Digital Geography & GIS

CSCE 100
October 15, 2020

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University of Nebraska
School of Global Integrative Studies

outline

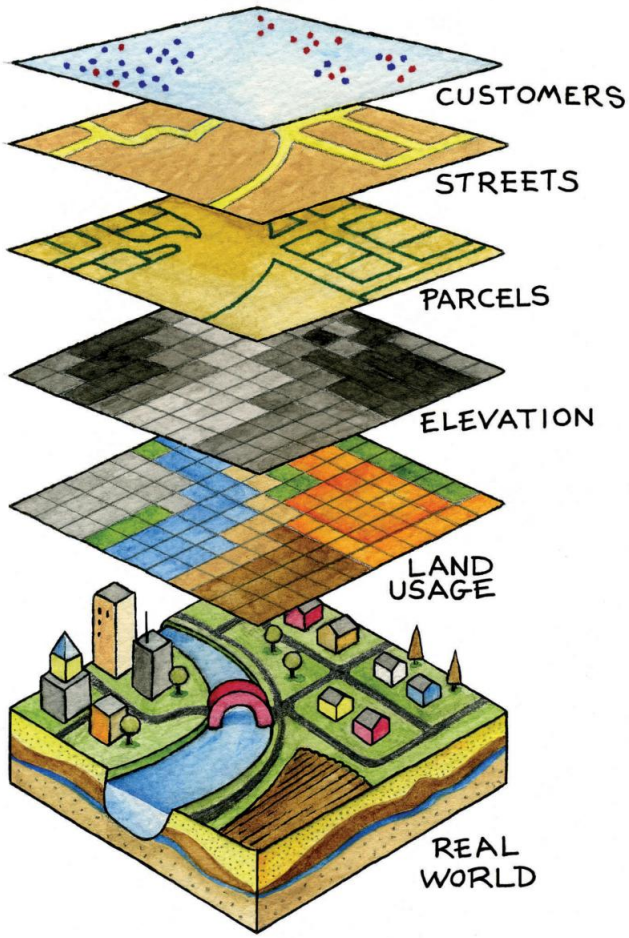
- “digital geography” / GIS

- applied examples
  - *Nebraska Homesteads*
  - *Railroads and the Making of Modern America*
  - *Placing Segregation*

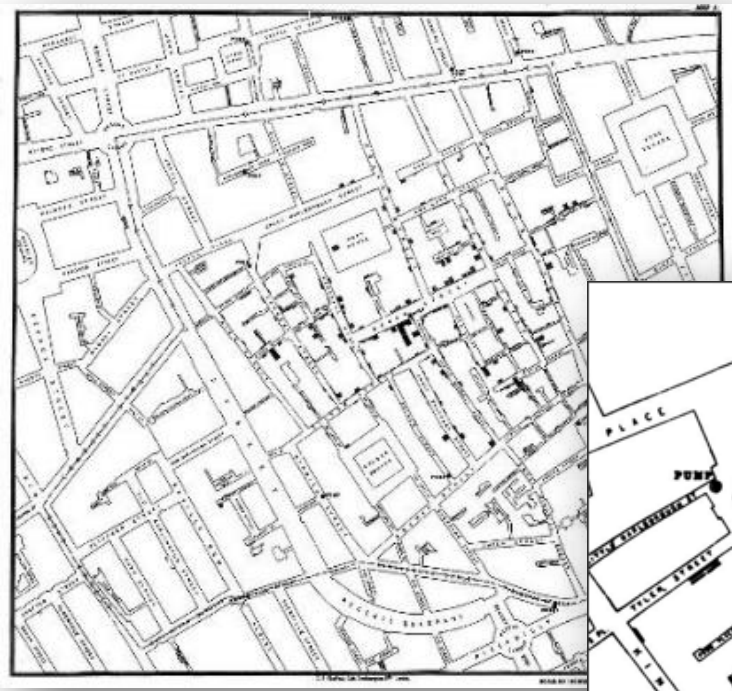
What is Geographic Information Systems (GIS)

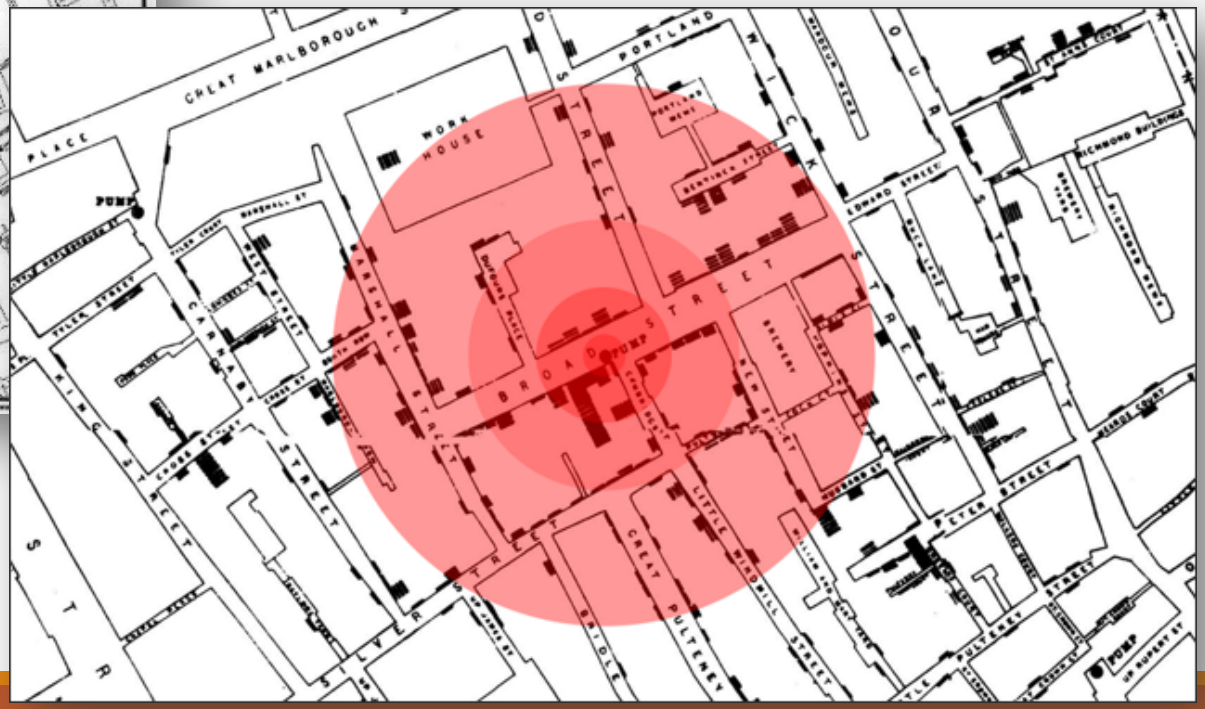
Unique content management system that can store data by attaching layers of descriptive information to absolute location as well as to a database

Among its unique benefits is the ability to relate otherwise disparate data sources on the basis of common geography, revealing patterns that are otherwise invisible



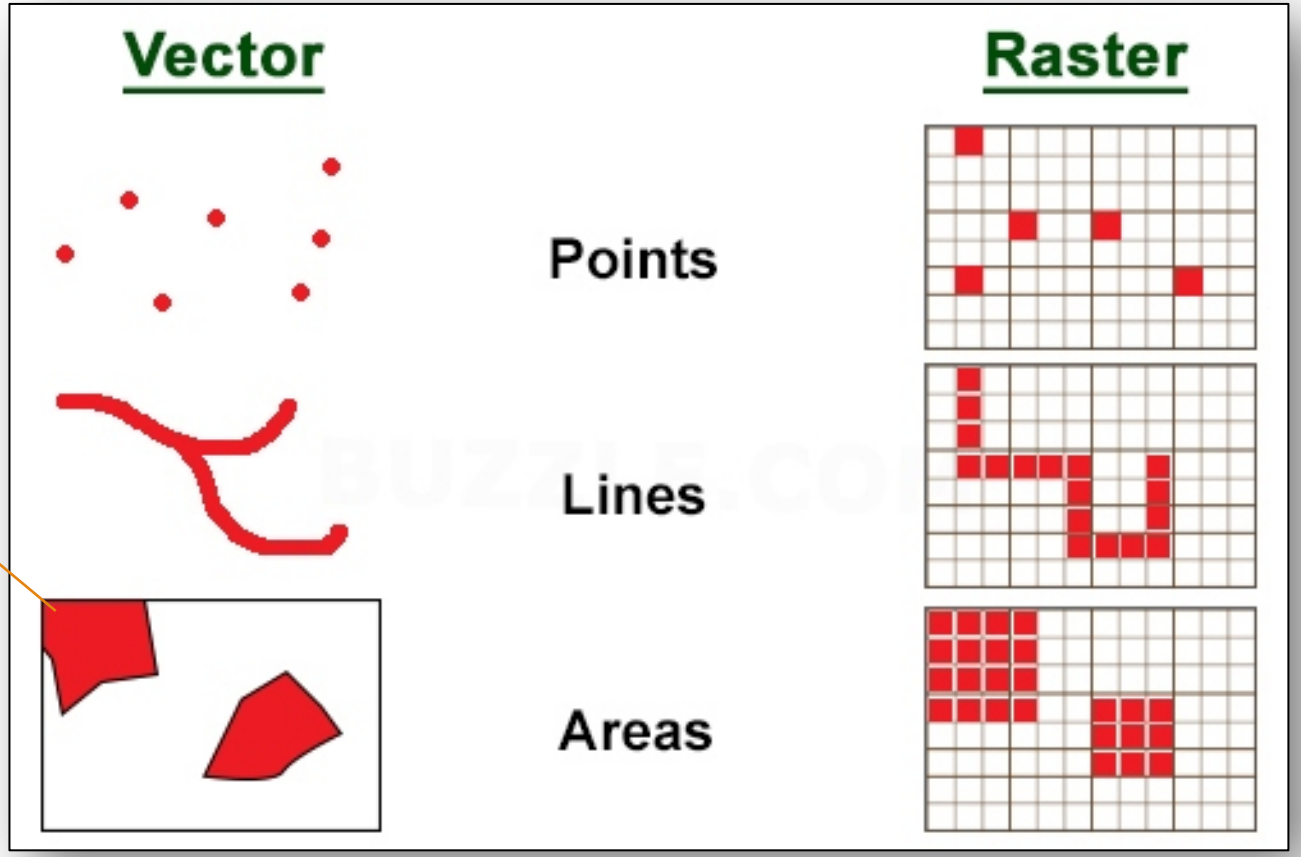
What is GIS




GREAT MARLBOROUGH
PLACE
PUMP
WORK HOUSE
PORTLAND
BROAD STREET
MARSHALL STREET
CARNABY STREET
KING STREET
SILVER STREET
GREAT PULTENEY
LITTLE WINDMILL STREET
PETER STREET
EDWARD STREET
RICHMOND BUILDINGS
PUMP

GIS Data Types

shape	quantity
1	30
2	50
3	1,00



So many technologies

Visualization Tools

•Google Earth
•GeoServer, ArcGIS for Server
•Neatline Maps (with Omeka)
•JS APIs: Google, OpenLayers, Leaflet, ESRI, D3
•Gephi
•TileMill
•MapBox

Processing Tools

- ArcGIS for Desktop
- Quantum GIS (QGIS)
- Open GeoDa
- IDRISI
- ERDAS Imagine
- R
- Microsoft Excel (yes)

So many current GIS resources

Data and Images

- US Census Bureau TIGER
- American Fact Finder
- The National Map
- USGS Earth Explorer
- Library of Congress – Map collection
- David Rumsey Collection
- NASA SEDAC
- Local governments

GIS Viewer

CITY OF LINCOLN - LANCASTER COUNTY, NE

Layers

Filter Layers...

Filter

- [x] Address Numbers
- [x] Ownership Parcel Information
- [ ] Subdivisions
- [x] Ownership Parcels
- [ ] Floodplain
- [ ] Districts
- [x] Parks
- [ ] Soils
- [ ] Zoning
- [ ] LandUse
- [ ] Village Limits
- [x] Buildings
- [x] PLSS

Home | Layers

I want to...

