

Using Geographic Information Systems for Medical Research

Clinical and Translational Science Center Seminar • Oct. 24, 2018

Michele Tobias, PhD • GIS Data Curator •



What is GIS?

GIS is both a...

Method of Investigation

Geographic Information SCIENCE

Asks questions about spatial relationships between data

Theoretical framework for understanding spatial relationships

Software System

Geographic Information SYSTEM

A **tool** to make spatial data & investigate spatial relationships between data

GIS Data = Location + Information

= Location + Attribute Information

= **Where + What**

Lowest Gas Prices in 95616

2.54

ARCO

705 Russell Blvd & Anderson Rd
Davis

2.61

Circle K

1930 Lake Blvd & W Covell Blvd
Davis

CASH

2.69

76

2002 Lyndell Terrace & John Jones Rd
Davis

2.75

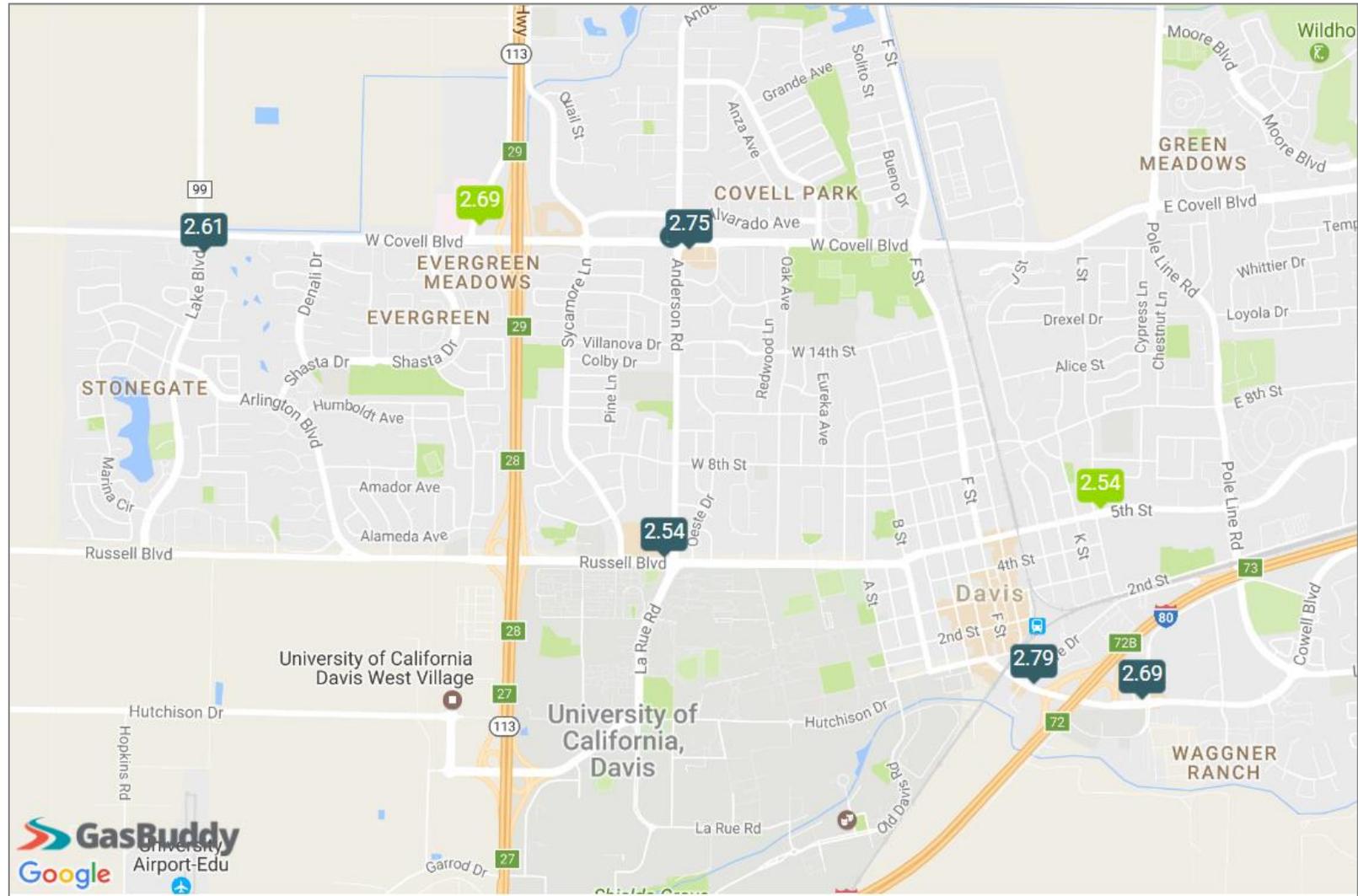
Shell

1944 Anderson Rd & W Covell Blvd
Davis

2.79

Shell

1010 Olive Dr & Richards Blvd
Davis



April 2017

Everything* is mappable.

It just needs a location.

Location Examples:

