

Introduction to Geographic Information Science

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GIS Specialists**

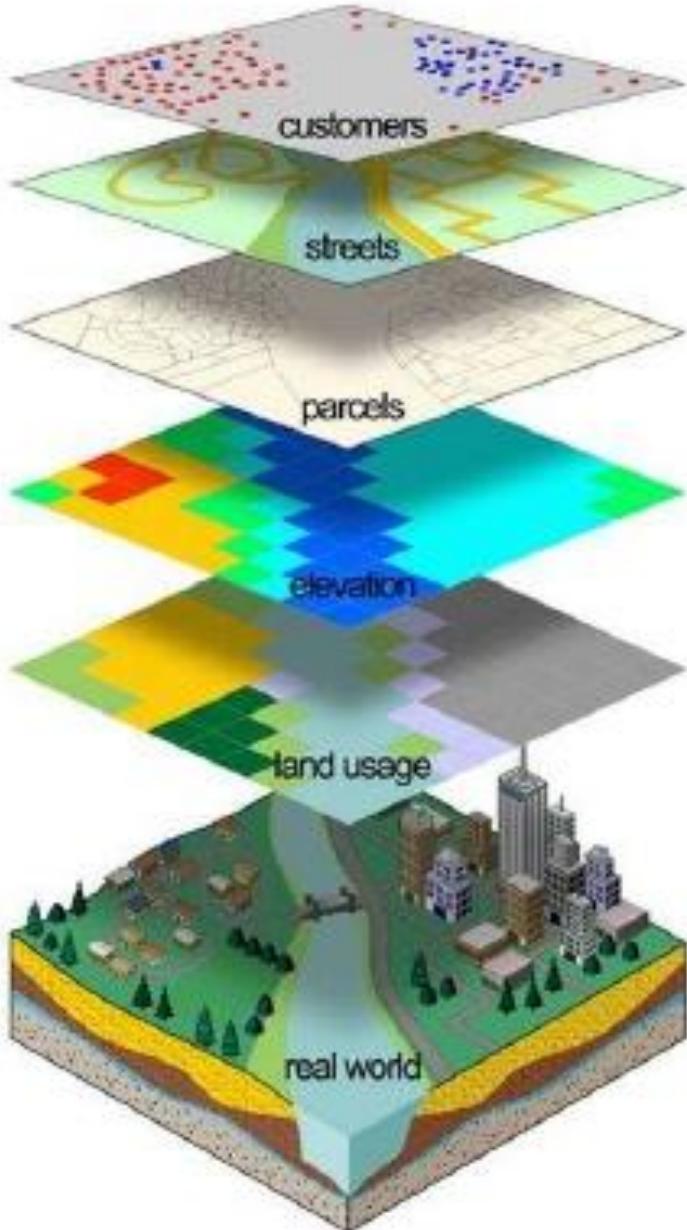
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uvagis@virginia.edu

THE SCHOLARS' LAB

What is a GIS?

“An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced data.”
(Understanding GIS, 1997)

What is GIS?

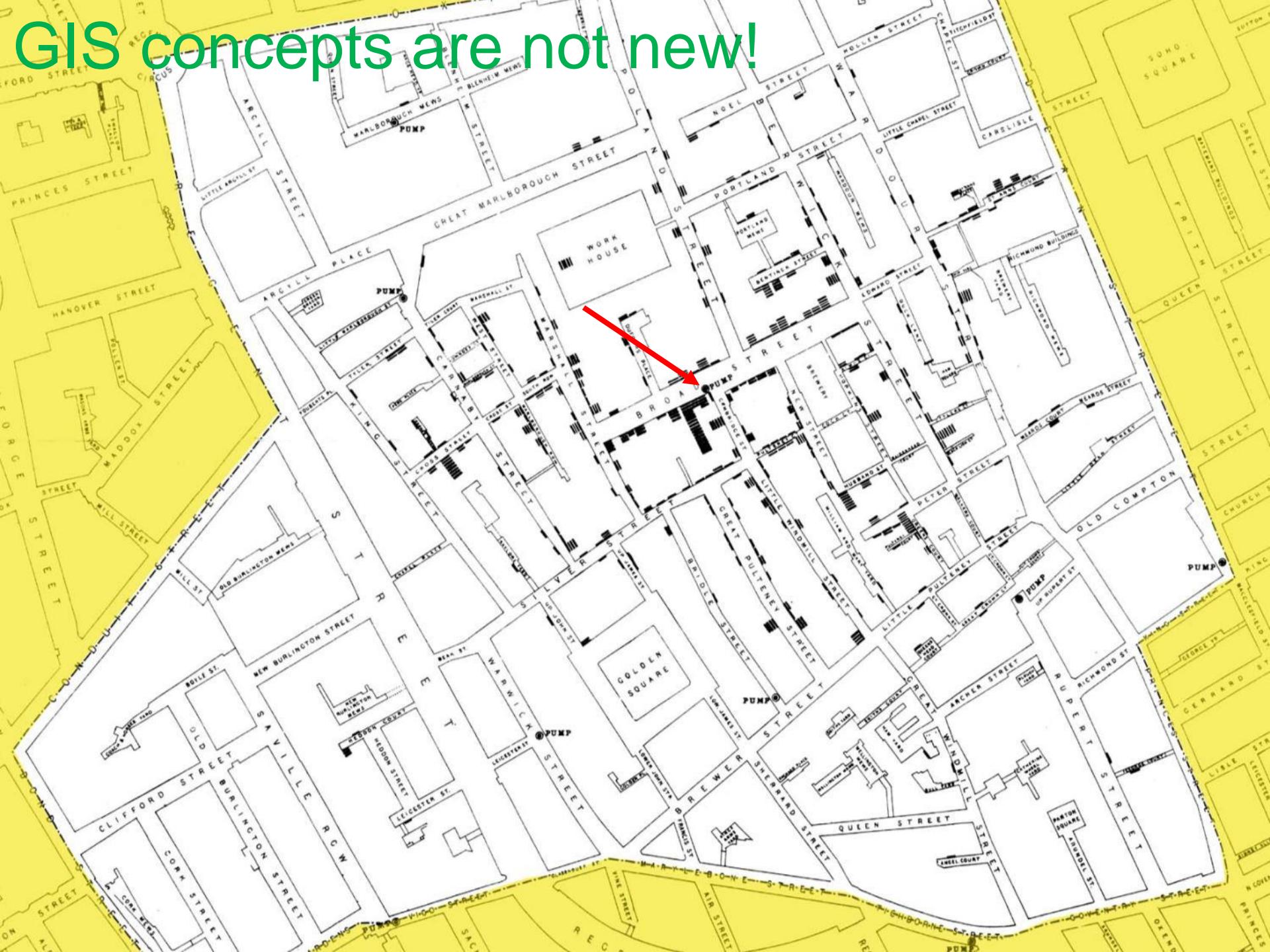


- A technology
Hardware, software & analysis tools
- An information handling strategy
- The objective: to improve overall decision making by visualizing data and seeing new patterns.

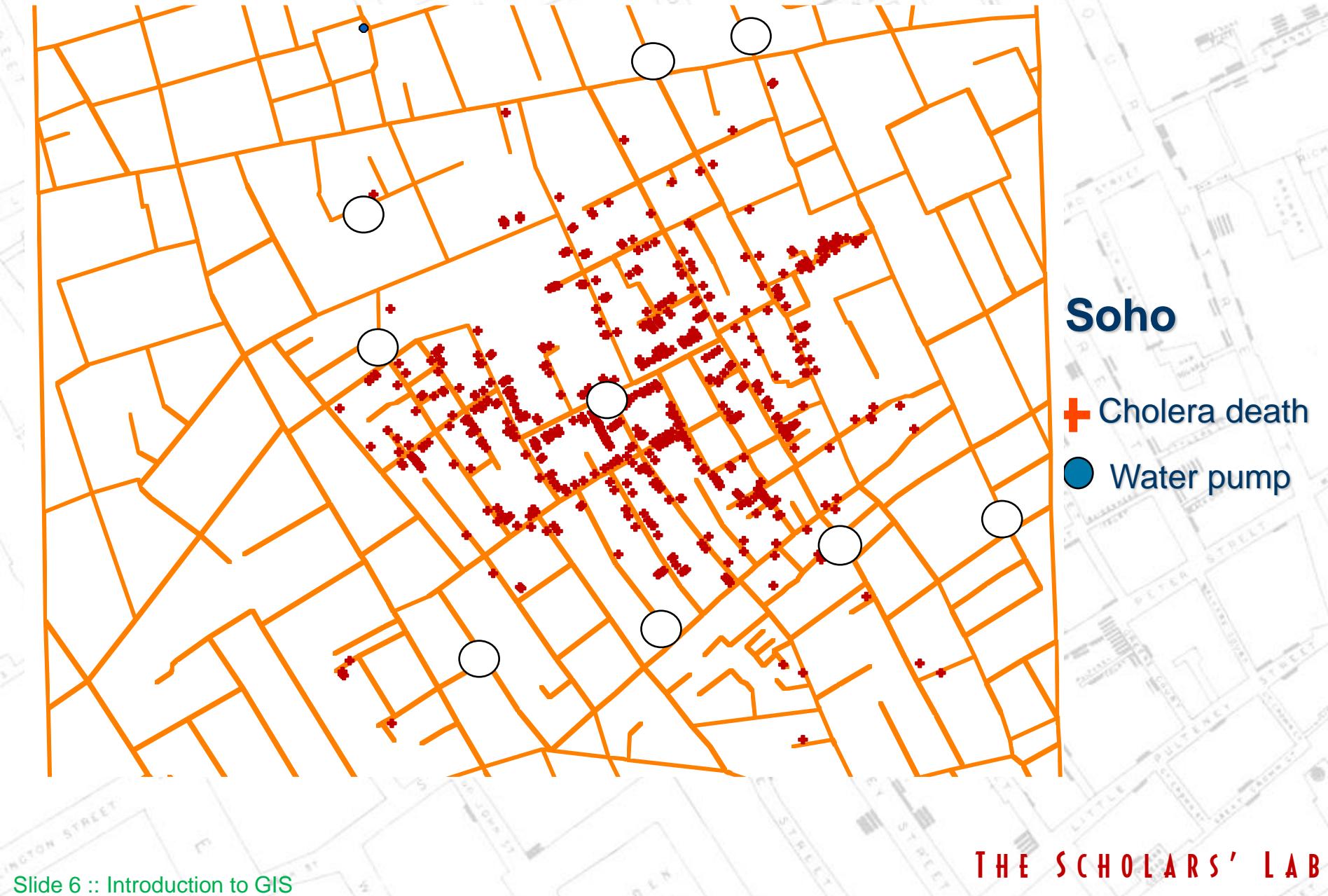
Why is GIS unique?