Ownership Parcels

1 of 2

Ownership Parcels

Legal Description: LINCOLN ORIGINAL, BLOCK 153, Lot 5 - 6

Owner Information:
STATE OF NEBRASKA
ATTN: DAS/STATE BLDG DIVISION PO BOX 98940
LINCOLN, NE 68509-8940

Assessed Value: $437,200

Assessor Property Details

Property Photo:

Add to Results | View Additional Details | Run a Report

S 16TH ST

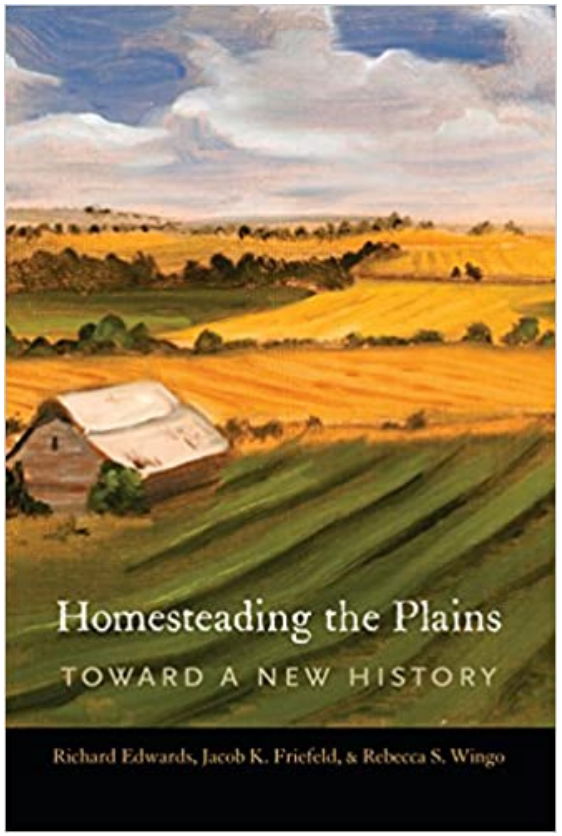
G ST

McPhee

Street

0 150 300ft

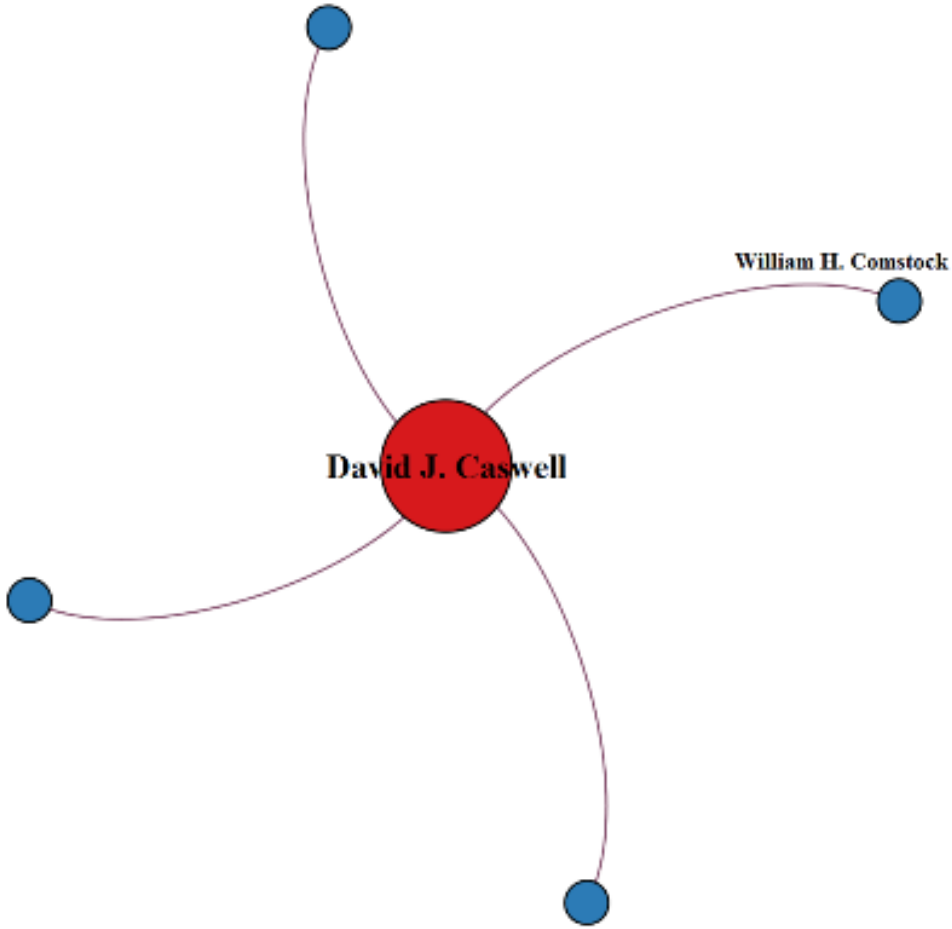
Nebraska Homesteads



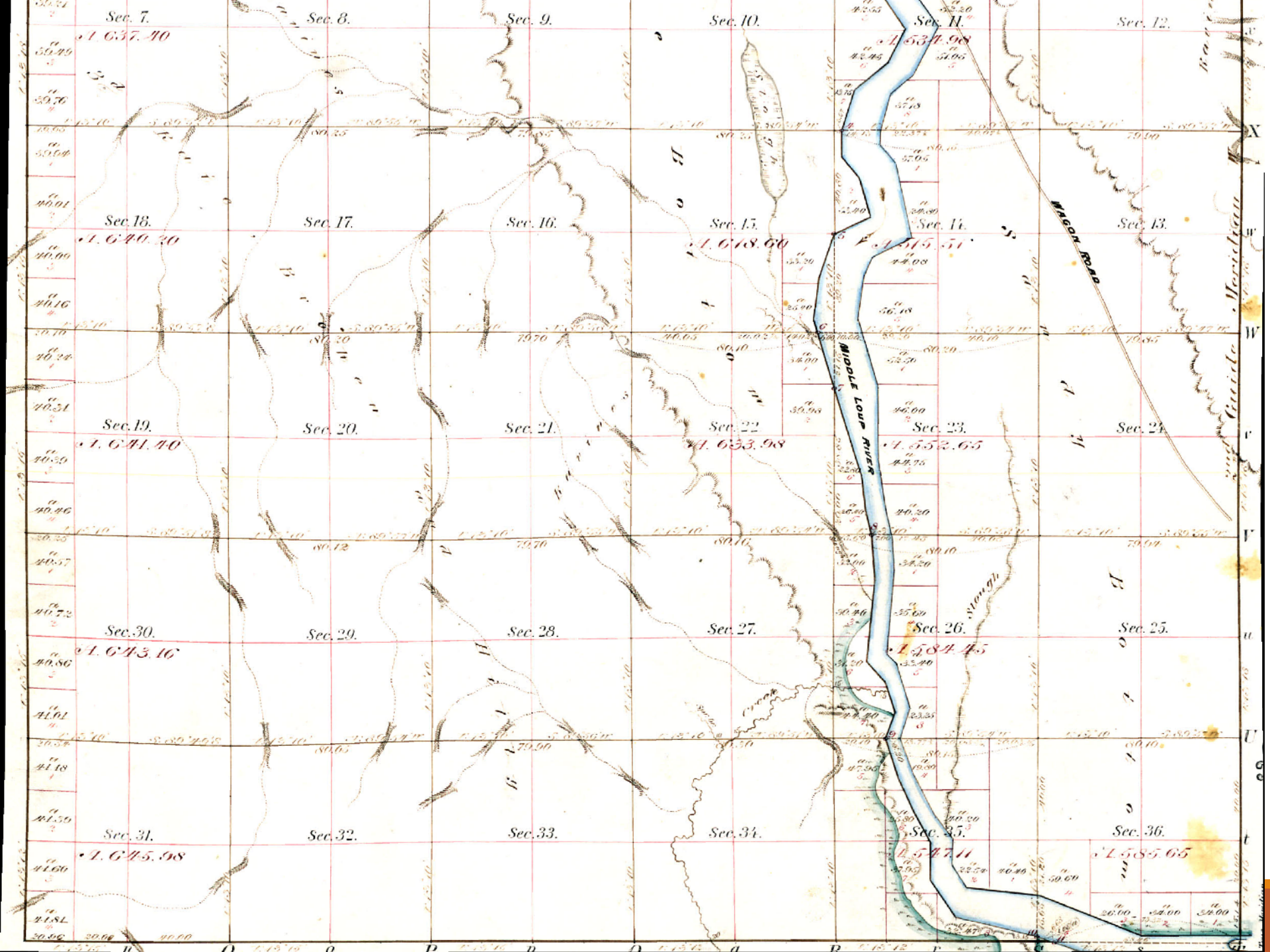
data

Data:

- **Homestead Records** (digitized by Fold3)
- **USGS Public Land Survey System** (via US Census Bureau TIGER),
- **original survey maps** (state archives)


William H. Comstock
David J. Caswell

T20N, R17W, Custer County, Nebraska
Community leaders as identified by In-Degree.
More about this visualisation
Legend:
People
Witnesses
In-Degree
Search:
Search by name
Group Selector:
Select Group


Sec. 7.
Sec. 8.
Sec. 9.
Sec. 10.
Sec. 11.
Sec. 12.
Sec. 18.
Sec. 17.
Sec. 16.
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Sec. 22.
Sec. 23.
Sec. 24.
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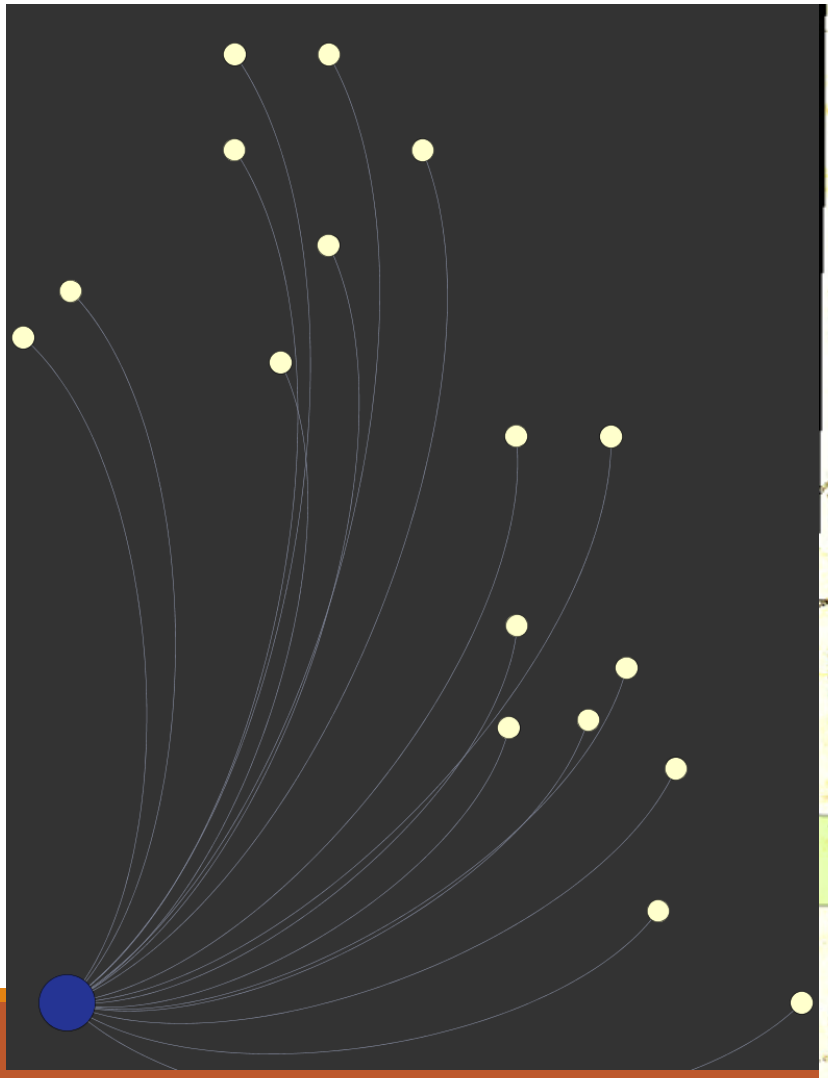
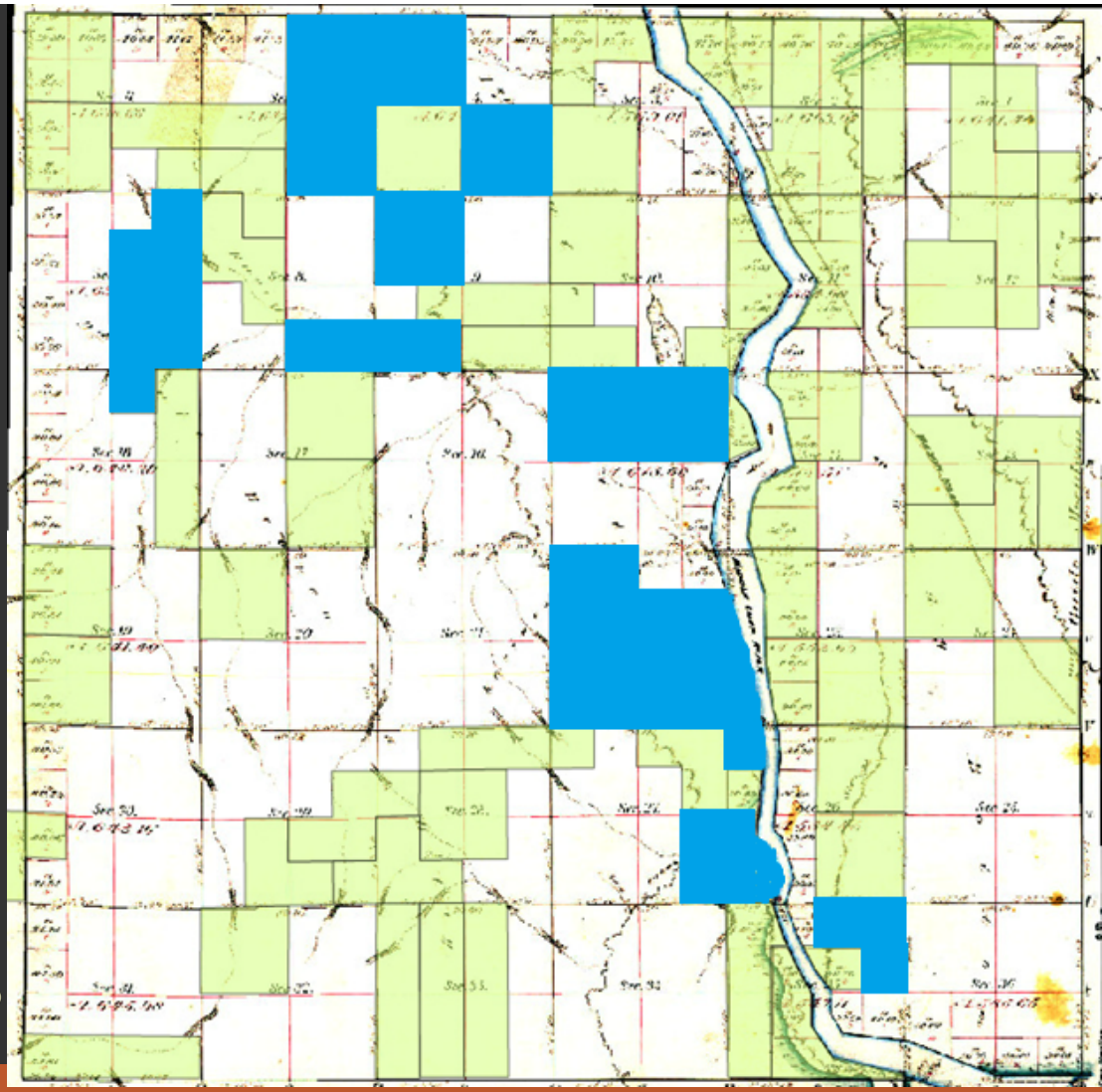
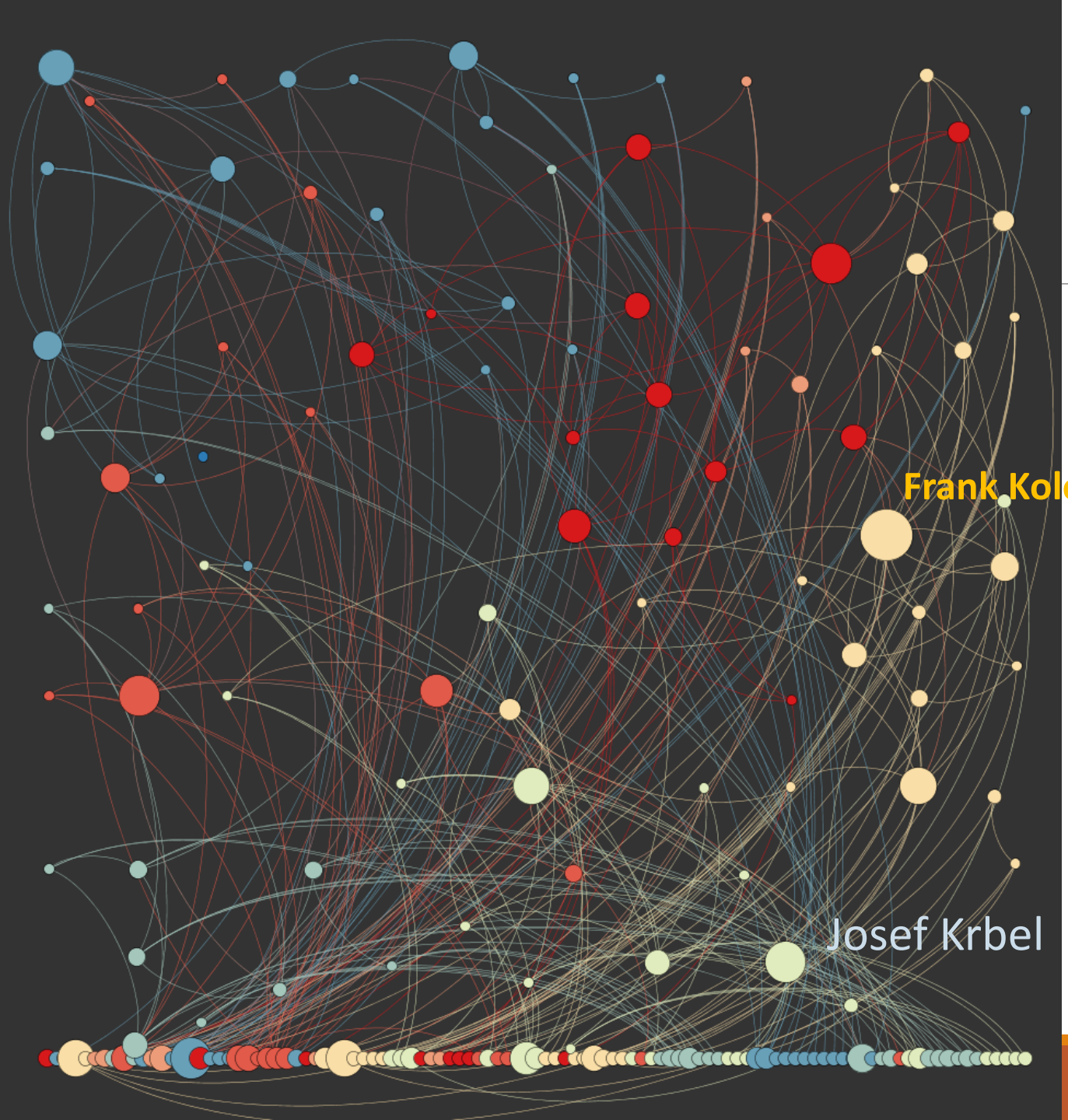
Sec. 28.
Sec. 27.
Sec. 26.
Sec. 25.
Sec. 31.
Sec. 32.
Sec. 33.
Sec. 34.
Sec. 35.
Sec. 36.
MIDDLE LOUP RIVER
WAGON ROAD
Slough
Creek