Address

Place Name

GPS Point

County

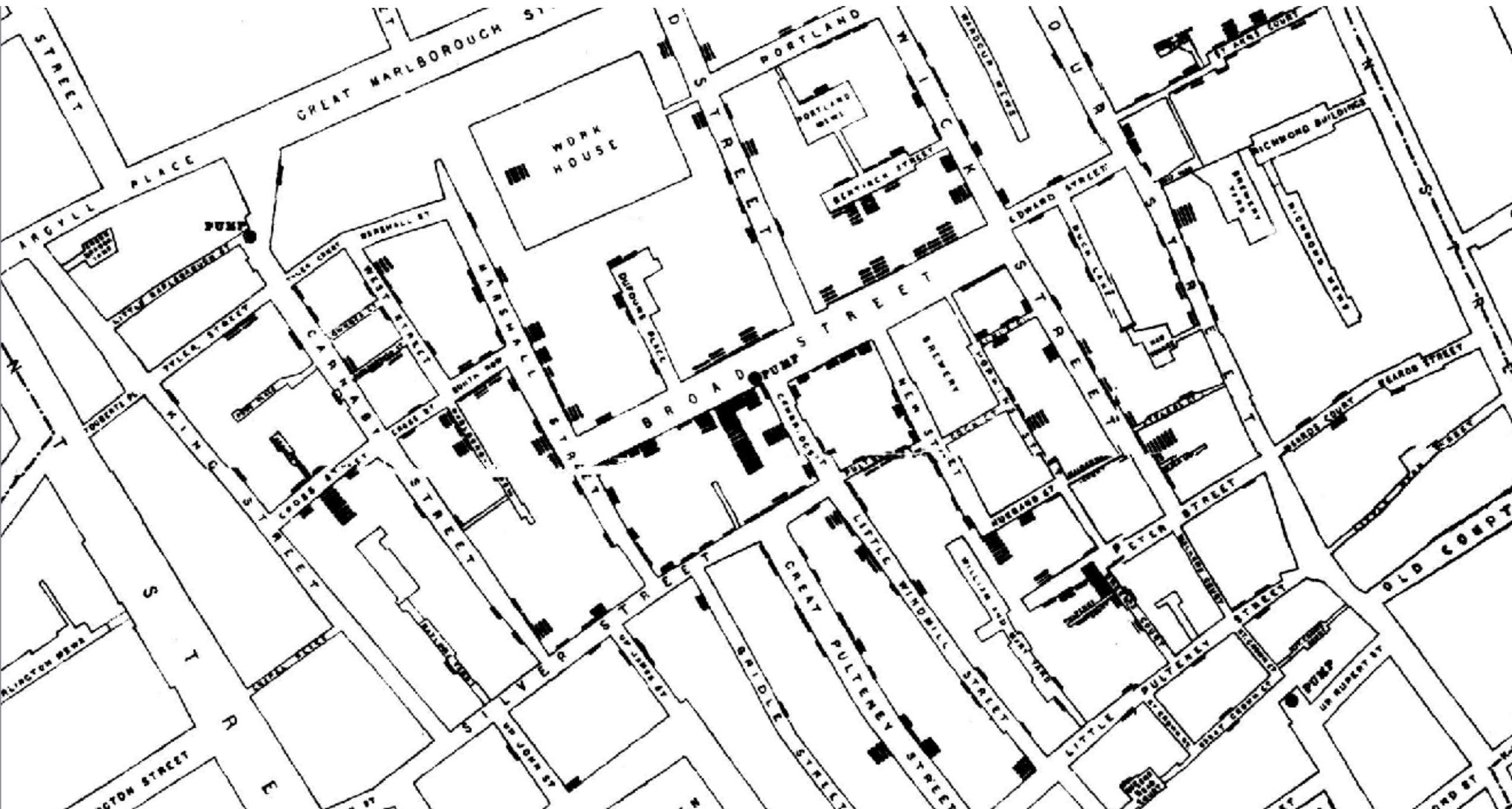
* Ok, maybe just MOST things are mappable.

It's not just about making maps!

Spatial Analysis = performing operations on coordinate & attribute data, often to answer a question.

