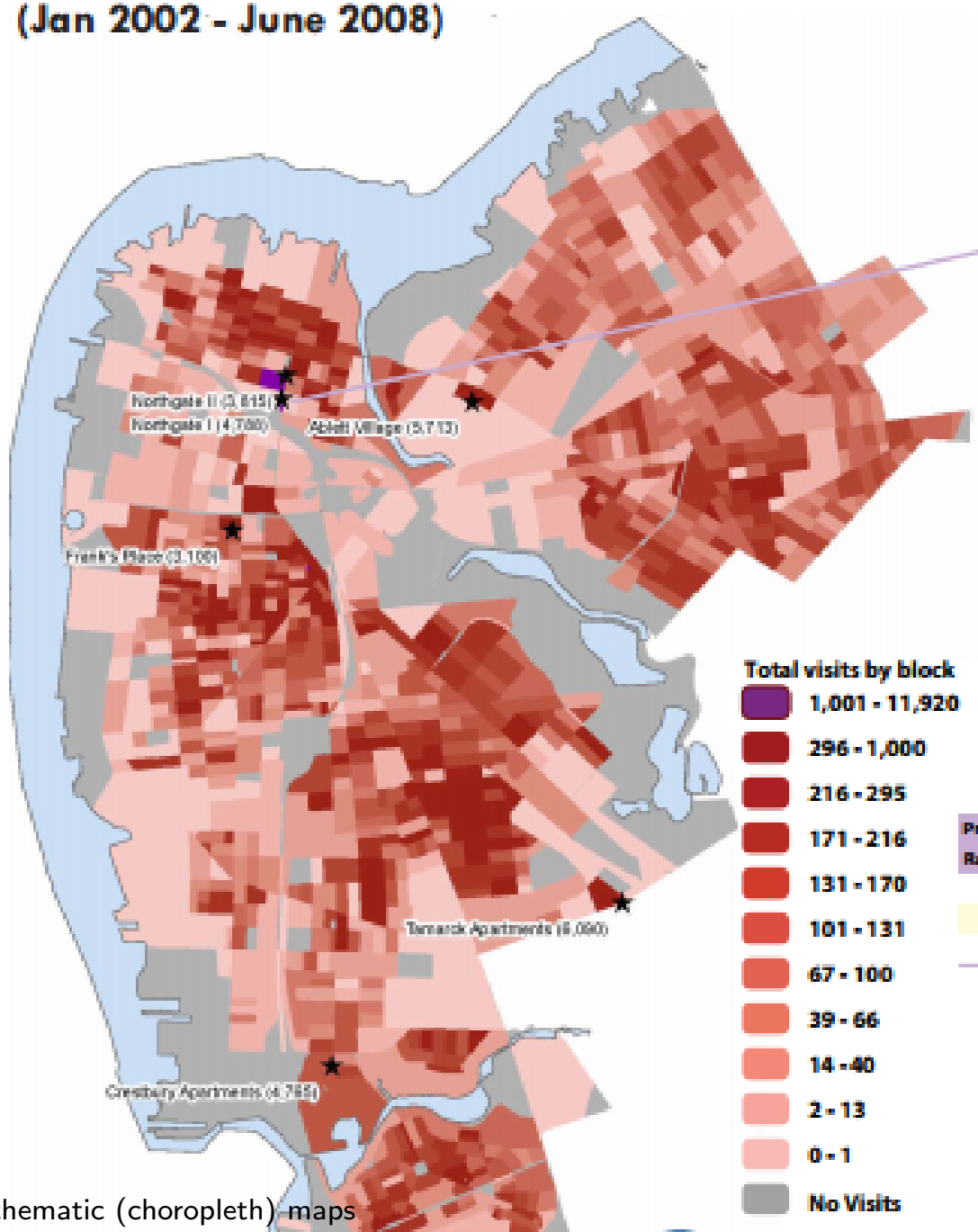
# why? discovery! just put it on a map

- Dick De Veaux: blackboard: US map with loc of faulty devices
- and Cooper's dr Brenner on next slide

# Inpatient and Emergency Room Visits in Camden, NJ
## (Jan 2002 - June 2008)




**Northgate I Public Housing**

| | Visits | Patients | Charges | Receipts | Collected |
|---|---|---|---|---|---|
| Cooper | 3,172 | 749 | $42,144,897 | $4,994,658 | 12% |
| Lourdes | 811 | 337 | $7,848,899 | $1,028,611 | 13% |
| Virtua | 805 | 331 | $1,742,487 | $345,092 | 20% |
| 2005 | 838 | 378 | $10,834,420 | $1,268,373 | 12% |
| 2006 | 738 | 355 | $6,867,995 | $880,549 | 13% |
| 2007 | 790 | 369 | $7,979,262 | $901,181 | 11% |
| ED | 3882 | 978 | $6,150,592 | $864,019 | 14% |
| Inpatient | 906 | 408 | $45,584,781 | $5,504,342 | 12% |
| Total | 4,788 | 1,078 | $51,735,374 | $6,368,361 | 12% |

**Primary Diagnosis**

| Rank | ED | Inpatient |
|---|---|---|
| 1 | abdominal pain (789.0) | live birth (V3X.0) |
| 2 | acute URI NOS (465.9) | chest pain (786.5) |
| 3 | chest pain (786.5) | congestive heart failure NOS (428.0) |

# say you have housing prices

- the "traditional" (non-gis) data in excel from
  `http://www.zillow.com/research/data/`
- reposted:
  `https://sites.google.com/site/adamokuliczkozaryn/gis_int/NJ-counties-Zillow-Home-Value-Index-TimeSeries.xls`
- note: we have geography! county! this is our key to map!

# geographic (map) data to match our spreadsheet

- now need to find map (geographic) data to match our spreadsheet
- let's search for what we need: NJ counties!
- just goog 'your geography' + 'shapefile' ='nj counties shapefile'
  - reposted: `https://docs.google.com/uc?id=1xJDhcRCkgv7k4tNCa72Oog5bohV6dTB2&export=download`
- download it, unzip it, and put into project folder and keep there
  - there are couple files, keep them intact
  - don't rename, don't change location within project folder

## load data into qgis!

- first icon on the left "line with nodes": nj_counties.shp
  - or just drag it over and drop
- can zoom in and out
  - either click the map with "+" "-" tool
  - or draw a rectangle to achieve appropriate zoom
- grab map and move around with "hand" pointer
- layer listed the left: right click-
  - Open Attribute Table [can select/highlight in table or map]
  - all right! we have county variable!
  - note how it looks like!
  - either upper or proper case (w 'county' string)

# your spreadsheet and geo data must have same ID

- "Camden county" $\neq$ "Camden"
- "Camden" $\neq$ "CAMDEN"
- "08012" $\neq$ "8012"

