

basic applied mapping/gis (geographic information systems)

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outline

geoda: thematic (choropleth) maps with joined data

qgis: thematic (choropleth) maps with joined data

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

just few/brave ones: 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)

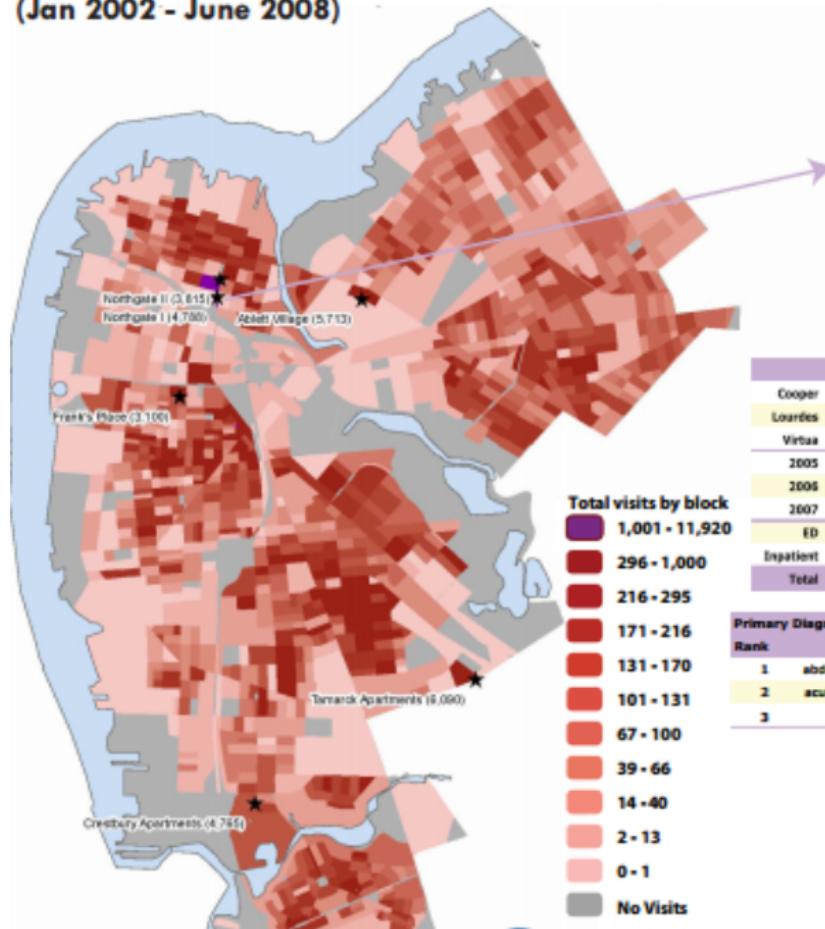
setup

- don't have much time: skip the intros
- we'll be mostly displaying data on maps using colors (thematic/choropleth)

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	\$7,948,899	\$1,038,611	13%
Virtua	805	331	\$1,742,467	\$345,002	20%
2005	838	370	\$10,834,420	\$1,269,373	12%
2006	738	355	\$6,867,999	\$881,549	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	1,070	\$91,735,374	\$6,398,361	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)

...you know what to change.

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=1xJDhcRCkgv7k4tNCa720og5bohV6dTb2&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

ADJUST HERE TO UNZIPPING LOL

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” ≠ “Camden”
- “Camden” ≠ “CAMDEN”
- “08012” ≠ “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

references

- https://geodacenter.github.io/workbook/1_datascience/lab1.html
- just search for 'merge'
- merging in geoda <https://www.youtube.com/watch?v=6ihK4xVTl00>

joining (merging)