= WHY + HOW

Example: John Snow's cholera deaths & wells in London 1854





STREET

GREAT MARLBOROUGH ST

WRK HOUSE

PORTLAND

ARGVLL PLACE

PUMP

ST. MARK'S ST

ST. MARK'S ST

ST. MARK'S ST

ST. MARK'S ST

BERWELL ST

BERWELL ST

BERWELL ST

BERWELL ST

BERWELL ST

BERWELL ST

DUPON ALIC

DUPON ALIC

DUPON ALIC

PORTLAND

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PORTLAND

PORTLAND

BAILEY

BAILEY

BAILEY

EDWARD ST

RICHMOND BUILDINGS

RICHMOND BUILDINGS

RICHMOND BUILDINGS

RICHMOND BUILDINGS

RICHMOND BUILDINGS

OLD COMPT

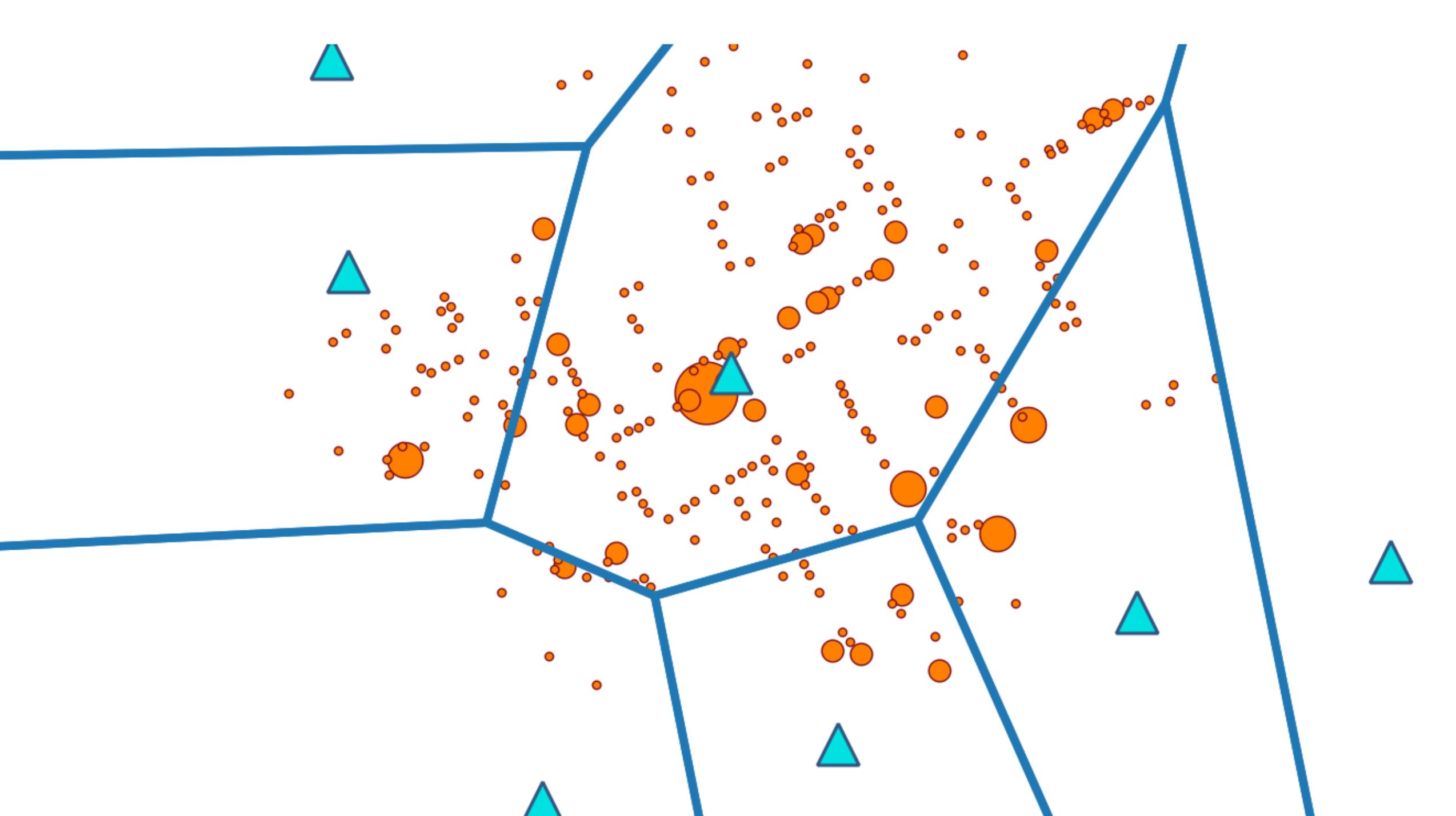
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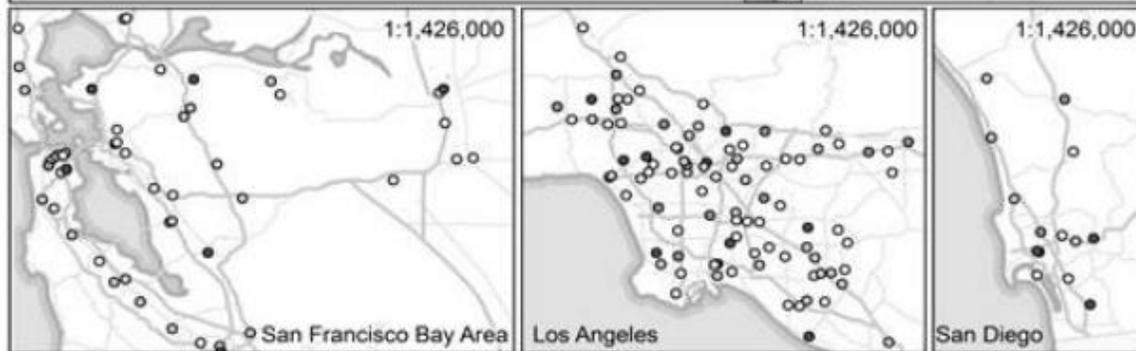
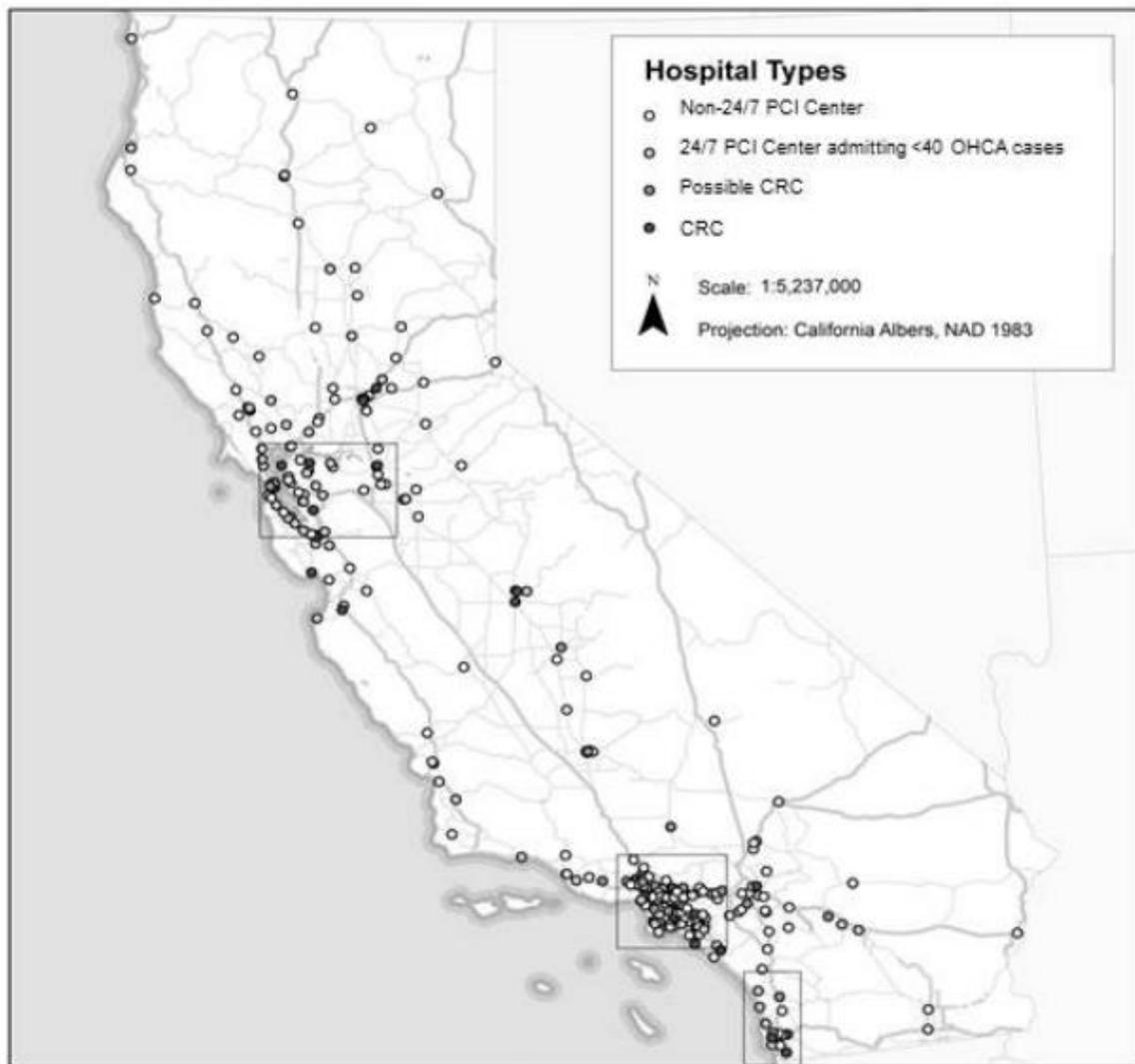
PUMP





The power of spatial analysis lies in combining otherwise unrelated data based on locations.