## adjusting and cleaning up spreadsheets

- adjust ID: make counties uppercase
  - (or could drop 'County' from COUNTY LABEL variable)
- always clean up the spreadsheet:
  - one row header (I dropped first row)
  - make col (variable) names brief: say <5 alphanumeric chars

    drop excessive columns you wont need, keep it clean
  - important! leave only plain numbers!
  - drop all special chars from vals: "#" "$" "," etc
- save as csv (just one sheet); reposted:

  `https://sites.google.com/site/adamokuliczkozaryn/gis_int/all_homes.csv`
  - note missing value! and save in project folder

# quick break

- thematic maps elaboration: `http://www.qgistutorials.com/en/docs/basic_vector_styling.html`

# install MMQGIS (just once) if not there already

- Plugins-Manage and Install Plugins:
  - Search: MMQGIS
  - and install
- now we can use MMQGIS to join and fix the data!
  - [another way to do joins:

    `http://www.qgistutorials.com/en/docs/performing_table_joins.html`]

# MMQGIS: join; and text to float

- MMQGIS-Combine-Attributes Join From CSV File
- Input CSV: all_homes.csv
- CSV File Field: UPPER
- Join Layer: nj_counties
- Join Layer Attribute: COUNTY
- make sure notfound.csv is where you want it
- check notfound.csv: header and 'NEW JERSEY': makes sense!
  - check the tables to see if it joined right; be very careful!
- MMQGIS-Modify-Text to Float (almost always need this!)
- highlight "Dec 2012" only (others are not clean:"$","","")

# missing value

- right click layer-Open Attribute Table
- note that now MORRIS has 0 for “Dec 2012”
- this is incorrect!
- hit pen icon at top left: “Toggle Editing Mode”
  - and remove zero from that cell
- hit “Toggle Editing Mode” again and Save

## your first thematic map

- nj_counties-Properties-Style and from drop-down: "Graduated"
- Column: "Dec 2012"
- Color ramp: can just leave Blues
- many ways to classify [if time, discuss later]
- usually good: 'natural breaks/jenks' say 3-7
- and hit "Classify" button
- and hit "OK" to see the map–viola!
- zoom in as much as needed

# print a map: Print Composer

- Project-New Print Composer
- NJ is tall: on the right "Composition" and do "portrait"
- left: blank icon "Add New Map" and draw a rectangle
- left: icon with arrows "Move Item Content" to adjust view
- right: "Item properties" change scale to adjust zoom
- left: legend button "Add new legend"
  - normally legend requires lots of editing
  - right: **uncheck** auto-update and beautify it:
  - drop items with minus sign
  - and edit by double clicking it
- top: on the left: Composer-Export as Image
  - probably jpg is fine, just increase resolution to say 600dpi
  - `http://www.qgistutorials.com/en/docs/making_a_map.html` and

# flip the class–work one-on-one

## thanks! we'll probably finish here

- do stuff like that at home! use it or lose it
- say use census data and especially join your own data!
  - again, the key is that you have some geography, eg:
  - address, school district, zip code, municipality, etc
  - as long as there is any geography, can join it to the map!
- i'll work with you to map it this week
  - do bother me outside of the workshop [this week only]
- eg you may want to ask me to find you the data
  - i also listed some sources at `https://sites.google.com/site/adamokuliczkozaryn/gis_int/data_sources.csv`
  - and also see gis data librarians `http://libguides.rutgers.edu/gis`

# the second day starts here

- any questions before we begin?
- student presentations
- Q&A

## census data: 5-yr ACS

- census is a good source of data, even at neighborhood level!
- for city/neighb lev probably want 5-yr ACS
- `https://geomap.ffiec.gov/FFIECGeocMap/GeocodeMap1.aspx`
- `https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t`
- can search in top box but probably best select on the left from "Topics" eg: people-poverty-poverty
- then select "Geographies": eg census tracts (ie neighborhoods)
  - go down to "All Census Tracts in Camden County" and hit "ADD TO YOUR SELECTIONS" and hit "CLOSE"
- and from "Show results from" pick "2015"
  - click "S1701, POVERTY STATUS IN THE PAST 12

# cont

- take note of margins of errors!!
  - most precise is decennial census, but much fewer variables
- ok, at top hit Download
  - and check "Use" not "View"
  - keep both checked: "Merge the annotations..." and "Include descriptive...", hit OK
  - csv reposted `https://docs.google.com/uc?id=1MD-P2IuOXWWkYAsInOWCYfqZ15cJya8n&export=download`

## again, always clean it up before getting into qgis

- open csv file, keep GEO ids (will use them for join)
  - and just keep only needed vars and rename them:
  - HC01_EST_VC01, Total; Estimate; Population for whom poverty status is determined: "tot"
  - HC01_EST_VC53 Total; Estimate; ALL INDIVIDUALS WITH INCOME BELOW THE FOLLOWING POVERTY RATIOS - 125 percent of poverty level: "pov125"
- then calculate ratio of pov to tot: "prop"
- and drop row 2, the long name
  - and save as csv
  - clean csv reposted: `https://docs.google.com/uc?id=1Hw-3nugfIpSvvyai7Jy-lwA2IsRA0Pz0&export=download`

# get geo data

- census has geo data for any US geog!: `https://www.census.gov/geo/maps-data/data/tiger-line.html`
- tracts: `https://www.census.gov/geo/maps-data/data/cbf/cbf_tracts.html`
  - doing 2015 because we have 2011-2015 data
- then note there are 2 similar IDs that would match census csv
  - shp: `https://docs.google.com/uc?id=1KNe_DSJQxiUiMVzKdVfHzYjUZSke2OnY&export=download`

# join!

- load shp and then
- MMQGIS-Combine-Attributes join from CSV file
- MMQGIS: csv GEOid, shp: AFFGEOID
- and check notfound.csv–should be none
- MMQGIS: modify: text to float: tot pov125 prop
  - (Ctrl and left click all three)
- right click layer-Properties-Style: "Graduated" map prop with say Blues 5 jenks
- move around and say zoom in on Camden

# print a map: Print Composer [same as earlier]

- Project-New Print Composer
- left: blank icon "Add New Map" and draw a rectangle
- left: icon with arrows "Move Item Content" to adjust view
- right: "Item properties" change scale to adjust zoom
- left: legend button "Add new legend"
  - normally legend requires lots of editing
  - right: **uncheck** auto-update and beautify it:
  - drop items with minus sign
  - and edit by double clicking it
- top: on the left: Composer-Export as Image
  - probably jpg is fine, just increase resolution to say 600dpi
  - `http://www.qgistutorials.com/en/docs/making_a_map.html` and
  - `http://docs.qgis.org/2.0/en/docs/user_manual/print_composer/print_composer.html`

## >>>the third day starts here

- any questions before we begin?