- start geoda by searching for it at the bottom-left
- input file: just navigate to nj counties
- Table-Merge: csv: all_homes.csv
- current table key: COUNTY
- import table key: UPPER
- hit ' ' to mv everything to 'Include'
- and hit Merge
 - (accept proposed changes for var names)
- then hit table icon to have a look at the table and compare with input csv

now can map

- Map-Quantile Map-5: 'Dec2012'
- change color for 'undefined': right-click: Color for category...and pick say white
- can pick a basemap, say Carto Light
- right-click-Save image as: map1.png
- keep it open, can have many windows at the same time

and let's map POPDEN2010

- Map: Quantile Map: 5
- Map: Percentile Map
- Map: Equal Intervals: 5
- what differences do you see?
- lets discuss :)

explore more

- Explore-Scatter Plot
 - X: POPDEN2010
 - Y: Dec2012
- and click right most and top most points

- meh guess later! another example: columbus; AND do see my old class on geoda! to see additional geodata stuff that should be useful lol
- advertising: my class, contact info: send students, take my class, hire our students, hire me

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- 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 qgis: thematic (choropleth) maps with joined data

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.ffcic.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-P2Iu0XWWkYAsIn0WCYfqZ15cJya8n&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-1wA2IsRAOPz0&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_DSJQxiUiMVzKdVfHzYjUZSke20nY&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=1xJDhcRCkgv7k4tNCa720og5bohV6dTb2&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!**

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_F0kUE

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/](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

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 measure 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_Mj5yQiWpZrbuuFFwmIVJ2QWFZ&export=download
- Vector-Analysis Tools-Count points in polygon
 - Polygons: buffer
 - Points: New Jersey Contaminated Sites
 - it created new layer—open attribute table
 - go to 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; tough 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 selection 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 matters 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&tbo=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&tbo=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!

outline

geoda: thematic (choropleth) maps with joined data

qgis: thematic (choropleth) maps with joined data

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

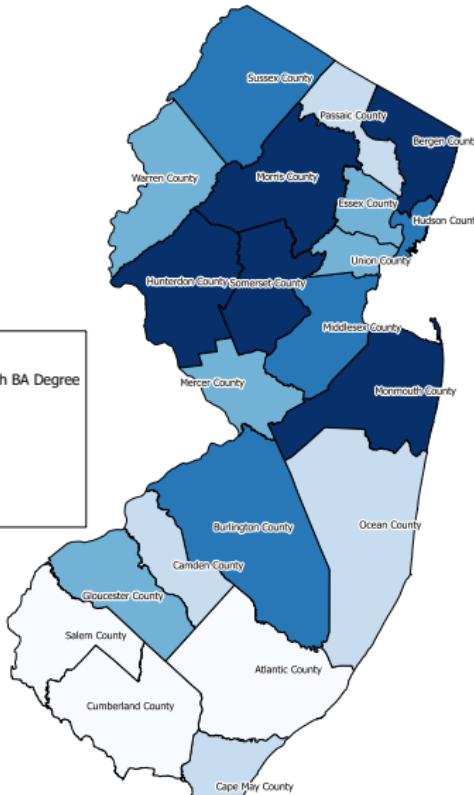
so what? geography matters!

- 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 Vaux: 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