Geolocated social networks





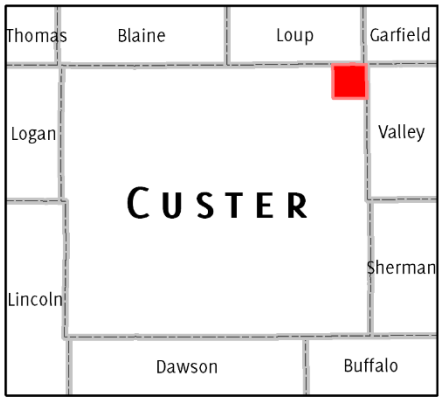

Frank Kolousek
Josef Krbel

APPLICANT

PLACE OF ORIGIN

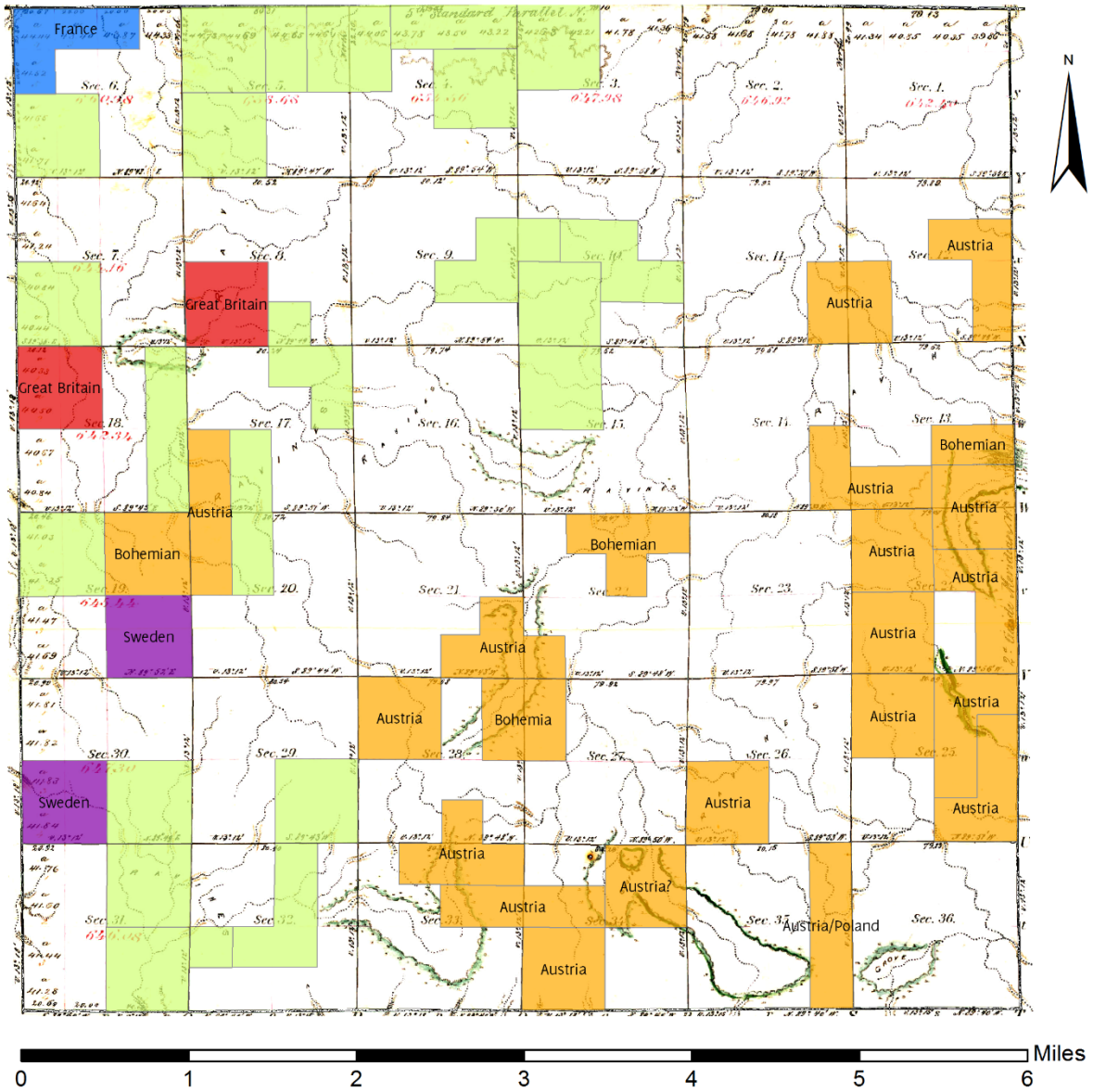
- **Central Europe** *Austria, Bohemia, Moravia*
- **United States**
- **United Kingdom**
- **France**
- **Sweden**

Location within Custer County



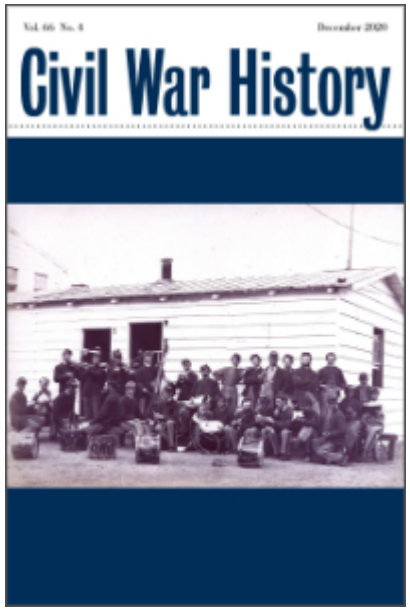
Base map is the original land survey, georeferenced by map author.

State Plane Nebraska (2600) coordinate system, using Lambert Conformal Conic Projection



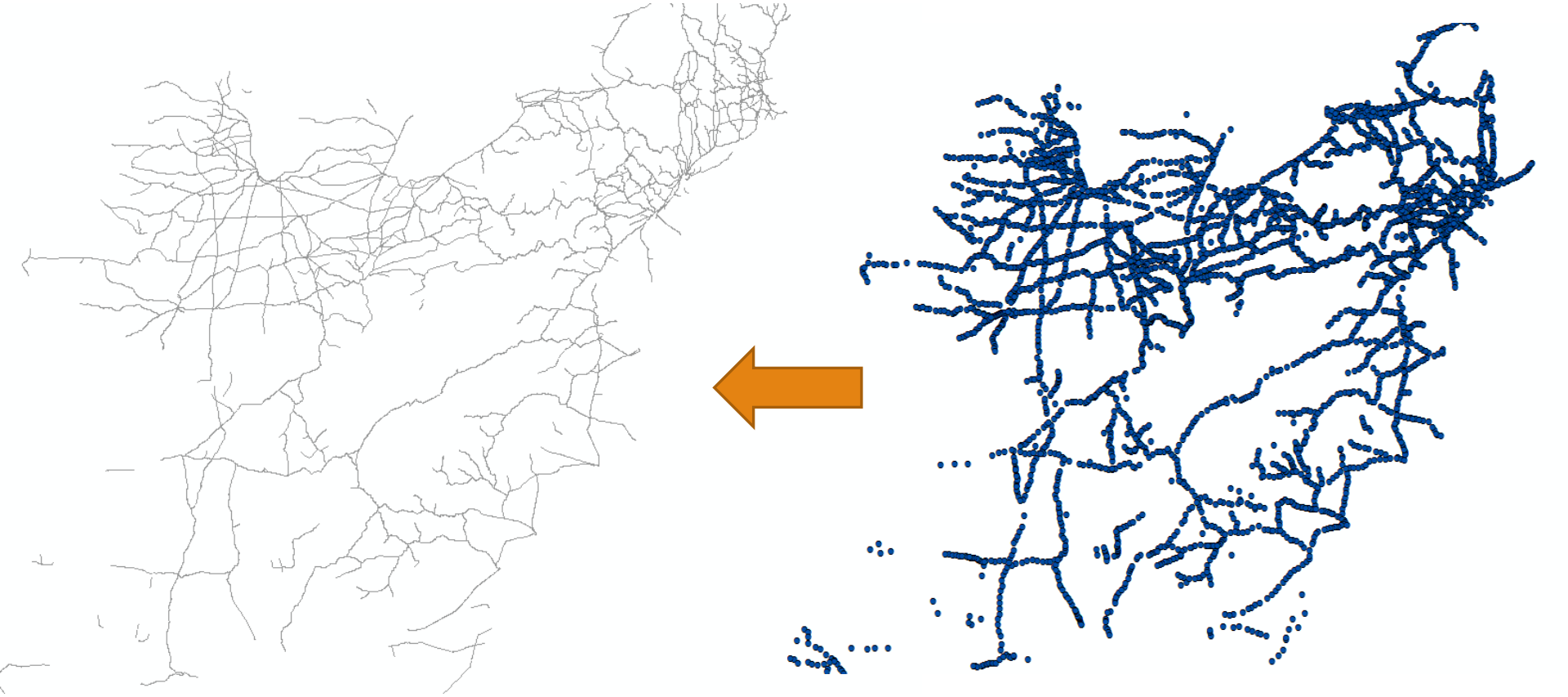
Center for Great Plains Studies | Center for Digital Research in the Humanities | Rob Shepard, Cartographer