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tips and tricks!

pretty maps: illustrative examples [did on Tues:)]

references

# first map a continuous variable again

- same nj counties shapefile `https://docs.google.com/uc?id=1xJDhcRCkgv7k4tNCa72Oog5bohV6dTB2&export=download`
- nj_counties-Properties-Style and from drop-down: "Graduated"
- Column: "POP2010"
- Color ramp: can just leave Blues
- usually best 'natural breaks/jenks' say 5
- and hit "Classify" button and "OK"

# mapping categorical variable: type of university

- `https://sites.google.com/site/adamokuliczkozaryn/gis_int/hsip_colleges.zip`
- load 2007_11_30_NJ_COLL_UNIV_njsp.shp
  - layer-Properties-Style; **not** "Graduated" but "Categorized"
  - Column: "NAICSDESCR"
  - and pick some big symbol for "universities" level
- then can easily only 2 universities in South Jersey
- use the "Identify tool" (arrow with i) to see what they are
- Aha! RU-Camden and Rowan

# labels [already done; skip]

- let's stick in some LABELS for counties
- can pick some of the text you get when you use IDENTIFY FEATURES TOOL
- nj_counties-Properties-Labels:
  - from drop down menu select "Show labels for this layer"
  - Label with; COUNTY LAB
- select "Buffer" and check "Draw text buffer"

# contaminations: too many points? heatmap!

- get
  `https://docs.google.com/uc?id=1T_n1y_Mj5yQiWpZwrbuuFFwmIVJ2QWFZ&export=download`
- load it and...we got a map
  - but lots of points! make them smaller:
  - under style, change size to say .4
- but can also do a heatmap:
  - right click layer-Properties-Style: Heatmap
  - play with Radius to achieve desired heat
  - (at home: overlay with county bounds etc to locate better)
- reference:
  - `http://www.qgistutorials.com/en/docs/creating_heatmaps.html`
  - `https://docs.qgis.org/2.8/en/docs/user_manual/plugins/plugins_heatmap.html`
  - `https://www.mapbox.com/tilemill/docs/guides/designing-heat-maps/`
  - `http://www.digital-geography.com/create-point-density-raster-in-qgis/#.VrtsS_FOkUE`

# Google Maps: OpenLayers Plugin

- Plugins-Manage and Install Plugins
  - search: "OpenLayers" and install
- Web-OpenLayers plugin-Google Maps
  - when loaded, it appears on the left as any layer
- move it as the last layer so that it does not cover your map
- nj_counties-Properties-Style: make transparency say 30perc

# geocoding: address$->$(lat,lon)

- let's say that we have some addresses and we want to geocode them
- `https://sites.google.com/site/adamokuliczkozaryn/gis_int/apartments-for-rent.xls`
  - open, and for simplicity just keep first 10!
- looks reasonably clean, and save as csv

# MMQGIS-Geocode

- MMQGIS-Geocode-Geocode CSV with Google/OpenStreetMap
- it works better if you specify more information
- make sure Address Field, City Field, State Field are right
- make sure notfound.csv is saved where you want
- let's hit ok, it takes like 10sec
- `https://mangomap.com/blog/how-to-make-a-web-map-from-a-list-of-addresses-in-a-spreadsheet/`
- if goog complains, try the other one, or get goog API key, cheap
-
- btw, if already got X/Y lat/lon: just add your csv with "Add Delimited Text Layer" tool

## important to check!

- see notfound.csv: mostly those with a range of street numbers
- need to fix them/adjust them:
  - to check can just google them and see if you get a clean hit
- check location on OpenLayers
  - does it make sense? houses in river or park?
  - zoom-in to street, click some points with "identify tool": pop-up address–does it match with the street?
  - usually some miscodings, say few percent
  - usually because the address is misspelled or incomplete

# MMQGIS: combining layers

- there was a question about how to combine layers
- MMQGIS-Combine-Merge layers
  - just make sure all are same type (polygon, line, point)
  - [do at home, say save as NJ into pieces and then combine]
  - [should also be able to merge overlying layers]
- more info on combining layers: `http://gis.stackexchange.com/questions/25061/how-to-merge-multiple-layers-to-one-layer-using-qgis`
  - `http://www.statsilk.com/maps/merge-multiple-map-layers-single-shapefile-using-quantum-gis`
  - `http://www.igismap.com/merge-two-shapefile-qgis/`

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# Select features using an expr (next to select tools)

- `regexp_match("COUNTY",'C.*N')`
  - there is 'C', some chars '.*' , 'N'
- `regexp_match("COUNTY",'^C.*N')`
  - must start with 'C'
- `regexp_match("COUNTY",'^C.*N$')`
  - must start with 'C' and end with 'N'
- "REGION" = 'CENTRAL'
  ("Load values" "all unique" to see levels)
- "REGION" = 'CENTRAL' AND "POP2010" > 598349

## replace var's values

- sometimes have to do it, but these things should be coded!
- write program in Stata, Py, etc for that
- and use qgis just for exploring, viewing, visualization
- don't point-and-click to change data!
- [so skip the following; shown just for reference]
- nj counties-Open attribute table
- and toggle editing (pen at the top left)
- and make few POPDEN1980 NULL (just del val)
- Open Field Calculator: Update existing: "POPDEN1980"
- case when "POPDEN1980" is NULL then '999' else "POPDEN1980" end
- it's picky! have double quotes and single quotes that way
- btw, right-click layer 'Save as' and can do csv :)

# Dissolve

- Plugins-Manage and Install Plugins-Dissolve With Stats
- and dissolve on REGION

# Simplify Polygons

- simplifying polygons/lines means dropping vertices, so that they're defined by fewer coordinates
- reduces size of a file
- Vector-Geometry tools-Simplify Geometries
  - Input: 'nj_counties'
- you can play with "tolerance" to simplify as much as needed
  - 1000 is fine; but 10,000 destroys NJ :(

# Centroids

- calculate a center of a polygon or turn polygon into a point
- Vector-Geometry tools-Polygon centroids
- the new shapefile will have the same data!
- can now map another variable as point
- can map both points and polygons with some symbology!
- let's map population for polygons
  - and population density for points
  - note: make points bigger to see symbology well
- this solves the problem of showing 2 vars in one map

# Buffering: applications

- kind of opposite of centroids:
  make point into polygon (circle)
- why?
  - sex offenders and schools
  - liquor stores and schools
  - waste processing plants and houses
  - 2-mile heavy pollution around hwy
  - walkability to healthy stores, etc
- really many applications!

# keep it simple and clean

- best close qgis and fire up again
  - too much stuff in it and things go wrong!
  - like i was getting buffers that look like elipsoid and distance was off as compared to measeure line tool
  - in qgis, always try to keep everything simple!
  - if things go wrong, close it, and start over super simple!