- GIS handles SPATIAL information
 - Information referenced by its location in space
- GIS makes connections between activities based on spatial proximity
- Creates relationships between otherwise unrelated data

GIS concepts are not new!



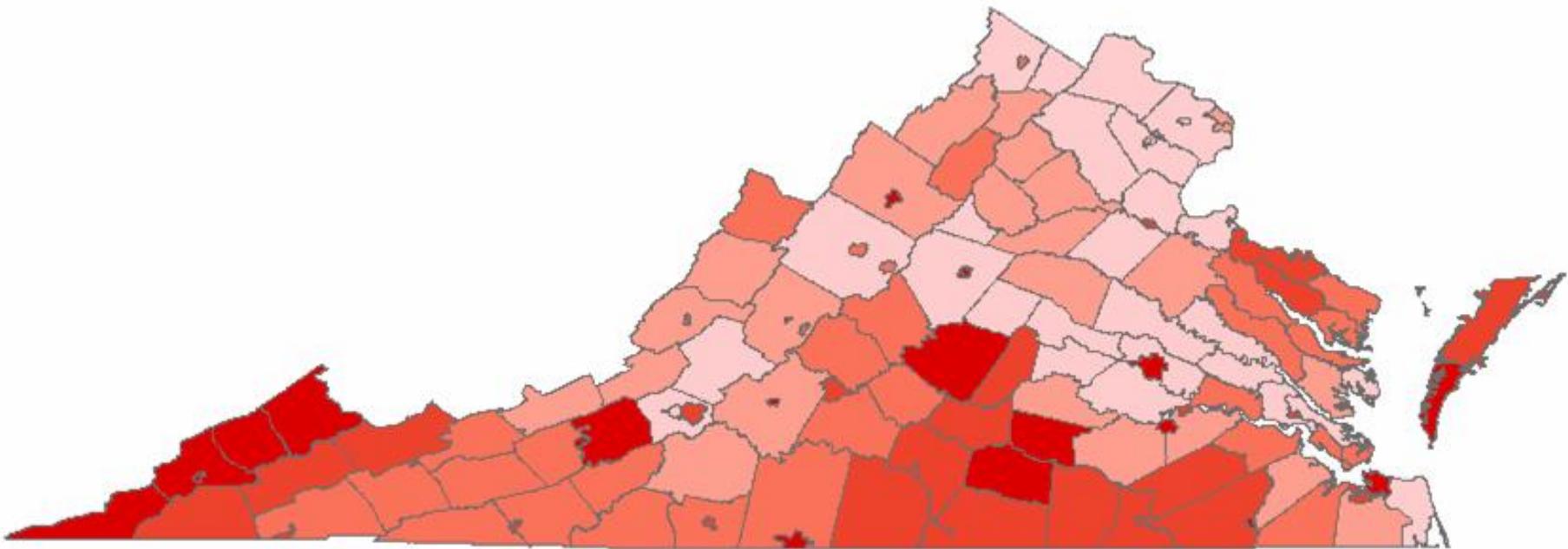
London Cholera Epidemic 1854



Visualizing Data

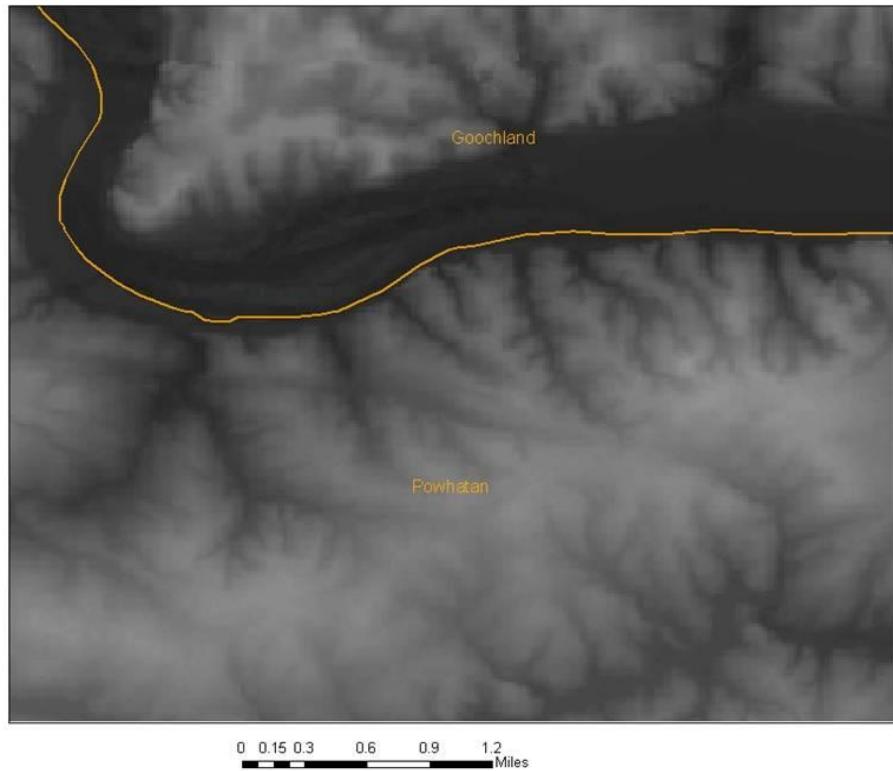
FIPS_1	NAME_1	TOTPOP	PERAA	PERINATIVE	PERASIAN	PEROTHER	PERMALE	PERFEMALE	PERLTS	PERGT65	PERPOV
51163	Rockbridge County, Virginia	20808	2.72	0.06	0.59	1.24	50.34	49.66	5.27	15.61	9.59
51143	Pittsylvania County, Virginia	61745	23.66	0.17	0.12	1.03	48.65	51.35	5.68	14.26	11.75
51105	Lee County, Virginia	23589	0.43	0.44	0.35	0.82	48.75	51.25	5.8	15.49	23.92
51019	Bedford County, Virginia	60371	5.94	0.23	0.96	1.19	49.8	50.2	5.78	12.86	7.11
51027	Buchanan County, Virginia	26978	2.34	0	0.2	0.4	50.87	49.13	4.87	11.39	23.17
51185	Tazewell County, Virginia	44598	2.17	0.07	0.5	0.87	47.51	52.49	5.36	15.37	15.30
51051	Dickenson County, Virginia	16395	0.3	0.09	0.16	0.53	49	51	5.42	14.49	21.31
51021	Bland County, Virginia	6871	4.58	0.22	0.23	0	54.37	45.63	4.48	14.76	12.36
51155	Pulaski County, Virginia	35127	5.65	0.29	0.07	1.51	49.41	50.59	5.74	15.35	13.09
51067	Franklin County, Virginia	47286	9.55	0.11	0.19	1.22	49.28	50.72	5.37	14.27	9.70
51195	Wise County, Virginia	40123	1.57	0.17	0.26	1.04	48.91	51.09	5.67	14	19.99
51121	Montgomery County, Virginia	83629	3.89	0.19	3.75	1.95	52.21	47.79	4.83	8.64	23.24
51197	Wythe County, Virginia	27599	2.64	0.12	0.43	1.37	47.52	52.48	5.49	15.79	11.05
51077	Grayson County, Virginia	17917	6.89	0.09	0.02	1.93	51.81	48.19	4.71	17	13.62
51167	Russell County, Virginia	30308	2.97	0.16	0.09	1.01	50.54	49.46	5.23	13.35	16.35
51173	Smyth County, Virginia	33081	2	0.24	0.1	0.93	48.24	51.76	5.34	16.31	13.33
51720	Norton city, Virginia	3904	5.97	0.15	1.08	2.64	43.78	56.22	5.48	15.7	22.76
51191	Washington County, Virginia	51103	1.54	0.12	0.43	0.7	48.45	51.55	5.06	15.33	10.93
51169	Scott County, Virginia	23403	0.87	0.27	0.06	0.54	48.16	51.84	5.06	17.75	16.76
51520	Bristol city, Virginia	17367	5.2	0.13	0.41	1.61	45.17	54.83	5.11	20.45	16.24
51023	Botetourt County, Virginia	30496	3.67	0.15	0.39	0.97	49.8	50.2	5.7	13.23	5.19
51045	Craig County, Virginia	5091	0.26	0.12	0.33	0.2	50.95	49.05	5.17	13.67	10.26
51071	Giles County, Virginia	16657	1.56	0.01	0.16	1.09	48.83	51.17	5.58	16.65	9.55
51750	Radford city, Virginia	15859	7.49	0.06	1.26	2.3	45.15	54.85	3.73	9.79	31.35
51005	Alleghany County, Virginia	12926	2.54	0	0.56	0.39	50.31	49.69	5.6	15.7	7.14
51580	Covington city, Virginia	6303	13.1	0	0.4	1.6	47.18	52.82	6.38	20.45	12.89
51678	Lexington city, Virginia	6867	10.27	0.19	1.09	1.78	56.53	43.47	3.07	16.37	21.57
51161	Roanoke County, Virginia	85778	3.15	0.15	1.16	1.42	47.31	52.69	5.25	15.82	4.46
51515	Bedford city, Virginia	6299	22.84	0.13	0.51	1.51	47.28	52.72	5.64	21.84	19.68
51770	Roanoke city, Virginia	94911	26.75	0.28	1.06	2.85	46.76	53.24	6.52	16.4	15.95
51775	Salem city, Virginia	24747	5.72	0.15	1.03	1.26	47.38	52.62	4.87	16.92	6.71
51063	Floyd County, Virginia	13874	1.33	0	0.15	1.74	49.06	50.94	5.72	15.79	11.72
51035	Carroll County, Virginia	29245	0.71	0.1	0.22	1.85	49.96	50.04	5.59	17.18	12.46
51141	Patrick County, Virginia	19407	6.81	0.1	0.45	1.59	48.96	51.04	5.82	16.46	13.41
51089	Henry County, Virginia	57930	22.88	0.37	0.27	2	48.68	51.32	5.3	14.89	11.65
51640	Galax city, Virginia	6837	7.3	0.12	0.23	6.1	47.68	52.32	5.47	18.62	18.61
51690	Martinsville city, Virginia	15416	41.84	0.06	0.45	1.58	44.81	55.19	5.76	20.87	19.19
51590	Danville city, Virginia	48411	44.19	0.3	0.5	1.26	45.4	54.6	5.9	19.68	19.96
51017	Bath County, Virginia	5048	5.74	0	0.32	0.69	49.76	50.24	4.46	17.12	7.79
51091	Highland County, Virginia	2536	0.08	0.24	0	0.35	49.92	50.08	3.67	20.19	12.56
51003	Albemarle County, Virginia	79236	9.72	0.2	3.1	1.75	48.15	51.85	6.29	12.5	6.74
51033	Caroline County, Virginia	22121	34.61	0.8	0.48	1.43	50.13	49.87	6.09	13.07	9.35