Railroads and the Making of Modern America +



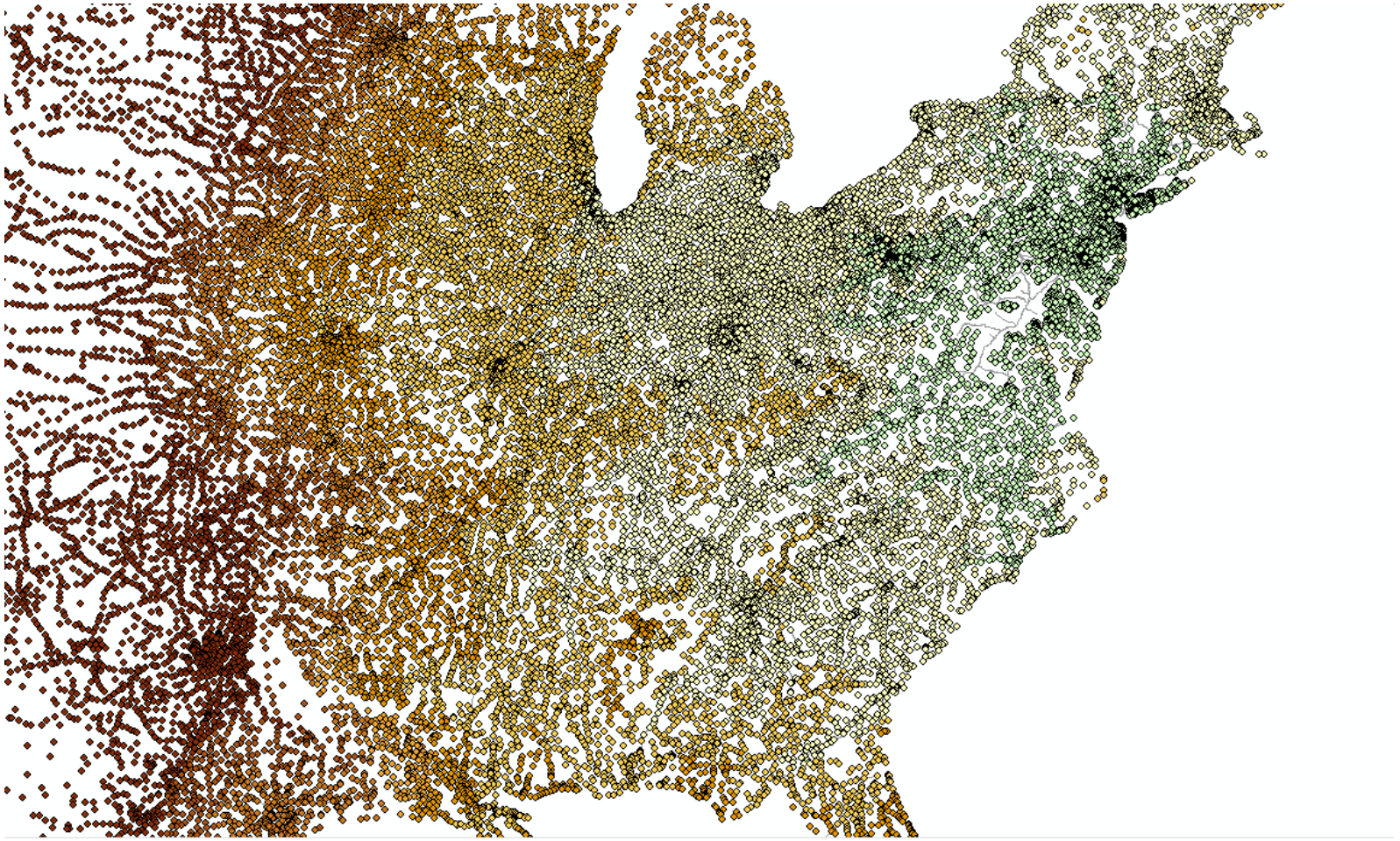
GIS PROCESSING: AN EXAMPLE FROM ARCGIS

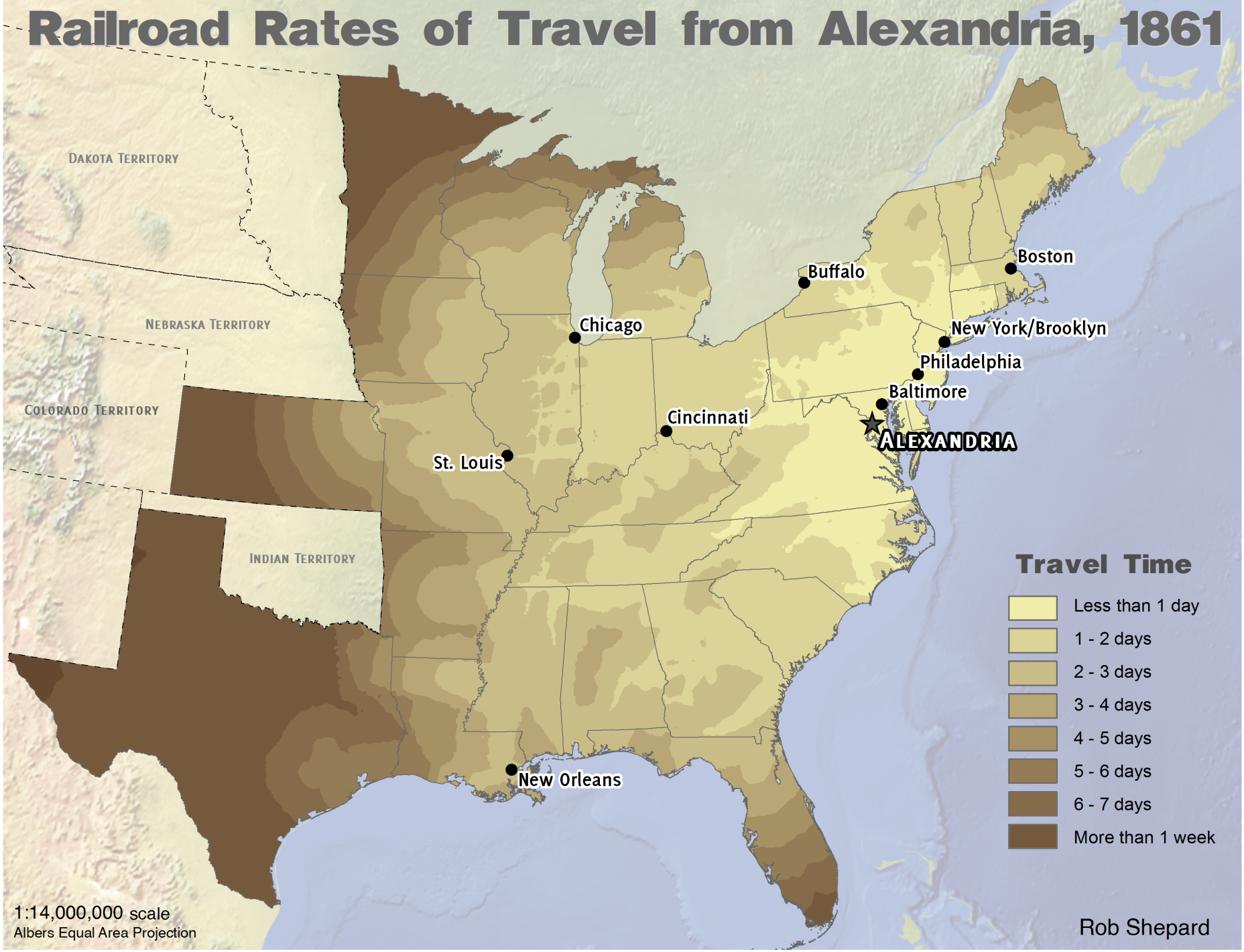
Data – Railroads and the Making of Modern America



geometric network

data generation




Railroad Rates of Travel from Alexandria, 1861
Dakota Territory
Nebraska Territory
Colorado Territory
Indian Territory
Buffalo
Boston
Chicago
New York/Brooklyn
Philadelphia
Baltimore
Cincinnati
ALEXANDRIA
St. Louis
New Orleans
Travel Time
Less than 1 day
1 - 2 days
2 - 3 days
3 - 4 days
4 - 5 days
5 - 6 days
6 - 7 days
More than 1 week
1:14,000,000 scale
Albers Equal Area Projection
Rob Shepard

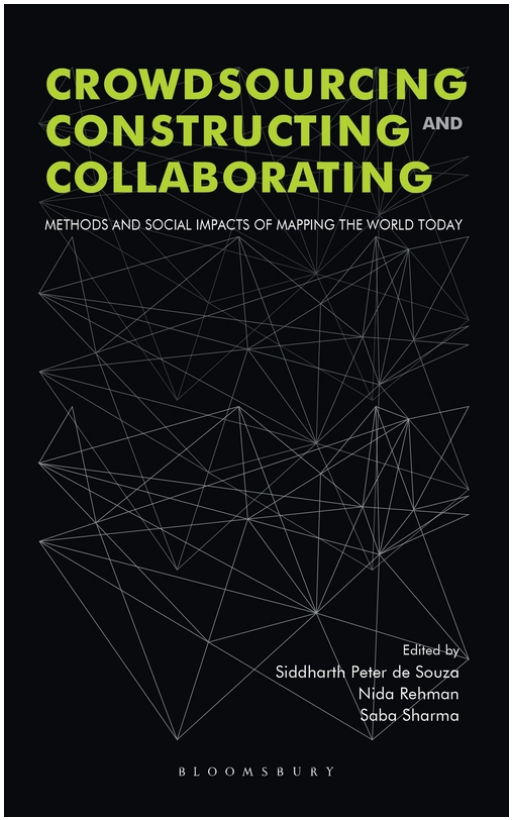
evolution & additional research

The initial project used spatial data to create a visualization (map) for the web, so that viewers could see what the rail network would have looked like during the Civil War

Mapping the data for visualization alerted scholar to additional spatial questions

ArcGIS for Desktop processing allowed calculations, value to be added to these data,

Placing Segregation



Human Objectives

The objective of this project is to investigate spatial patterns of residential segregation in mid-to-late Nineteenth Century American cities (1860s, 1870s) as they relate to issues such as wealth, occupation (jobs), ethnicity, and race, while working from a very small unit of data – the household

Spatial Research Questions

What is the impact and significance of (the common practice) of using aggregate data units to analyze human disparities across space?

To what extent do political boundaries limit/influence our understandings of the geographical analysis of population?

Interest in measuring this directly but creating something that is simultaneously accessible, stimulating for wider audiences

Introduction

Existing research often has relied on existing, aggregate datasets (wards, census tracts, etc.)

- The assumption here is one of scale – looking for separation, patterns, disparities among ethnic or socio-economic groups that might only be present on a smaller scale, such as city blocks or smaller

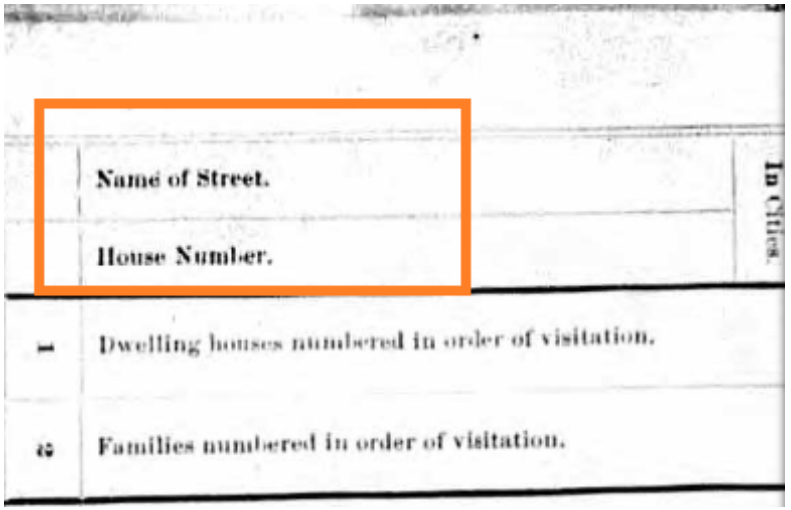
Work in the field of "historical GIS" has started to pursue geocoding all census records to study individual-level differences across space

Very few studies prior to 1880 due to absence of addresses

1) Beveridge 2002 2)Diamond and Bodenhamer 2001 3) DeBats and Gregory 2011 4) DeBats 2008 5) Massey and Denton 1993

Introduction

1880 was the **first year** that census noted the **address** of the respondent



1860 and 1870 were years that the census recorded **information about personal estate values**, but these questions were removed beginning with 1880.

Problem Statement

Although census records are available for the years 1860-1870, additional research is needed to determine the residential location of all individuals.