# load schools and create buffer

- `https://sites.google.com/site/adamokuliczkozaryn/gis_int/hsip_colleges.zip`
- but first right click layer-Properties-Metadata
  - scroll down and you will see "ft"–that's map units
- Vector-Geoprocessing Tools-Fixed Distance Buffer
- do 10k (it's in map units, ie ft); segments: like 50
- next to selection tools there's measure line tool
  - and convince yourself that radius is 10k ft
  - (make sure you have ft selected!)

# now get contaminations and count poi in poly

- https://docs.google.com/uc?id=1T_n1y_Mj5yQiWpZwrbuuFFwmIVJ2QWFZ&export=download
- Vector-Analysis Tools-Count points in polygon
  - Polygons: buffer
  - Points: New Jersey Contaminated Sites
- it created new layer–open attribute table
  - go the the last col, NUMPOINTS, and click header to sort
- highlight 1st one, and zoom to it to check, yeah, just one
- highlight the last one; tought to see
  - bring in goog maps and zoom in onto Jersey City
  - the armpit of the US

# other ideas about selection

- eg famous Londons well map or Fergusson killing
  - the closer to it, the stronger the effect
  - can just select U/As by radius!
- can use Select tool to select obs in radius
- and then save slection say as csv
- and then draw a bigger radius and save as those little further etc

# student presentations

- Lori, Patrice, Kristin/Michelle, Shauna
- Q&A

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# a tip of the week...

- get yourself a hi-res screen (if you don't have one yet)
- it immensely helps working with any research, especially gis
- it's just 150$ or so
- 2560 x 1080 or larger would do, say `https://www.newegg.com/Product/Product.aspx?Item=N82E16824025340`
- what maters is # of pixels not so much size of the screen!

## workflow

- save the whole project (with many layers) and next time just open it
  - (again, dont rename, move shapefiles around–it'd break things)
- can move layer up/down in layer window
  - and can turn it on and off
- can have many layers with say different symbology of the same shapefile
- example–let's load nj_counties and produce several different symbologies and save whole project...and open it

# misbehaving software

- most of the software sometimes misbehaves...
  - it does silly things, refuses to do something, crashes, etc
- troubleshooting:
  - email me
  - do what you are doing in a different way-e.g try different dataset; different var; different approach etc (usually can do same thing in many ways)
  - shut it down and fire it up again
  - reinstall

# don't trust anybody! not even yourself

- remember, always be critical
- triangulate your results: compare with other source
- google for similar maps to check with others!
  - use them to double check, and get inspiration

# google MAPS

- google and see images, say: 'nj counties contamination sites' `https://www.google.com/search?q=nj+counties+contamination+sites&tbm=isch`
- or "Philadelphia healthy stores map" (sometimes need word 'map' otherwise get pics of healthy food)
  - `https://www.google.com/search?q=philadelphia+healthy+stores+map&tbm=isch`
- get ideas, inspiration from these googled maps
- still, usually the key to success is to join great data!
  - innovative/new: eg twitter, flickr, etc
  - innovative/new join: lead-crime; pools/guns-baby deaths, etc

# google DATA

- can't overestimate the usefulness of goog for finding data
- so easy! "what you are looking for, shapefile"
- eg "new jersey public schools, shapefile"
- eg "nj school districts shapefile"
- tips:
  - may need to look for a higher level
  - eg NJ schools instead of Depford Twshp schools
- if you cannot find it, contact govt
  - eg city of Camden, state of NJ, etc
- again, may find only traditional data and need to join with gis data

# flip the class

- flip the class
- tomorrow: google maps and will try to start Py, exciting!