Visualizing Data

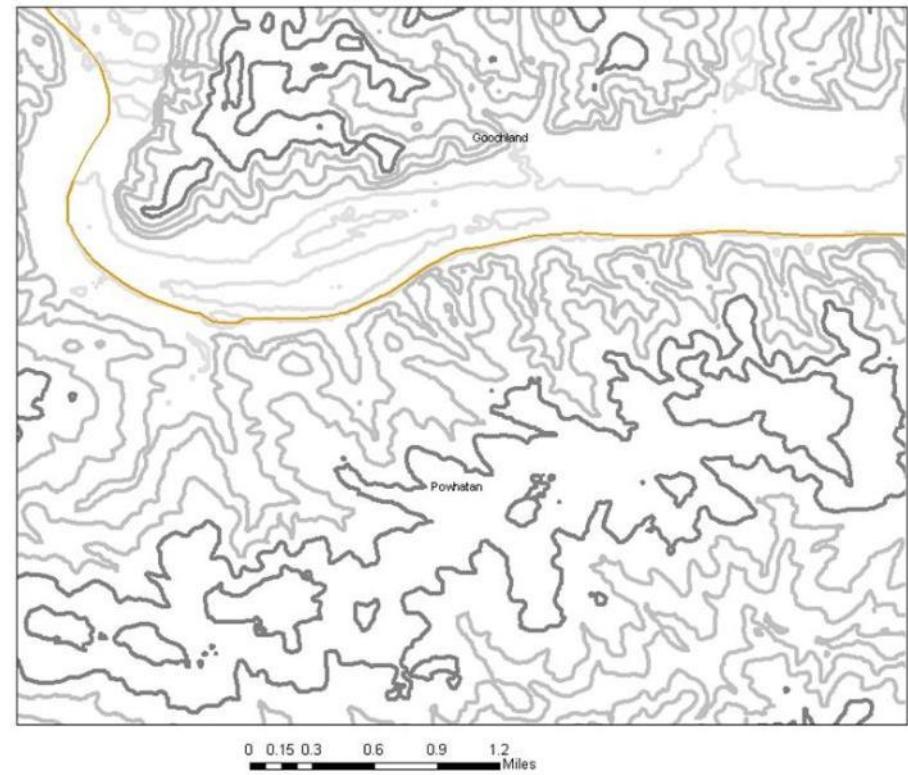


Types of Geographic Data

Raster



Vector



Types of Geographic Data

Vector

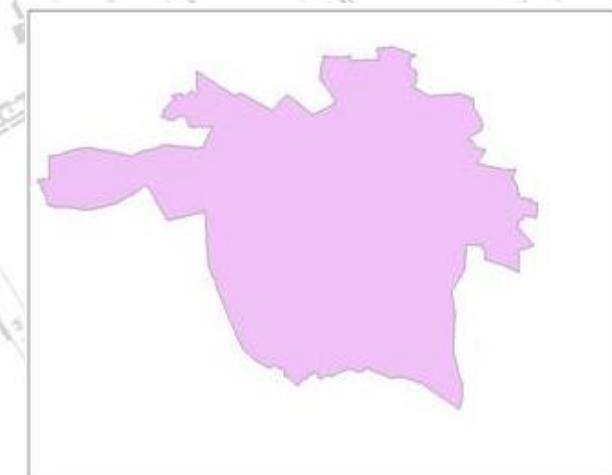
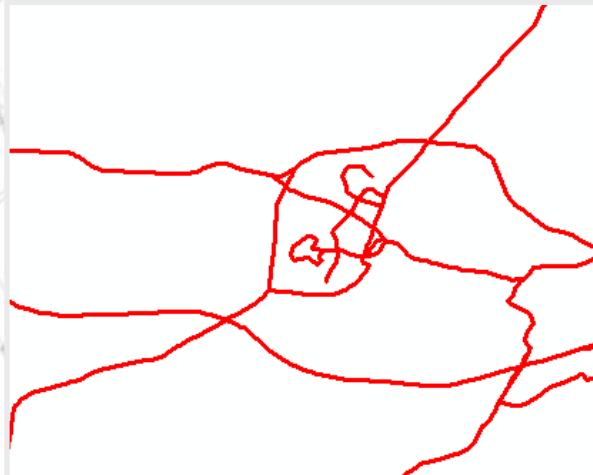
Point



Arc(Polyline)



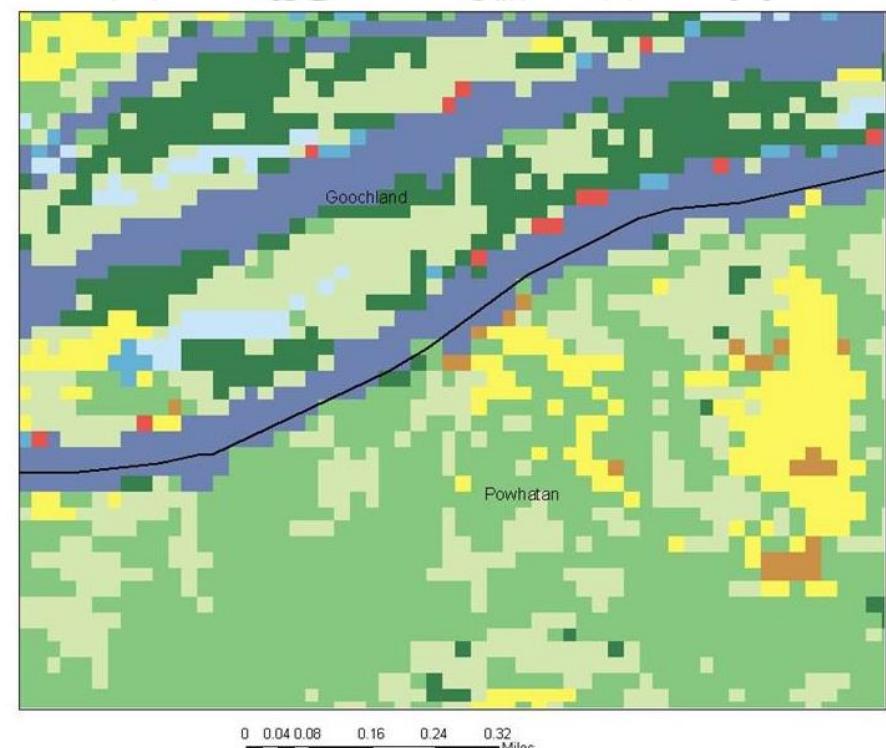
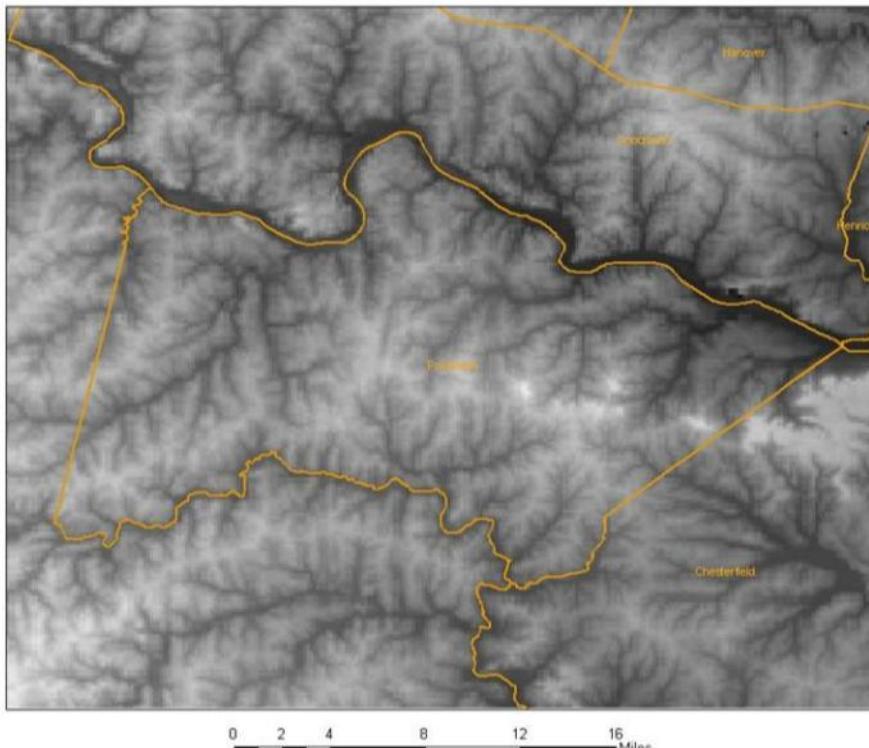
Polygon