Census records must be geolocated and examined for a comprehensive understanding of socioeconomic segregation

Study Area

- **Washington, D.C.** (1860)
- Nashville, TN (1860)
- Omaha, NE (1870)

Data

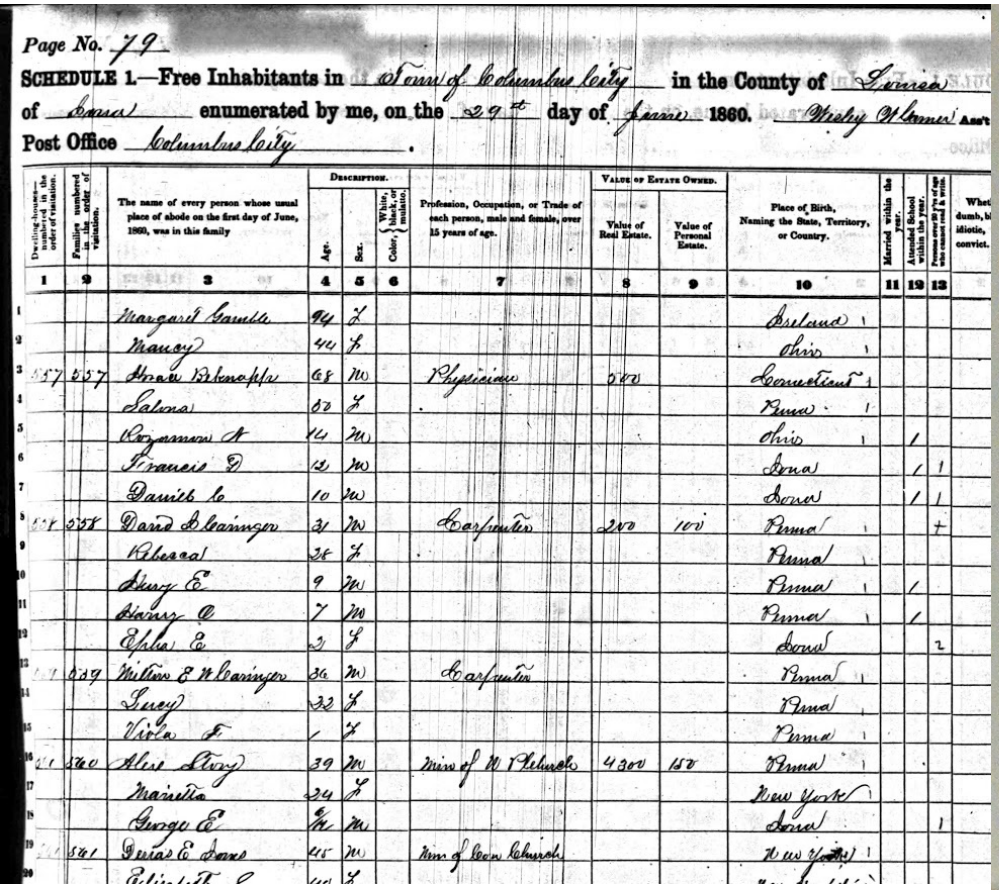
- city directories
- street directories
- census records
- (detailed) historical maps

Census Records

Some census attributes

- Real estate value (1850-1870)
- Place of Birth
- Race
- Personal estate worth (1860-1870)
- Occupation
- Family Size
- Slave owner (1860) – yes or no; number of slaves (slave schedule)

Research Design: Data



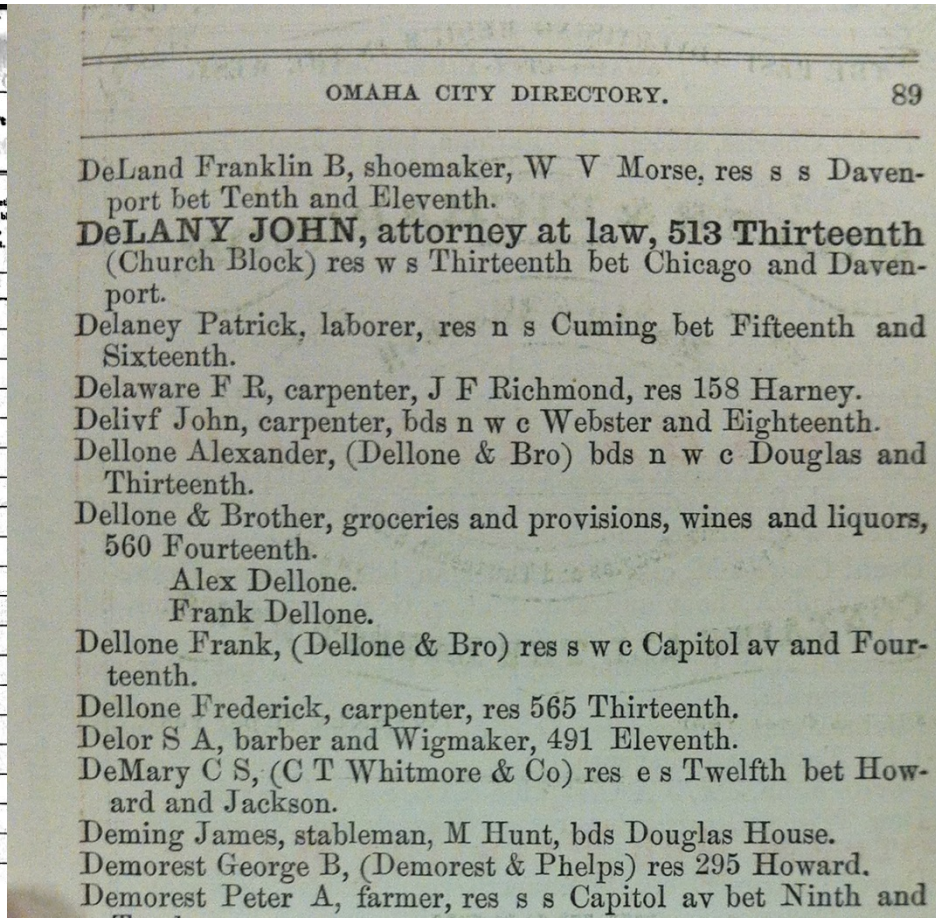
Page No. 79

SCHEDULE 1.—Free Inhabitants in Town of Columbus City in the County of Lenawee

of Iowa enumerated by me, on the 29th day of June 1860. Wesley W Garner Ass't

Post Office Columbus City.

Dwelling-houses—in the order of visitation	Families numbered in the order of visitation	The name of every person whose usual place of abode on the first day of June, 1860, was in this family	Description: Age	Sex	Color, (White, Black, or Mulatto)	Profession, Occupation, or Trade of each person, male and female, over 15 years of age.	Value of Estate Owned: Value of Real Estate.	Value of Personal Estate.	Place of Birth, Naming the State, Territory, or Country.	Married within the year.	Attended School within the year.	Persons over 20 yrs of age who cannot read & write.	Whether dumb, blind, idiotic, convict.
1	2	3	4	5	6	7	8	9	10	11	12	13	
		Margaret Gamble	94	F					Ireland				
		Mancy	40	F					Ohio				
557	557	Hiram Bloomfield	68	M		Physician	5000		Connecticut				
		Salina	62	F					Iowa				
		Benjamin A	40	M					Ohio		1		
		Frances D	12	M					Iowa		1	1	
		Daniel C	10	M					Iowa		1	1	
558	558	David S Grainger	31	M		Carpenter	200	100	Iowa			+	
		Rebecca	28	F					Iowa				
		Henry E	9	M					Iowa		1		
		Harry C	7	M					Iowa		1		
		Effie E	3	F					Iowa			1	
559	559	William E M Grainger	36	M		Carpenter			Iowa				
		Lucy	32	F					Iowa				
		Viola F	1	F					Iowa				
560	560	Alex Story	39	M		Miss of M E Church	4300	150	Iowa				
		Marietta	34	F					New York				
		George E	9	M					Iowa			1	
561	561	Silas E Jones	45	M		Min of Meth Episcopal Church			New York	1			



OMAHA CITY DIRECTORY. 89

DeLand Franklin B, shoemaker, W V Morse, res s s Davenport bet Tenth and Eleventh.

DeLANY JOHN, attorney at law, 513 Thirteenth (Church Block) res w s Thirteenth bet Chicago and Davenport.

Delaney Patrick, laborer, res n s Cuming bet Fifteenth and Sixteenth.

Delaware F R, carpenter, J F Richmond, res 158 Harney.

Delivf John, carpenter, bds n w c Webster and Eighteenth.

Dellone Alexander, (Dellone & Bro) bds n w c Douglas and Thirteenth.

Dellone & Brother, groceries and provisions, wines and liquors, 560 Fourteenth.
Alex Dellone.
Frank Dellone.

Dellone Frank, (Dellone & Bro) res s w c Capitol av and Fourteenth.

Dellone Frederick, carpenter, res 565 Thirteenth.

Delor S A, barber and Wigmaker, 491 Eleventh.

DeMary C S, (C T Whitmore & Co) res e s Twelfth bet Howard and Jackson.

Deming James, stableman, M Hunt, bds Douglas House.

Demorest George B, (Demorest & Phelps) res 295 Howard.

Demorest Peter A, farmer, res s s Capitol av bet Ninth and

Census Records & City Directories

These provide complete address information, occupation information, data on personal estate value, worth of real estate… ideally, for each person

Limitations:

- Women, people of color, transient populations are under-represented in the city directories
- City directories are sometimes vague about residence locations

Street Directories

496 493 7th W.
526 531 6th W.
— — Massachts. av.
528 555 5th W.
604 605 4th W.
622 — 3d W.
652 — 2d W.
— — New Jersey av.

K North, from Rock Creek, Georgetown, to Boundary.
Left Rt.
2 1 Bridge.
26 25 27th W.
40 49 26th W.
66 65 25th W.
84 83 24th W.
— — Circle.
— — Pennsylvania av
— 91 22d W.
128 121 21st W.
148 — 20th W.
168 167 19th W.
178 177 18th W.
— 189 Connecticut av.
224 211 17th W.
254 235 16th W.
280 291 15th W.
292 — Vermont av.
300 — 14th W.
340 339 13th W.
358 365 12th W.
370 377 11th W.
— 381 10th W.

204 195 19th W.
— — 18th W.
— — Connecticut av.
— — 17th W.
Creek, not open.
314 327 16th W.
344 357 15th W.
— — 14th W.
416 417 Massachts. av.
— — Vermont av.
446 449 13th W.
476 479 12th W.
488 493 11th W.
508 — 10th W.
542 541 9th W.
564 — 8th W.
584 581 7th W.
614 613 6th W.
624 625 5th W.
686 685 4th W.
— — 3d W.

N North, from Rock Creek, Georgetown, to Boundary.
Left Rt.
368 — 15th W.
410 — 14th W.
426 — Vermont av.
438 439 13th W.
462 465 12th W.
— — 11th W.
488 485 10th W.
528 525 9th W.
— — 8th W.

— — 8th W.
— 215 7th W.
— 257 6th W.
Re-opens at
208 — 2d W.
242 239 1st W.
— — S. Capitol.
Re-opens at
268 265 New Jersey av.
— 301 1st E.
350 351 2d E.
— — Pennsylvania av
364 — 3d E.
384 387 4th E.
— — 5th E.

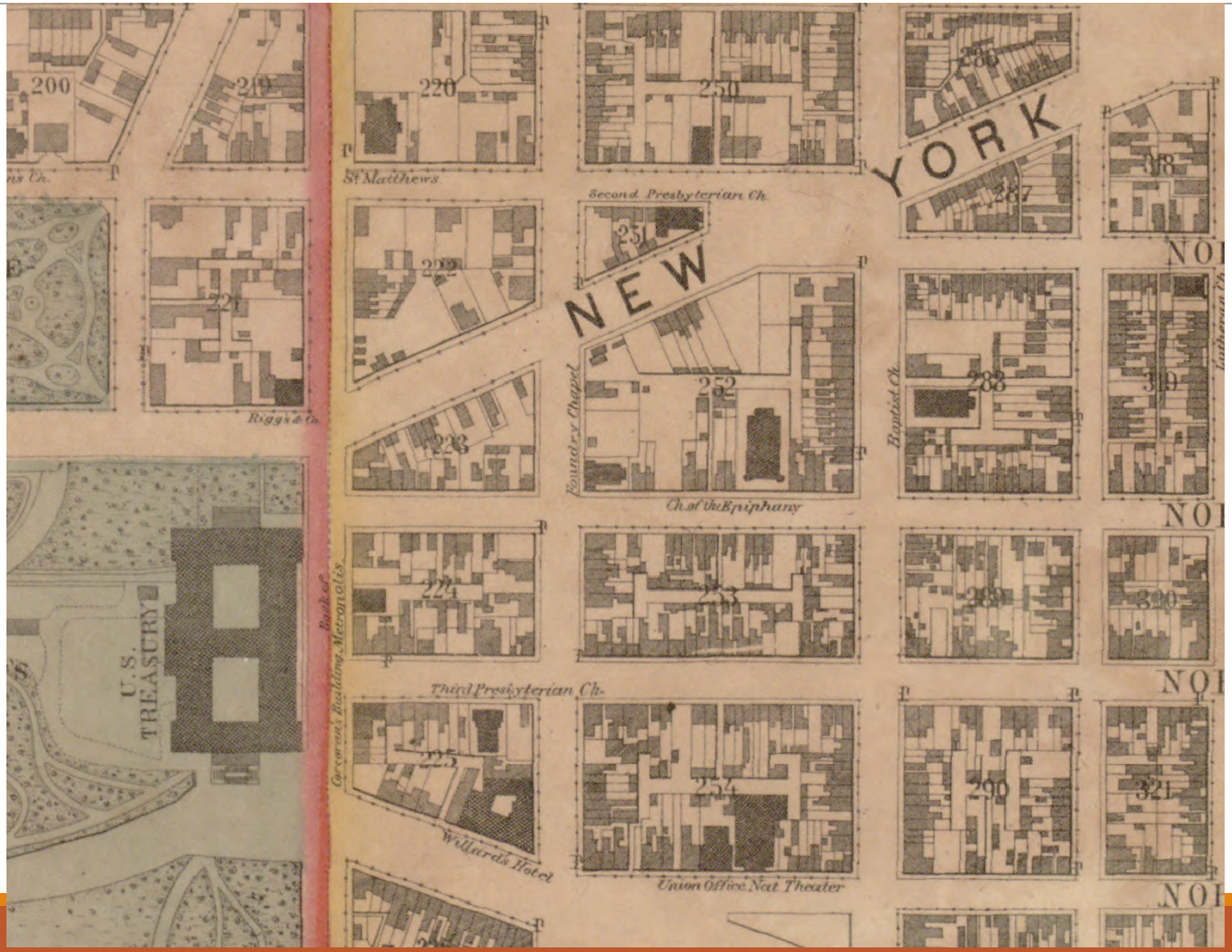
C, South, from the Potomac to 19th East.
Left Rt.
58 — 14th W.
80 — 13½th W.
106 — 13th W.
142 — 12th W.
150 — 11th W.
170 — 10th W.
— — Virginia av.
— — Maryland av.
— 185 6th W.
274 277 4½th W.
316 — 3d W.
332 331 2d W.
— 353 1st W.
Canal, no Bridge, from New Jersey av. eastward. But par-

508 505 7th E.
— — 8th E.
— — 9th E.
— 551 10th E.
— — 11th E.
572 571 12th E.
— 607 13th E.

