Intro to IPUMS NHGIS

Geographic U.S. Census Data from 1790 to the Present

Jonathan Schroeder
Dave Van Riper

IPUMS Webinar Series – November 9, 2018

University of Minnesota
IPUMS
MPC
Minnesota Population Center

Webinar plan

1. What is IPUMS NHGIS?
2. Basic walkthrough
3. How does NHGIS differ from alternatives?
4. Highlights: block data, time series tables
5. Q&A / Guided website tour

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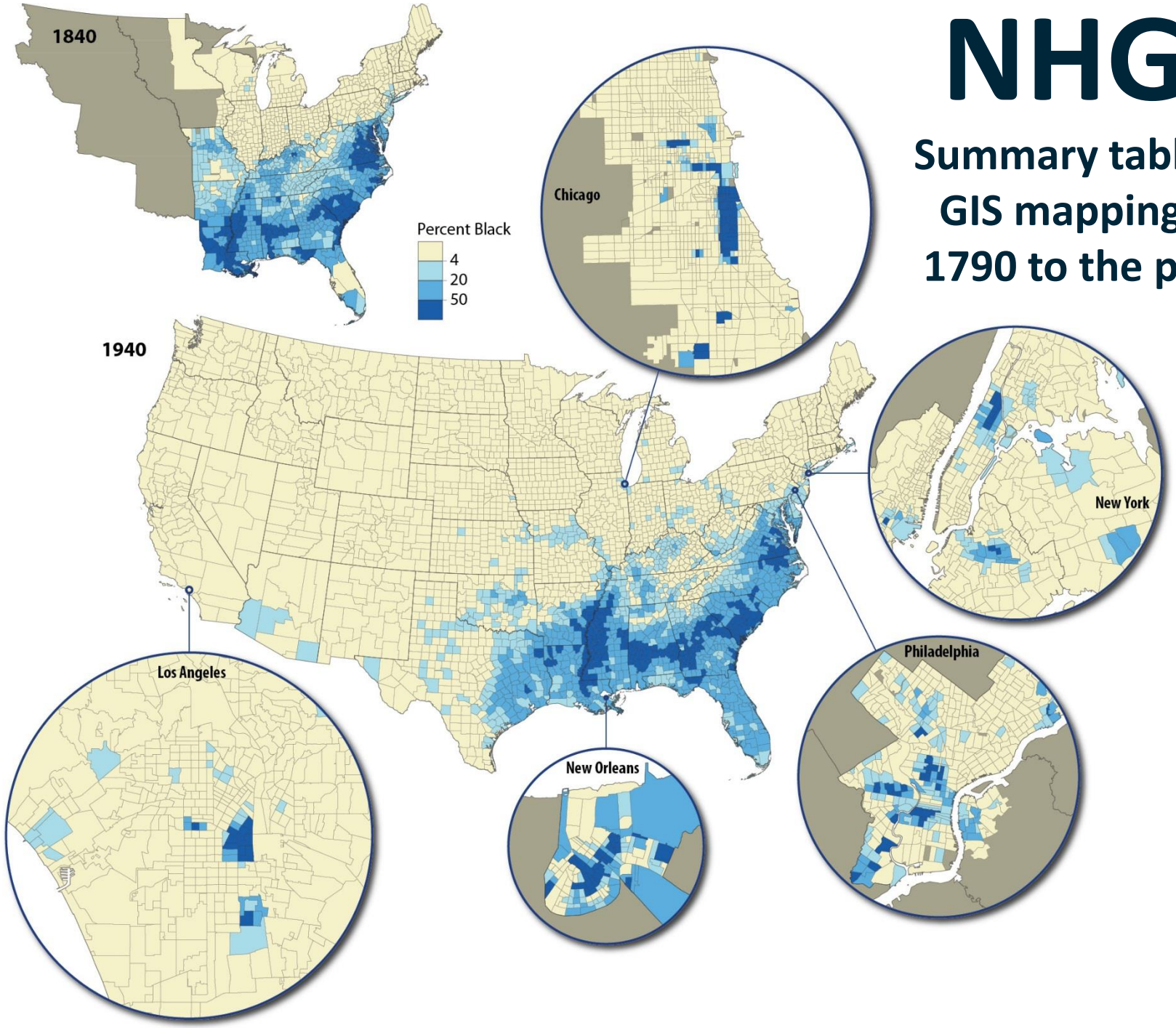


NHGIS

Summary tables *and* GIS mapping files, 1790 to the present

Observation units of census data

Microdata: *Respondents*

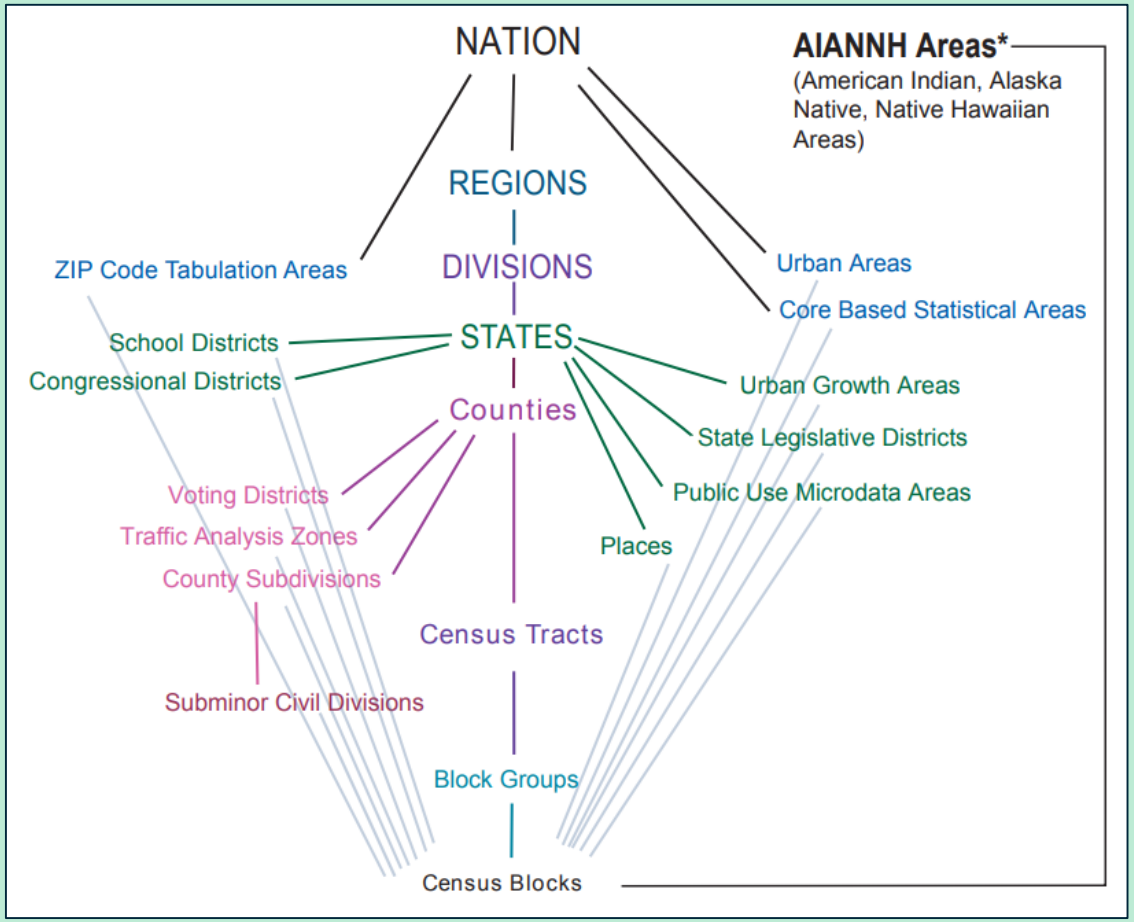
Households

|

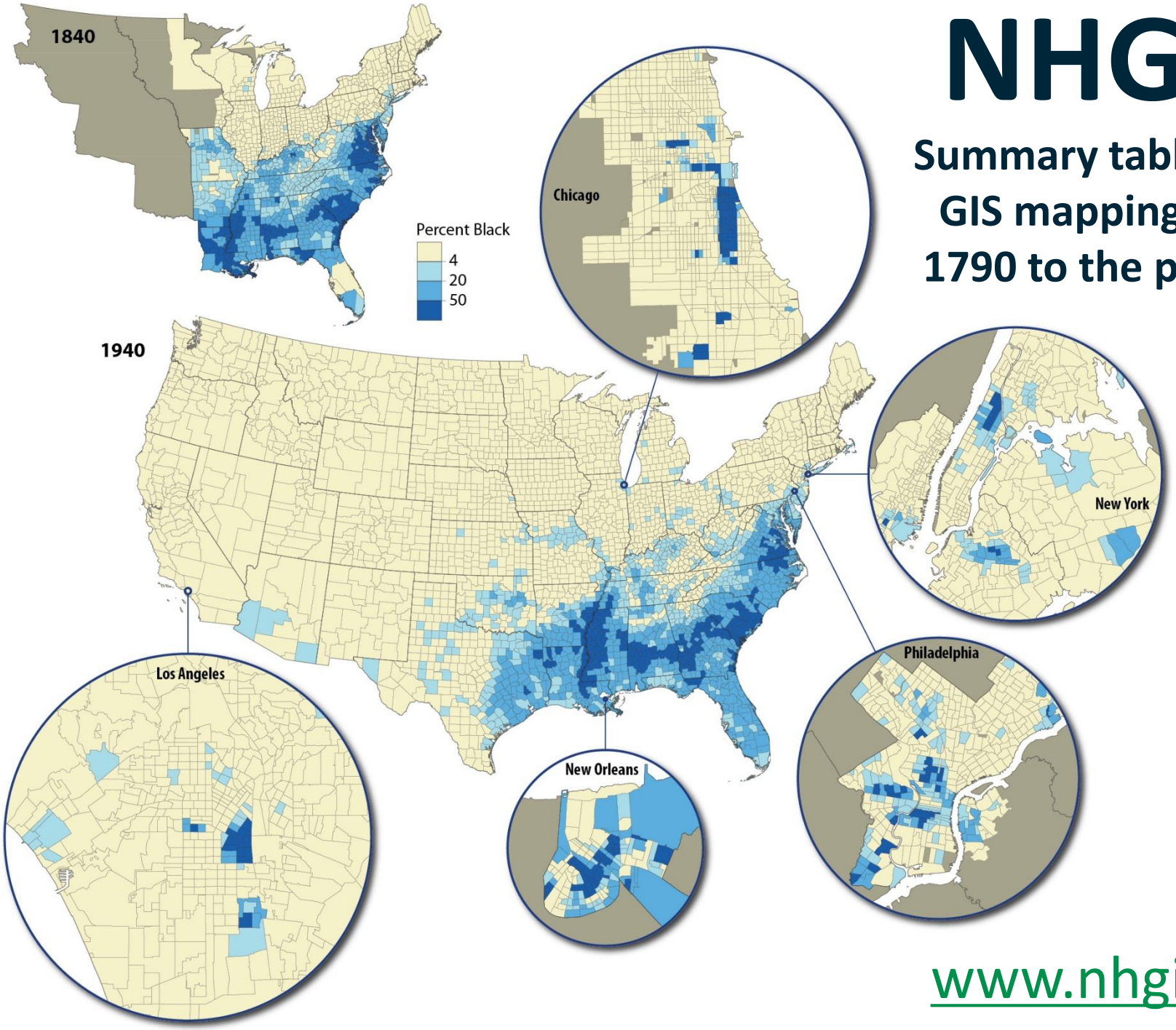
Persons

+ Flexible classification, modeling & cross-tabulation
- Restricted geographic detail
- Limited sample sizes

Geographic summary data: *Areas*



https://www.census.gov/geo/reference/hierarchy.html



NHGIS

Summary tables *and* GIS mapping files, 1790 to the present

www.nhgis.org

Basic walkthrough…

In web browser, use NHGIS website to find & download data tables and GIS files needed to map Percent Black in 1940 census tracts.

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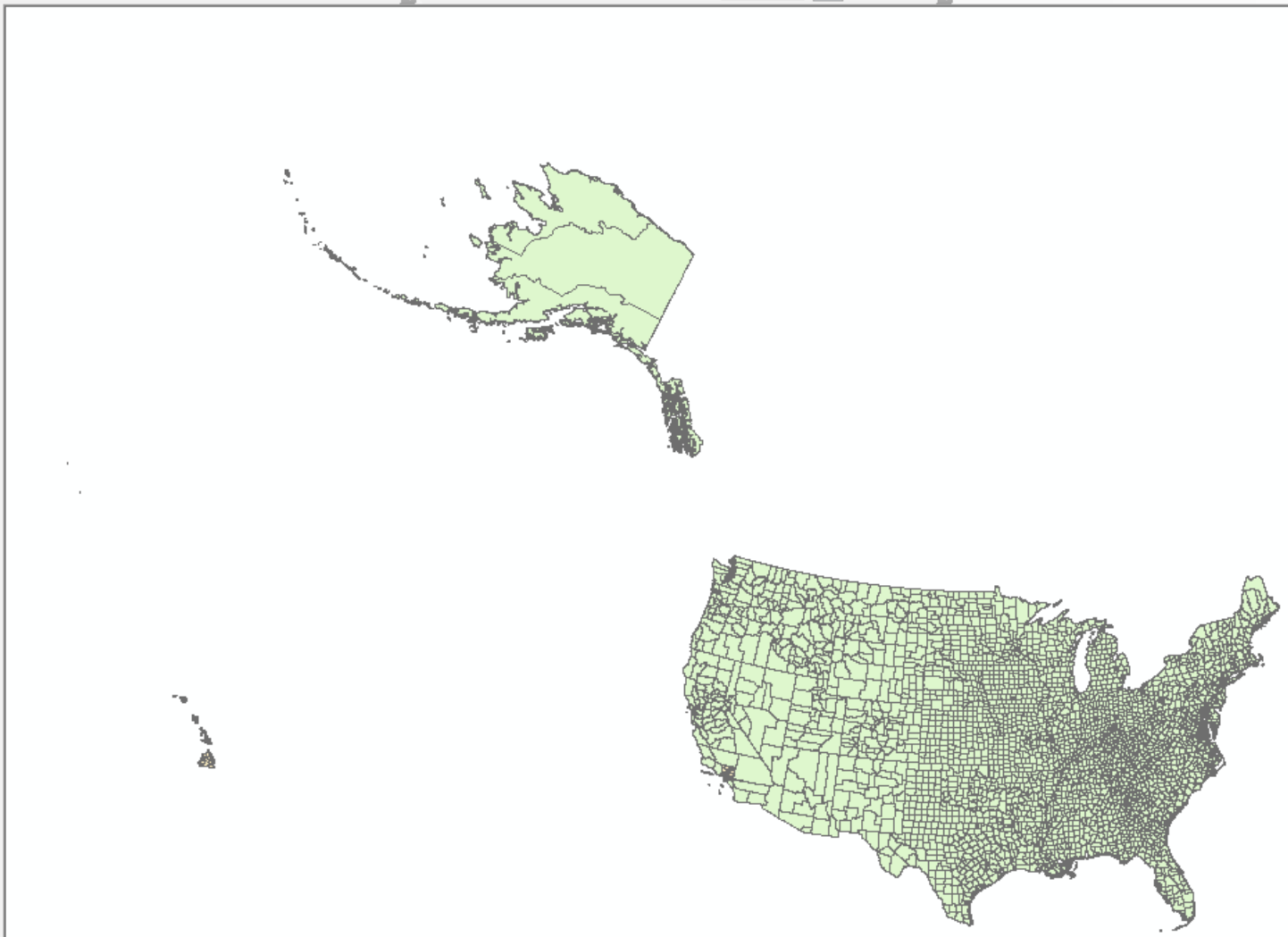
- US_county_1940