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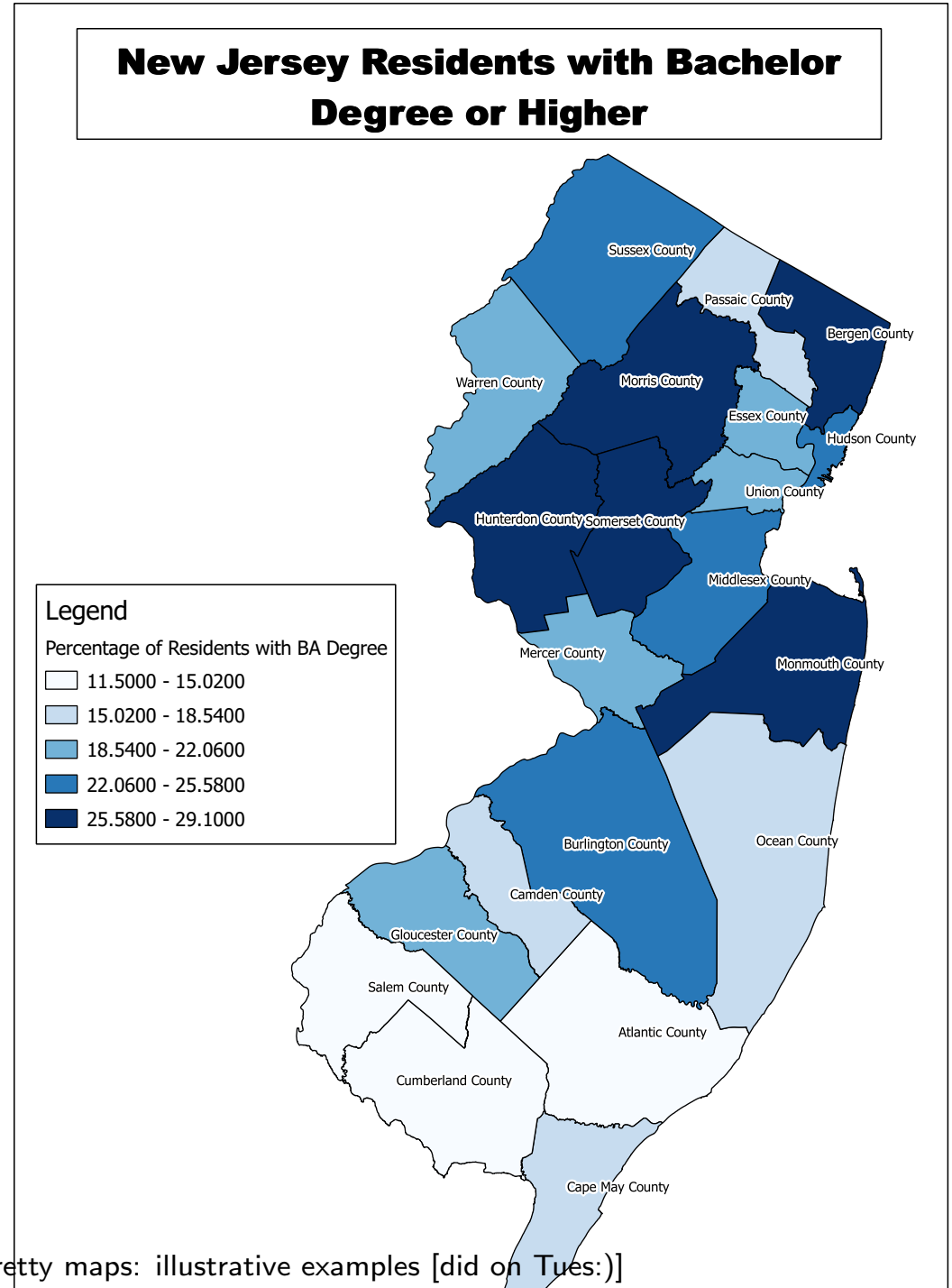
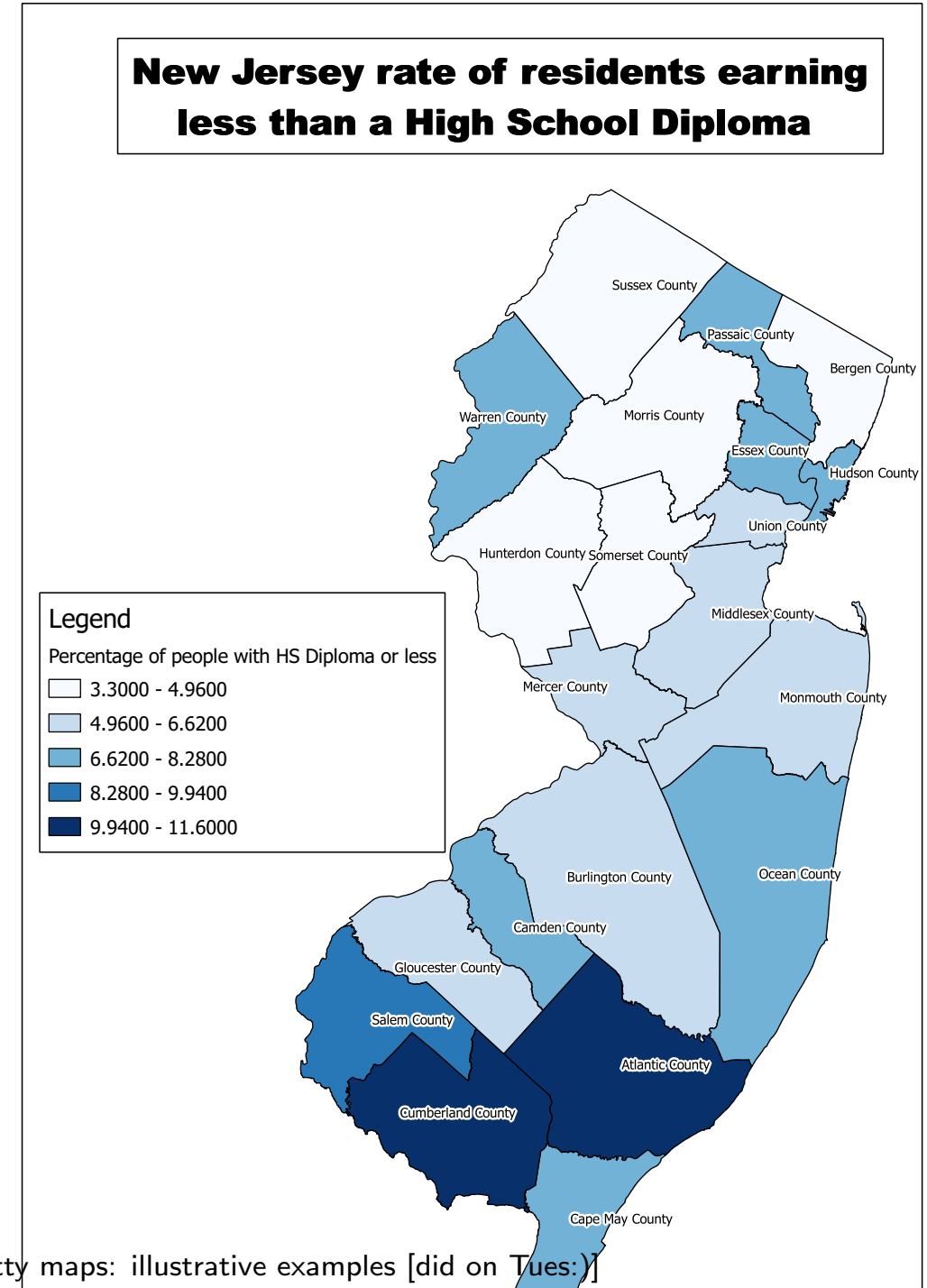
# so what? geography matters!