Types of Geographic Data

Raster

Collection of cells or pixels, each with a specific value

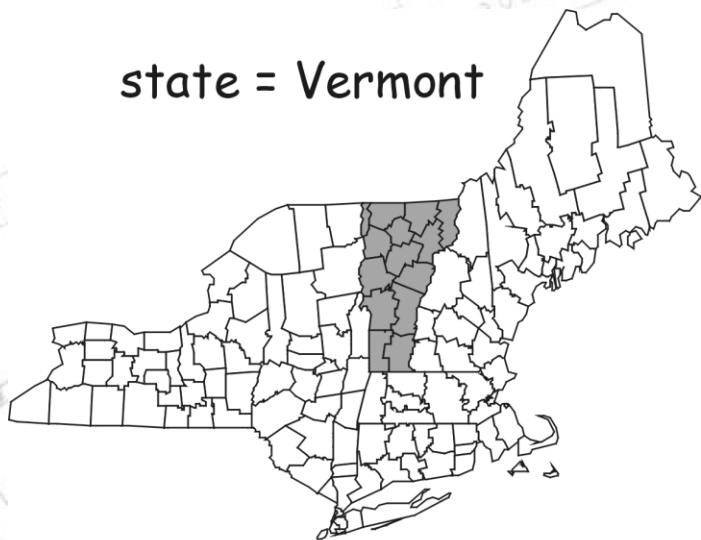


Core Spatial Analysis

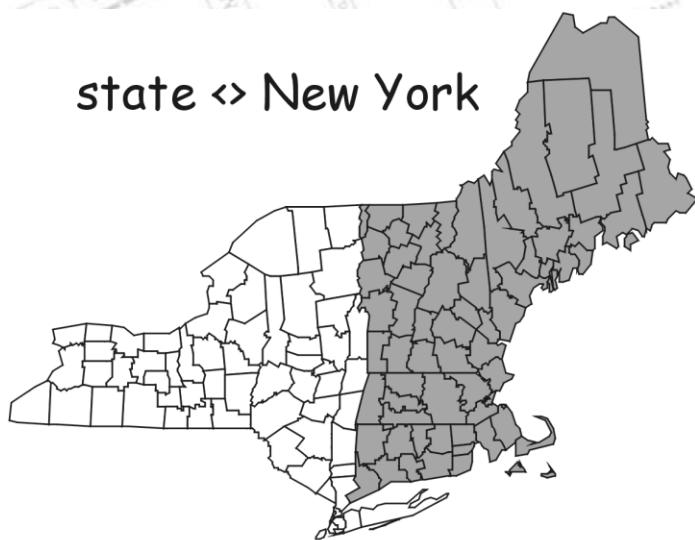
- Selection and Classification
- Proximity and Buffering
- Overlay
 - Clip
 - Intersection
 - Union
- Network Analysis
- Extract by Point

Selection and Classification

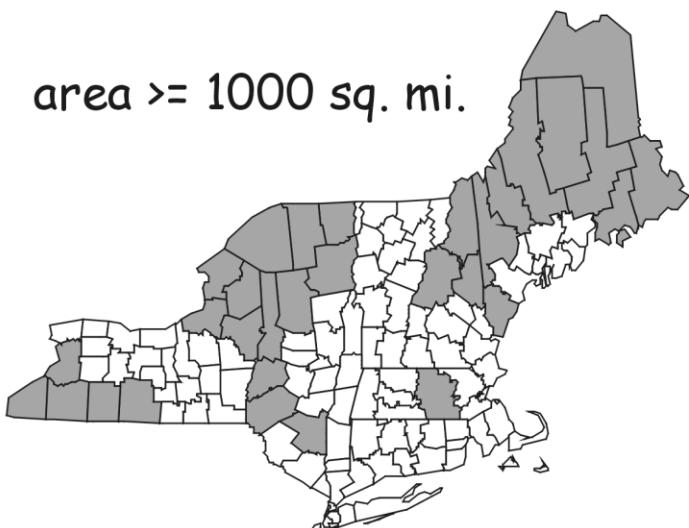
state = Vermont



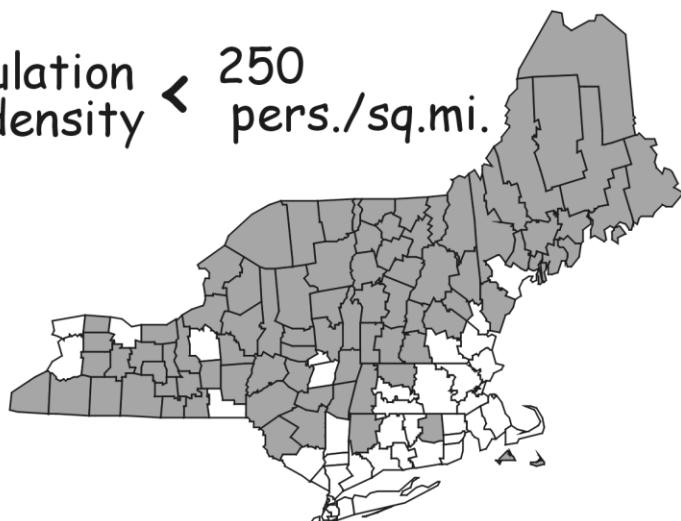
state <> New York



area \geq 1000 sq. mi.



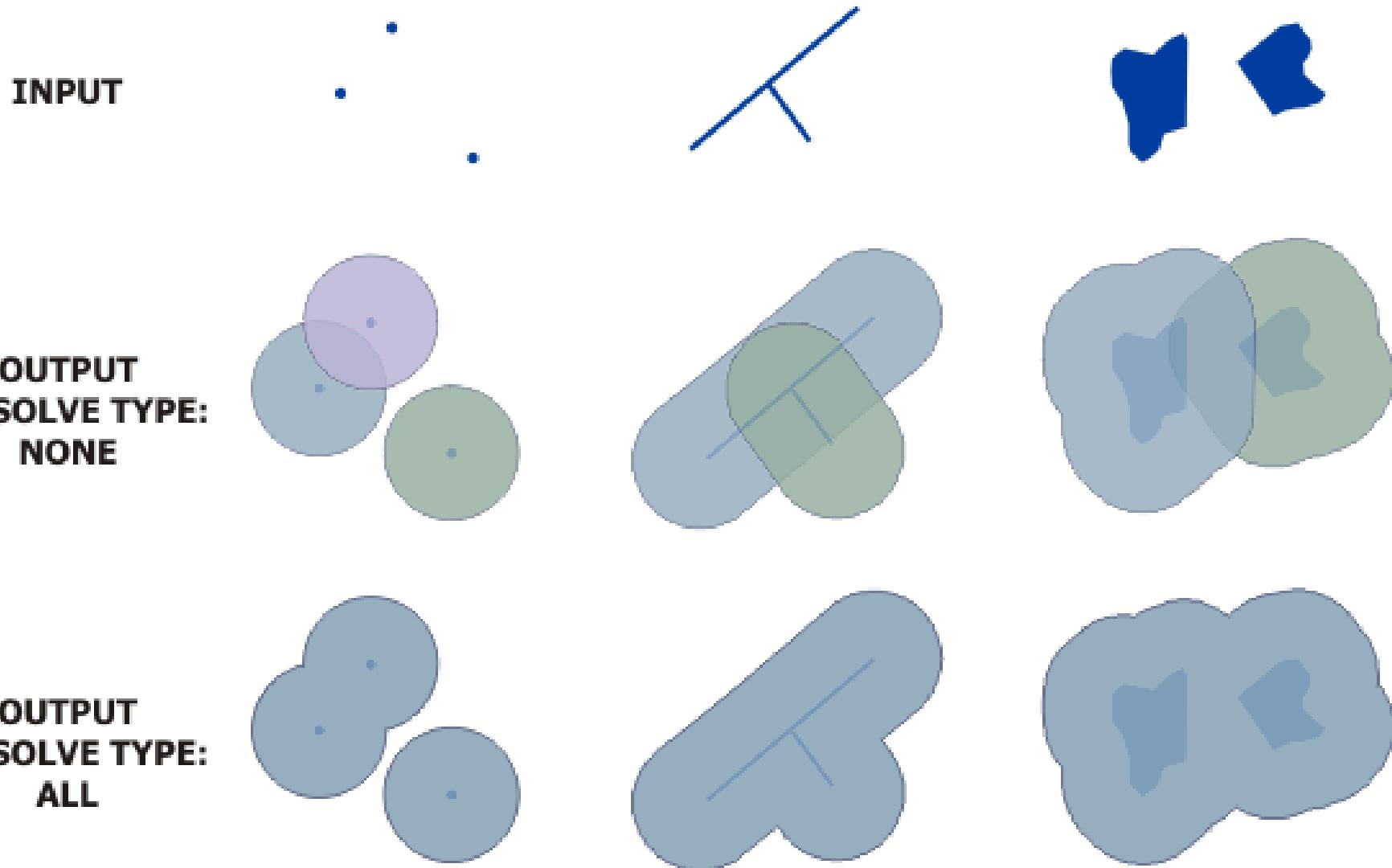
population
density $<$ 250
pers./sq.mi.