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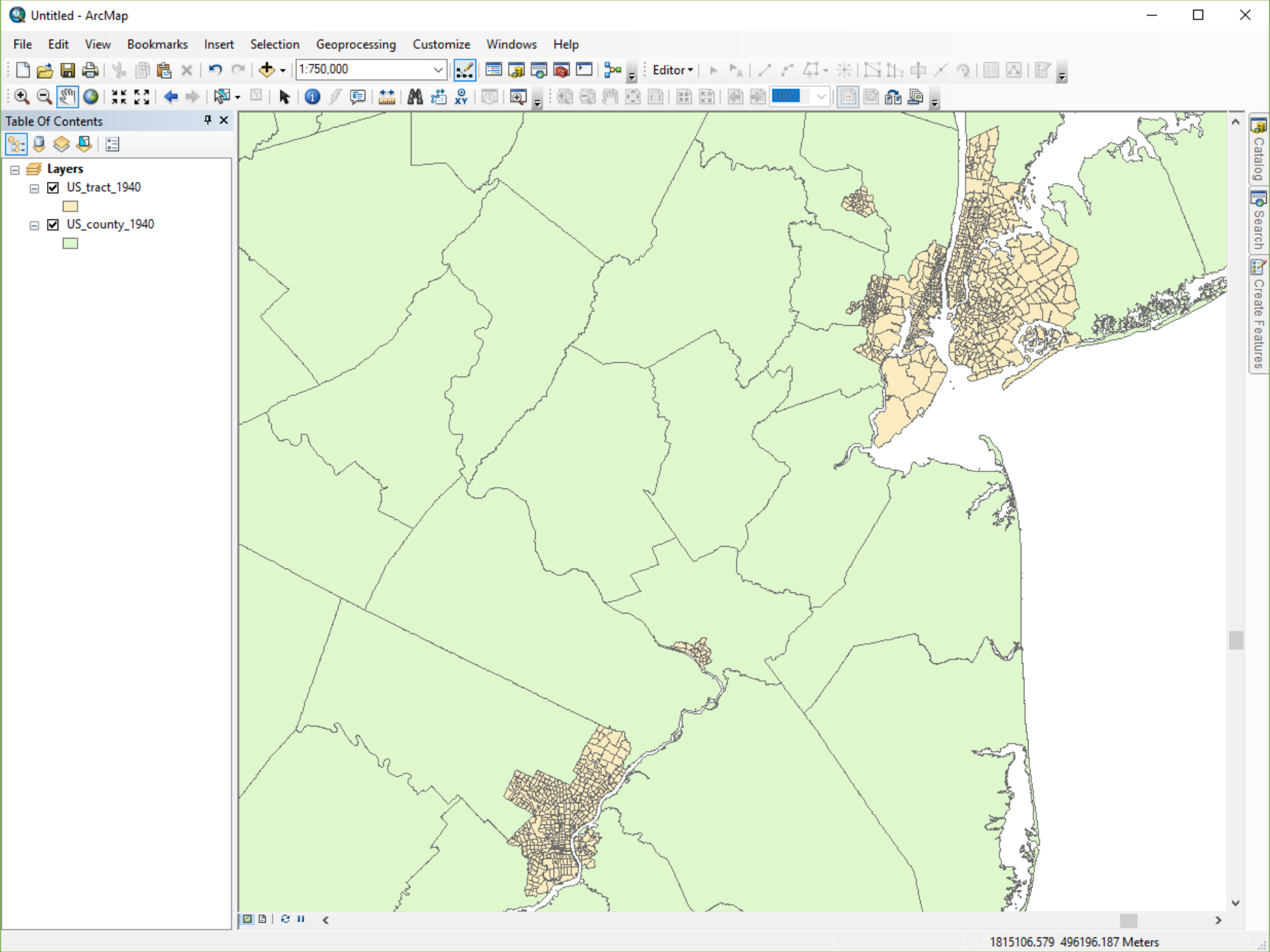
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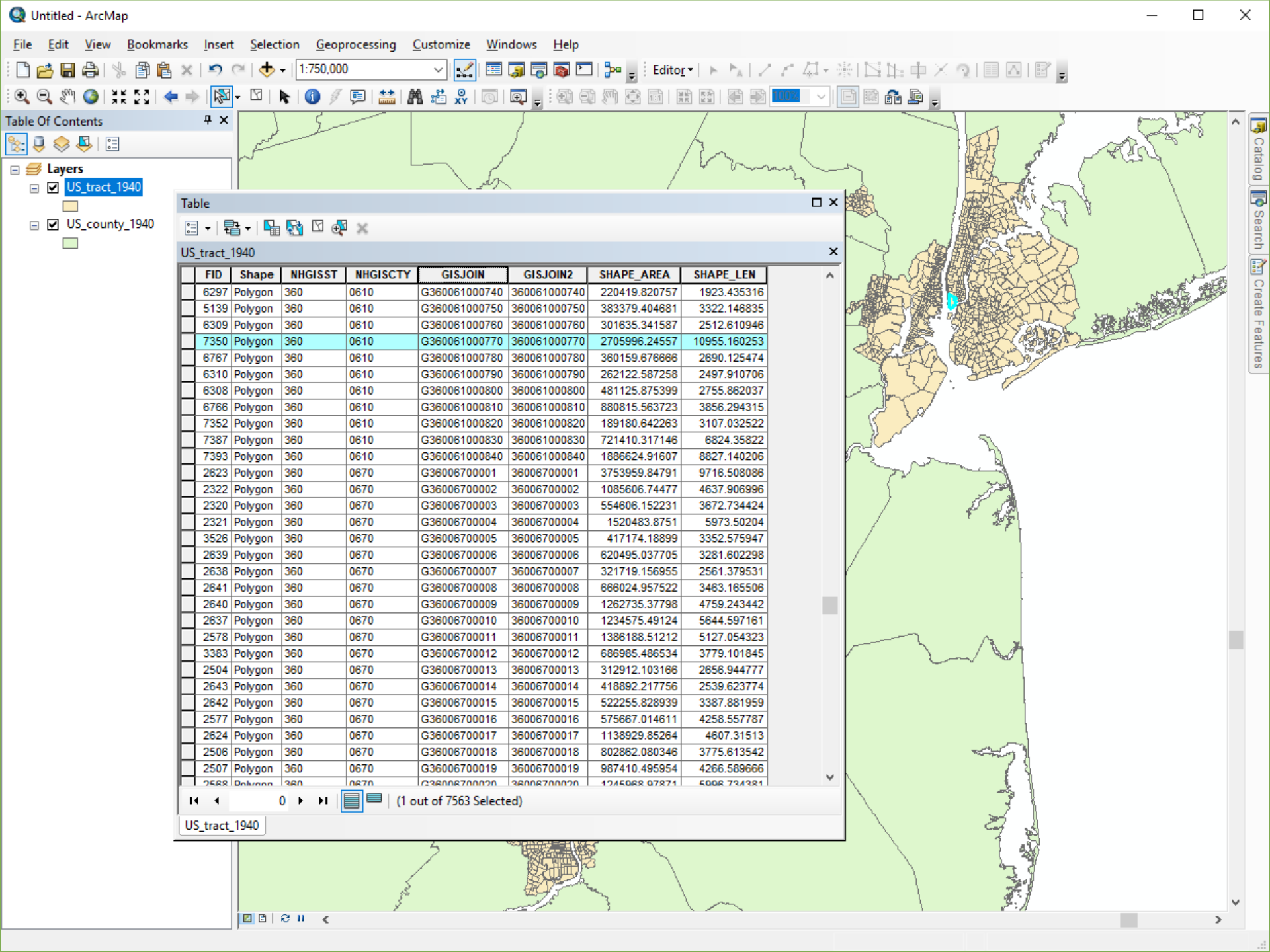
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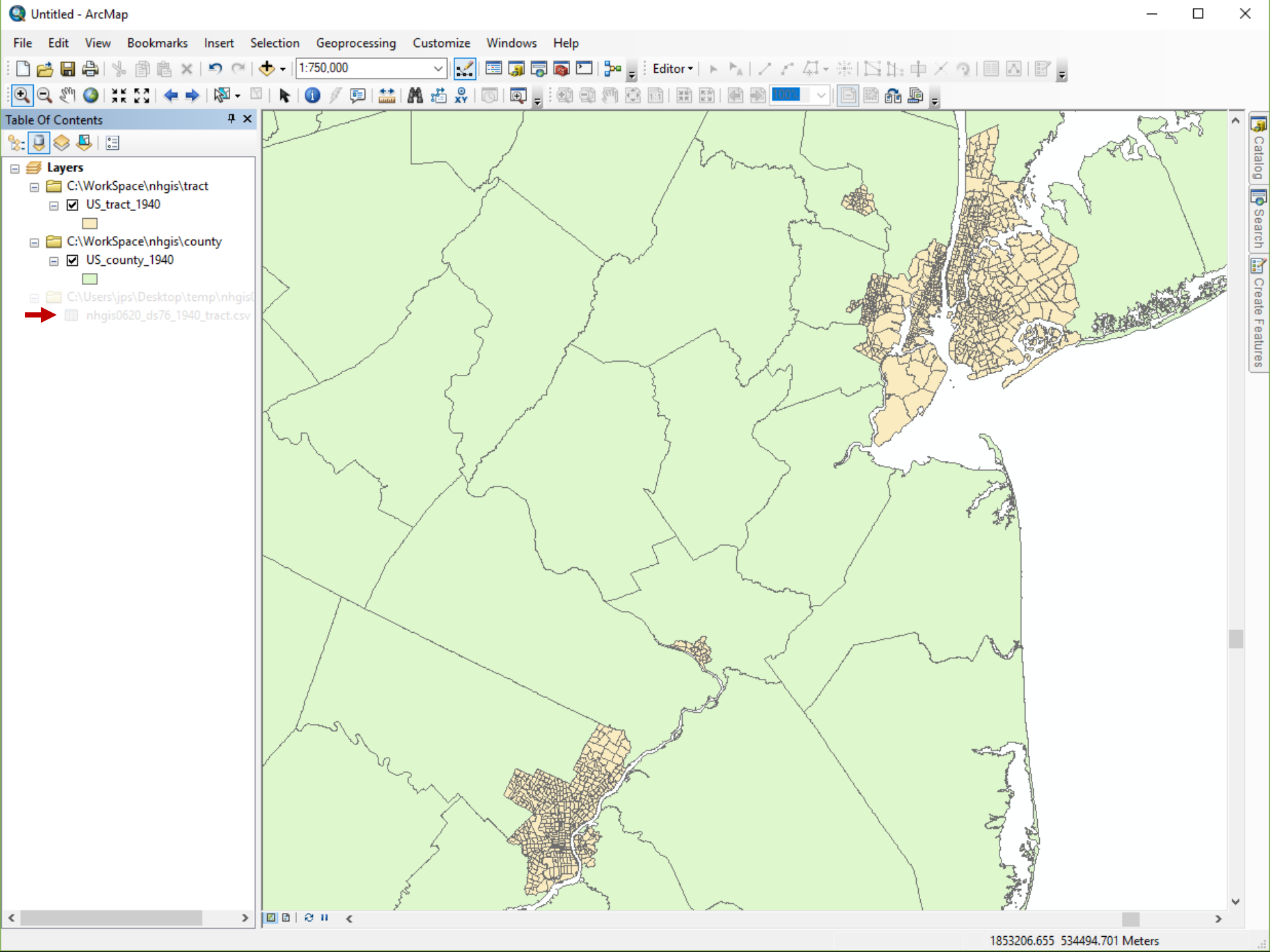
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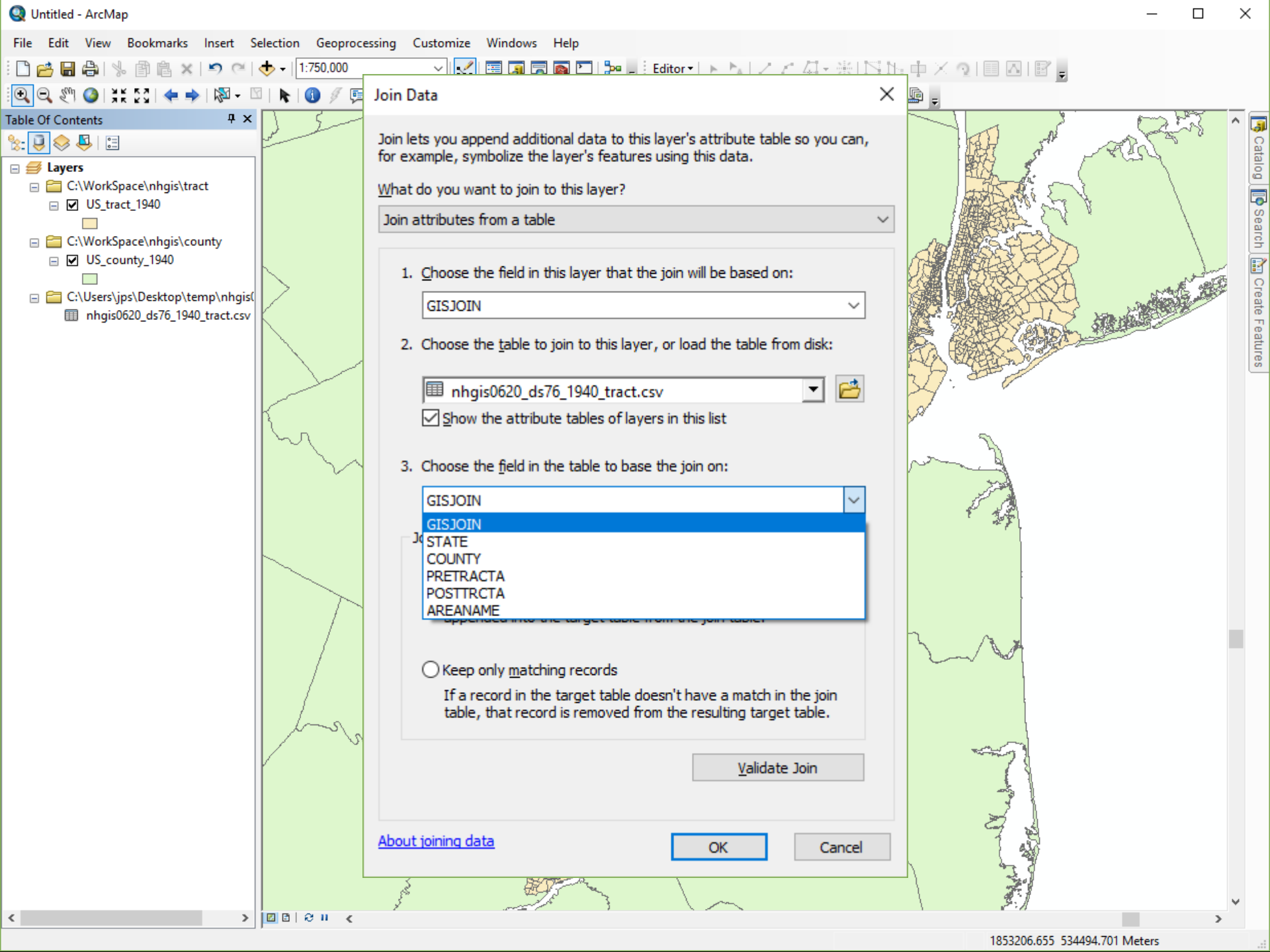
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Join Data
Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.
What do you want to join to this layer?
Join attributes from a table
1. Choose the field in this layer that the join will be based on:
GISJOIN
2. Choose the table to join to this layer, or load the table from disk:
nhgis0620_ds76_1940_tract.csv
Show the attribute tables of layers in this list
3. Choose the field in the table to base the join on:
GISJOIN
GISJOIN
STATE
COUNTY
PRETRACTA
POSTTRCTA
AREANAME
Keep only matching records
If a record in the target table doesn't have a match in the join table, that record is removed from the resulting target table.
Validate Join
About joining data
OK
Cancel
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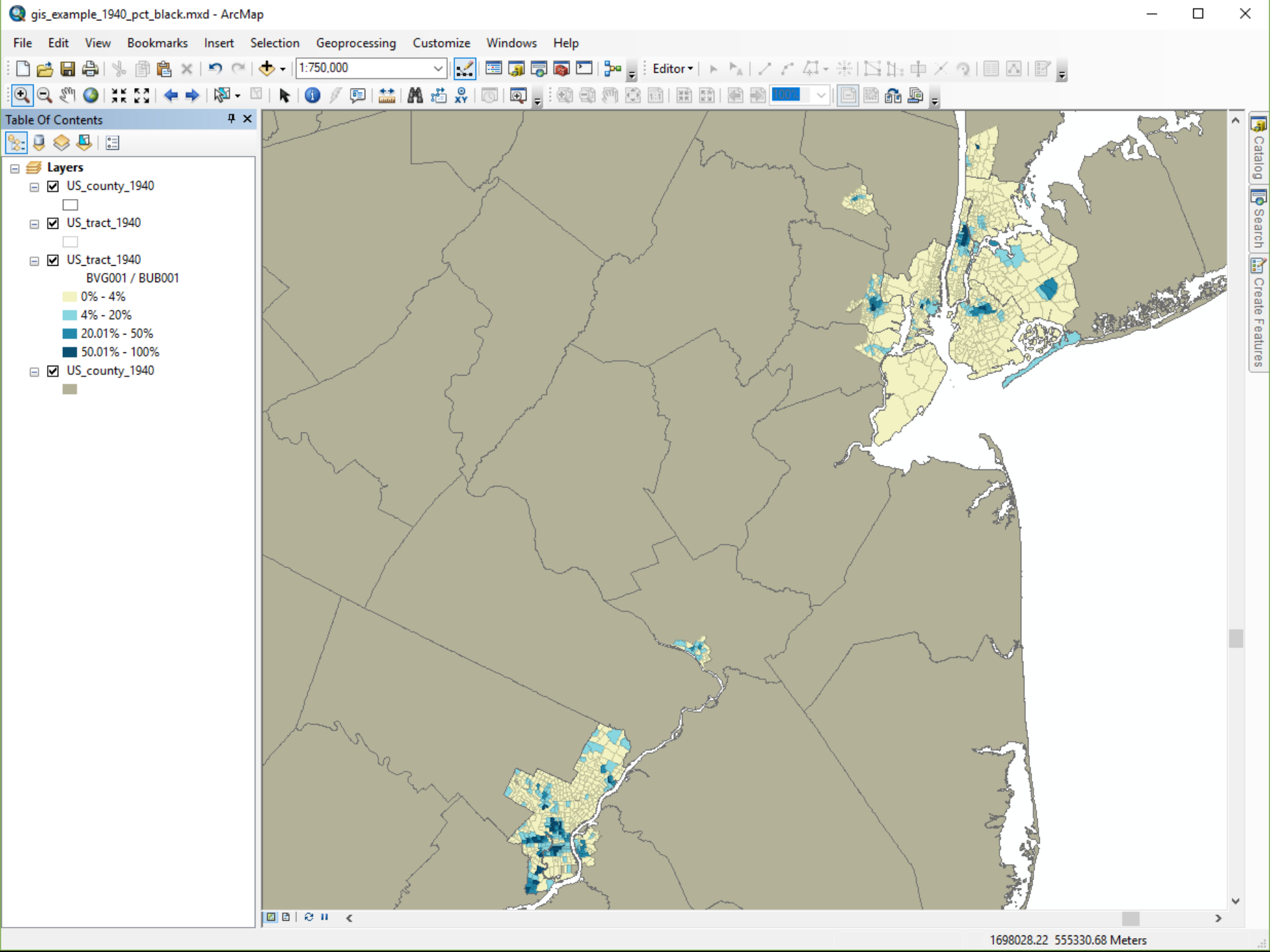
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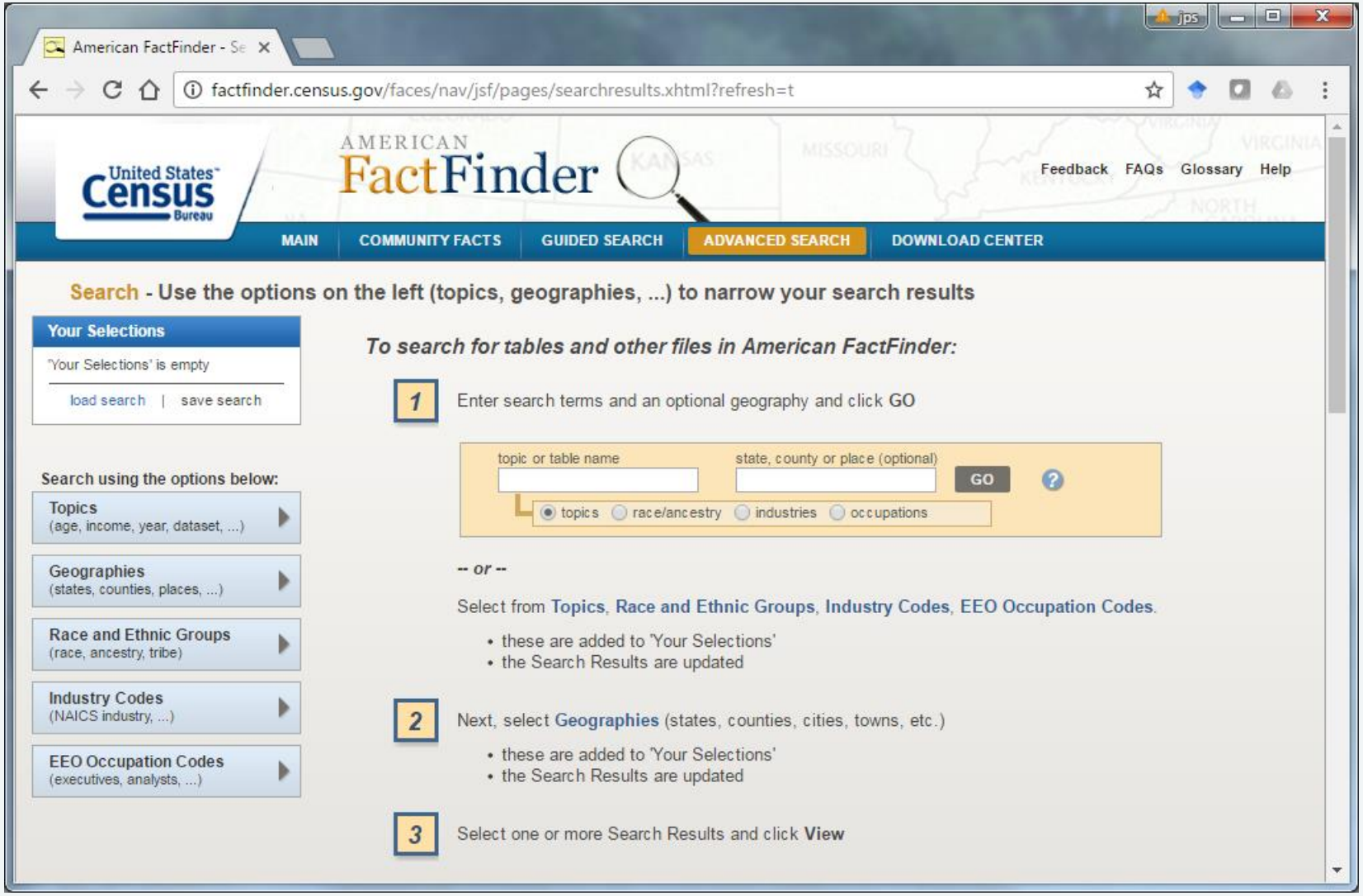
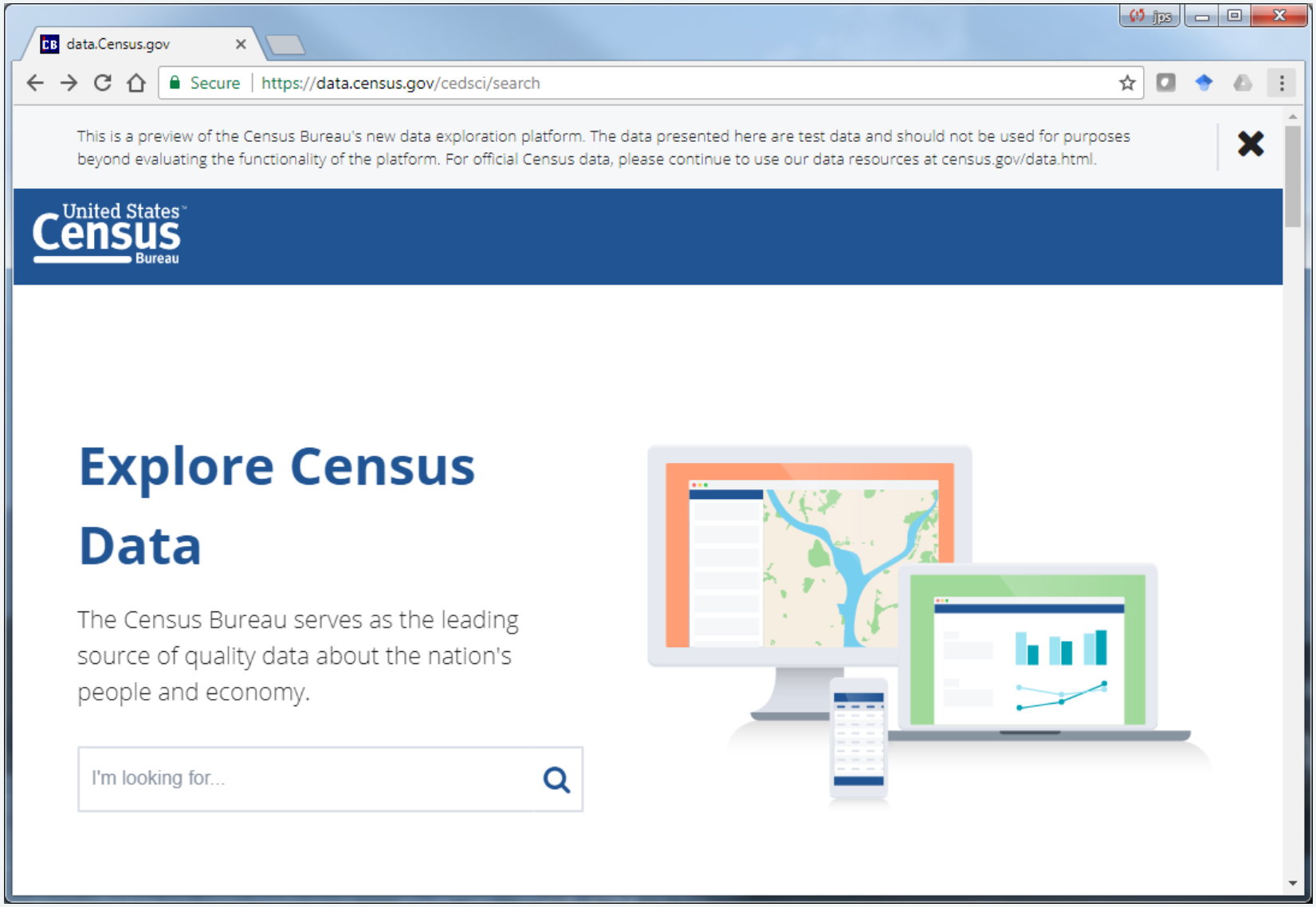
Alternative: American FactFinder