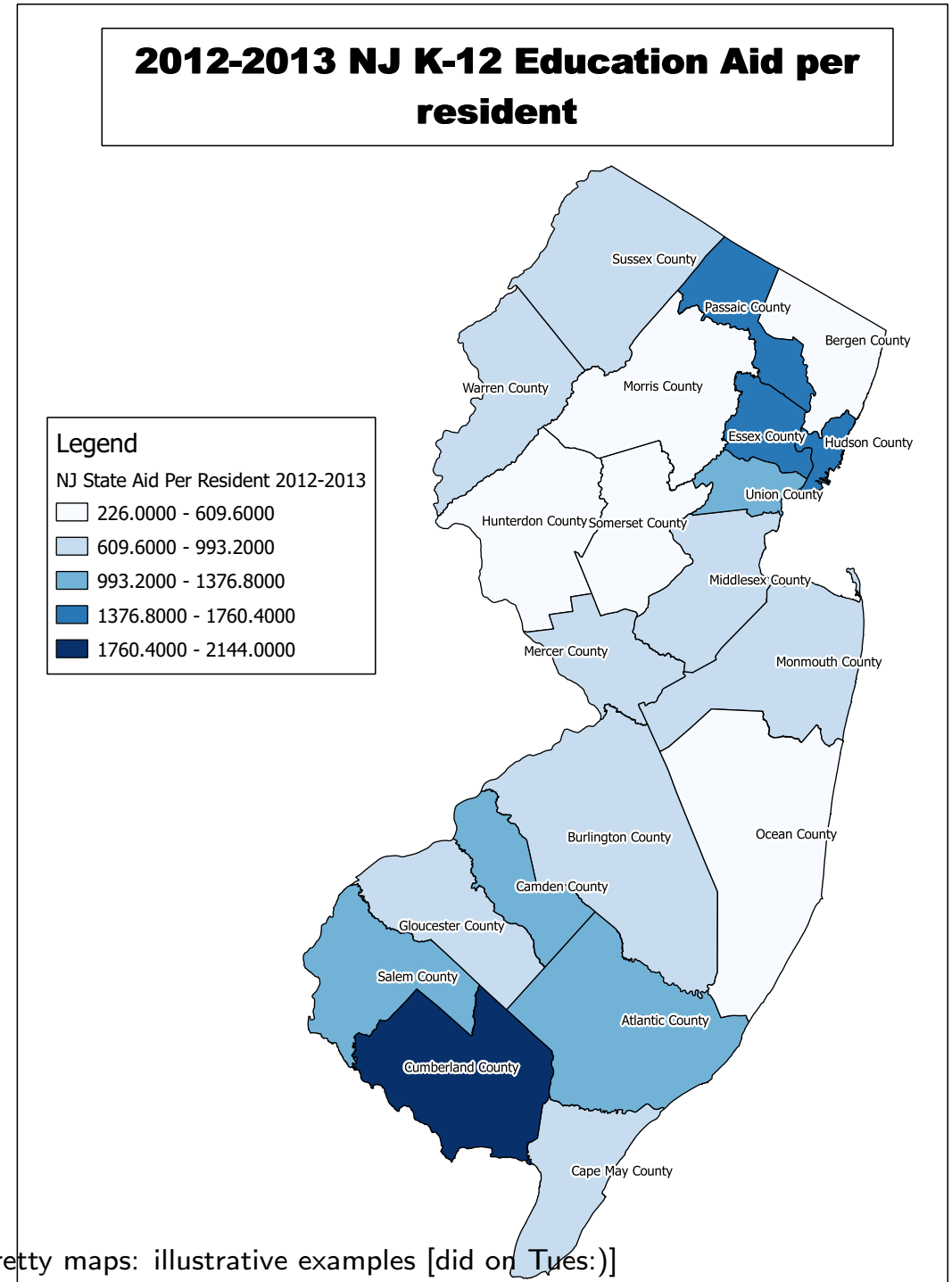
- with maps you get insight you won't get otherwise
- oftentimes all you have to do is to map it
  - and think **a lot** about what you have mapped
  - and what it really means
  - eg Dick De Veaux: faulty devices around Rocky Mountains
  - eg Cooper's Hospital dr Brenner: map ER visits home addresses

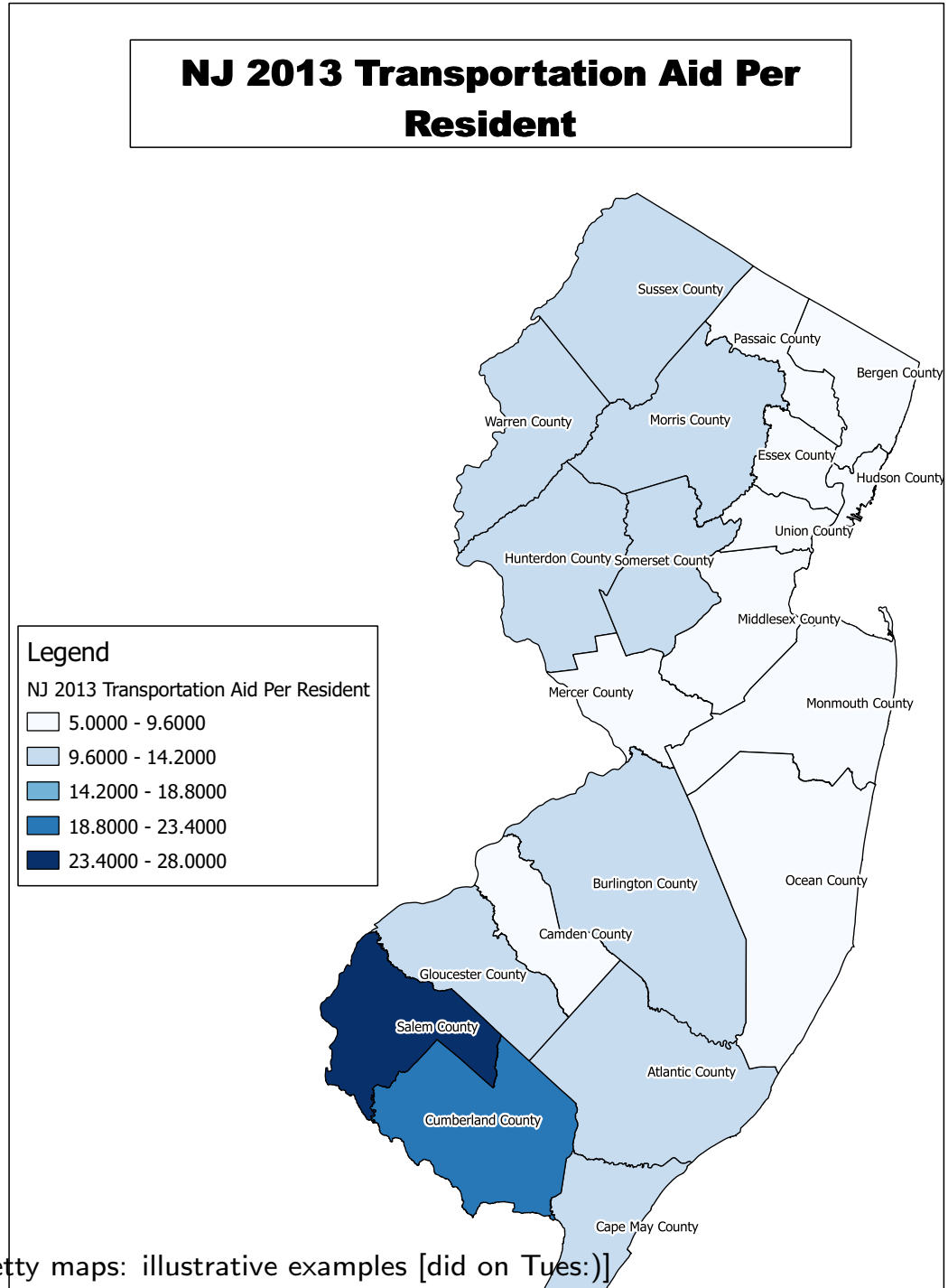
# NJ counties: education-related stuff

- one way to go about mapping is to have many maps on related things
- so you tell a story with related variables
-
- variables about same topic: education
- good use of space
- nice color ramp
- good fonts, maybe title little smaller
- fewer decimal points!
- could list data source (but may do it elsewhere, say in paper)


New Jersey Residents with Bachelor Degree or Higher
Legend
Percentage of Residents with BA Degree
11.5000 - 15.0200
15.0200 - 18.5400
18.5400 - 22.0600
22.0600 - 25.5800
25.5800 - 29.1000
Sussex County
Passaic County
Bergen County
Warren County
Morris County
Essex County
Hudson County
Union County
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
Burlington County
Ocean County
Camden County
Gloucester County
Salem County
Atlantic County
Cumberland County
Cape May County