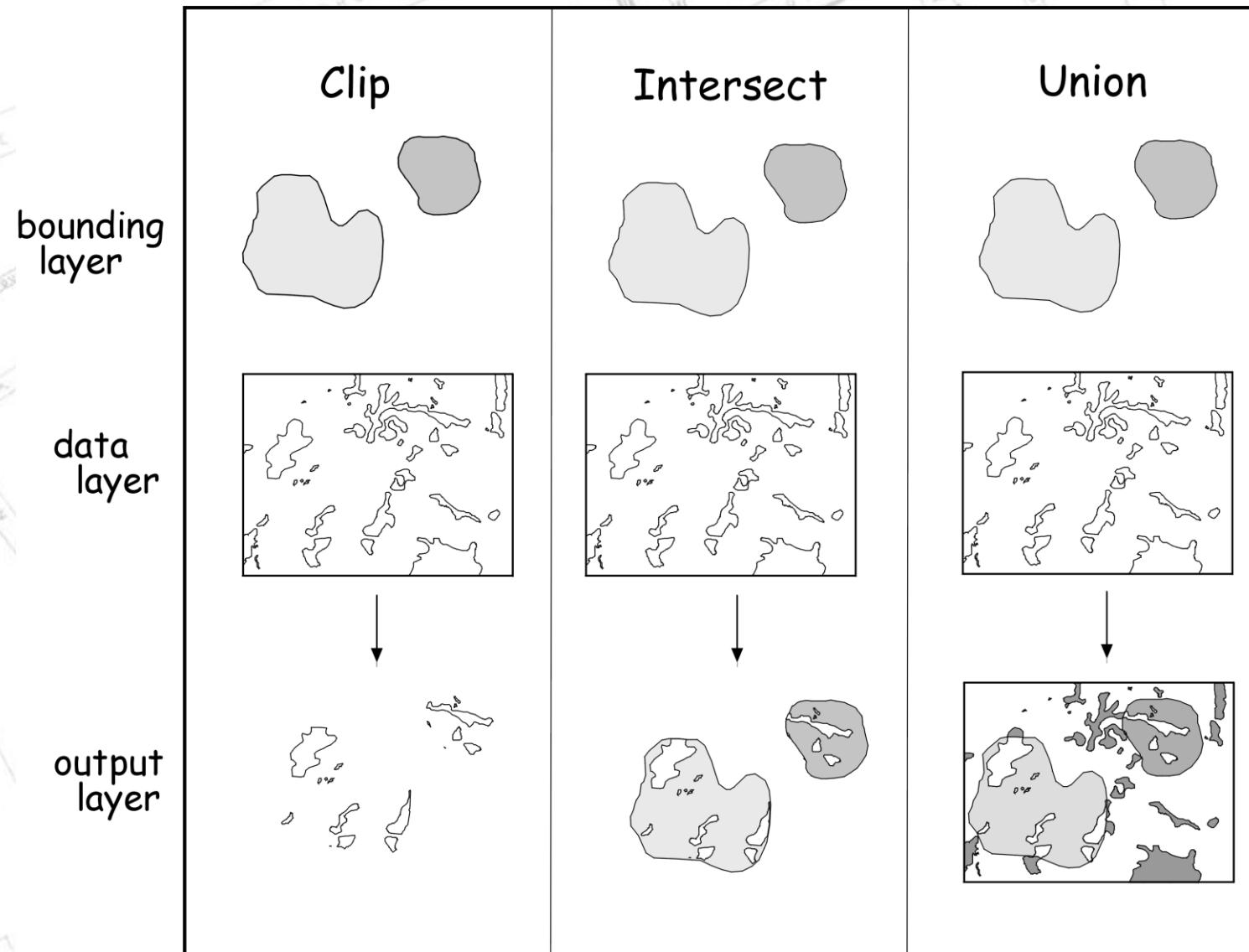
Selection and Classification



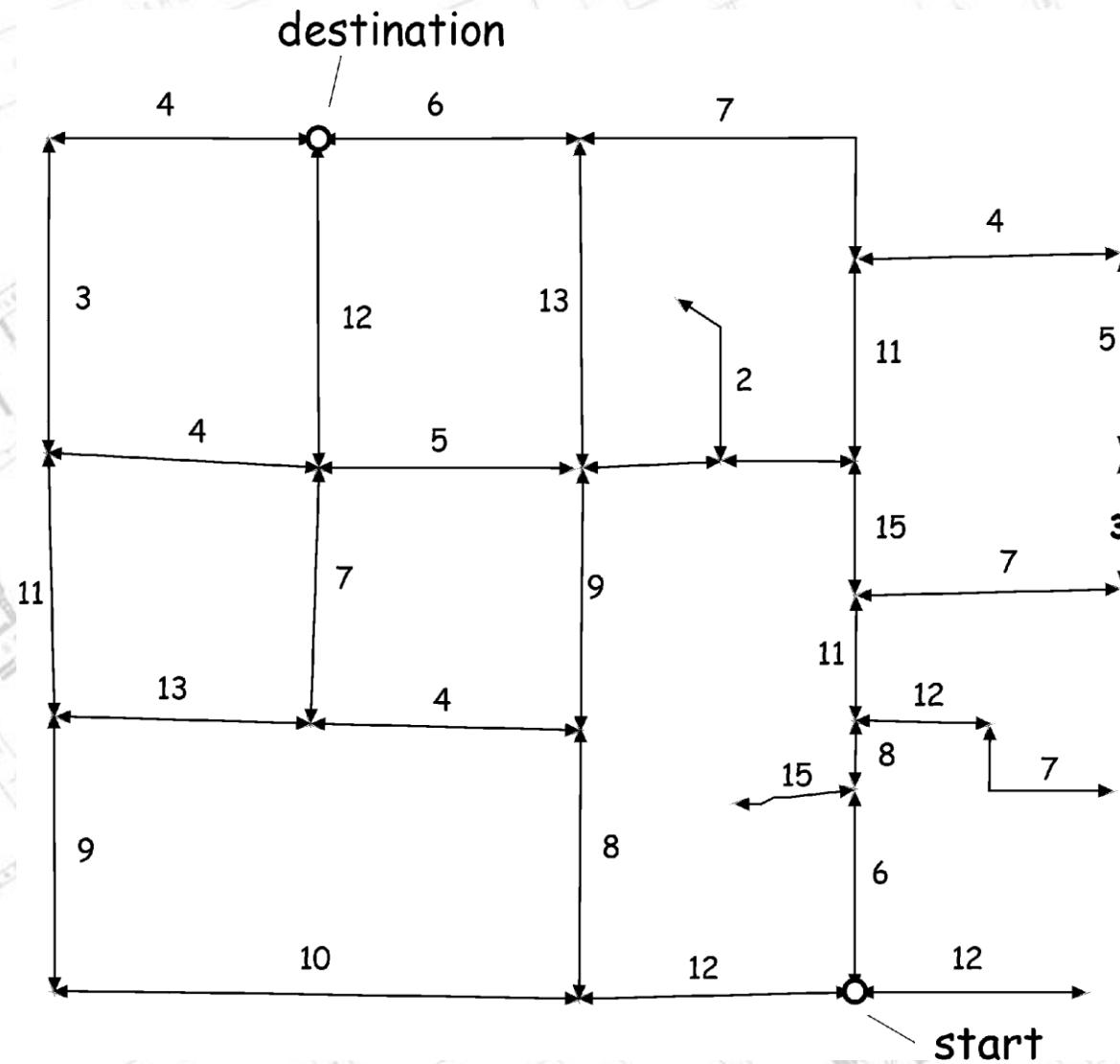
Proximity and Buffering



Clip, Intersect, Union



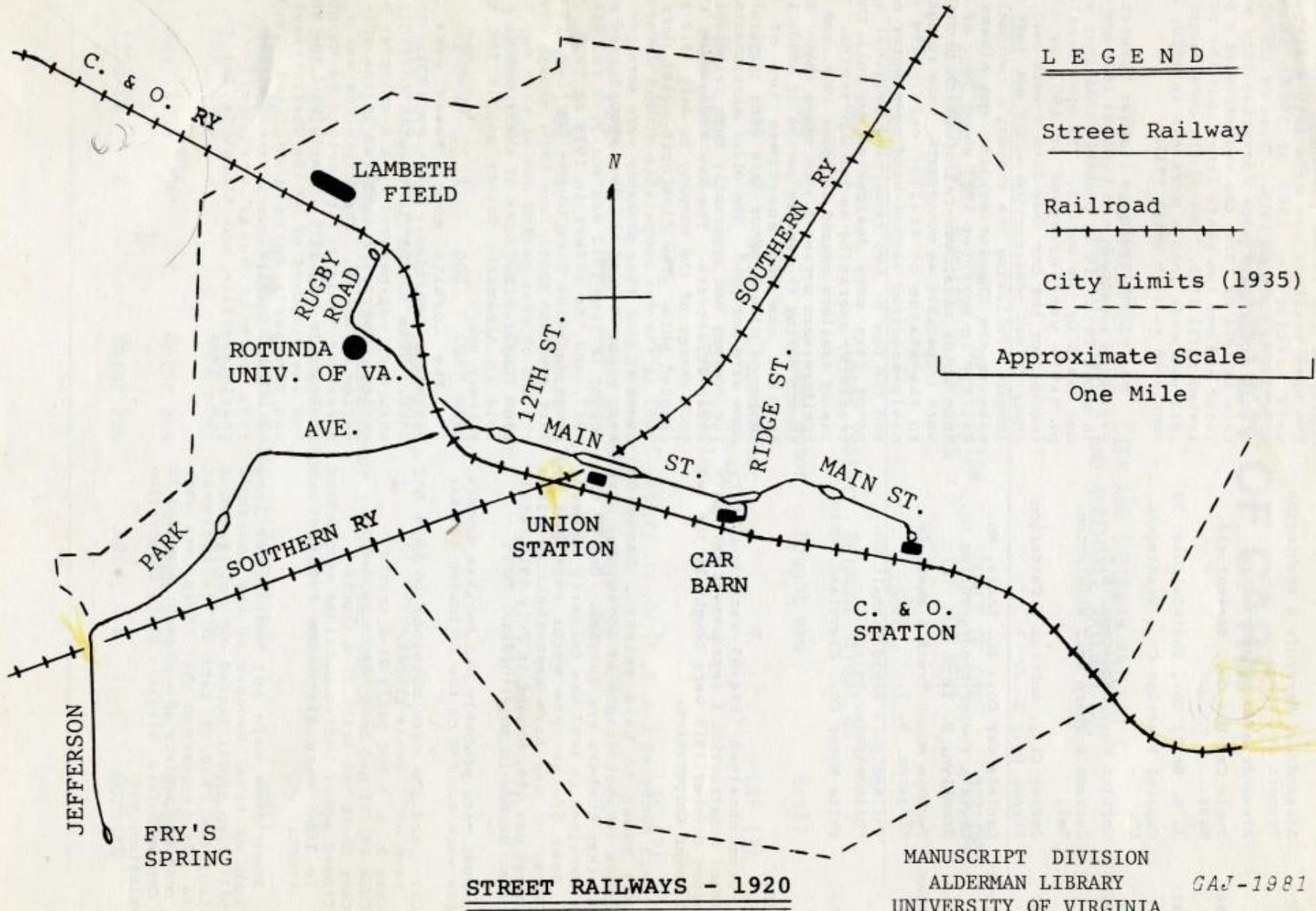
Network Analysis



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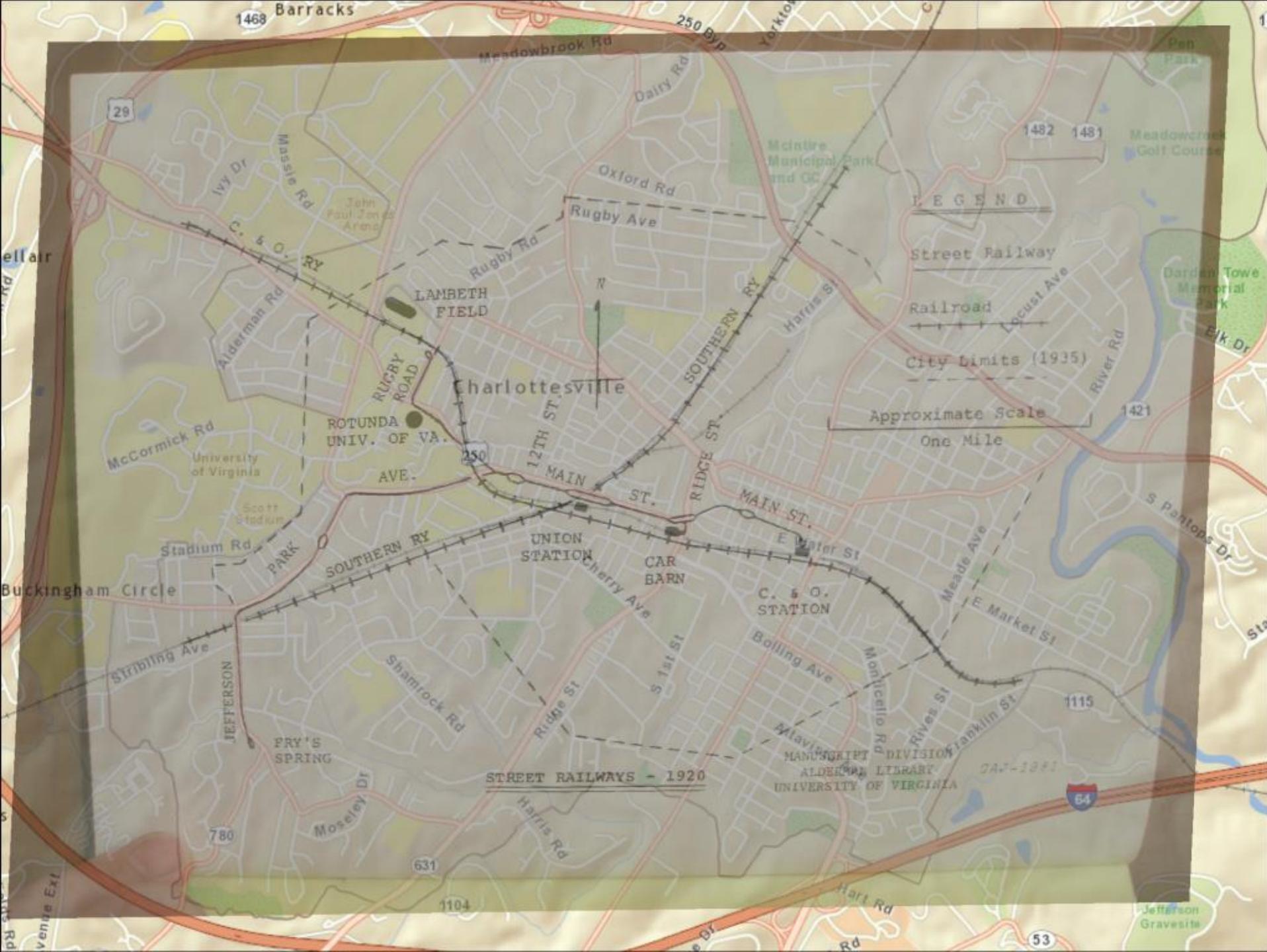
C.N.A.R.Y.