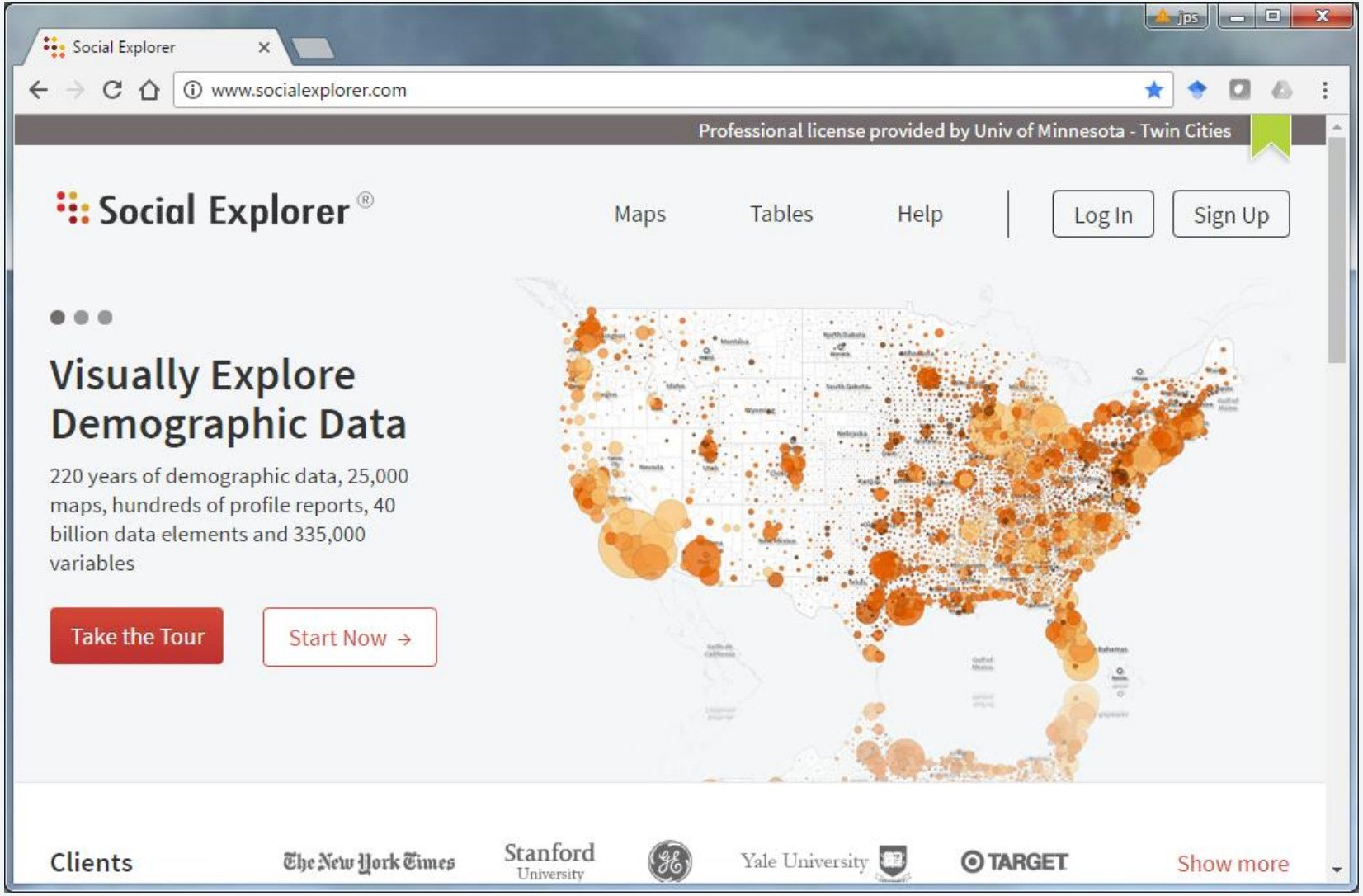
American FactFinder

- Data since 2000 only
- Tables here, boundary files elsewhere
- Limited extents for small-area data
  - Tracts by state
  - Block groups by county
- No block data
- Download only one table per file