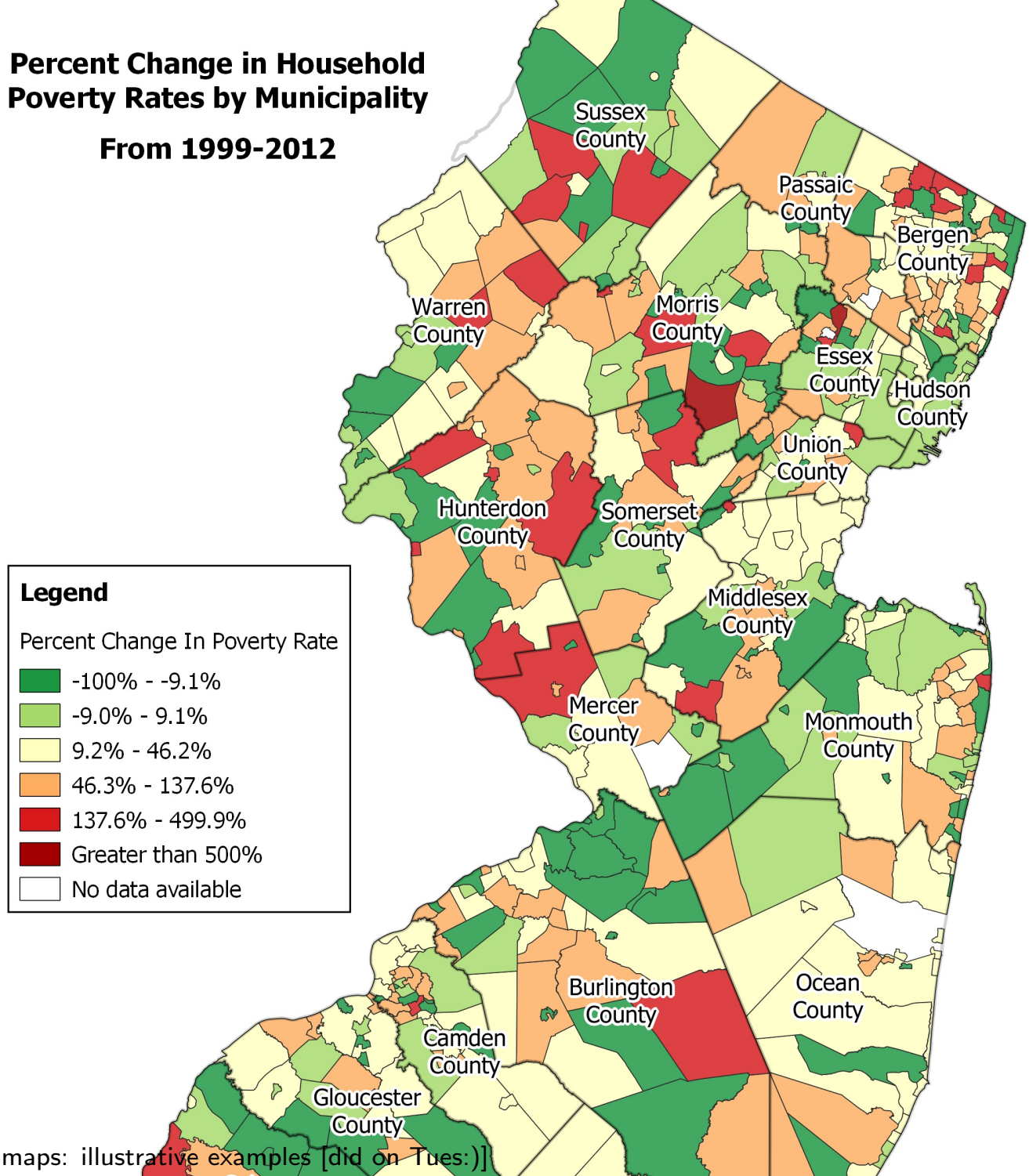

New Jersey rate of residents earning less than a High School Diploma
Legend
Percentage of people with HS Diploma or less
3.3000 - 4.9600
4.9600 - 6.6200
6.6200 - 8.2800
8.2800 - 9.9400
9.9400 - 11.6000
Sussex County
Passaic County
Bergen County
Warren County
Morris County
Essex County
Hudson County
Union County
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
Burlington County
Ocean County
Camden County
Gloucester County
Salem County
Atlantic County
Cumberland County
Cape May County


2012-2013 NJ K-12 Education Aid per resident
Legend
NJ State Aid Per Resident 2012-2013
226.0000 - 609.6000
609.6000 - 993.2000
993.2000 - 1376.8000
1376.8000 - 1760.4000
1760.4000 - 2144.0000
Sussex County
Passaic County
Bergen County
Warren County
Morris County
Essex County
Hudson County
Union County
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
Burlington County
Ocean County
Camden County
Gloucester County
Salem County
Atlantic County
Cumberland County
Cape May County