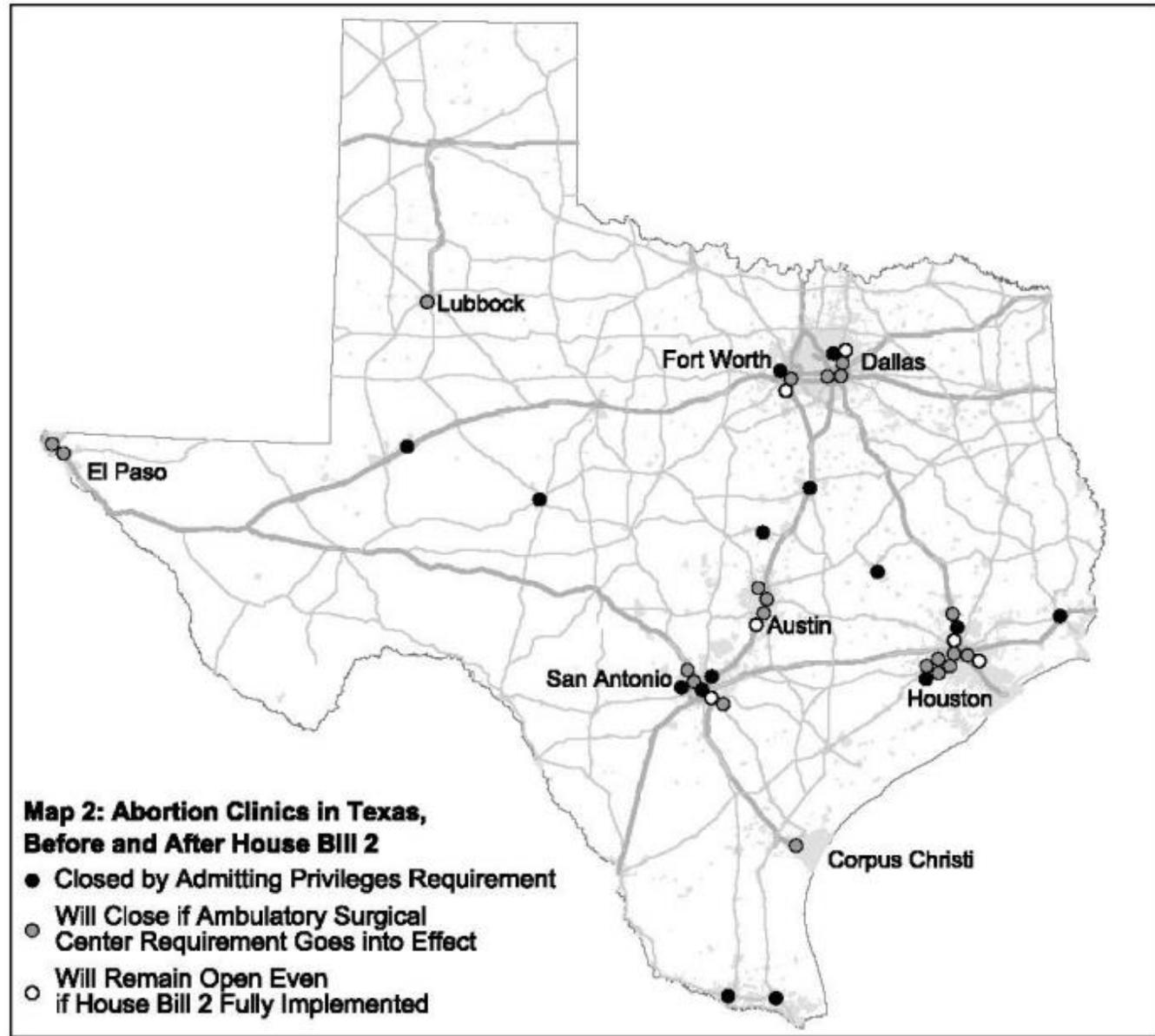
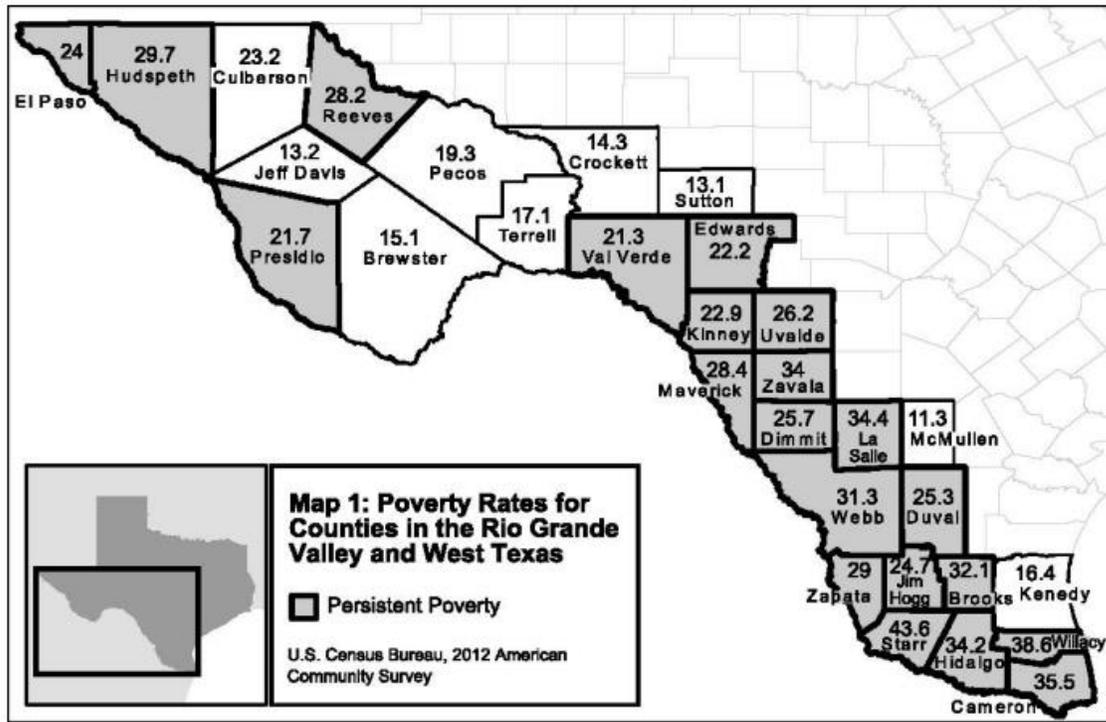
Examples in Medical Research & Law



Mumma, M.D., D.B. Biercks, & J.F. Holmes. 2014.

Availability and Utilization of Cardiac Resuscitation Centers.