F, South, from the Potomac to S. Capitol.
Left Rt.
18 — 11th W.
34 31 10th W.
76 73 9th W.
94 93 8th W.
— 115 7th W.
144 141 6th W.
194 193 4½th W.
238 243 3d W.
272 281 2d W.
304 — 1st W.
— — S. Capitol.

G. South, from the Potomac to Eastern Branch.
Left Rt.
2 — 11th W.
24 — 10th W.
72 59 9th W.
90 87 8th W.
110 — 7th W.
148 147 6th W.
— 179 4½th W.
202 201 3d W.
— 241 2d W.

Historical base maps



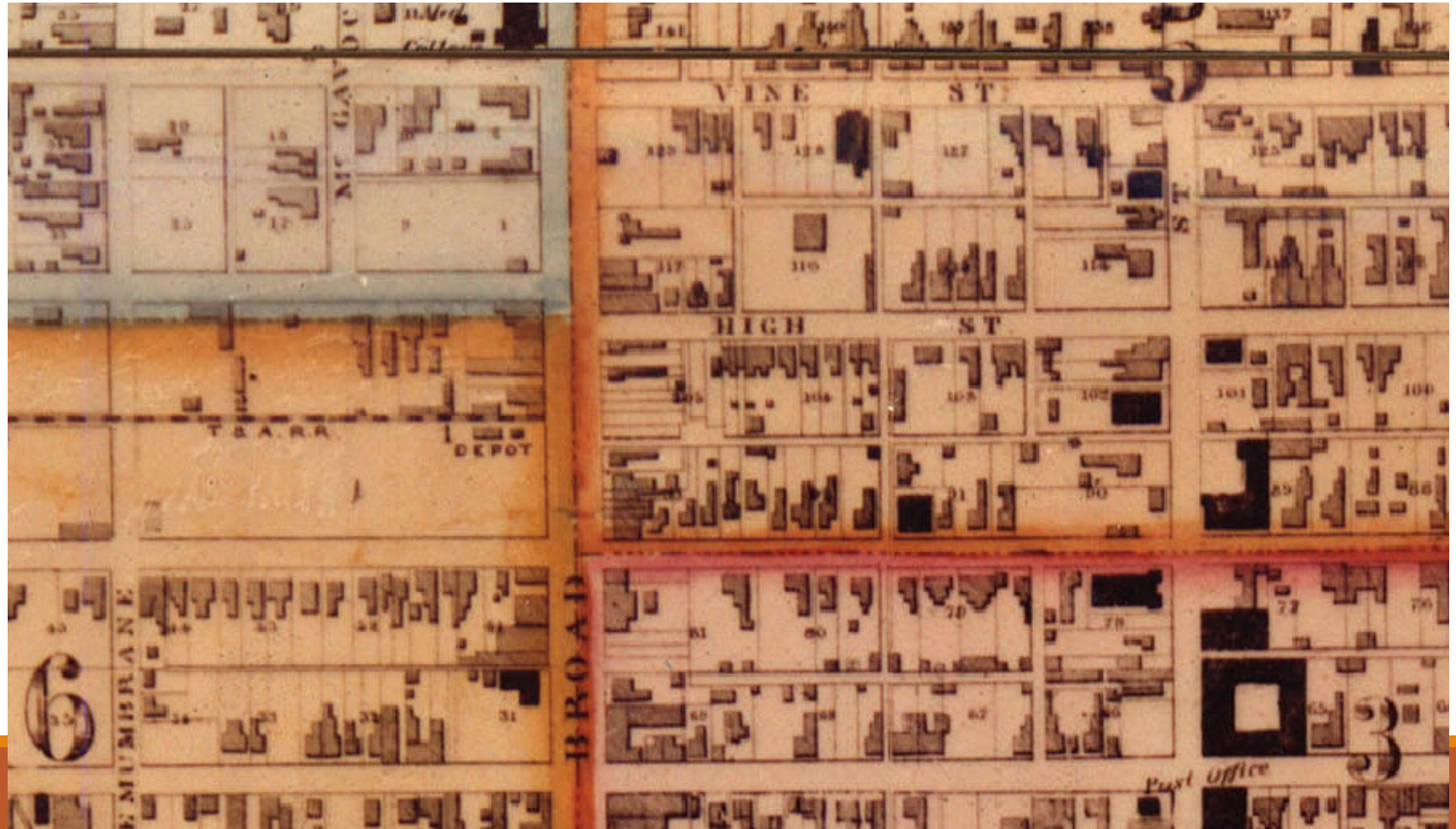
Methods

- Dealing with missing/incomplete data
- Geolocating the records
- Mapping data
- Analyzing with index of dissimilarity

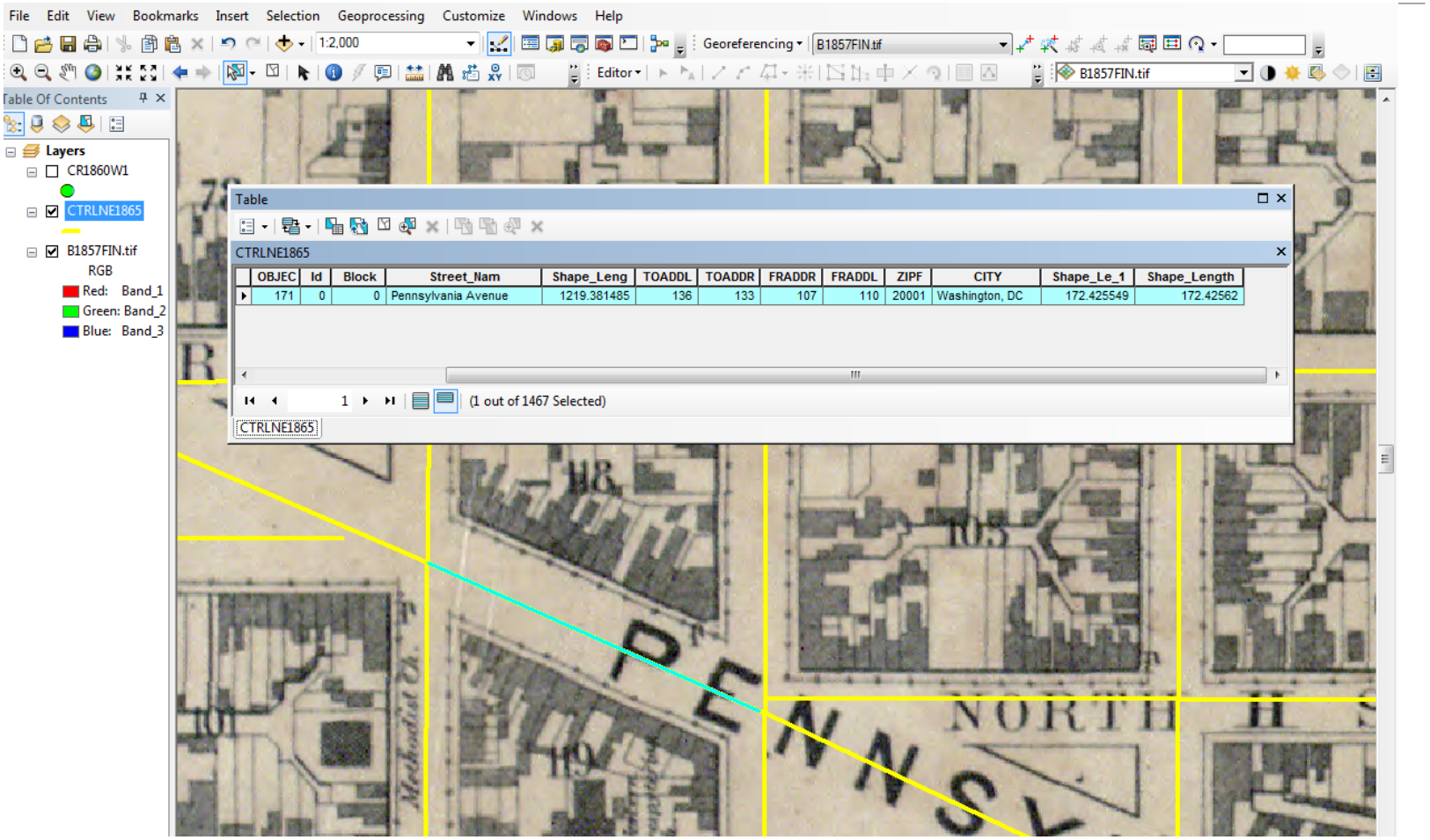
Imprecise Data

Imprecise Data

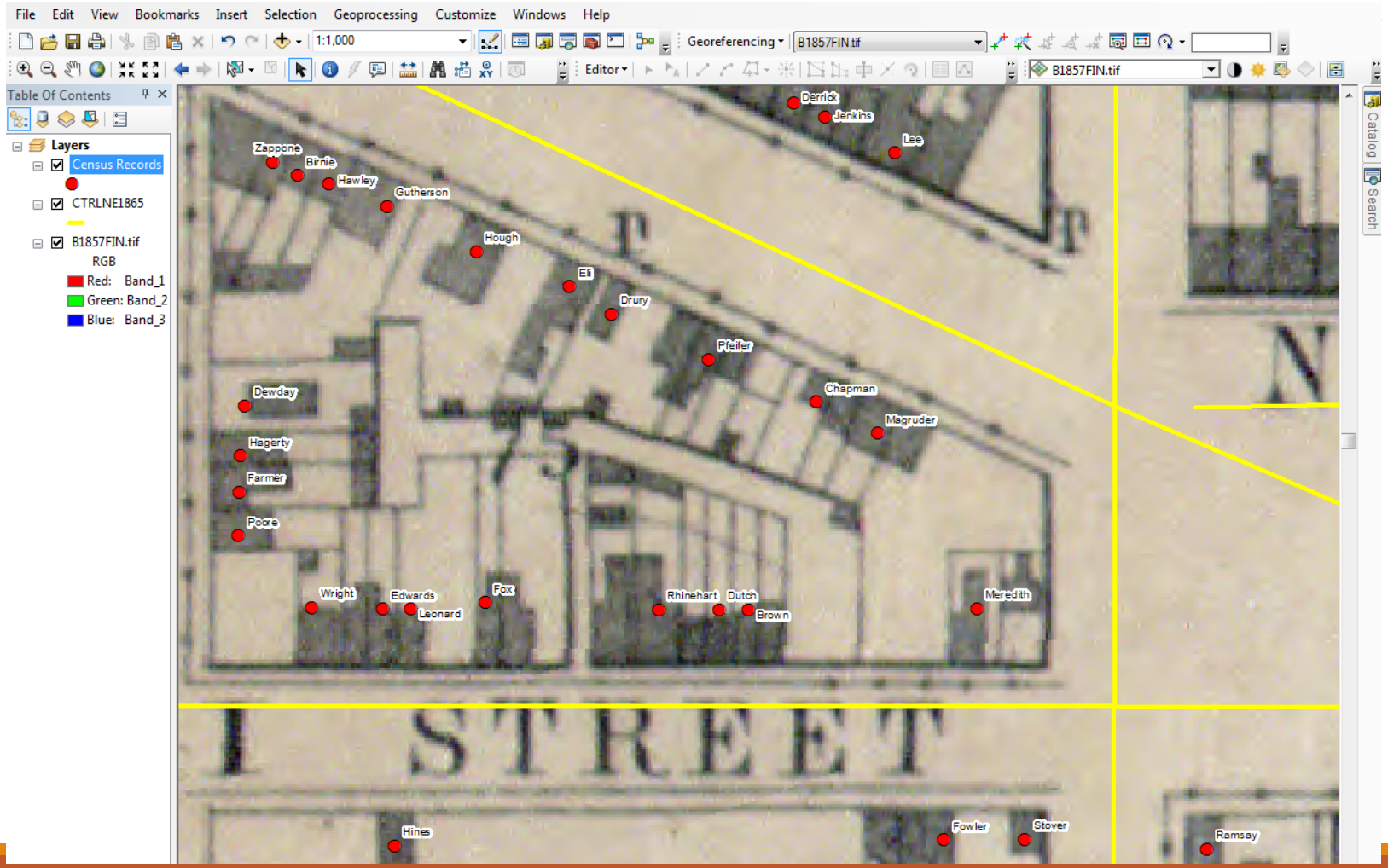
Ward boundaries are listed for Washington, Nashville.