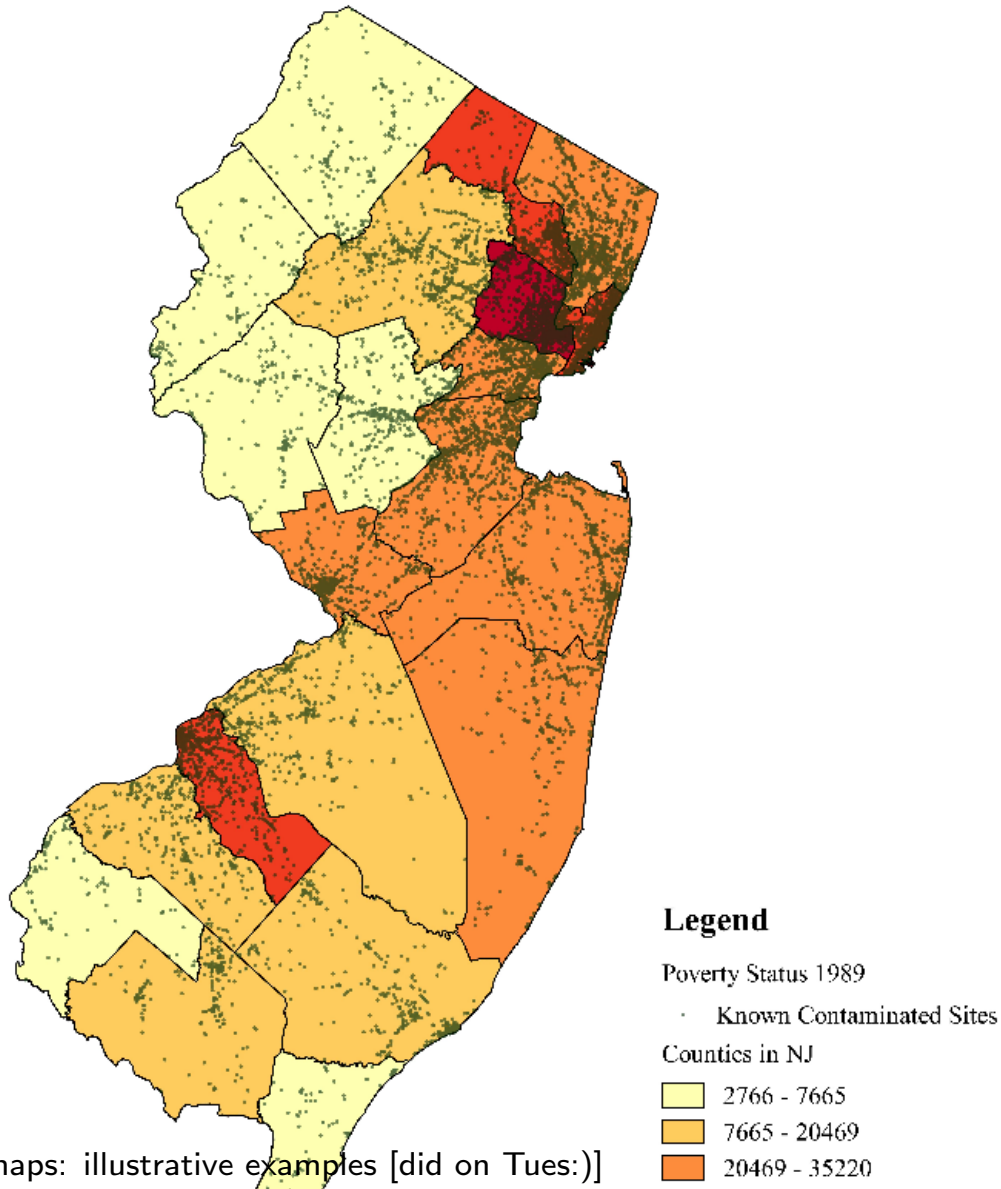

NJ 2013 Transportation Aid Per Resident
Legend
NJ 2013 Transportation Aid Per Resident
5.0000 - 9.6000
9.6000 - 14.2000
14.2000 - 18.8000
18.8000 - 23.4000
23.4000 - 28.0000
Sussex County
Passaic County
Bergen County
Warren County
Morris County
Essex County
Hudson County
Union County
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
Burlington County
Ocean County
Camden County
Gloucester County
Salem County
Atlantic County
Cumberland County
Cape May County

# poverty change in NJ (South cut to display detail)

- another way to go about mapping is to produce one dense powerful map–the one map that tells the full story
-
- nice title, we know timeframe
- love 2 color ramp (say red-green) to signal bad-good
- legend: note decimal points; distinct white for missing
- perhaps use white borders for municipalities–little cleaner
- fascinating!: such big disparities so close to each other


Percent Change in Household Poverty Rates by Municipality
From 1999-2012
Sussex County
Passaic County
Bergen County
Warren County
Morris County
Essex County
Hudson County
Union County
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
Burlington County
Ocean County
Camden County
Gloucester County
Legend
Percent Change In Poverty Rate
-100% - -9.1%
-9.0% - 9.1%
9.2% - 46.2%
46.3% - 137.6%
137.6% - 499.9%
Greater than 500%
No data available

# Contaminations Sites in New Jersey 1992



# NYT examples and other media

- https://www.nytimes.com/interactive/2014/10/29/upshot/obamacare-who-was-helped-most.html?_r=0
- 
- http://www.nytimes.com/interactive/2015/07/08/us/census-race-map.html?_r=0

  http://www.nytimes.com/newsgraphics/2014/01/05/poverty-map/?ref=multimedia

  http://www.nytimes.com/2016/09/13/upshot/the-most-detailed-map-of-gay-marriage-in-america.html https://www.wired.com/2013/08/how-segregated-is-your-city-this-eye-opening-map-shows-you/

- https://flowingdata.com/ has great examples vioty

# more examples: what is a pretty map?

- pretty maps:
  http://gis.stackexchange.com/questions/3083/what-makes-a-map-beautiful
  http://grindgis.com/blog/9-beautiful-maps-that-you-would-like-to-see
  http://gisgeography.com/most-beautiful-weather-maps/
- ugly maps: http://gis.stackexchange.com/questions/3087/what-makes-a-map-be-classed-as-badly-designed
  - this one looks like vomit
    http://i.stack.imgur.com/3hBTV.jpg
- some inspiring examples http://twistedsifter.com/2013/08/maps-that-will-help-you-make-sense-of-the-world/

## thanks!

- tomorrow google maps–make sure you have goog acct (as for gmail, goog calendar etc)
- MARKETING: building quant lab at 321 Cooper–stop by in a month!

# outline

thematic (choropleth) maps

categorical vars, heatmaps, goog maps, geocoding

SQL/regexp and geo-processing/tools

tips and tricks!

pretty maps: illustrative examples [did on Tues:)]

references

# VisionZ; probably most useful!; watch them

- the whole thing https://www.youtube.com/watch?v=KjvFil3o4y8&list=PLNCPalajQvg7wQvzf3fM8fOZ5lMKl86Q4
- 01 - open and view data

  https://www.youtube.com/watch?v=KjvFil3o4y8&list=PLNCPalajQvg7wQvzf3fM8fOZ5lMKl86Q4&index=1
- 04 - Working with attributes

  https://www.youtube.com/watch?v=G6UeiGg2Cp8&list=PLNCPalajQvg7wQvzf3fM8fOZ5lMKl86Q4&index=4
- 07 - Basic vector styling

  https://www.youtube.com/watch?v=b-0MQ7dnVJk&index=7&list=PLNCPalajQvg7wQvzf3fM8fOZ5lMKl86Q4
- 03 - print composer

  https://www.youtube.com/watch?v=YnqbC1hkfnk&list=PLNCPalajQvg7wQvzf3fM8fOZ5lMKl86Q4&index=3

# other references

- http://www.youtube.com/results?search_query=qgis

  not sure, any of these useful in particular? email listserv

- pretty good and comprehensive

  http://www.qgistutorials.com/en/

- http://www.qgistutorials.com/en/docs/teach_qgis.html

- Good howto, references
  - http://hub.qgis.org/projects/quantum-gis/wiki/
  - http://hub.qgis.org/projects/quantum-gis/wiki/How_do_I_do_that_in_QGIS

- other (rather lengthy and dry):
  - https://docs.qgis.org/2.8/en/docs/gentle_gis_introduction/
  - https://docs.qgis.org/2.14/en/docs/training_manual/