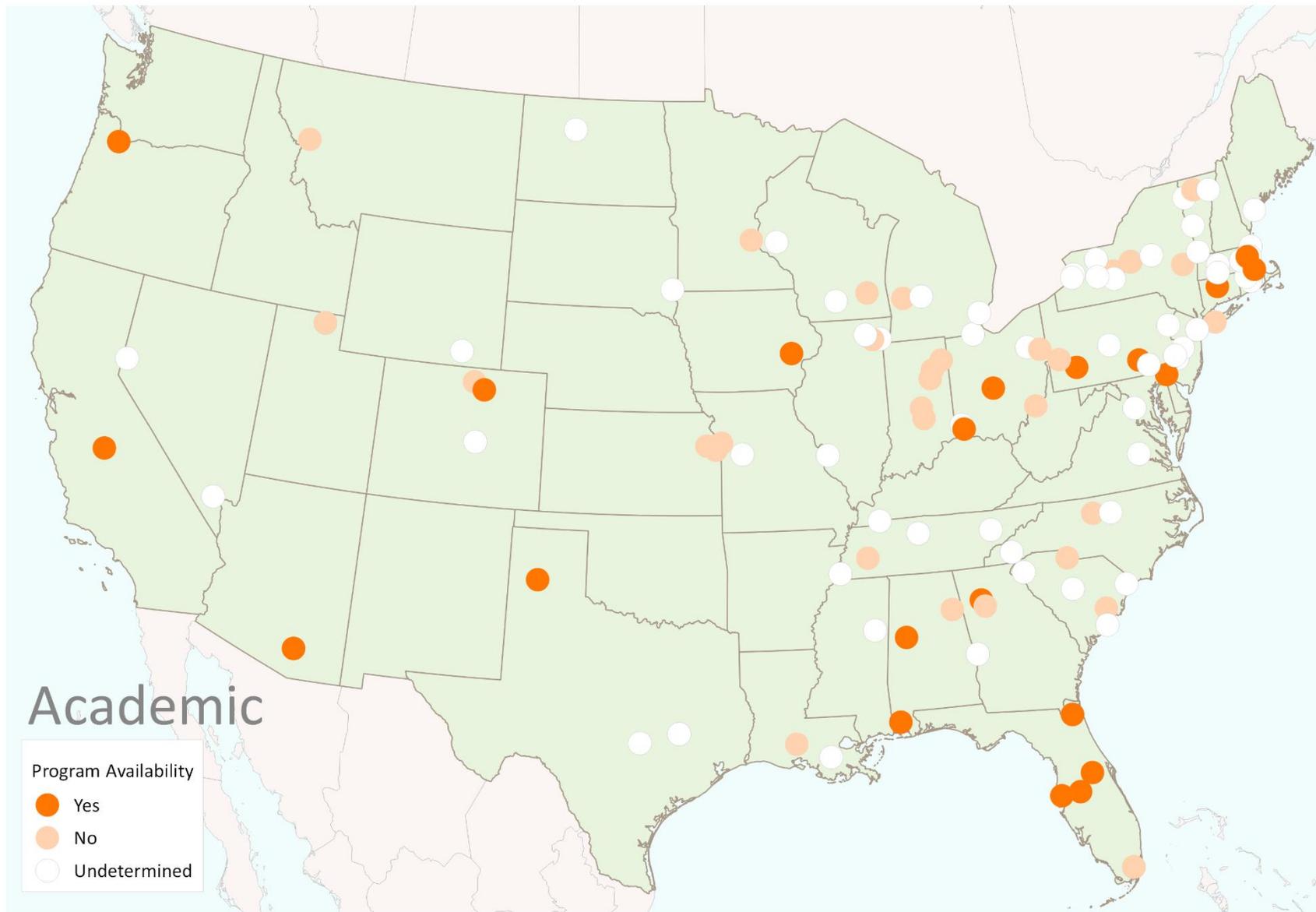
Western Journal of Emergency Medicine.



Pruitt, L.R. & M.R. Vanegas. 2015.

Urbanormativity, Spatial Privilege, and Judicial Blind Spots in Abortion Law.

Berkeley Journal of Gender, Law, & Justice.



Conner, M. In Progress

Book Clubs for Intellectually Disabled People.

Ferguson, WJ, K. Kemp, & G. Kost. 2016.

Using a geographic information system to enhance patient access to point-of-care diagnostics in a limited-resource setting.

Int J Health Geogr (2016) 15:10.

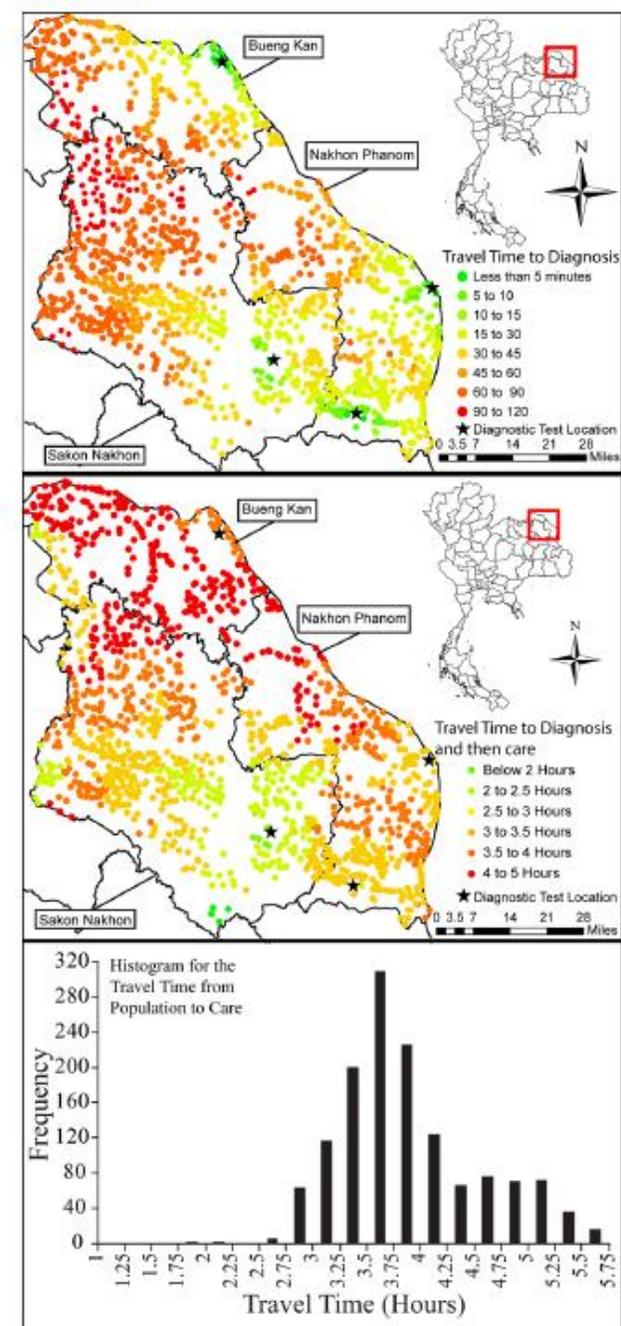


Fig. 1 Travel times to diagnosis (top frame) and care (middle frame) for current health care access. Histogram (bottom frame) shows distribution of travel time to care in 15 min bins