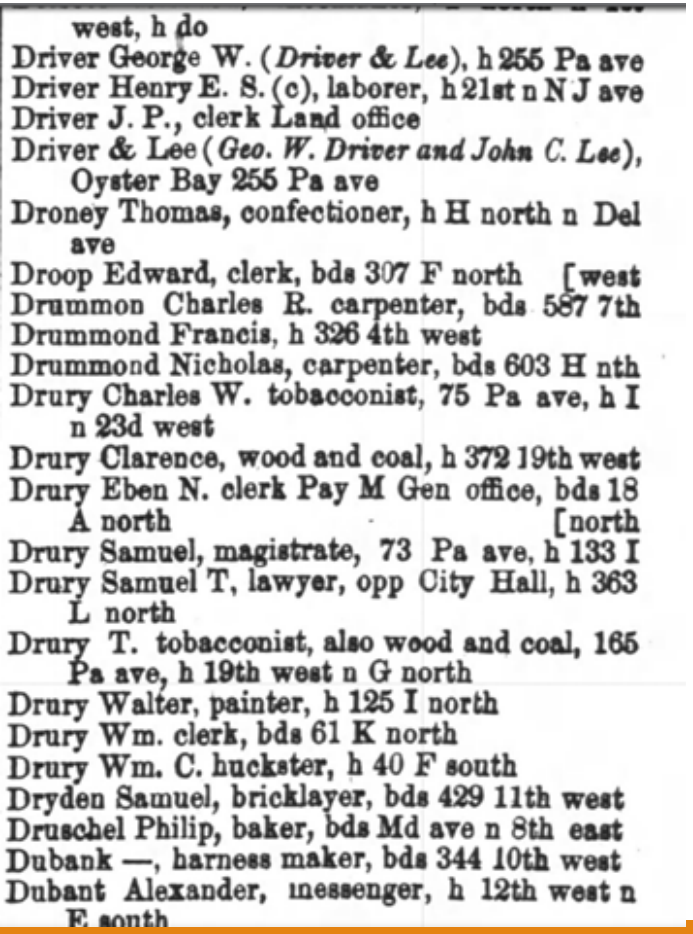
Creating Address Locators

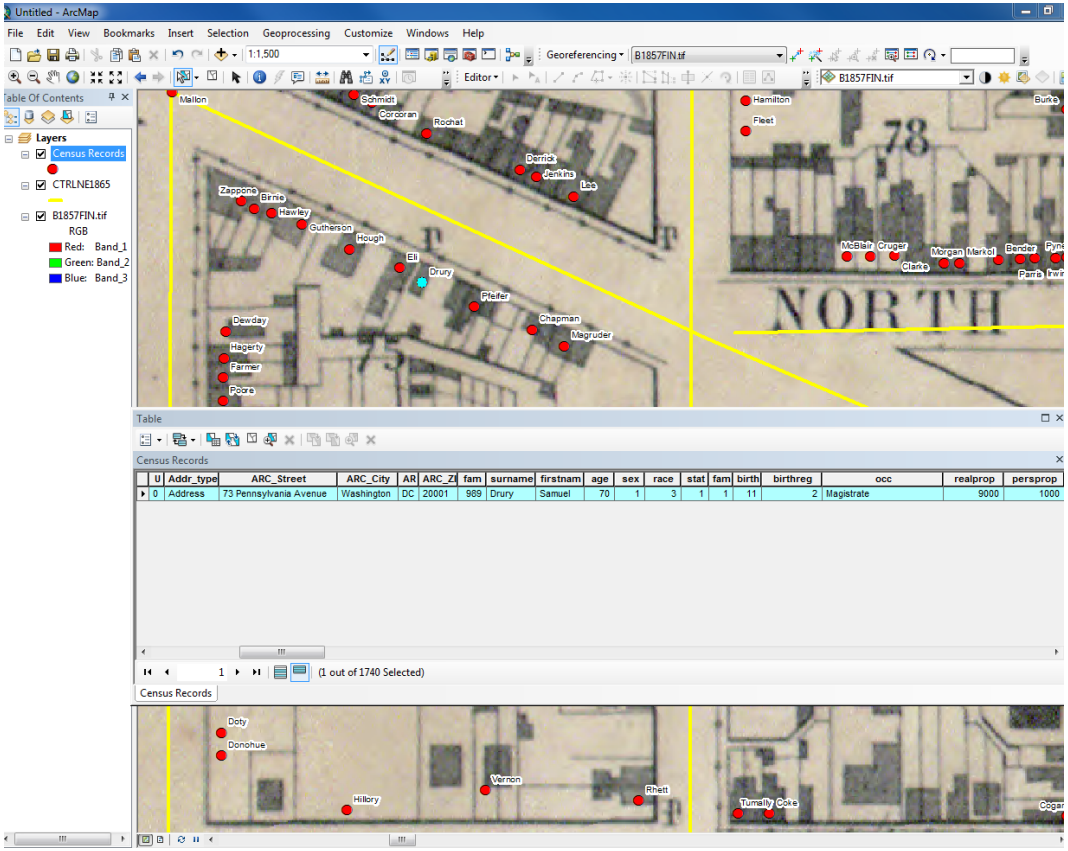


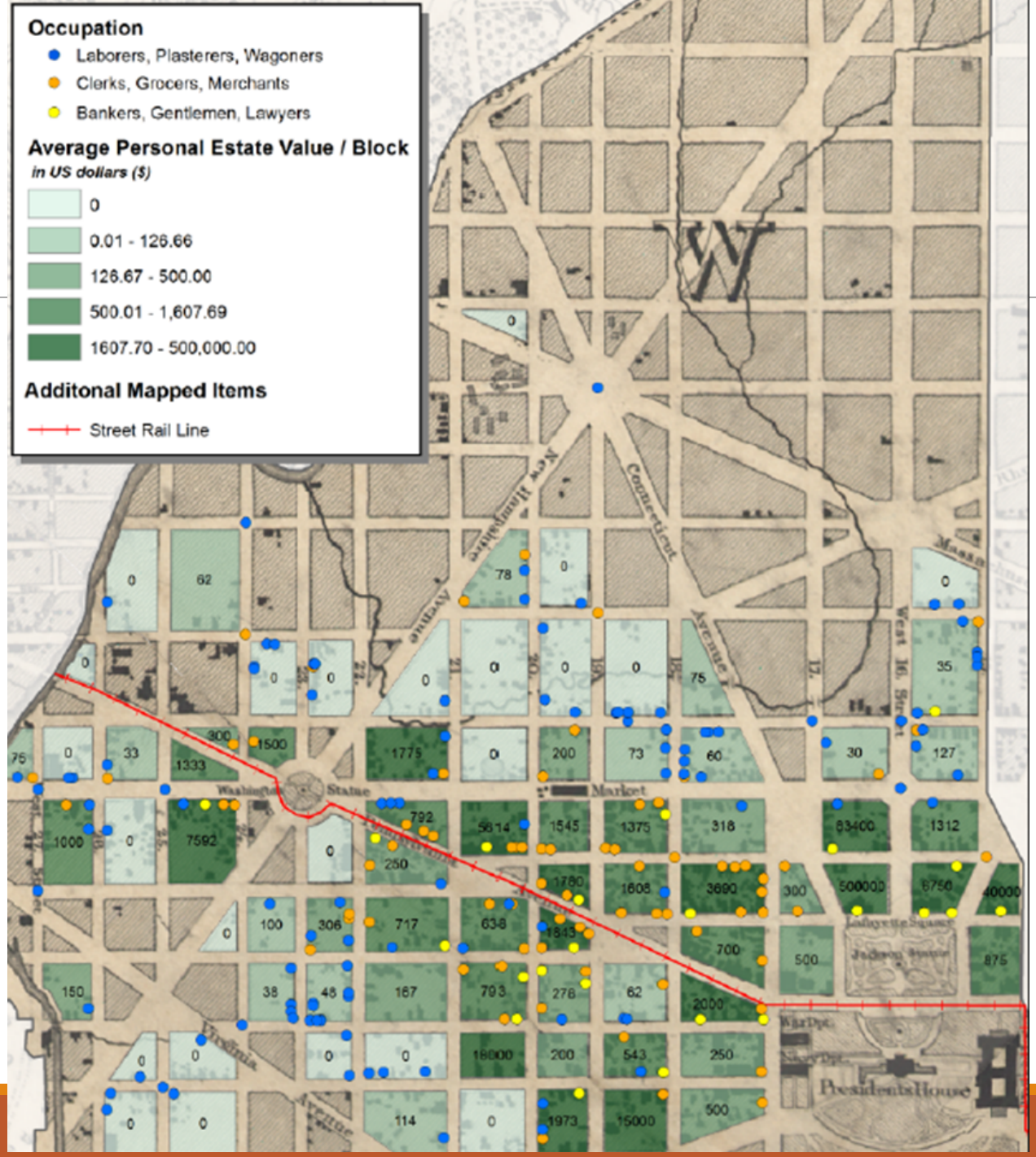
Geocoded Records



Geocoded Records


west, h do
Driver George W. (*Driver & Lee*), h 255 Pa ave
Driver Henry E. S. (c), laborer, h 21st n N J ave
Driver J. P., clerk Land office
Driver & Lee (*Geo. W. Driver and John C. Lee*), Oyster Bay 255 Pa ave
Droney Thomas, confectioner, h H north n Del ave
Droop Edward, clerk, bds 307 F north [west
Drummon Charles R. carpenter, bds 587 7th
Drummond Francis, h 326 4th west
Drummond Nicholas, carpenter, bds 603 H nth
Drury Charles W. tobacconist, 75 Pa ave, h I n 23d west
Drury Clarence, wood and coal, h 372 19th west
Drury Eben N. clerk Pay M Gen office, bds 18 A north [north
Drury Samuel, magistrate, 73 Pa ave, h 133 I
Drury Samuel T, lawyer, opp City Hall, h 363 L north
Drury T. tobacconist, also wood and coal, 165 Pa ave, h 19th west n G north
Drury Walter, painter, h 125 I north
Drury Wm. clerk, bds 61 K north
Drury Wm. C. huckster, h 40 F south
Dryden Samuel, bricklayer, bds 429 11th west
Druschel Philip, baker, bds Md ave n 8th east
Dubank —, harness maker, bds 344 10th west
Dubant Alexander, messenger, h 12th west n E south




Occupation
Laborers, Plasterers, Wagoners
Clerks, Grocers, Merchants
Bankers, Gentlemen, Lawyers
Average Personal Estate Value / Block
in US dollars ($)
0
0.01 - 126.66
126.67 - 500.00
500.01 - 1,607.69
1607.70 - 500,000.00
Additonal Mapped Items
Street Rail Line
New Hampshire Avenue
Connecticut Avenue
West 16. Street
Washington Statue
Market
Lafayette Square
Jackson Statue
Virginia Avenue
War Dpt.
Navy Dpt.
Presidents House

North W Street
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North U Street
North T Street
North S Street
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N
Race
Mulatto
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White

Race
City Wards
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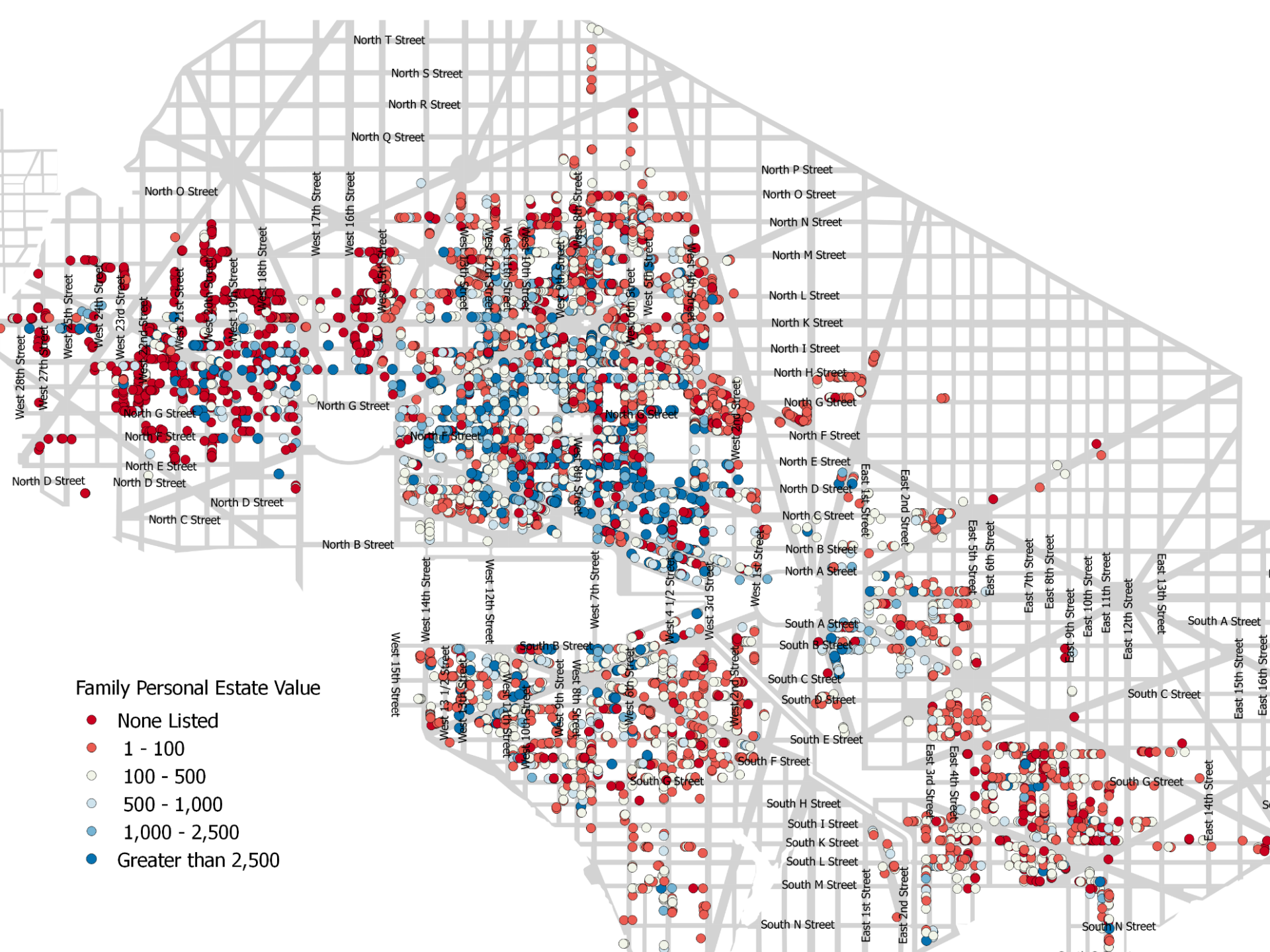
Legend
City Wards
Race
Mulatto
Black
White
Slaveowner
Yes
N