Alternative: data.census.gov



Alternative: Social Explorer



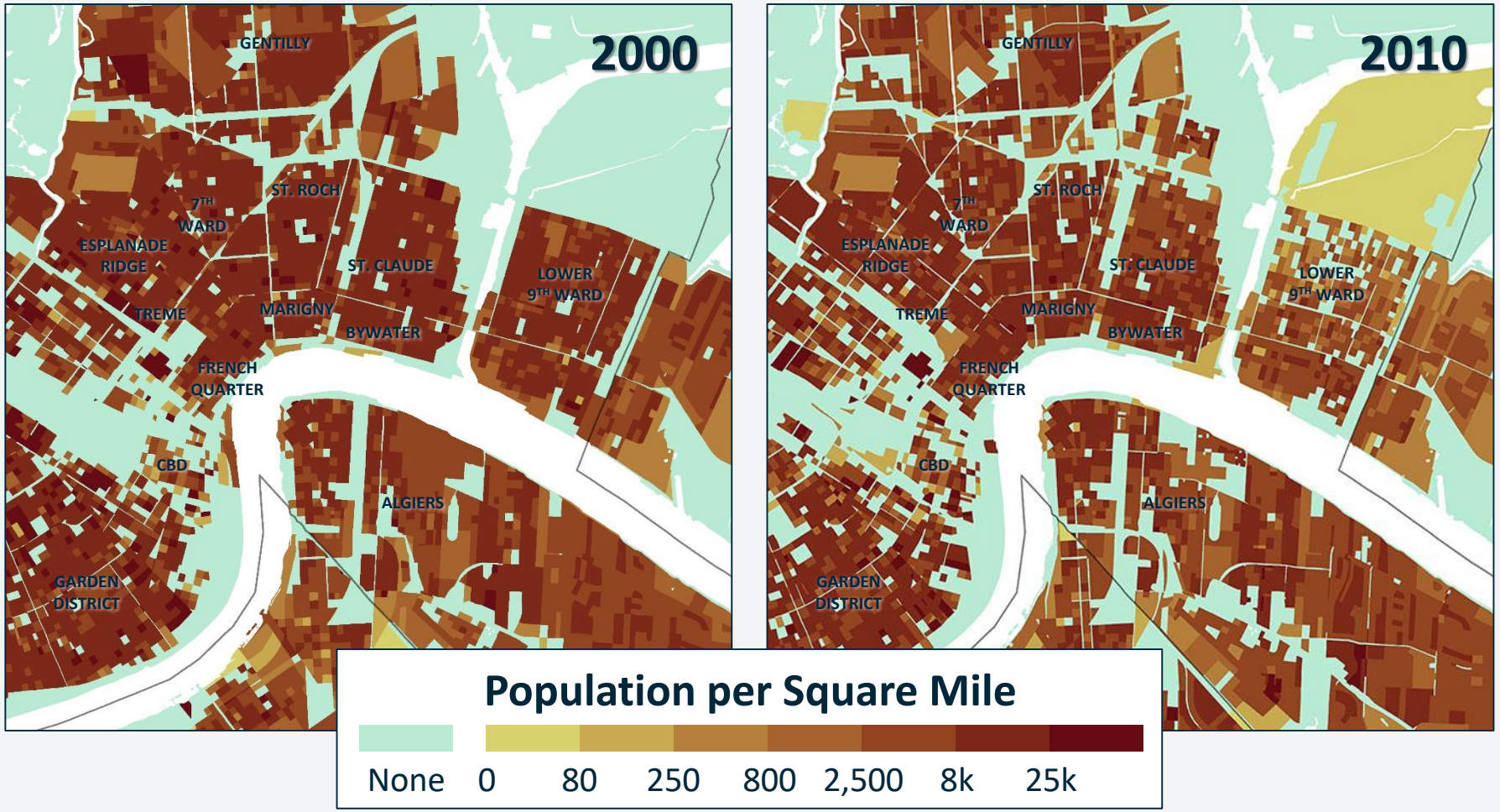
Social Explorer

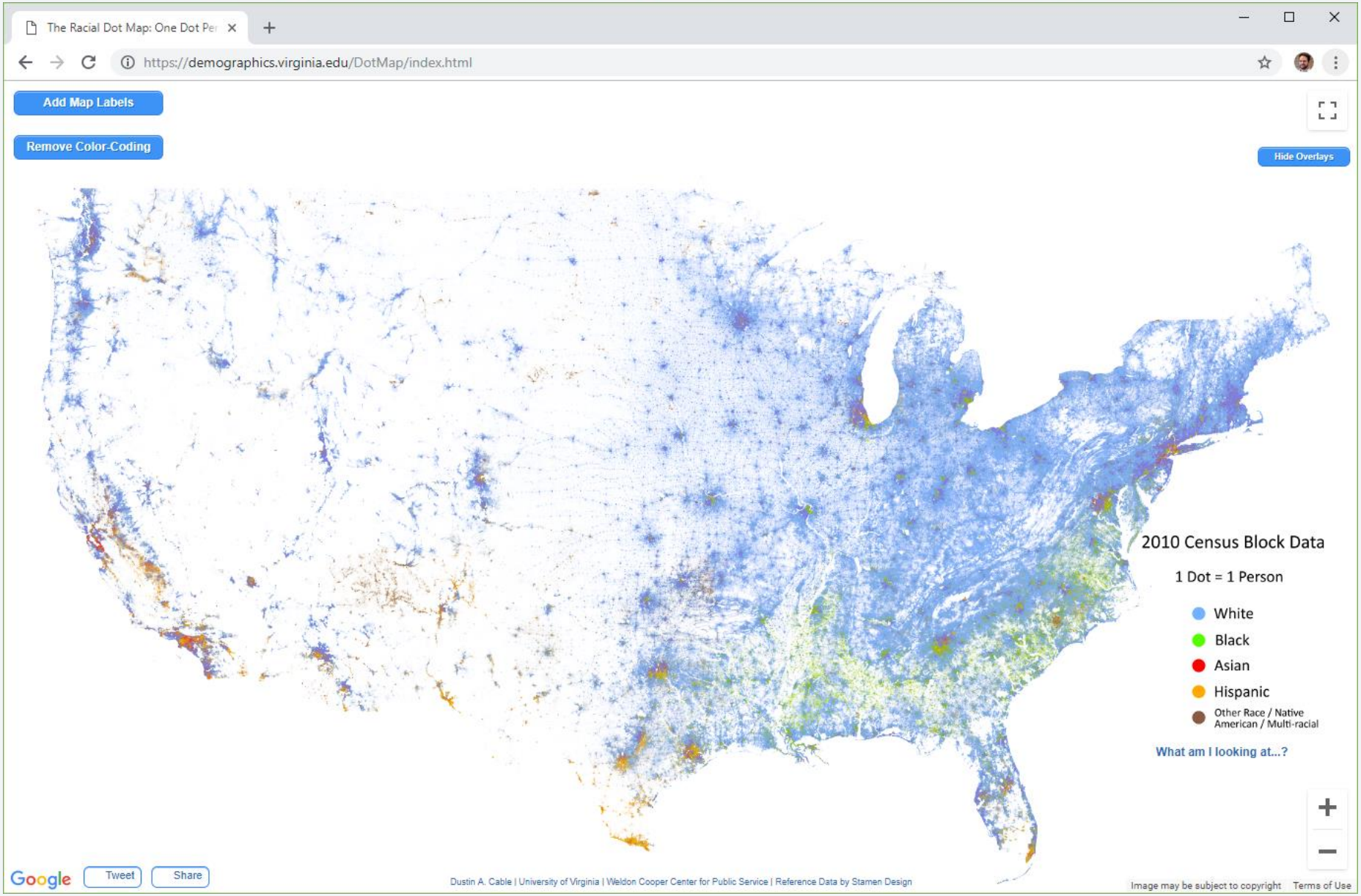
- From 1790 through most recent ACS
- Online mapping + tables (view or download)
- Many unique sources:
  - U.S. religion, health, crime, Canada & UK …
- No boundary files
- No Decennial Census Summary Files 2 or 4
- Requires license for full access

Unique to NHGIS

- Historical census tables ***and*** GIS files
- Universal data filtering & selection
  - All years, levels & data types accessible at once
- Nationwide extent for all levels
  - *Census block boundaries by state
- Historical vital statistics, agriculture, businesses, religious bodies…
- Complete 1970-2010 summary file data
- Time series tables
- **FREE**

Census block data: New Orleans




The Racial Dot Map: One Dot Per
https://demographics.virginia.edu/DotMap/index.html
Add Map Labels
Remove Color-Coding
Hide Overlays
2010 Census Block Data
1 Dot = 1 Person
White
Black
Asian
Hispanic
Other Race / Native American / Multi-racial
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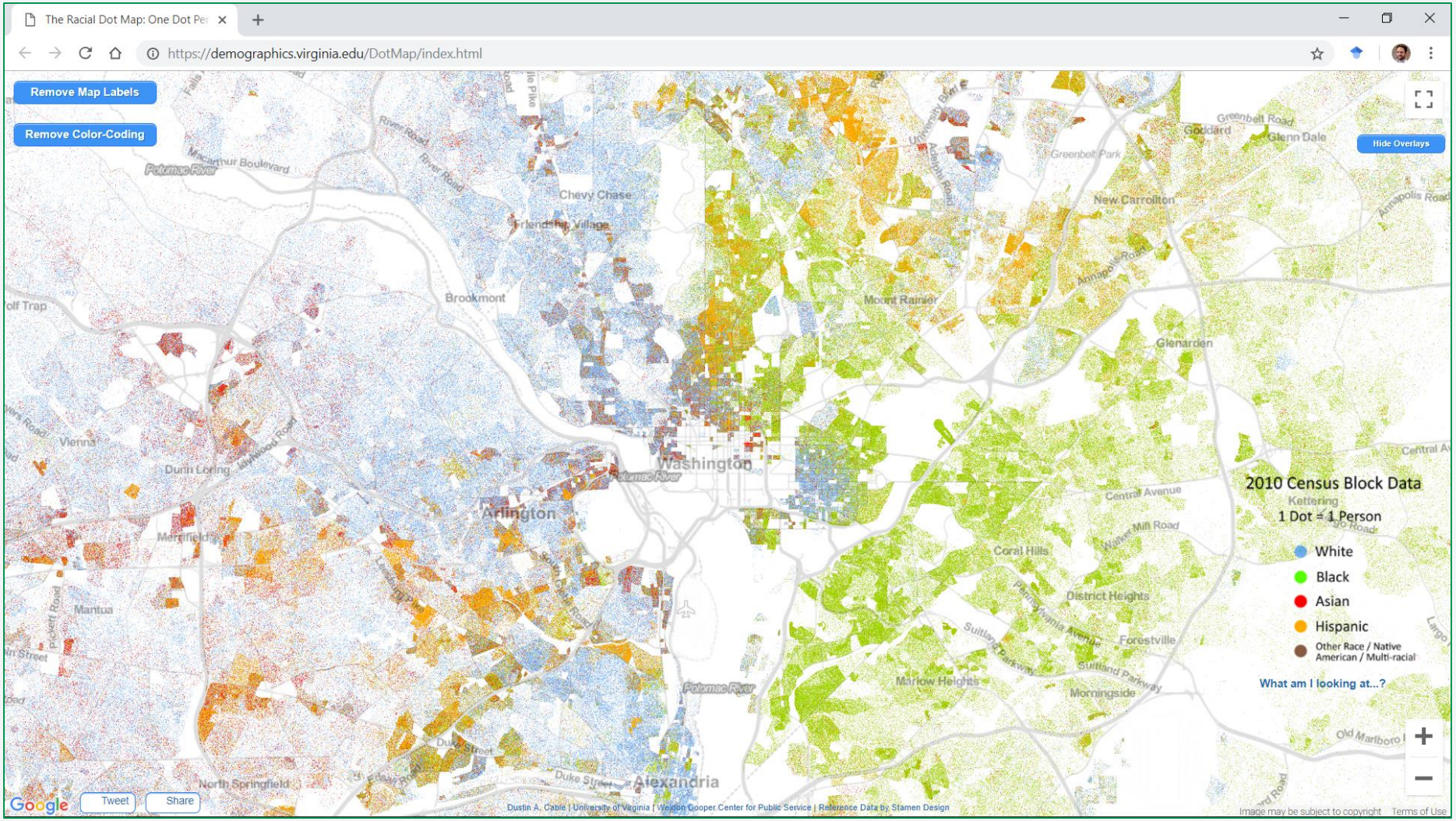
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Arlington
Alexandria
Chevy Chase
Brookmont
Friendship Village
Mount Rainier
Glenarden
New Carrollton
Greenbelt
Glenn Dale
Vienna
Dunn Loring
Merrifield
Mantua
North Springfield
Coral Hills
District Heights
Forestville
Marlow Heights
Morningside
Kettering
Potomac River

See U.S. racial and ethnic diversit
https://www.nationalgeographic.com/magazine/2018/10/diversity-race-ethnicity-united-states-america-interactive-map/

NATIONAL GEOGRAPHIC

Where we live, block by block

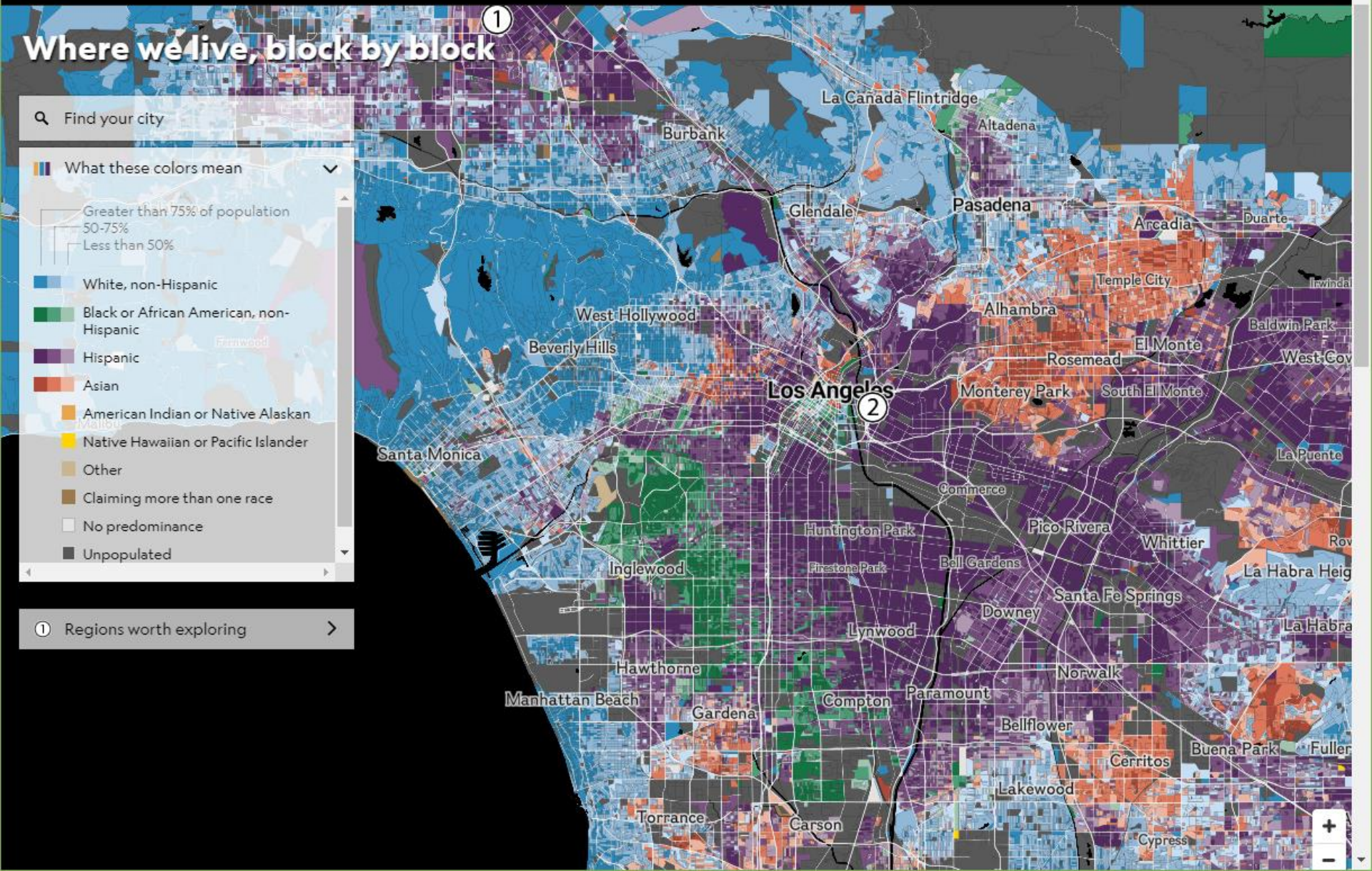
Find your city

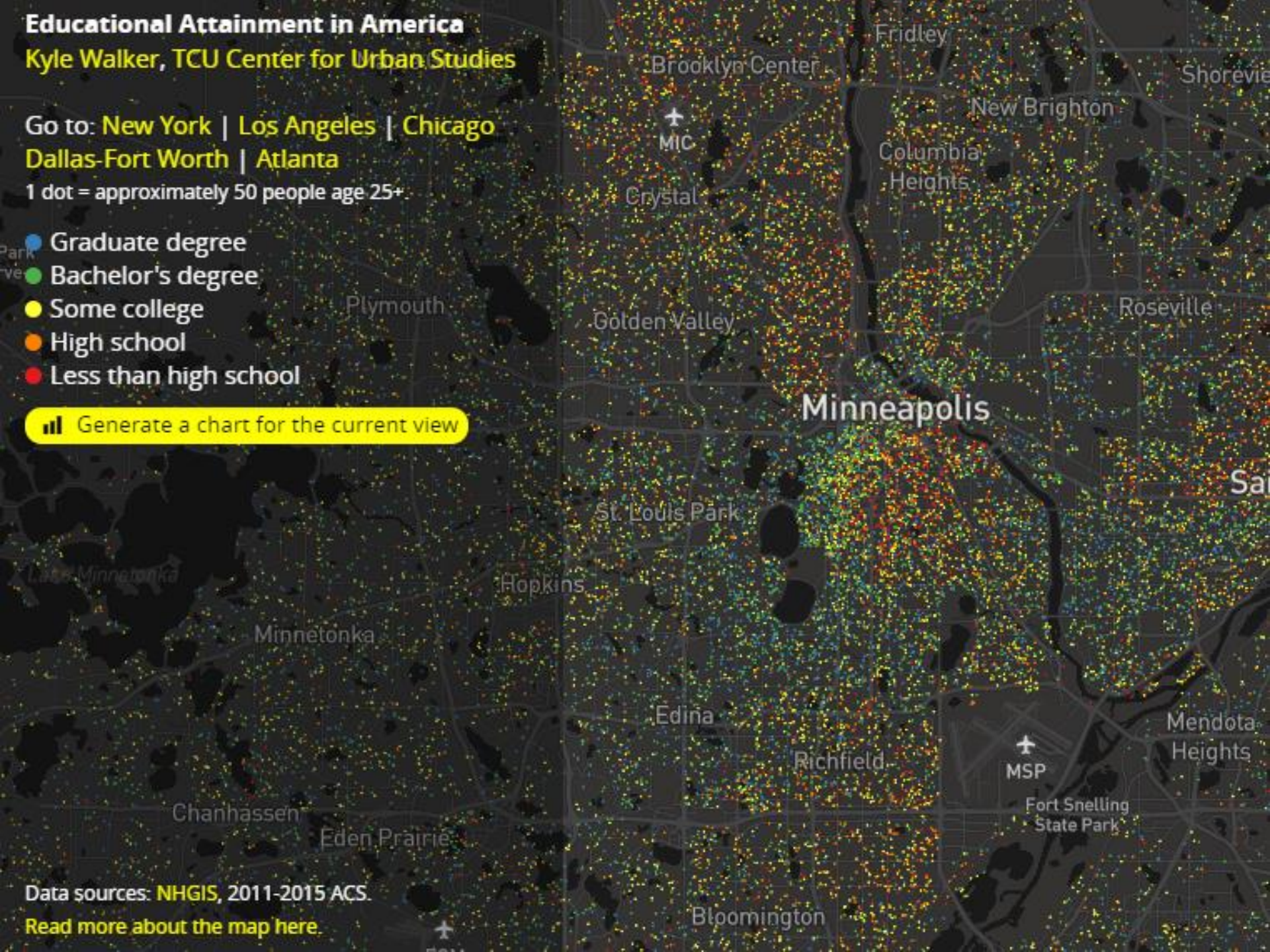
What these colors mean

Greater than 75% of population
50-75%
Less than 50%

- White, non-Hispanic
- Black or African American, non-Hispanic
- Hispanic
- Asian
- American Indian or Native Alaskan
- Native Hawaiian or Pacific Islander
- Other
- Claiming more than one race
- No predominance
- Unpopulated