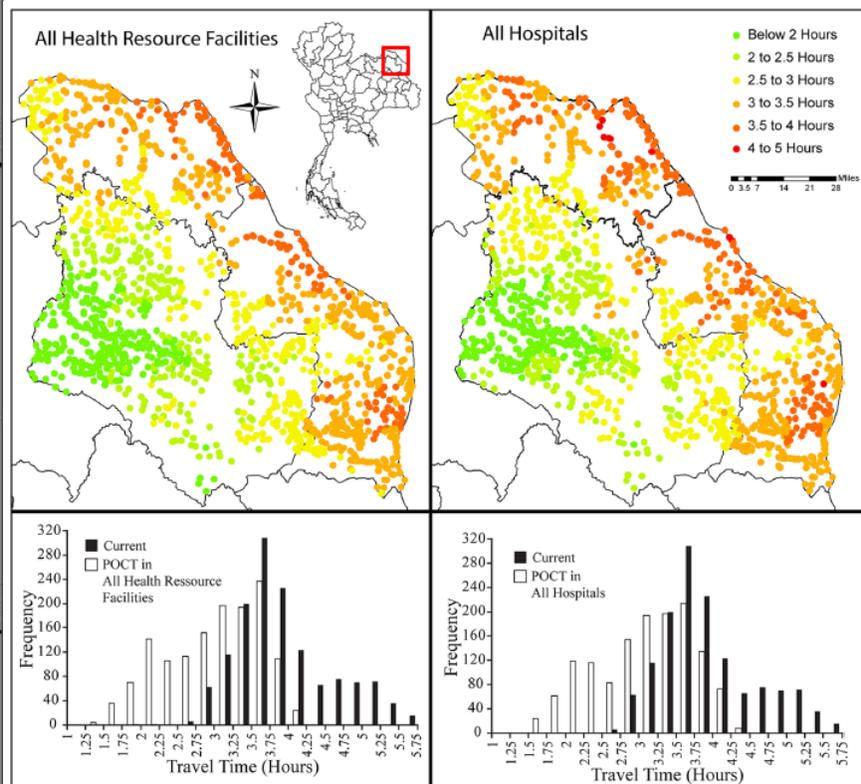
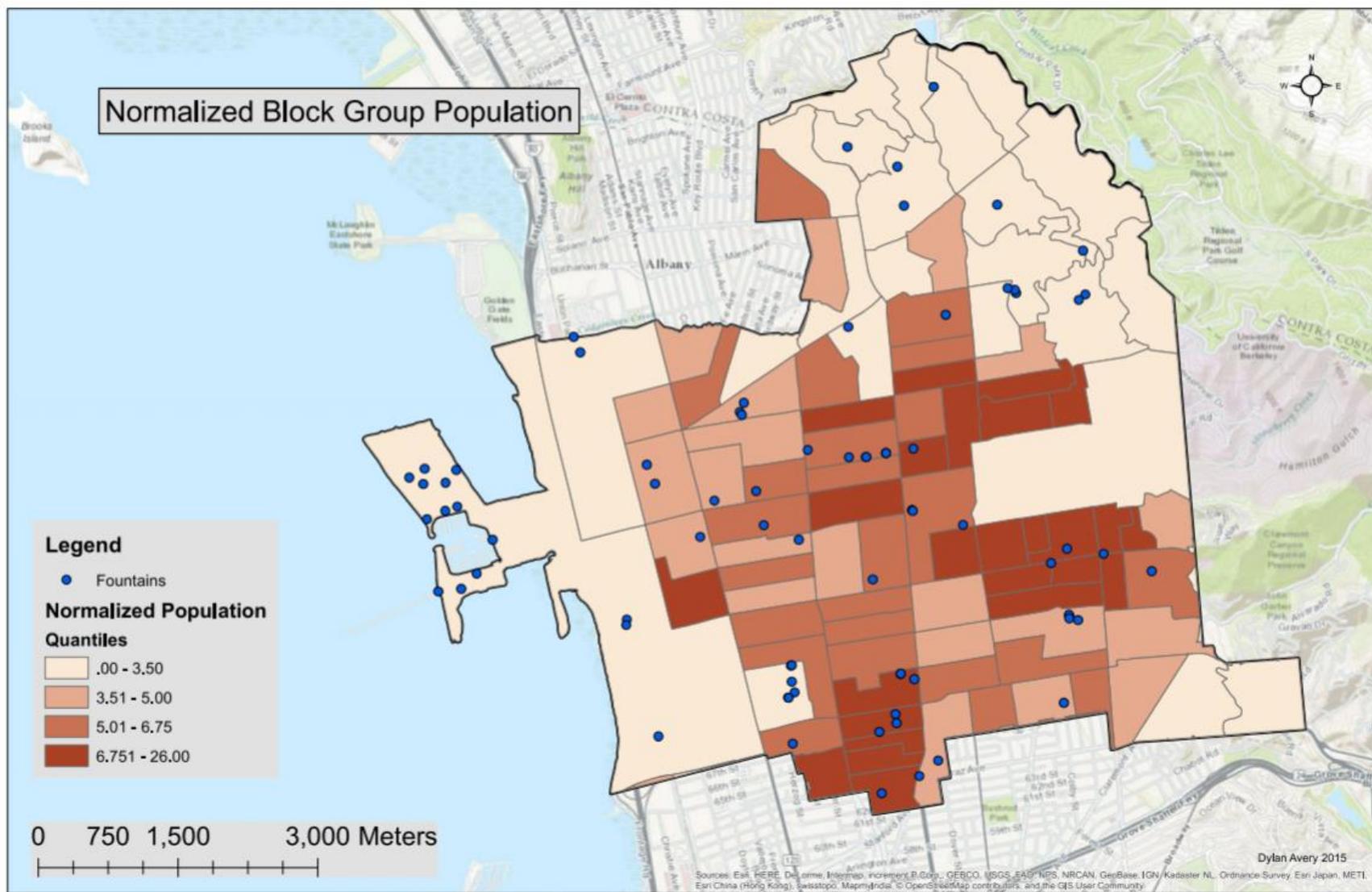


Fig. 2 Comparison of widespread integration strategies where POCT is placed in all health resource facilities (left frames) and only in hospitals (right frames). While both strategies indicate improved access when compared with current health care access, neither offer improvements over the other