Family Personal Estate Value
None Listed
1 - 100
100 - 500
500 - 1,000
1,000 - 2,500
Greater than 2,500
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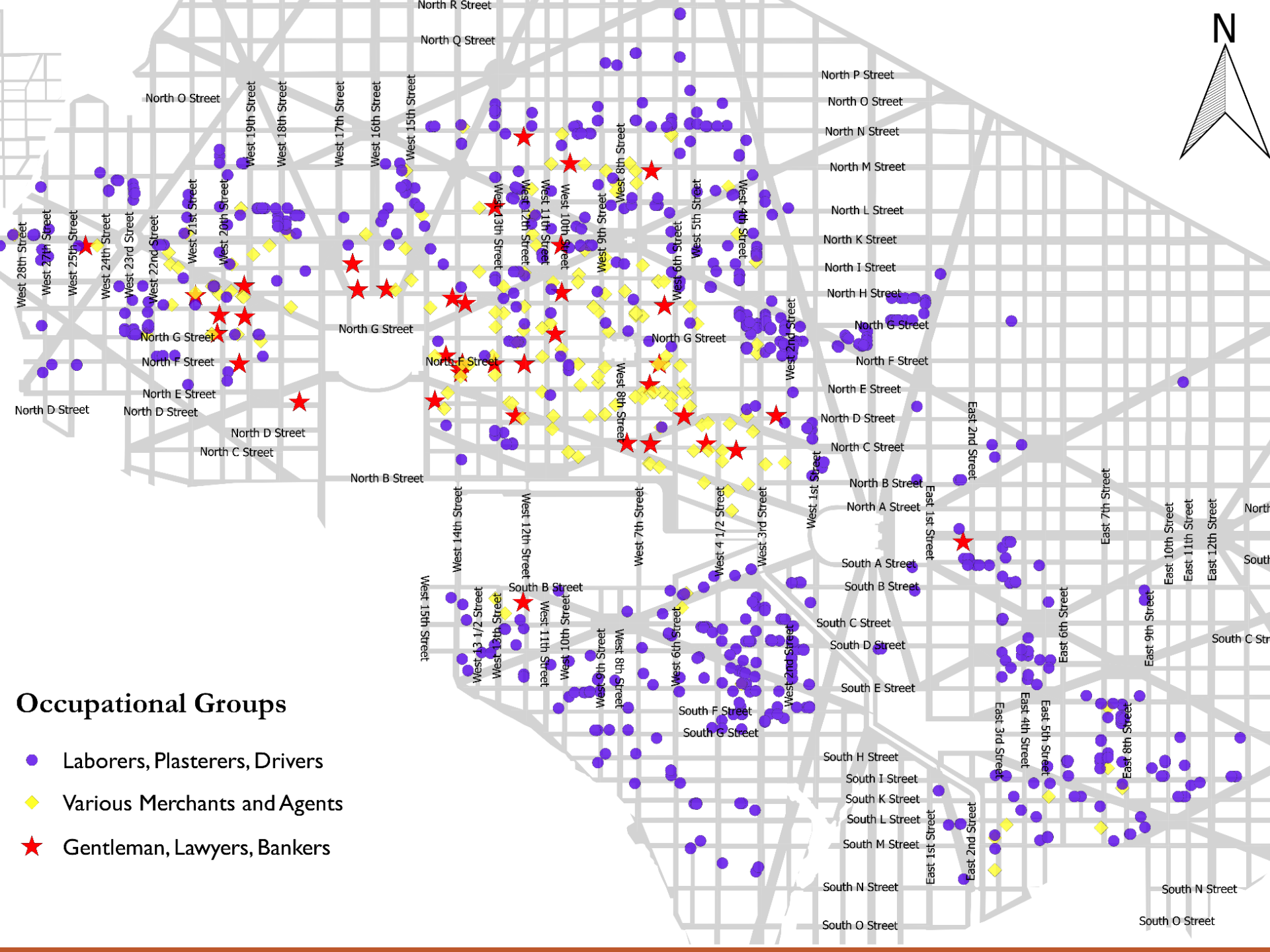
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Occupational Groups
Laborers, Plasterers, Drivers
Various Merchants and Agents
Gentleman, Lawyers, Bankers

Ethnic Separation, D.C.

Irish and German combined population – relative to the white, native-born population, had a dissimilarity index of **44.4 at the *city block* level**

Massey and Denton (1993) calculated average of index of dissimilarity – between native-born white population and these immigrant groups – to be 20-45 across American cities, using ward-level analyses, and the black-white index of dissimilarity was thought to be similar

Racial Separation, D.C.

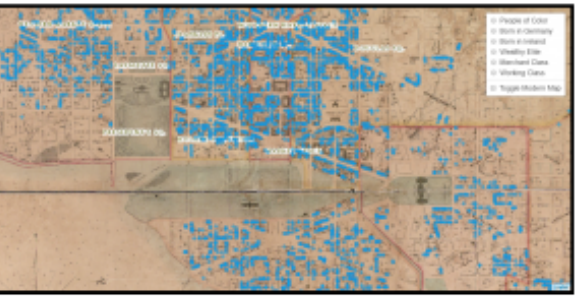
Free African American population – relative to the white, native-born population, had a dissimilarity index of **69 at the *city block* level** among heads of household

In other words, 69% of heads of household would have needed to relocate to achieve basic equilibrium.

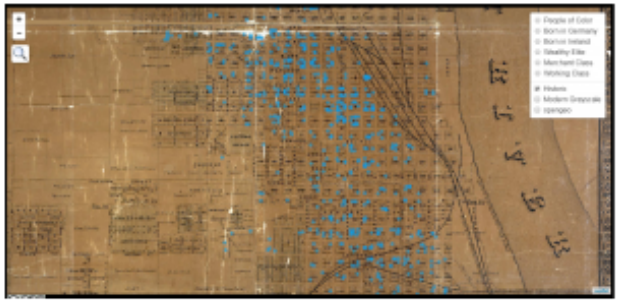
Across **all** residents and all city blocks the dissimilarity index was 53.7 (rather than 18.7)

PLACING SEGREGATION

HOME



Washginton | 1860



Omaha | 1870

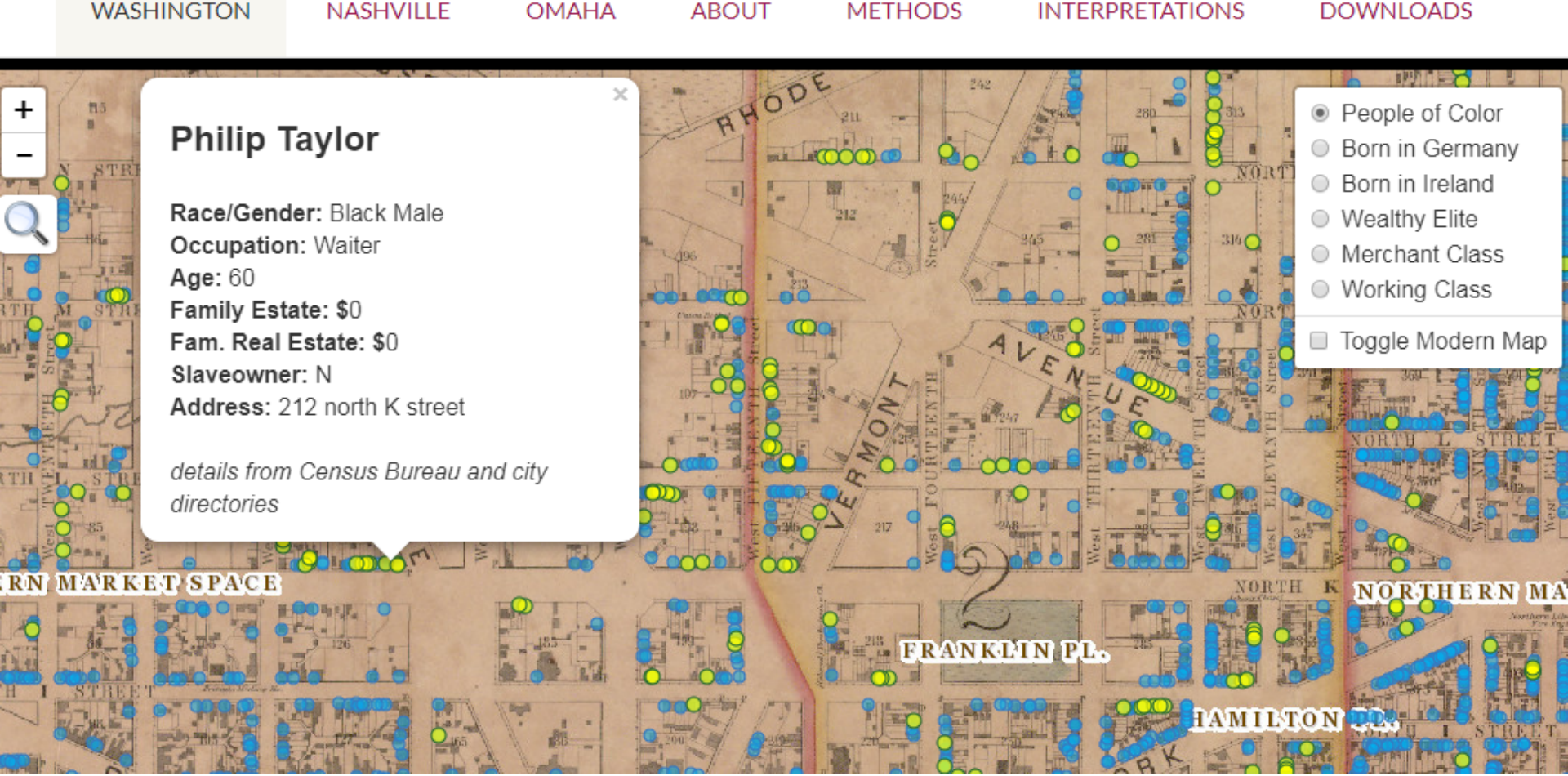
Downtown Nashville | 1860

Digital Project

- Interactive Maps (Leaflet, JavaScript & HTML)
  - Simple name search
  - Popups with data
  - Pre-defined queries rather than managing multiple layers
- Downloadable data
- Address locator files
- Interpretations

Map Design

- Ward-level map from 1857 paired up with 1860 data, rather than pairing 1860 map, which didn't include this, with 1860 data
  - maps with lot lines illustrate clustering
  - because the wards are important to underestimation/representation
- Households pinpointed, geolocated rather than aggregated to larger unit areas to illustrate the very small areas of exclusion that were created de facto segregation in early modern American history, before many of the more infamous formal laws and policies were adopted
  - Pop-up details on individuals

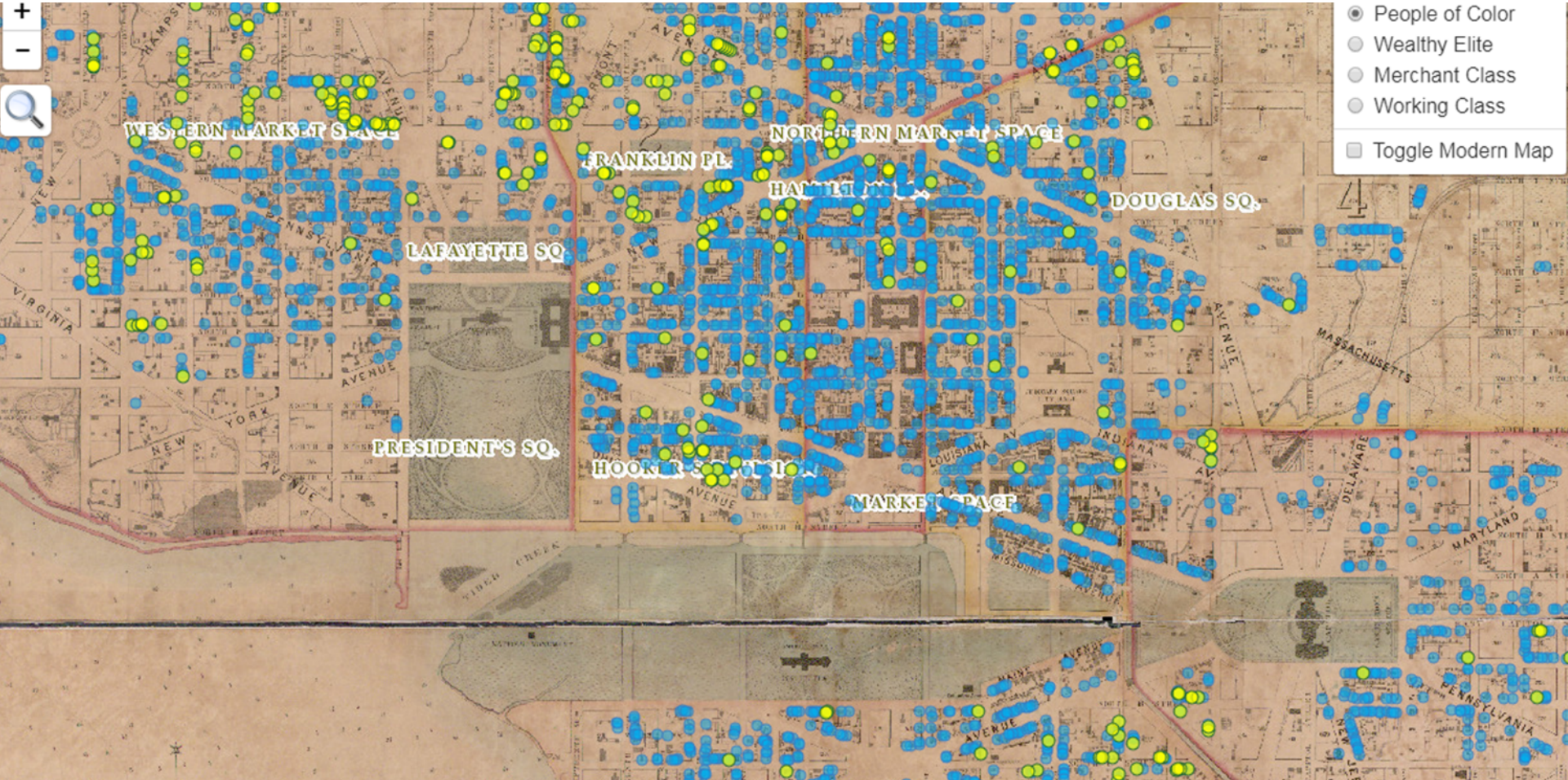


dsps.lib.uiowa.edu/placingsegregation

lib.uiowa.edu/studio/projects

Filtering

Pre-sorted representative classes for occupation, ethnicity, race



Searching

Fuse JS used to parse text

Fuzzy search

Not case sensitive