① Regions worth exploring




Educational Attainment in America
Kyle Walker, TCU Center for Urban Studies
Go to: New York | Los Angeles | Chicago
Dallas-Fort Worth | Atlanta
1 dot = approximately 50 people age 25+
Graduate degree
Bachelor's degree
Some college
High school
Less than high school
Generate a chart for the current view
Data sources: NHGIS, 2011-2015 ACS.
Read more about the map here.
Fridley
Brooklyn Center
New Brighton
MIC
Columbia Heights
Crystal
Plymouth
Golden Valley
Roseville
Minneapolis
St. Louis Park
Hopkins
Minnetonka
Edina
Richfield
MSP
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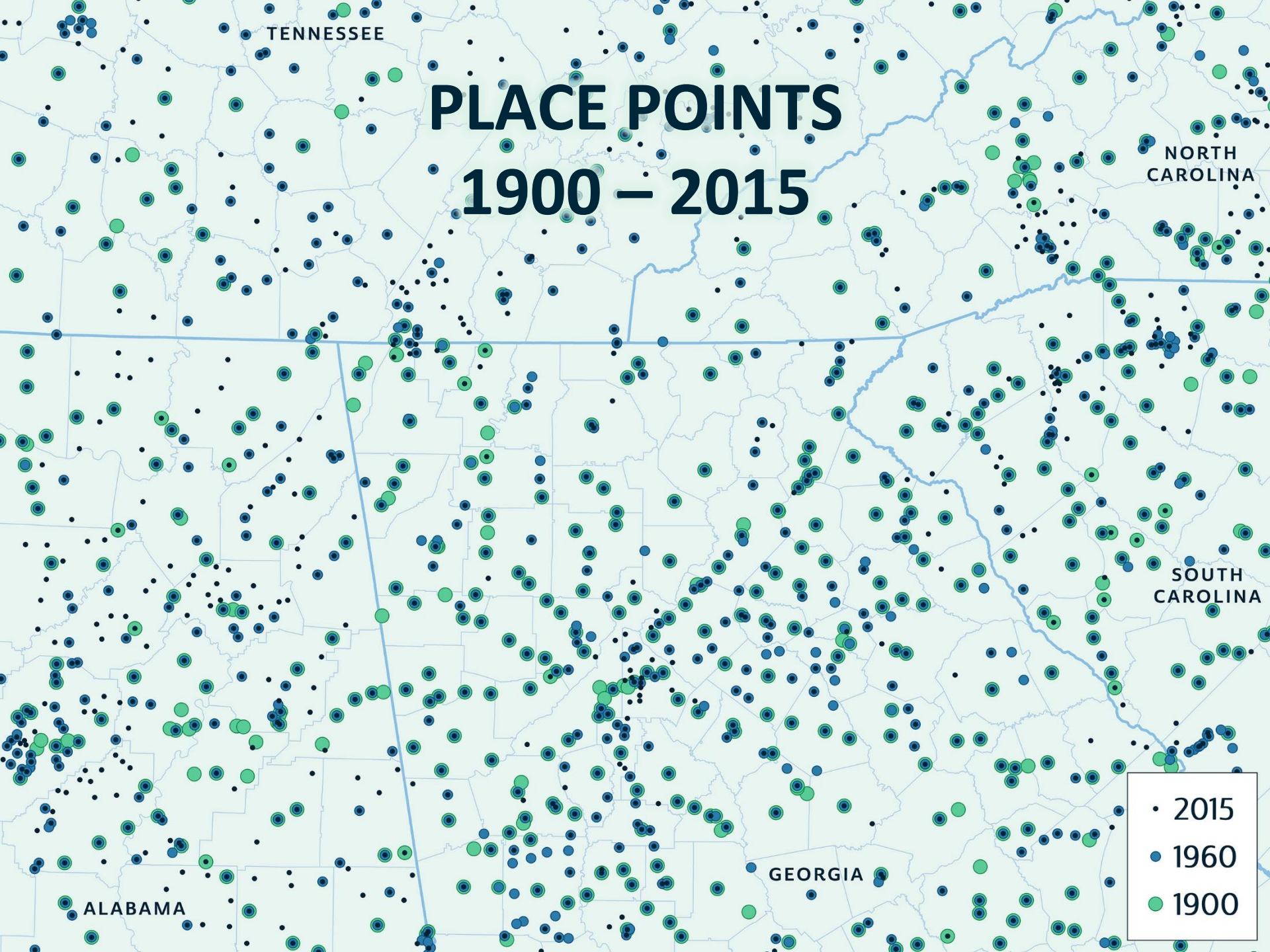
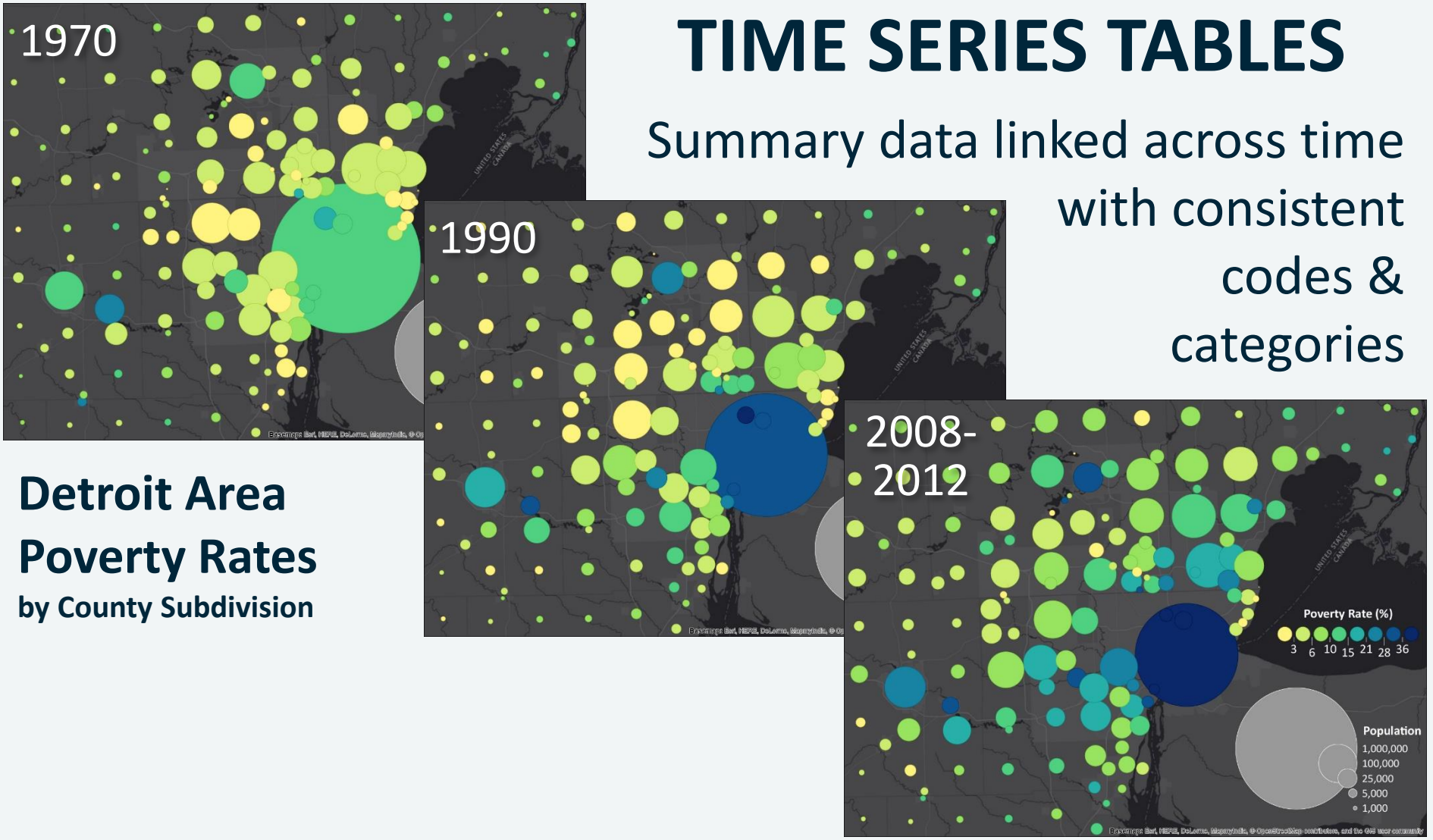
Fort Snelling State Park
Chanhassen
Eden Prairie
Bloomington


PLACE POINTS
1900 – 2015
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
2015
1960
1900

TIME SERIES TABLES

Summary data linked across time with consistent codes & categories



Detroit Area Poverty Rates

by County Subdivision

APPLY FILTERS

HOW TO USE THE DATA FINDER

GEOGRAPHIC LEVELS ✓ TRACT

YEARS

TOPICS

DATASETS

RESET FILTERS

SELECT DATA

11783 SOURCE TABLES | 291 TIME SERIES TABLES | 28 GIS BOUNDARY FILES

PAGE 1 OF 15 20 VIEW 1 - 20 OF 291

POPULARITY	TABLE NAME	GEOGRAPHIC INTEGRATION	YEARS	GEOGRAPHIC LEVELS
⊕	Total Population	Nominal	1970, 1980, 1990, 2000, 2010, 2008-2012	STATE, COUNTY, TRACT, CTY_SUB, PLACE
⊕	Total Population	Nominal	1980, 1990, 2000, 2010, 2008-2012	NATION, REGION, DIVISION, STATE, COUNTY, TRACT, CTY_SUB, PLACE
⊕	Total Population	Standardized to 2010	1990, 2000, 2010	STATE, COUNTY, TRACT, BLCK_GRP, CTY_SUB, PLACE, CD110TH-112TH, CBSA, URB_AREA, ZCTA
⊕	Persons by Urban/Rural Status [4]	Nominal	1980, 1990, 2000, 2010	NATION, REGION, DIVISION, STATE, COUNTY, TRACT, CTY_SUB, PLACE
⊕	Persons by Urban/Rural Status [4]	Standardized to 2010	1990, 2000, 2010	STATE, COUNTY, TRACT, BLCK_GRP, CTY_SUB, PLACE, CD110TH-112TH, CBSA, URB_AREA, ZCTA
⊕	Persons by Sex [2]	Nominal	1970, 1980, 1990, 2000, 2010, 2008-2012	STATE, COUNTY, TRACT, CTY_SUB, PLACE
⊕	Persons by Sex [2]	Standardized to 2010	1990, 2000, 2010	STATE, COUNTY, TRACT, BLCK_GRP, CTY_SUB, PLACE, CD110TH-112TH,

Nominal integration

	A	B	C	D	E	F	G	H	I	J
1	GISJOIN	STATE	STATEA	BL1AA1970	BL1AA1980	BL1AA1990	BL1AA2000	BL1AA125	BL1AA125M	BL1AB1970
2	GIS Join Match Code	State Name	State Code	1970: Persons: Male ~ Never married	1980: Persons: Male ~ Never married	1990: Persons: Male ~ Never married	2000: Persons: Male ~ Never married	2008-2012: Persons: Male ~ Never married	Margin of error: 2008-2012: Persons: Male ~ Never married	1970: Persons: Male ~ Now married
3	G010	Alabama	10	324572	375515	406140	444450	584355	4261	792229
4	G020	Alaska	20	38428	53423	67827	78955	105333	1532	69046
5	G040	Arizona	40	170463	286183	409976	581715	876661	5440	410438
6	G050	Arkansas	50	170171	200864	209851	245874	330745	3312	464000
7	G060	California	60	2102965	2938148	4034185	4343790	5778554	18439	4611973
8	G080	Colorado	80	230115	341985	373157	516816	678866	4145	510105
9	G090	Connecticut	90	306085	369471	412921	385888	496941	3768	706908
10	G100	Delaware	100	52624	67052	76997	87154	122851	1650	126479
11	G110	District Of C	110	99908	112013	118273	112516	142162	1558	142605
12	G120	Florida	120	596651	950049	1336469	1702648	2553294	14356	1687636
13	G130	Georgia	130	446917	564696	716125	940487	1299191	7312	1050444
14	G150	Hawaii	150	104625	137448	152188	166715	205985	2060	169920
15	G160	Idaho	160	69395	86794	91380	128613	172169	2427	169553
16	G170	Illinois	170	1115952	1318480	1395167	1495795	1838840	9371	2542632
17	G180	Indiana	180	477592	541264	569459	643222	814989	5228	1222896
18	G190	Iowa	190	271540	301518	281081	318000	375129	2818	665781
19	G200	Kansas	200	223168	241362	244866	281338	345753	3010	542632
20	G210	Kentucky	210	318856	358353	361278	401465	518929	4039	757239
21	G220	Louisiana	220	370838	450684	464285	514633	633702	4170	793188
22	G230	Maine	230	97253	116576	126930	132473	163254	1650	227135
23	G240	Maryland	240	392646	501319	587368	610852	814952	4997	906860
24	G250	Massachuse	250	622162	743825	832633	817954	981462	5728	1243732
25	G260	Michigan	260	872687	1036241	1078995	1159693	1352844	6714	2021198
26	G270	Minnesota	270	403762	484050	504483	591866	716441	4620	849440
27	G280	Mississippi	280	222569	252992	275422	319922	388559	3394	480663