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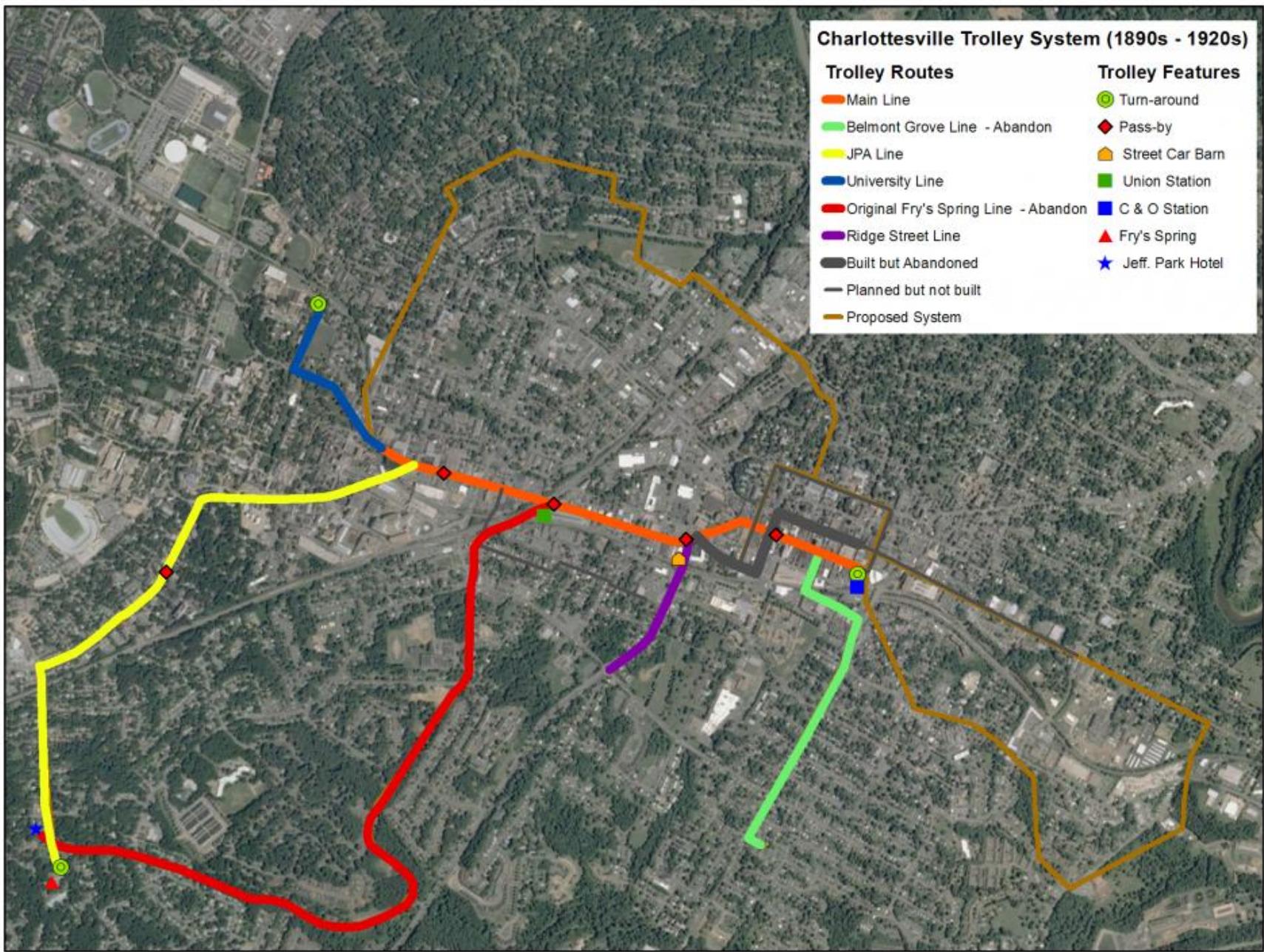
Charlottesville Trolley System (1890s - 1920s)

Trolley Routes

- Main Line
- Belmont Grove Line - Abandon
- JPA Line
- University Line
- Original Fry's Spring Line - Abandon
- Ridge Street Line
- Built but Abandoned
- Planned but not built
- Proposed System