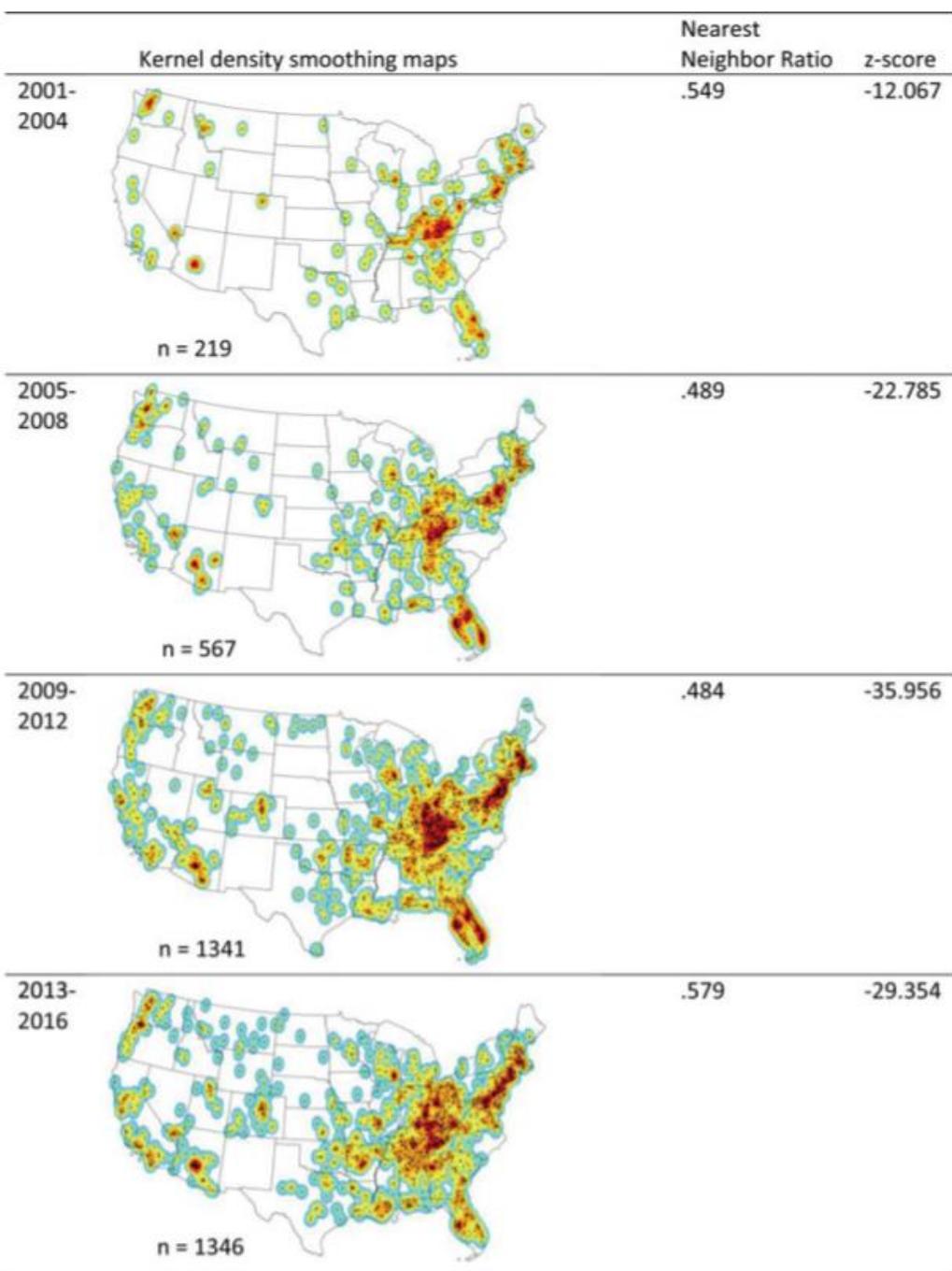


Avery, D C; Smith, C D. 2018.

Access to public drinking water fountains in Berkeley, California: a geospatial analysis.

BMC Public Health; London Vol. 18.

DOI:10.1186/s12889-018-5087-4



Bryan D. Rookey. 2018.

Drugged Driving in the Opioid Era: Spatial Patterns of Oxycodone Use in Fatal Traffic Crashes, 2001–2016.

Substance Use & Misuse, 53:8, 1288-1298

Figure 3. Point location pattern analysis of oxycodone positivity among drivers in fatal traffic crashes, 2001–2016.

Other Examples

- Psychiatry:
<http://journals.sagepub.com/doi/pdf/10.1177/0706743717745870>
- Childhood Obesity:
<http://journals.sagepub.com/doi/pdf/10.1177/0009922809336073>
- Vaccinations:
<https://reader.elsevier.com/reader/sd/pii/S0264410X18306042?token=F787C521DA6CCF2D2695F0FD8B5A395A1922892259904CA5C9966307A860F2DD1401AD9164D8EADFF0BFADA6498152B>
- Malaria Climate Change Predictions: <https://ij-healthgeographics.biomedcentral.com/track/pdf/10.1186/s12942-018-0122-3>

Publically Available Data

UCD Library Guide for Health Statistics

<https://www.library.ucdavis.edu/guide/health-statistics/#mapping-visualization-data-sets-28>

Mapping, Visualization, & Data Sets

DATASETS, MAPPING APPS, AND VISUALIZATION APPS

- [California Health and Human Services Open Data Portal](#)
- [Chronic Disease GIS Exchange \(CDC\)](#)
The Chronic Disease GIS exchange is an on-line forum for public health professionals and community leaders to learn and share techniques for using GIS to enhance chronic disease prevention and treatment.
- [Data-Planet statistical datasets](#)
Provides access to statistical data produced by U.S. Federal agencies, States, private organizations, and major intergovernmental organizations. There are up to 2 billion charts, maps, views, rankings, time series and tables available for use in the Data-Planet repository. Data-Planet Statistical Datasets offers powerful capabilities to compare & contrast multiple data series, perform statistical calculations on the data, and customize output views.
- [Dartmouth Atlas of Health Care](#)
Documents variations in how medical resources are distributed and used in the United States, using Medicare data.
- [Diabetes Map](#)
Interactive maps with global, country, and regional data from the International Diabetes Foundation
- [Eurostat Database](#)
Eurostat is the statistical office of the European Union situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions.
- [Global Open Data Index](#)
The Global Open Data Index, an initiative of Open Knowledge International, is at once an index of government open data and an assessment of these indexes
- [Google Dataset Search](#) Dataset Search enables users to find datasets stored across thousands of repositories on the Web, making these datasets universally accessible and useful.
- [Google Public Data Explorer](#)
Makes large datasets easy to explore, visualize, and communicate. As charts and maps animate over time, the changes in the world become easier to understand.
- [HealthMap: Global Disease Alert Map](#)
Compiles data sources on the current global state of infectious diseases and their effects on human and animal health.
- [Institute for Health Metrics and Evaluation \(IHME\) Data Visualizations](#)
Free and easily accessible data provided in innovative ways to visualize complex health issues in the U.S. and abroad.
- [Interactive Atlas of Heart Disease and Stroke \(CDC\)](#)
- [USDA Food Environment Atlas](#)
- [World Mapper](#)
A collection of world maps, where territories are re-sized on each map according to the subject of interest.