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Nominal integration

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	A	H	I	J	K	L	M	N	U	V	W	X	Y
1	NHGISCODE	STATE	STATEFP	STATENH	COUNTY	COUNTYFP	COUNTYNH	TRACTA	AV0AA1970	AV0AA1980	AV0AA1990	AV0AA2000	AV0AA2010
2	NHGIS Integrated Geographic Unit Code	NHGIS Integrated State Name	FIPS State Code	NHGIS Integrated State Code	NHGIS Integrated County Name	FIPS County Code	NHGIS Integrated County Code	NHGIS Integrated Census Tract Code	1970: Persons: Total	1980: Persons: Total	1990: Persons: Total	2000: Persons: Total	2010: Persons: Total
73390	G3701190001400	North Carolina	37	370	Mecklenburg	119	1190	1400	3338	2799	2400	2656	2607
73391	G3701190001501	North Carolina	37	370	Mecklenburg	119	1190	1501	4660	6891	9260		
73392	G3701190001502	North Carolina	37	370	Mecklenburg	119	1190	1502	7506				
73393	G3701190001503	North Carolina	37	370	Mecklenburg	119	1190	1503		5047	7081	9191	
73394	G3701190001504	North Carolina	37	370	Mecklenburg	119	1190	1504		4728	4629	4806	6401
73395	G3701190001505	North Carolina	37	370	Mecklenburg	119	1190	1505				2906	3678
73396	G3701190001506	North Carolina	37	370	Mecklenburg	119	1190	1506				6423	
73397	G3701190001507	North Carolina	37	370	Mecklenburg	119	1190	1507					4004
73398	G3701190001508	North Carolina	37	370	Mecklenburg	119	1190	1508					6061
73399	G3701190001509	North Carolina	37	370	Mecklenburg	119	1190	1509					2976
73400	G3701190001510	North Carolina	37	370	Mecklenburg	119	1190	1510					3047
73401	G3701190001601	North Carolina	37	370	Mecklenburg	119	1190	1601	7408				
73402	G3701190001602	North Carolina	37	370	Mecklenburg	119	1190	1602	5815	5401	6735	8346	
73403	G3701190001603	North Carolina	37	370	Mecklenburg	119	1190	1603		3351	3675	4082	4598
73404	G3701190001604	North Carolina	37	370	Mecklenburg	119	1190	1604		4028	6191	6993	
73405	G3701190001605	North Carolina	37	370	Mecklenburg	119	1190	1605					1776
73406	G3701190001606	North Carolina	37	370	Mecklenburg	119	1190	1606					4295
73407	G3701190001607	North Carolina	37	370	Mecklenburg	119	1190	1607					2613
73408	G3701190001608	North Carolina	37	370	Mecklenburg	119	1190	1608					3933
73409	G3701190001609	North Carolina	37	370	Mecklenburg	119	1190	1609					3168
73410	G3701190001700	North Carolina	37	370	Mecklenburg	119	1190	1700	6784	7399			
73411	G3701190001701	North Carolina	37	370	Mecklenburg	119	1190	1701				4111	3749
73412	G3701190001702	North Carolina	37	370	Mecklenburg	119	1190	1702				5151	4881
73413	G3701190001798	North Carolina	37	370	Mecklenburg	119	1190	1798			7840		
73414	G3701190001800	North Carolina	37	370	Mecklenburg	119	1190	1800	5485	4031		4380	

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Geographic standardization

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	GISJOIN	GEOGYEAR	STATE	STATEA	COUNTY	COUNTYA	TRACTA	CL8AA199	CL8AA199	CL8AA199	CL8AA200	CL8AA200	CL8AA200	CL8AA2010
2	GIS Join Match Code	Geography Year	State Name	State Code	County Name	County Code	Census Tract Code	1990: Persons: Total	Lower bound: 1990: Persons: Total	Upper bound: 1990: Persons: Total	2000: Persons: Total	Lower bound: 2000: Persons: Total	Upper bound: 2000: Persons: Total	2010: Persons: Total
49315	G3701190001400	2010	North Carolina	37	Mecklenburg Co	119	1400	2389.68	2366	2391	2652.31	2640	2653	2607
49316	G3701190001504	2010	North Carolina	37	Mecklenburg Co	119	1504	4629	4629	4629	4806	4806	4806	6401
49317	G3701190001505	2010	North Carolina	37	Mecklenburg Co	119	1505	2901	2901	2901	2906	2906	2906	3678
49318	G3701190001507	2010	North Carolina	37	Mecklenburg Co	119	1507	3419	3419	3419	4791	4791	4791	4004
49319	G3701190001508	2010	North Carolina	37	Mecklenburg Co	119	1508	3662	3662	3662	4400	4400	4400	6061
49320	G3701190001509	2010	North Carolina	37	Mecklenburg Co	119	1509	3213	3213	3213	3229	3229	3229	2976
49321	G3701190001510	2010	North Carolina	37	Mecklenburg Co	119	1510	3146.1	3146	3211	3194.36	3194	3367	3047
49322	G3701190001603	2010	North Carolina	37	Mecklenburg Co	119	1603	3660	3660	3660	4065	4065	4065	4598
49323	G3701190001605	2010	North Carolina	37	Mecklenburg Co	119	1605	1389	1389	1389	1978	1978	1978	1776
49324	G3701190001606	2010	North Carolina	37	Mecklenburg Co	119	1606	3822	3822	3822	4154	4154	4154	4295
49325	G3701190001607	2010	North Carolina	37	Mecklenburg Co	119	1607	1524	1524	1524	2214	2214	2214	2613
49326	G3701190001608	2010	North Carolina	37	Mecklenburg Co	119	1608	3872	3872	3872	4321	4321	4321	3933
49327	G3701190001609	2010	North Carolina	37	Mecklenburg Co	119	1609	2251.16	1687	2334	2445.55	2137	2635	3168
49328	G3701190001701	2010	North Carolina	37	Mecklenburg Co	119	1701	3303	3303	3303	4111	4111	4111	3749
49329	G3701190001702	2010	North Carolina	37	Mecklenburg Co	119	1702	4537	4537	4537	5151	5151	5151	4881
49330	G3701190001801	2010	North Carolina	37	Mecklenburg Co	119	1801	1813.95	1349	1814	1706.96	1702	1707	1249
49331	G3701190001802	2010	North Carolina	37	Mecklenburg Co	119	1802	2775	2775	2775	2673	2673	2673	2892
49332	G3701190001910	2010	North Carolina	37	Mecklenburg Co	119	1910	4277	4277	4277	4614	4614	4614	5117
49333	G3701190001911	2010	North Carolina	37	Mecklenburg Co	119	1911	4613	4613	4613	5041	5041	5041	5441
49334	G3701190001912	2010	North Carolina	37	Mecklenburg Co	119	1912	5096.84	5014	5661	5506.45	5317	5815	6565
49335	G3701190001914	2010	North Carolina	37	Mecklenburg Co	119	1914	3295	3295	3295	3965	3965	3965	3485
49336	G3701190001915	2010	North Carolina	37	Mecklenburg Co	119	1915	4403	4403	4403	5460	5460	5460	6293
49337	G3701190001916	2010	North Carolina	37	Mecklenburg Co	119	1916	3003.8	2465	3050	3005.23	2508	3009	3725
49338	G3701190001917	2010	North Carolina	37	Mecklenburg Co	119	1917	3050.2	3004	3589	3294.77	3291	3792	3567
49339	G3701190001918	2010	North Carolina	37	Mecklenburg Co	119	1918	2842.4	698	3700	3129	3129	3129	3527
49340	G3701190001919	2010	North Carolina	37	Mecklenburg Co	119	1919	3243.6	2386	5388	3837	3837	3837	3379

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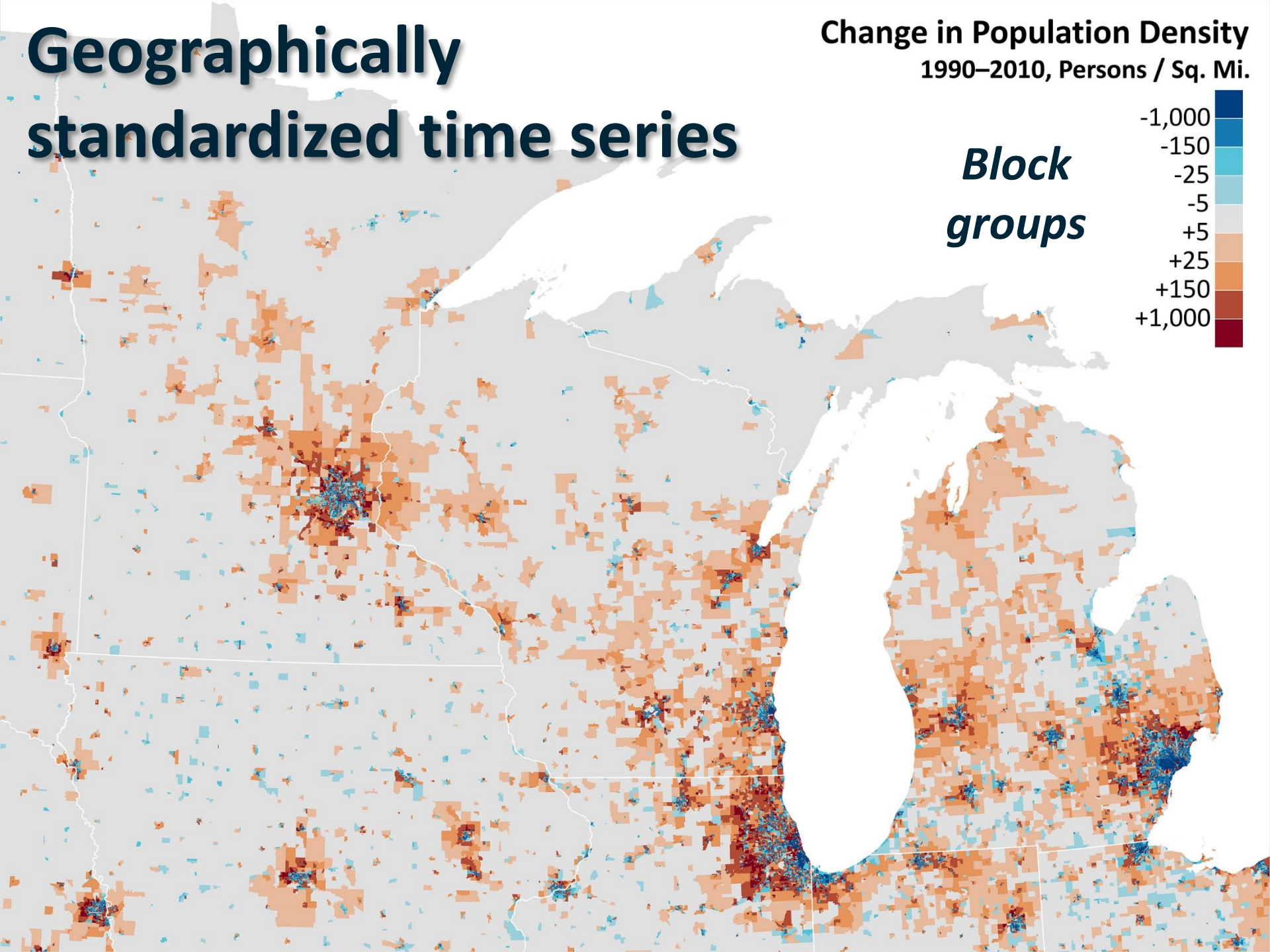
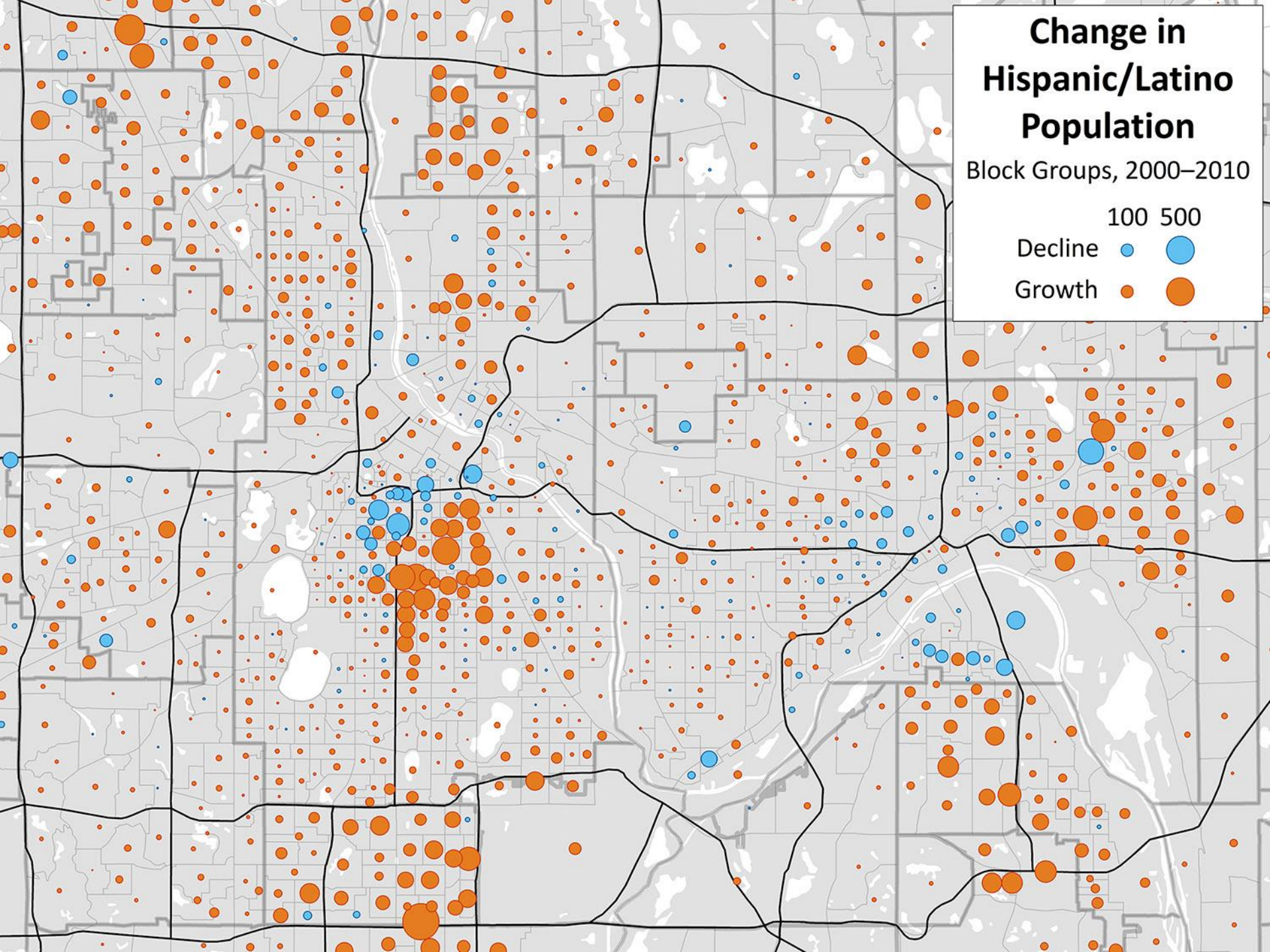
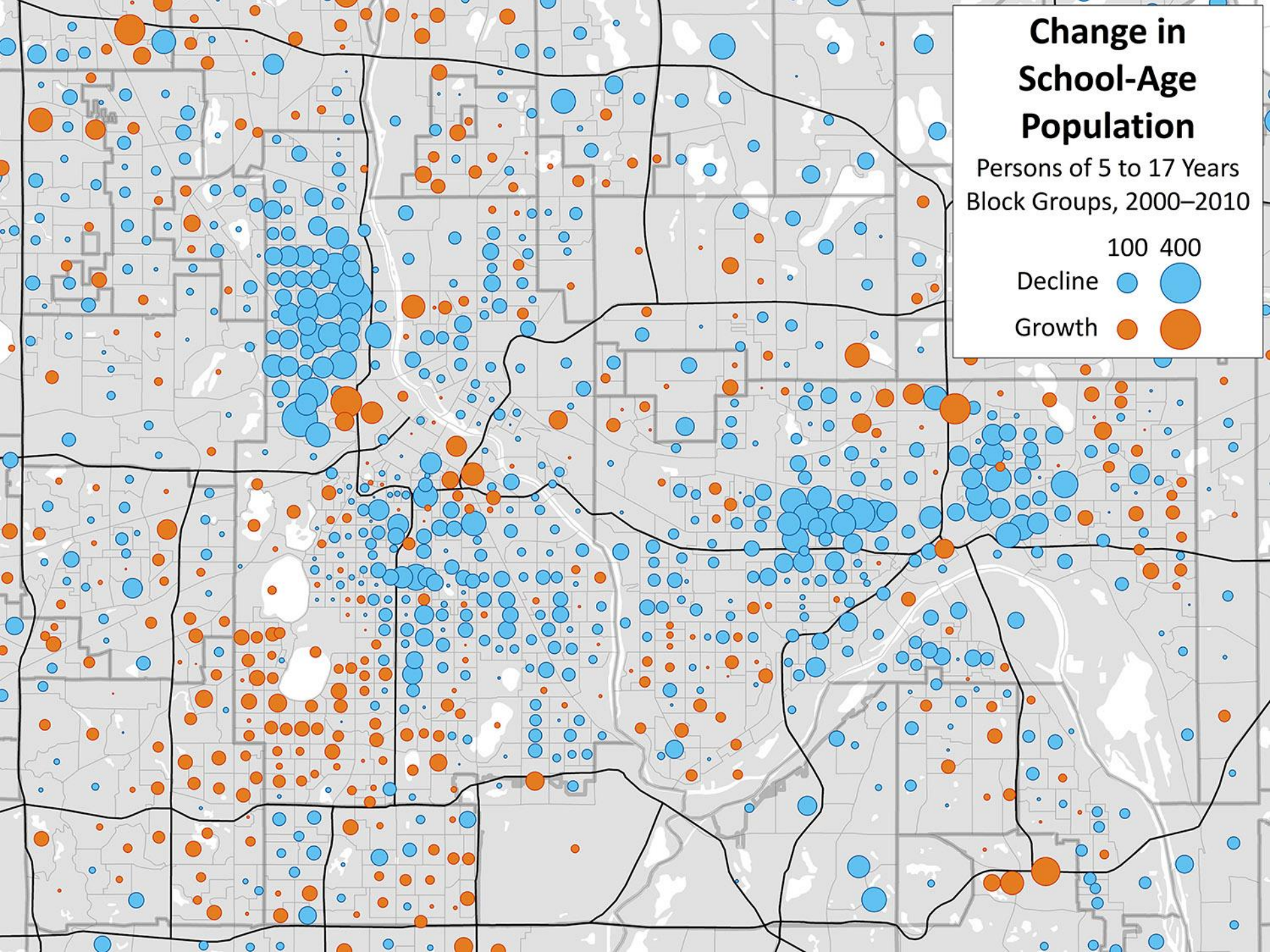
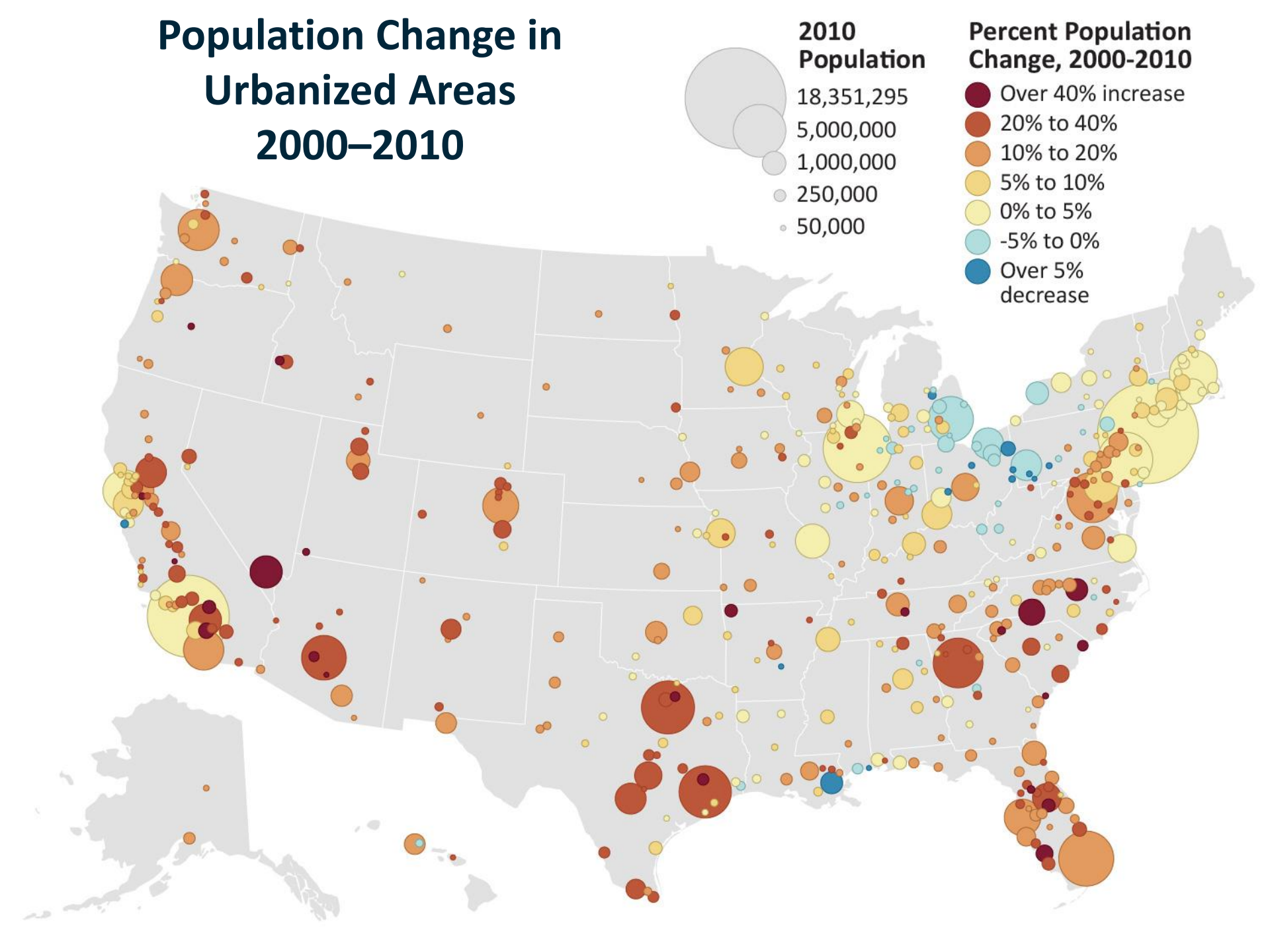
Geographically standardized time series