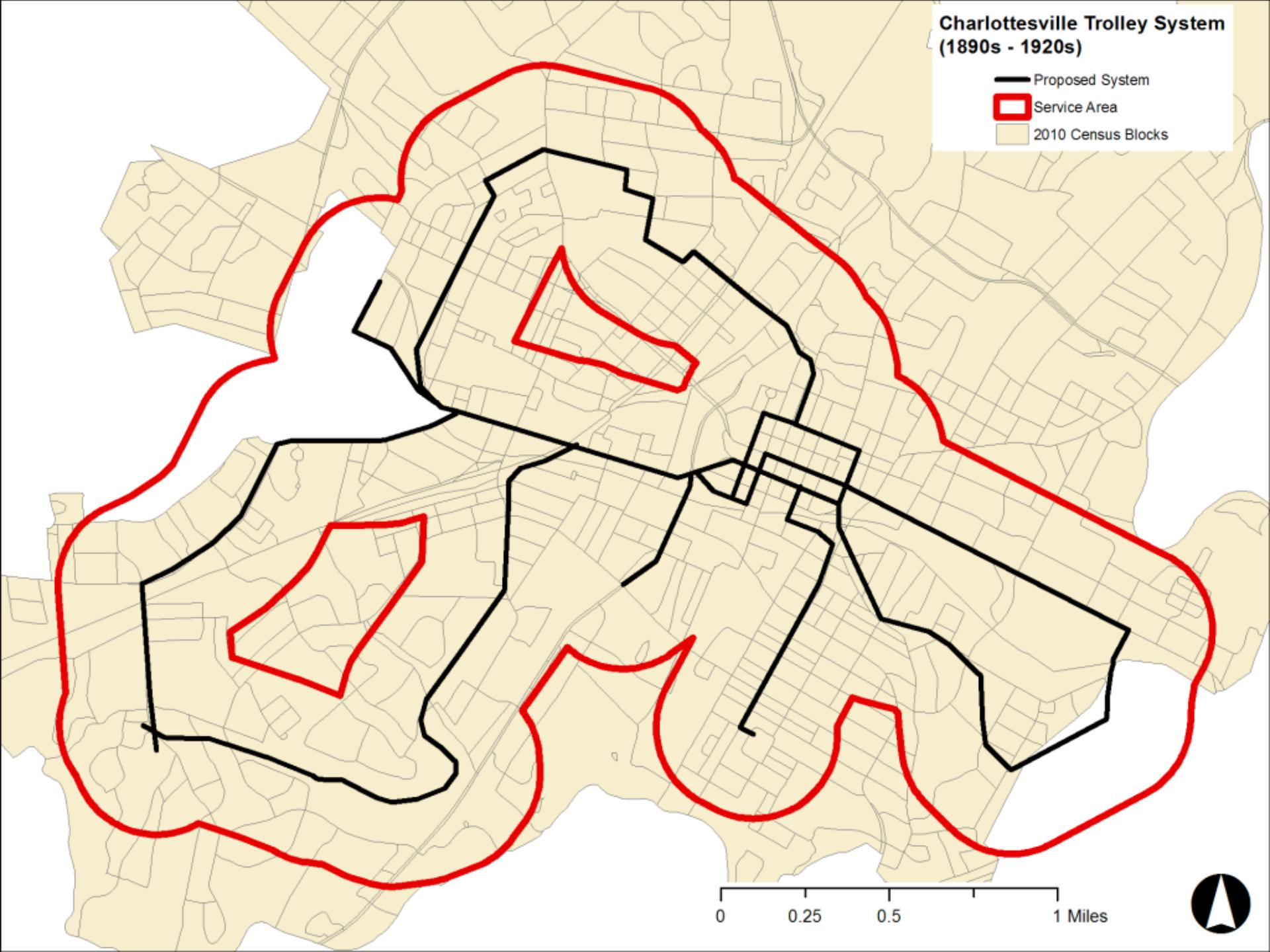
Trolley Features

- Turn-around
- Pass-by
- Street Car Barn
- Union Station
- C & O Station
- Fry's Spring
- Jeff. Park Hotel



**Charlottesville Trolley System
(1890s - 1920s)**

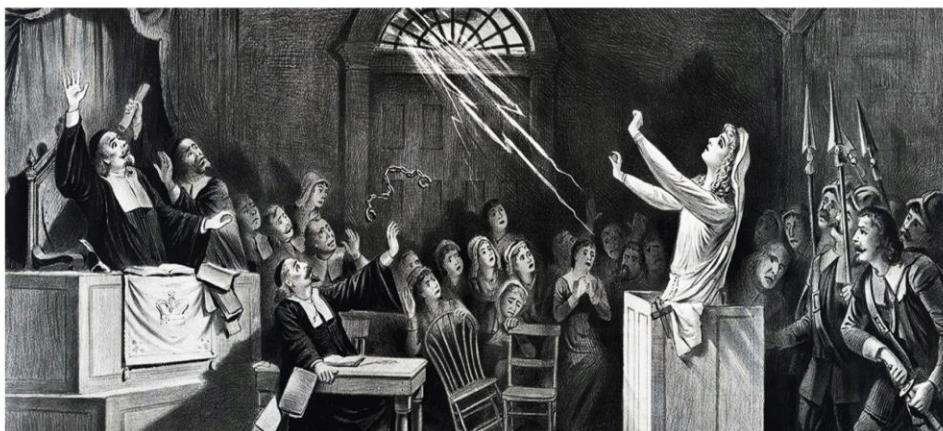
- Proposed System
- Service Area
- 2010 Census Blocks