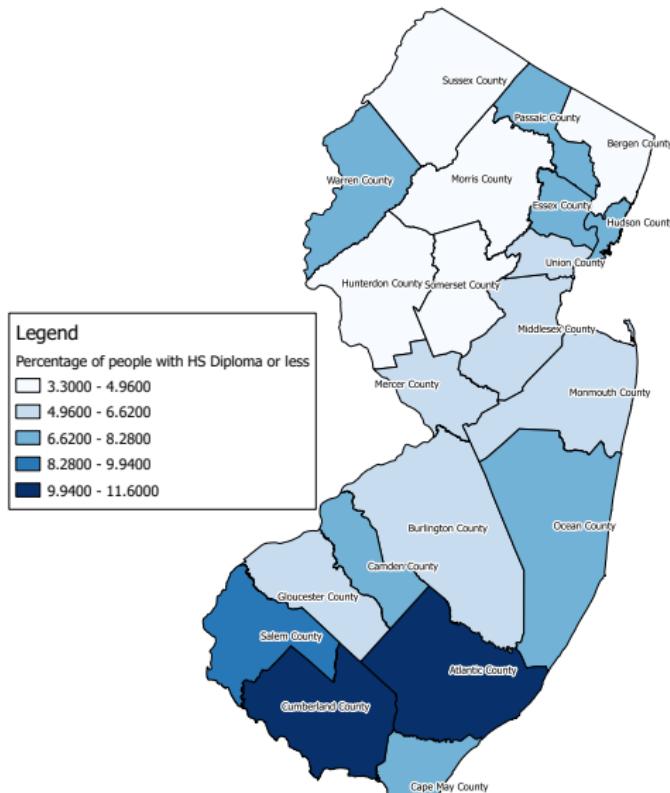


Legend

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

New Jersey rate of residents earning less than a High School Diploma

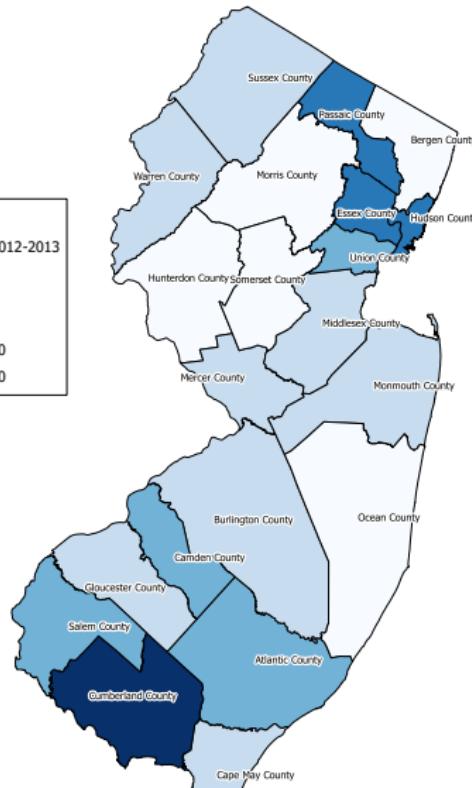


2012-2013 NJ K-12 Education Aid per resident

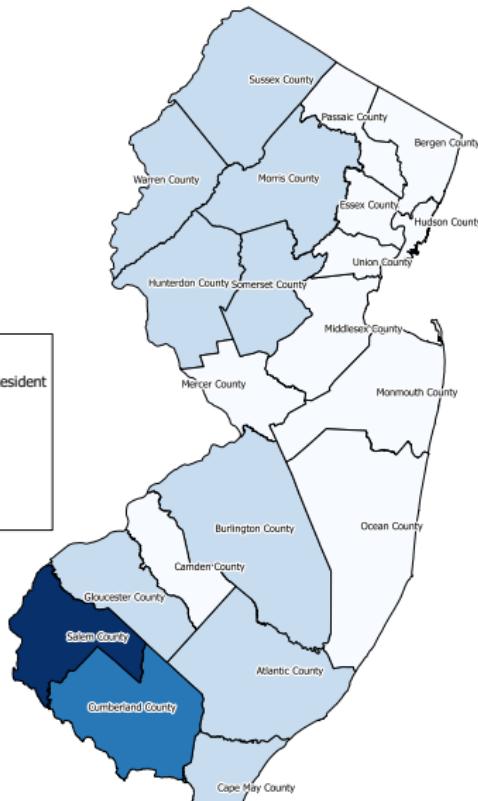
Legend

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



NJ 2013 Transportation Aid Per Resident



Legend

NJ 2013 Transportation Aid Per Resident

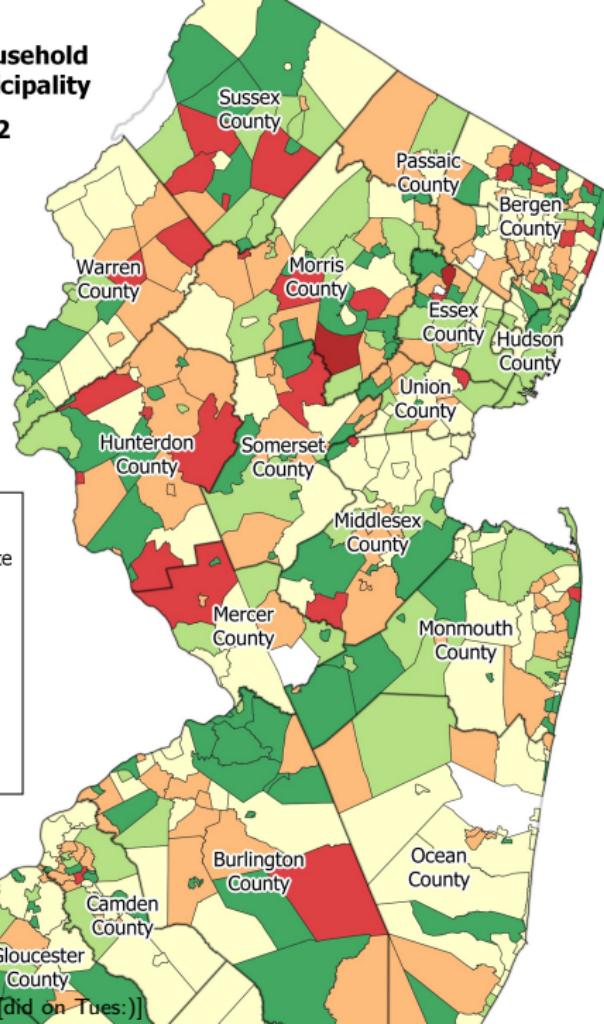
- 5.0000 - 9.6000
- 9.6000 - 14.2000
- 14.2000 - 18.8000
- 18.8000 - 23.4000
- 23.4000 - 28.0000

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

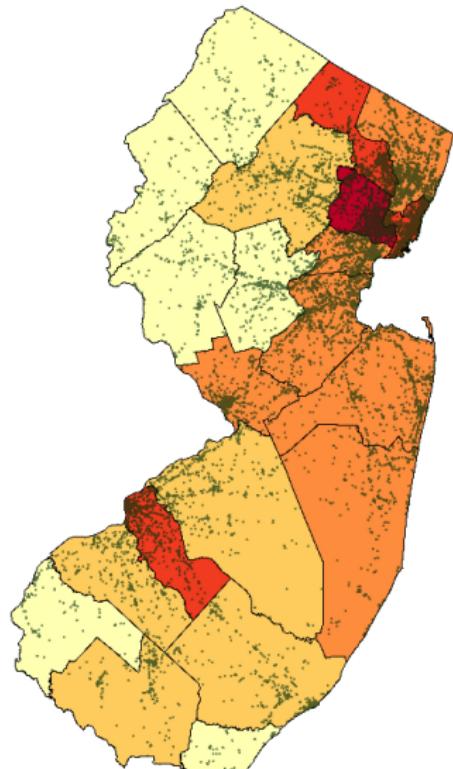


Legend

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



Legend

- Poverty Status 1989
- Known Contaminated Sites
- Counties in NJ
- 2766 - 7665
 - 7665 - 20469
 - 20469 - 35220

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://twistsifter.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!

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references

VisionZ; probably most useful!; watch them

- the whole thing <https://www.youtube.com/watch?v=KjvFil3o4y8&list=PLNCPalajQvg7wQvzf3fM8f0Z51MK186Q4>
- 01 - open and view data
<https://www.youtube.com/watch?v=KjvFil3o4y8&list=PLNCPalajQvg7wQvzf3fM8f0Z51MK186Q4&index=1>
- 04 - Working with attributes
<https://www.youtube.com/watch?v=G6UeiGg2Cp8&list=PLNCPalajQvg7wQvzf3fM8f0Z51MK186Q4&index=4>
- 07 - Basic vector styling
<https://www.youtube.com/watch?v=b-0MQ7dnVJk&list=PLNCPalajQvg7wQvzf3fM8f0Z51MK186Q4&index=7>
- 03 - print composer
<https://www.youtube.com/watch?v=YnqbC1hkfnk&list=PLNCPalajQvg7wQvzf3fM8f0Z51MK186Q4&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/