Change in Hispanic/Latino Population
Block Groups, 2000–2010
100 500
Decline
Growth


Change in School-Age Population
Persons of 5 to 17 Years
Block Groups, 2000–2010
100 400
Decline
Growth

Population Change in Urbanized Areas 2000–2010



Geographically standardized time series

- 1990, 2000 & 2010 data for 2010 units
- 10 geographic levels:

  states, counties, tracts, block groups,
  county subdivisions, places,
  congressional districts, CBSAs, urban areas, ZCTAs
- ~1,600 time series in 109 tables
- "Short-form" counts only
  - Race, ethnicity, age, sex, household size & relationships, housing occupancy & tenure
  - *Not* income, education, employment, …

Nominally integrated time series

- ~5,700 time series in 271 tables
- 8 geographic levels:
  nation, regions, divisions, states, counties, tracts, county subdivisions, places
- Years mainly in 1970-2010 range
  - *Total Population* back to 1790 & *Persons by Sex* back to 1820
  - "Long-form" tables use 2008-2012 ACS

Guided tour

- www.nhgis.org

- *Any questions?*

Still to come…

- IPUMS NHGIS
  - Annual tract population estimates, 1990-2020
  - More time series data → more years & subjects
  - New historical tables from full-count microdata
  - 1980 & 1970 block boundaries
- IPUMS GeoMarker…
  - Attach small-area data to address data
  - *Webinar in December!*
- All IPUMS projects: API's

Acknowledgements

Funding:
Eunice Kennedy Shriver National Institute of Child Health & Human Development
[NIH-R01HD043392,
NIH-R01HD057929]

National Science Foundation
[SES-1324875]

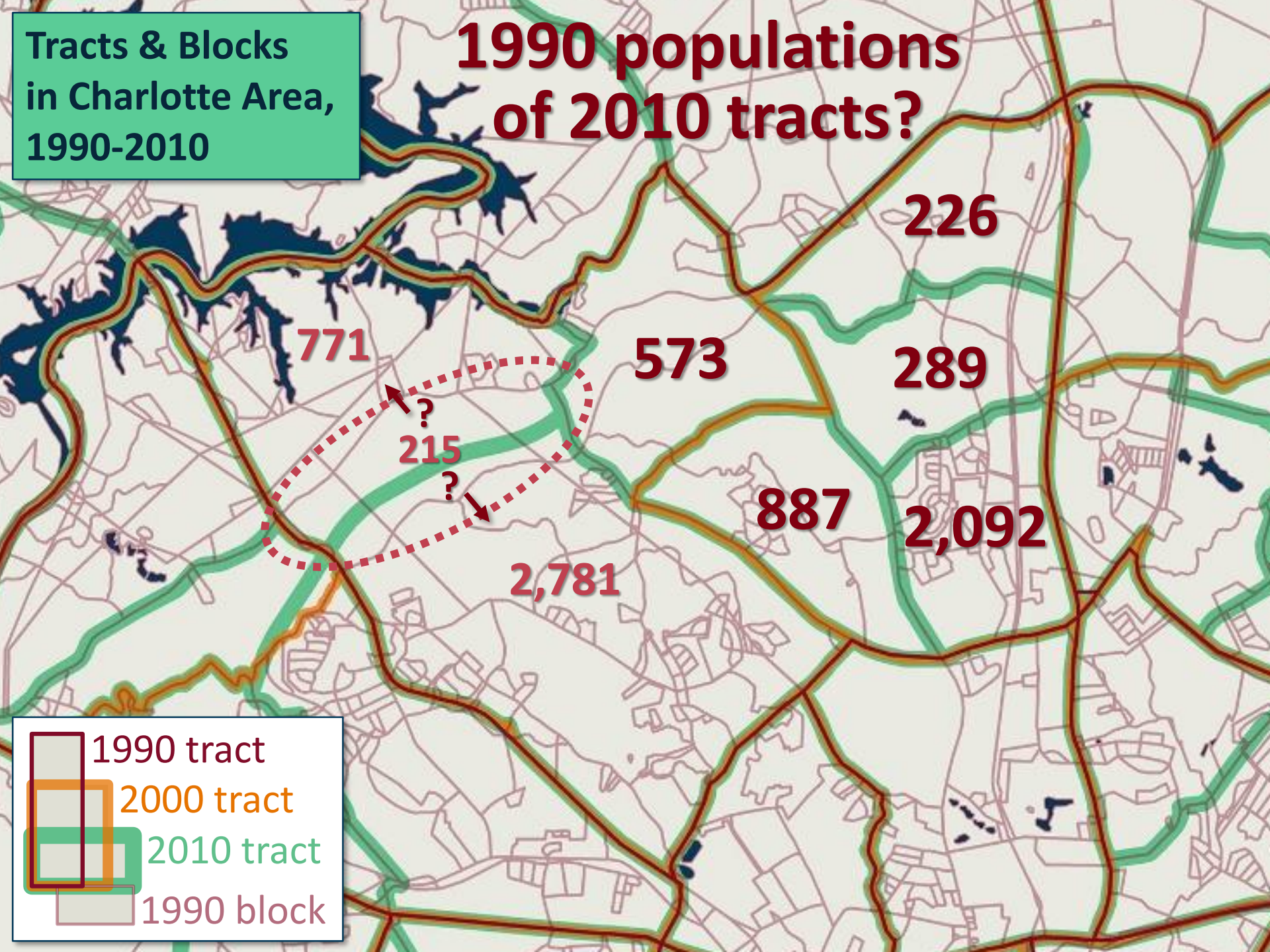
MPC
MINNESOTA POPULATION CENTER

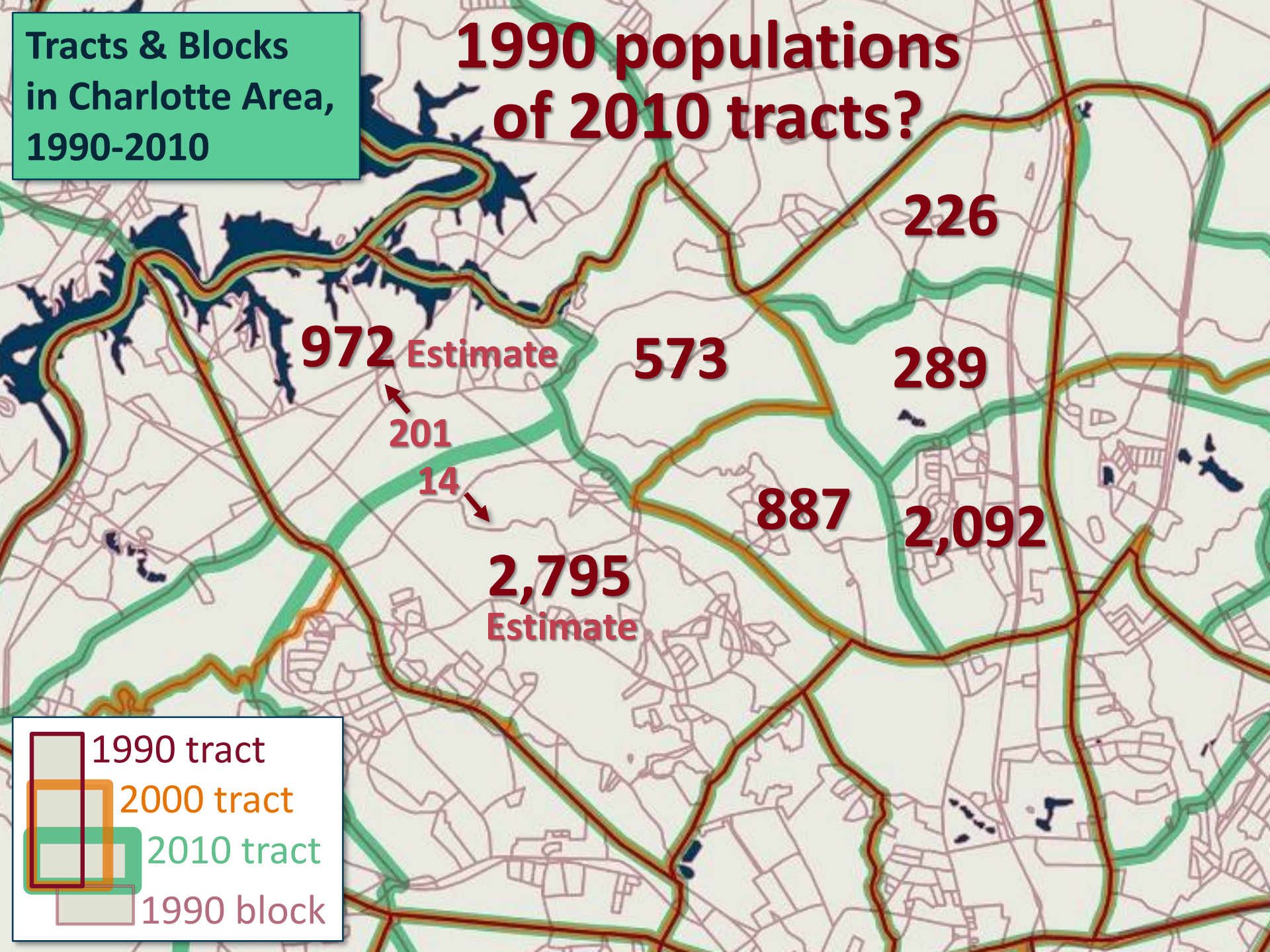
(NIH/NICHD R24HD041023)