0 0.25 0.5 1 Miles



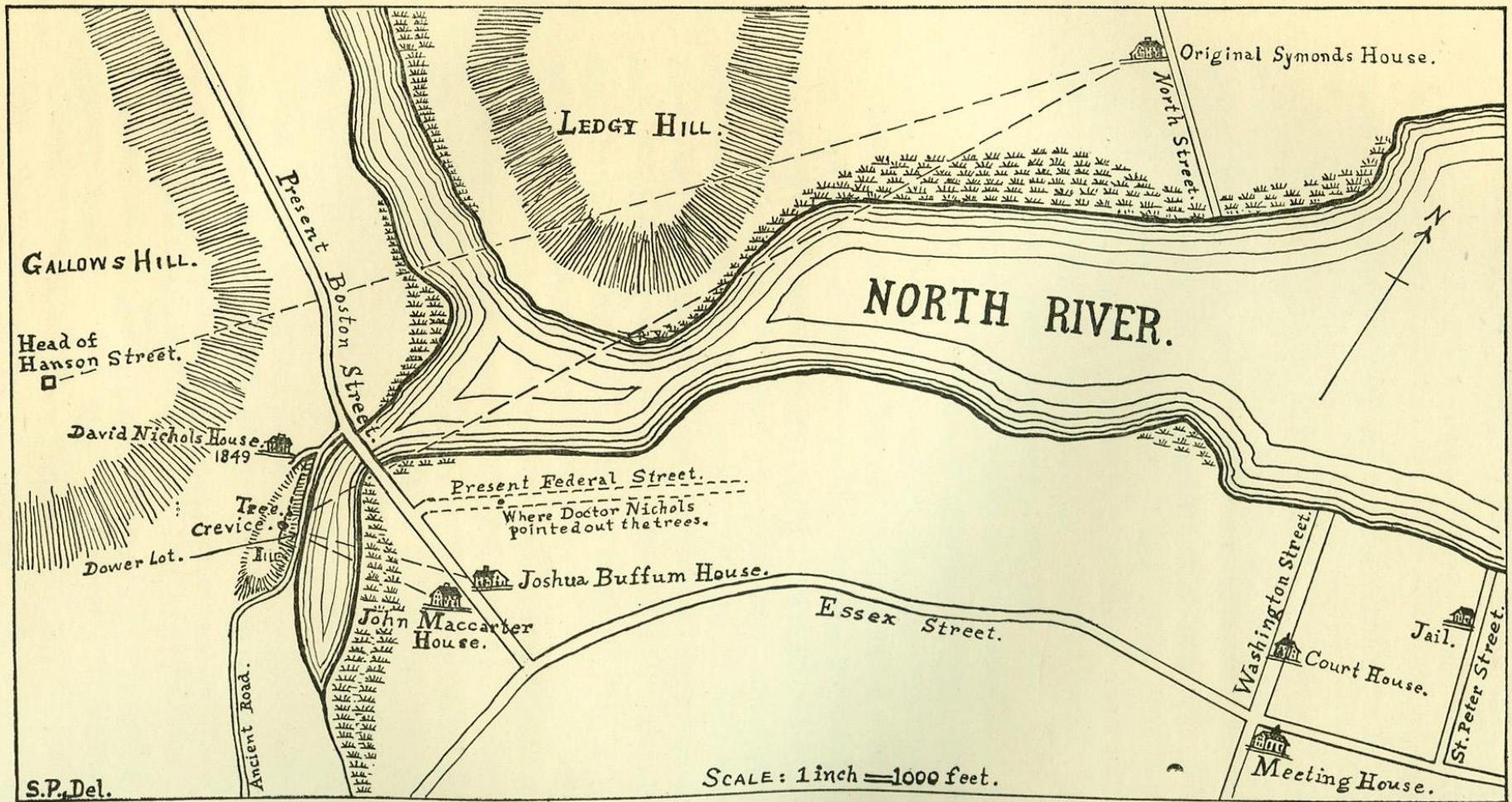
WITH UVA'S HELP, SALEM FINALLY DISCOVERS WHERE ITS 'WITCHES' WERE EXECUTED

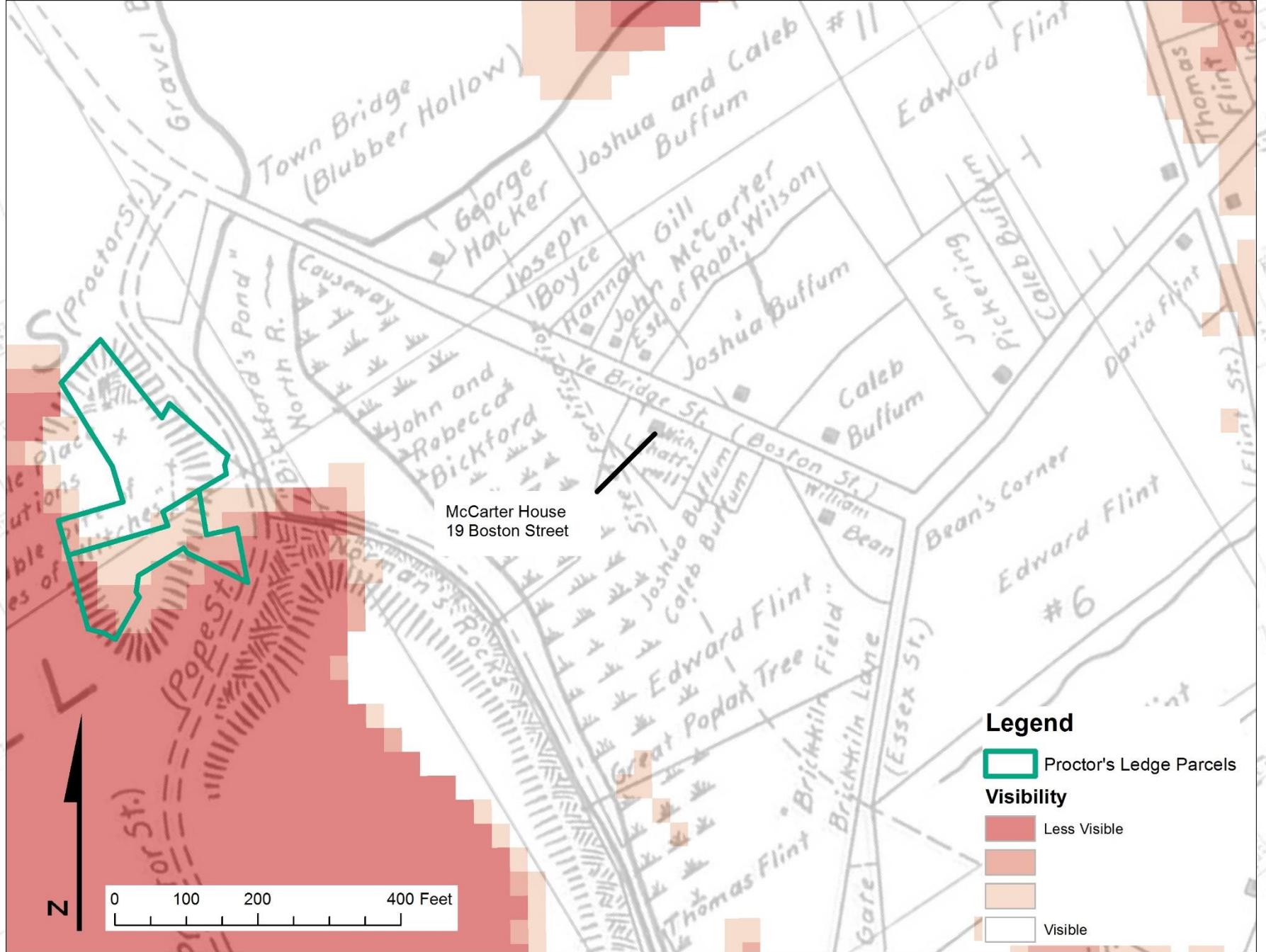


January 19, 2016 • Caroline Newman, news@virginia.edu

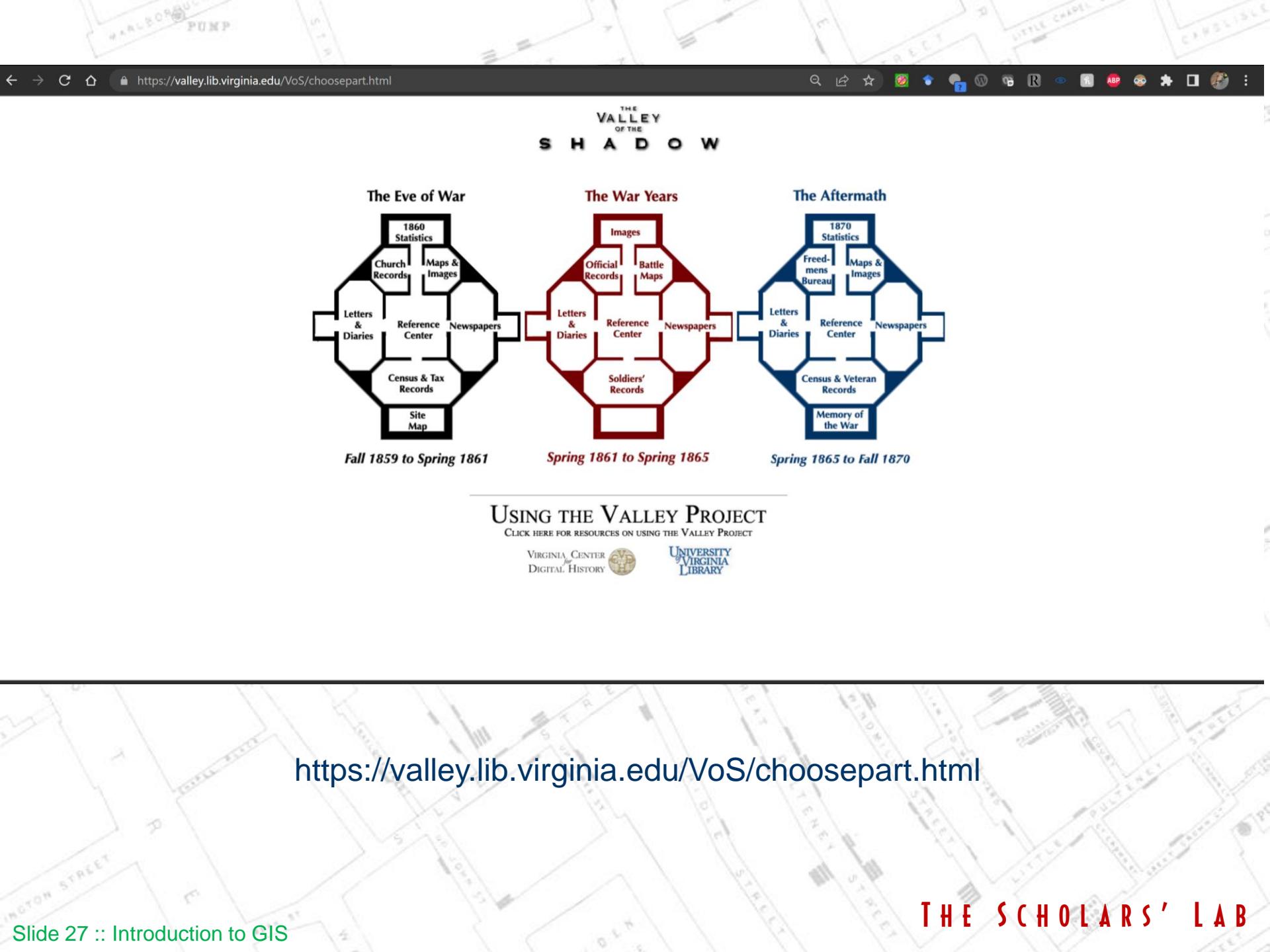


Chris Gist, left, and Benjamin Ray, right, used geographic information systems technology in UVA's



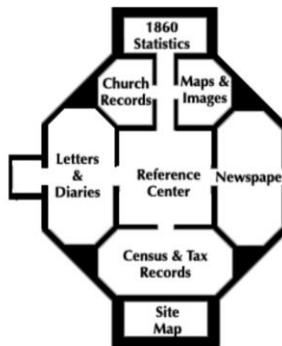






THE VALLEY OF THE SHADOW

The Eve of War



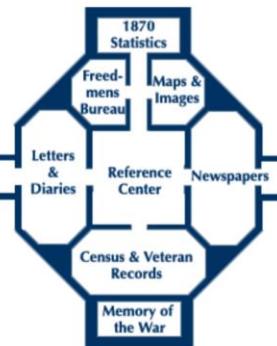
Fall 1859 to Spring 1861

The War Years



Spring 1861 to Spring 1865

The Aftermath



Spring 1865 to Fall 1870

USING THE VALLEY PROJECT

[CLICK HERE FOR RESOURCES ON USING THE VALLEY PROJECT](#)

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<https://valley.lib.virginia.edu/VoS/choosepart.html>

ORBIS The Stanford Geospatial Network Model of the Roman World

About Tutorial

Walter Scheidel
Elijah Meeks

- Home
- Introduction
- Understanding
- Building
- Geospatial
- Using
- Gallery
- Research
- Media
- Credits
- News

Access from the
are this far away.

Spanning one-ninth of the earth's circumference across three continents, the Roman Empire ruled a quarter of humanity through complex networks of political power, military domination and economic exchange. These extensive connections were sustained by premodern transportation and communication technologies that relied on energy generated by human and animal bodies, winds, and currents.

Conventional maps that represent this world as it appears from space signally fail to capture the severe environmental constraints that governed the flows of people, goods and information. Cost, rather than distance, is the principal determinant of connectivity.

For the first time, ORBIS allows us to express Roman communication costs in terms of both time and expense. By simulating movement along the principal routes of the Roman road network, the main navigable rivers, and hundreds of sea routes in the Mediterranean, Black Sea and coastal Atlantic, this interactive model reconstructs the duration and financial cost of travel in antiquity.

Taking account of seasonal variation and accommodating a wide range of modes and means of transport, ORBIS reveals the true shape of the Roman world and provides a unique resource for our understanding of premodern history.

[Learn More](#)



[Start exploring the Roman World](#)

Welcome to the new version of ORBIS!

You can access the old version [here](#).

If you see any bugs please let us know on [Twitter](#) or via email at orbisproject@stanford.edu.

- Mediolanum (38 Days)

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<https://orbis.stanford.edu/>

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The screenshot shows the homepage of the Texas Freedom Colonies Project. The header features a large, semi-transparent image of a person standing in front of a weathered wooden building with peeling paint. A white stylized bird logo is positioned on the left side of the image. To the right, the project's name is displayed in large, bold, white capital letters: "THE TEXAS FREEDOM COLONIES PROJECT". On the far left, a vertical navigation menu is visible, listing various project sections: Home, About Us, What Are Freedom Colonies?, The Atlas: Map & Database, Get Involved, Community Resources, Research, Digital Projects, Contact Us, and News. The "Home" link is currently active, indicated by a red underline.

THE TEXAS FREEDOM COLONIES PROJECT

Home

About Us >

What Are Freedom Colonies?

The Atlas: Map & Database >

Get Involved >

Community Resources >

Research >

Digital Projects

Contact Us

News >

<https://www.thetexasfreedomcoloniesproject.com/>

ARCGIS ONLINE

1

DATA

Find authoritative
data sources



2

APPS

Build mobile and field
apps

2

SHARE

Collaborate with your
organization

4

MAPS

Design web maps and
scenes

<https://uvalibrary.maps.arcgis.com/home/index.html>

Home - UVa GIS Resources - LibC X +

https://guides.lib.virginia.edu/gis/home

ACCOUNT HOURS ASK A LIBRARIAN

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UVa / LibGuides / UVa GIS Resources / Home

UVa GIS Resources

Geographic Information Science

Home Software Data Consultation Education GIS Users Group Teaching Resources


Chris Gist

Email Me

Intro

The Scholars' Lab located in Alderman Library is the home of the UVa Geographic Information Science (GIS) support group. We support all UVa affiliates in four basic areas of GIS: software, data, consultations, and education.

Got a spatial question? Ask us! uvagis@virginia.edu

Announcement

ArcGIS Online and ArcGIS Pro 2.9 Issues

November 4.2022

We have had numerous requests for assistance around two issues in recent weeks.

1. People using ArcGIS Pro 2.9 on Windows 11 experience crashing when accessing Symbology tools. The best option here is to upgrade ArcGIS Pro to ver 3.0. Pro has an automatic update option. Please check the following link on how to turn this on.
<https://pro.arcgis.com/en/pro-app/latest/get-started/update-arcgis-pro.htm>
2. Users on-Grounds using Eduroam do not have access to certain services from ArcGIS Online. Users attempting to access layers and background layers via ArcGIS Pro are receiving errors that those layers are not available. While we attempt to correct this issue, we have found that using the University's VPN (UVa Anywhere) seems to alleviate the problem.
[UVa Anywhere](#)

<https://guides.lib.virginia.edu/gis/home>

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