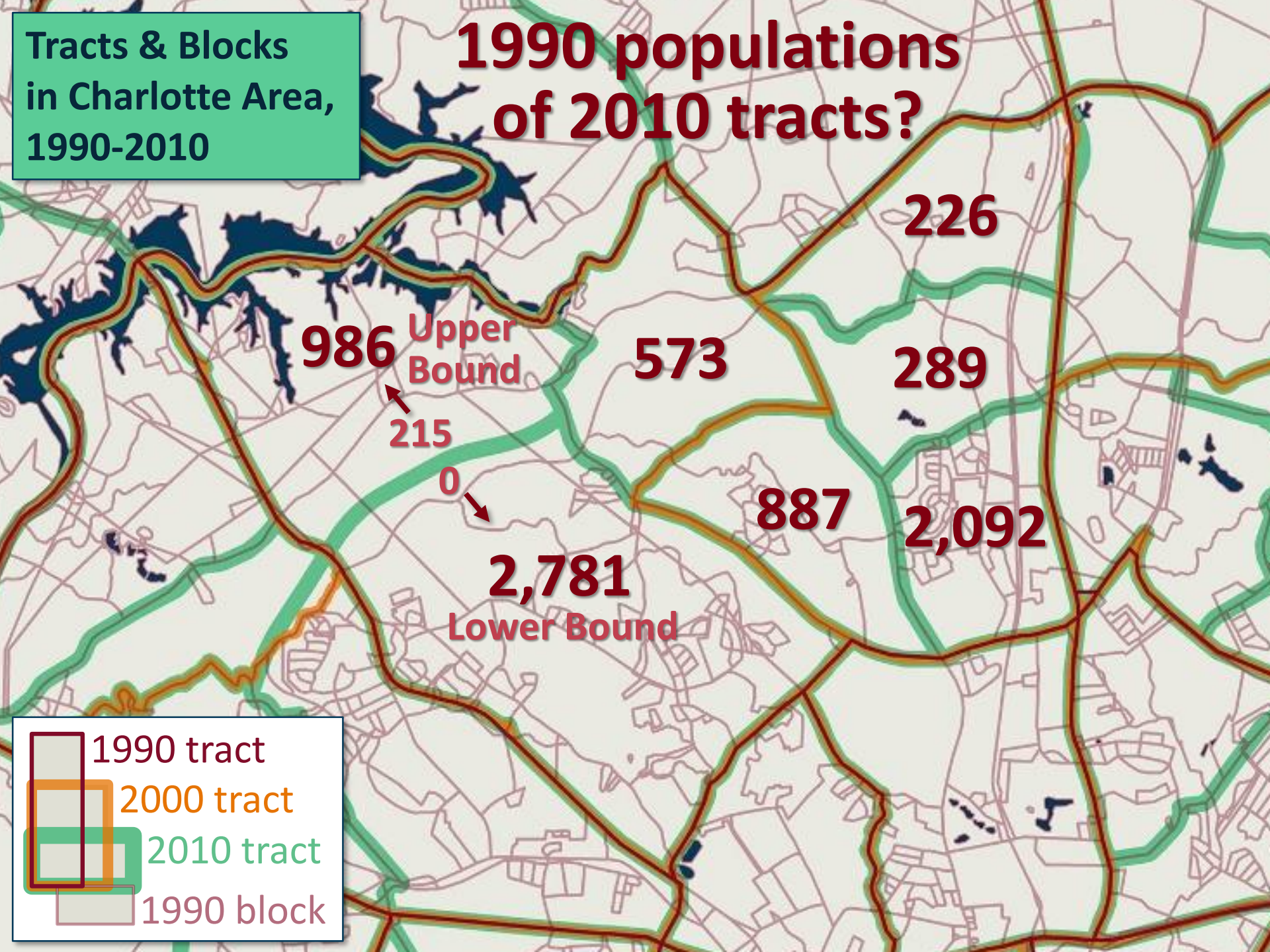
Follow-up

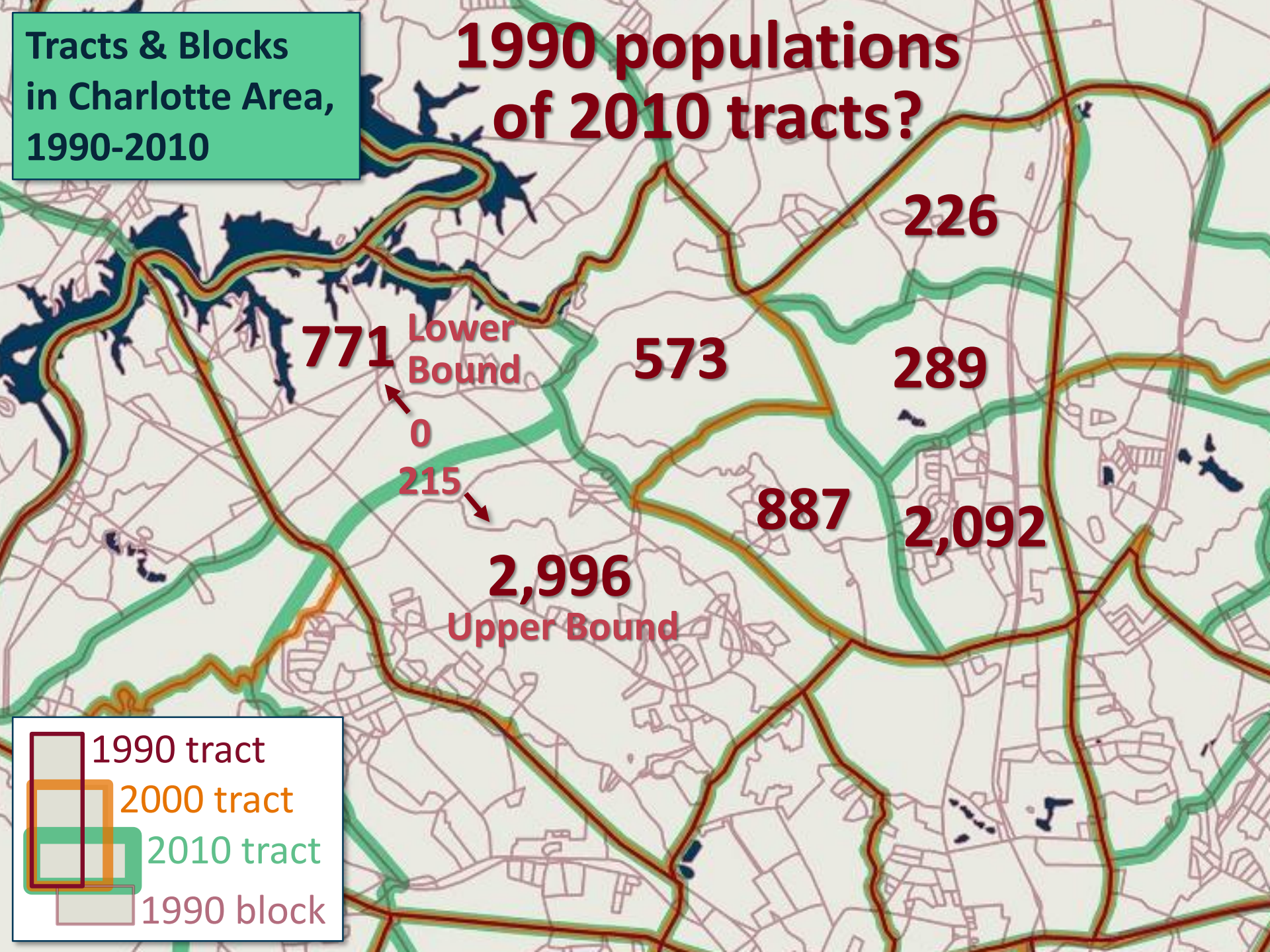
- Training exercises: https://www.ipums.org/exercises.shtml
  - R package *ipumsr:* https://cran.r-project.org/web/packages/ipumsr
- Twitter: @nhgis
- Email: nhgis@umn.edu

SLIDES USED IN Q&A…


Tracts & Blocks in Charlotte Area, 1990-2010
1990 populations of 2010 tracts?
226
771
573
289
?
215
?
887
2,092
2,781
1990 tract
2000 tract
2010 tract
1990 block


Tracts & Blocks in Charlotte Area, 1990-2010
1990 populations of 2010 tracts?
226
972 Estimate
573
289
201
14
887
2,092
2,795 Estimate
1990 tract
2000 tract
2010 tract
1990 block


Tracts & Blocks in Charlotte Area, 1990-2010
1990 populations of 2010 tracts?
226
986
Upper Bound
573
289
215
0
887
2,092
2,781
Lower Bound
1990 tract
2000 tract
2010 tract
1990 block


Tracts & Blocks in Charlotte Area, 1990-2010
1990 populations of 2010 tracts?
226
771
Lower Bound
573
289
0
215
887
2,092
2,996
Upper Bound
1990 tract
2000 tract
2010 tract
1990 block

Time Series Tables | IPUM

Secure | https://www.nhgis.org/documentation/time-series#standardization

Documentation at nhgis.org

2. ***Geographically standardized tables*** provide data from multiple times for a single census's geographic units. At this time, NHGIS's standardized time series tables provide 1990, 2000, and 2010 data for *2010 census units*.

   To allocate 1990 and 2000 summary data to 2010 census units, NHGIS reaggregates data from the smallest source units for which 1990 and 2000 data are available: census blocks. Where a source block intersects multiple 2010 units, NHGIS applies interpolation to estimate how the source block's characteristics are distributed among the 2010 units.

   Detailed methodology:

   - 2000 Block Data Standardized to 2010 Geography
   - 1990 Block Data Standardized to 2010 Geography

   For each standardized statistic, NHGIS also supplies lower and upper bounds based on the spatial relationship between the source units and standard units. For example, if there are three 2000 census blocks that straddle a 2010 census unit's boundary, then it is possible that either all or none of the three blocks' 2000 residents were located in the 2010 unit. The upper bound assumes that all residents and housing units in straddling blocks were located in the 2010 unit, and the lower bound assumes that none were. Bounds for 1990 estimates also take account of additional uncertainty due to accuracy improvements in Census Bureau's geographic data files, which make it impossible to determine exact spatial relationships between 1990 and 2010 units.

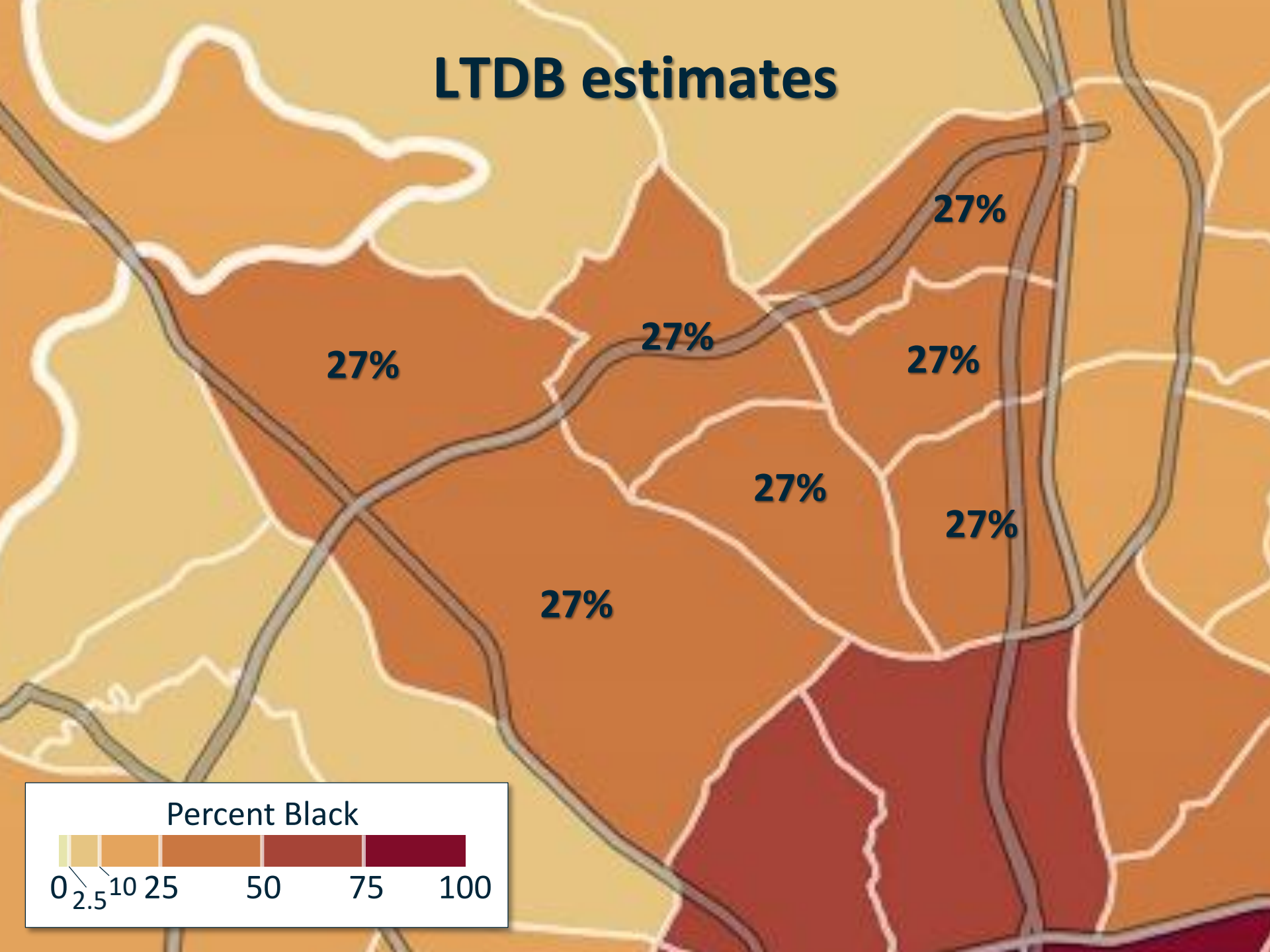
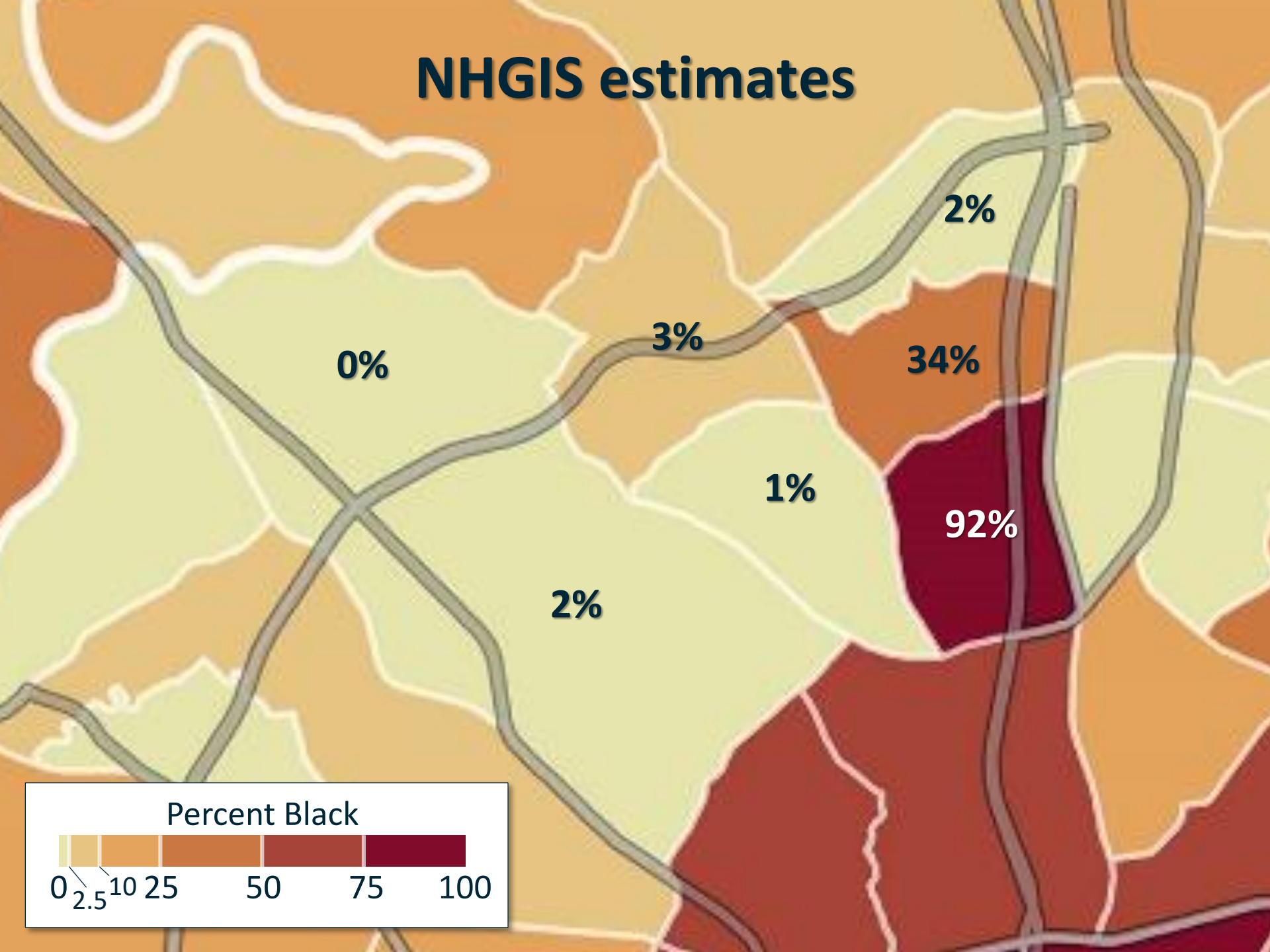
   NHGIS has not yet implemented standardization for non-count statistics such as medians and quotients. Therefore, currently available standardized tables supply only count statistics.

   NHGIS delivers standardized statistics with two decimal digits of precision in order to reduce the size of rounding errors when users sum estimates. Rounding errors may still

Sources of geographically standardized data

Geolytics NCDB	LTDB	Social Explorer	NHGIS
Tracts with codes for larger areas	Tracts with codes for larger areas	Tracts, counties, states	10 levels: tracts, BGs, ZCTAs, places…
1970–2010	1970–2010	1970–2010	1990–2010
~1,000 variables, *specific to source year*	83 variables, *aligned categories* + tract-to-tract crosswalk	1970 Count 4; 1980, 1990, 2000 SF1 & SF3; 2000: 114 *aligned* tables	~1,600 variables in 109 *aligned* tables + block-to-block crosswalk
No error bounds	No error bounds	No error bounds	Lower, upper bounds
Tract source, area-weighted (including water!)	Tract source, guided by land areas & 2000 block populations	*LTDB crosswalks*	***Block source,*** guided by 2000 & 2010 block info, road buffers, land cover

LTDB estimates



NHGIS estimates