Amy Studer

Medicine — Blaisdell Medical Library — UC Davis Health, Sacramento

As a subject specialist librarian, Amy is responsible for outreach, instruction, reference, and collection services to the faculty, students, and staff of the School of Medicine at UC Davis.

[On LinkedIn](#)

ASK ME ABOUT

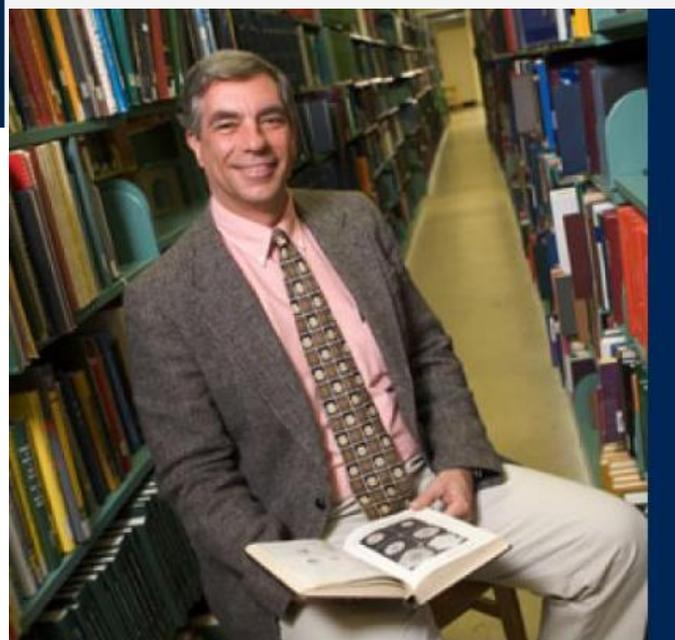
Evidence-Based Practice

Medicine

Public Access Policies

ACSTUDER@UCDAVIS.EDU

916-734-0206



Bruce Abbott

Nursing, Blaisdell Medical Library — Blaisdell Medical Library

Bruce provides in-depth reference support and collection services to the Sacramento Campus. He is an experienced medical librarian with expertise in online searching, collection development, and electronic resources. He has experience in many aspects of library work, although all related to medical libraries. Currently he is the liaison to the School of Nursing and the UC Davis Hospital's Patient Care Services Department.

[On LinkedIn](#)

ASK ME ABOUT

Health Sciences

Nursing

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Book an Appointment

530-752-2086

David Michalski

Social and Cultural Studies Librarian — Research Support Services — Shields Library

David Michalski is available for research assistance, term paper help, orientations, research collaborations, library instruction, and collection development requests. As the Social and Cultural Studies Librarian, Dr. Michalski is one of the librarians at UC Davis who is responsible for making sure the University Library serves the research and teaching mission of the University. He works at a public reference desk and helps build and maintain our extensive reference and research collections available at UC Davis. He holds office hours for research consultations for students, graduates and faculty. He is also available to teach information and research skills classes in the humanities and social sciences. He has taught hundreds of such sessions over the [Read More](#)

ASK ME ABOUT

African Studies

African American Studies

American Studies

Anthropology

Archaeology

Asian American Studies

Human and Child Development

Community and Regional Development

Critical Theory

Cultural Studies

Ethnic Studies

Geography

Human Development

Sociology

Sexuality Gender and Women's Studies

Library and Information Science

Resources for GIS Research at UC Davis



VENSBERG@UCDAVIS.EDU
530-752-4914

Vessela Ensberg

**Associate Director Data Management Program — Data and Digital Scholarship
Department — Shields Library**

Data Management Program

Vessela leads the Data Management Program which aims to make research data easily discoverable, accessible and understandable both among immediate collaborators and for long-term re-use. Vessela wants to see data used to their full potential, and the researchers who produced them to be recognized for their valuable work. She has experience with data both as a scientist (Ph.D. in Cellular and Molecular Biology) and as a curator. In her work as a curator, she has worked with data from multiple disciplines in the sciences and social sciences. She strives to provide solutions for data organization and standardization to enable UC Davis researchers to both seamlessly collaborate on an active project and to fulfill federal and publisher requirements for sharing [Read More](#)

[On Twitter](#) | [On LinkedIn](#)



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Michele Tobias

GIS Data Curator/ Specialist — Data Management — 161 Shields

Data Management Program

Michele Tobias is the GIS Data Curator in the Data Management Program. With 15 years of experience in the field of geospatial science, a PhD in Geography, and expertise in both proprietary and open source software, she's here to help you with your geospatial data needs.

ASK ME ABOUT

GIS

Remote Sensing

Cartography

Spatial Data

Spatial Data Collection

Spatial Research Planning

GIS Drop-In Hours – Wednesdays 2:00-4:00 – Shields Library Map Room

One-on-One Consultations with GIS Data Curator – email
mmtobias@ucdavis.edu

#maptimeDavis Geospatial Skills Workshop Series – Mondays 1:00-3:00
– DSI Classroom (room 360 Shields Library)

Geospatial Email List – <https://lists.ucdavis.edu> search: “geospatial”

Data processing

Map & figures for publication

Data management

Data management plans for funding source requirements

Repository assistance

Options

Traditional Courses: UCD's LDA 150, Geo 200CN; see also American River College

Online Courses: Coursera, Lynda

Workshops: #maptimeDavis, Davis R Users Group

Tutorials, GIS Drop-In Hours

On Your Own: Open Software, give it a try

Formality

Structured, Graded Course



Casual Learning

Further Learning

Questions?

Michele Tobias – mmtobias@ucdavis.edu - @MicheleTobias

Extra slides... just in case I need an example of
modern data

Example: National Transportation Noise Map

<https://maps.bts.dot.gov/arcgis/apps/webappviewer/index.html?id=a303ff5924c9474790464cc0e9d5c9fb>

What is this a map of?

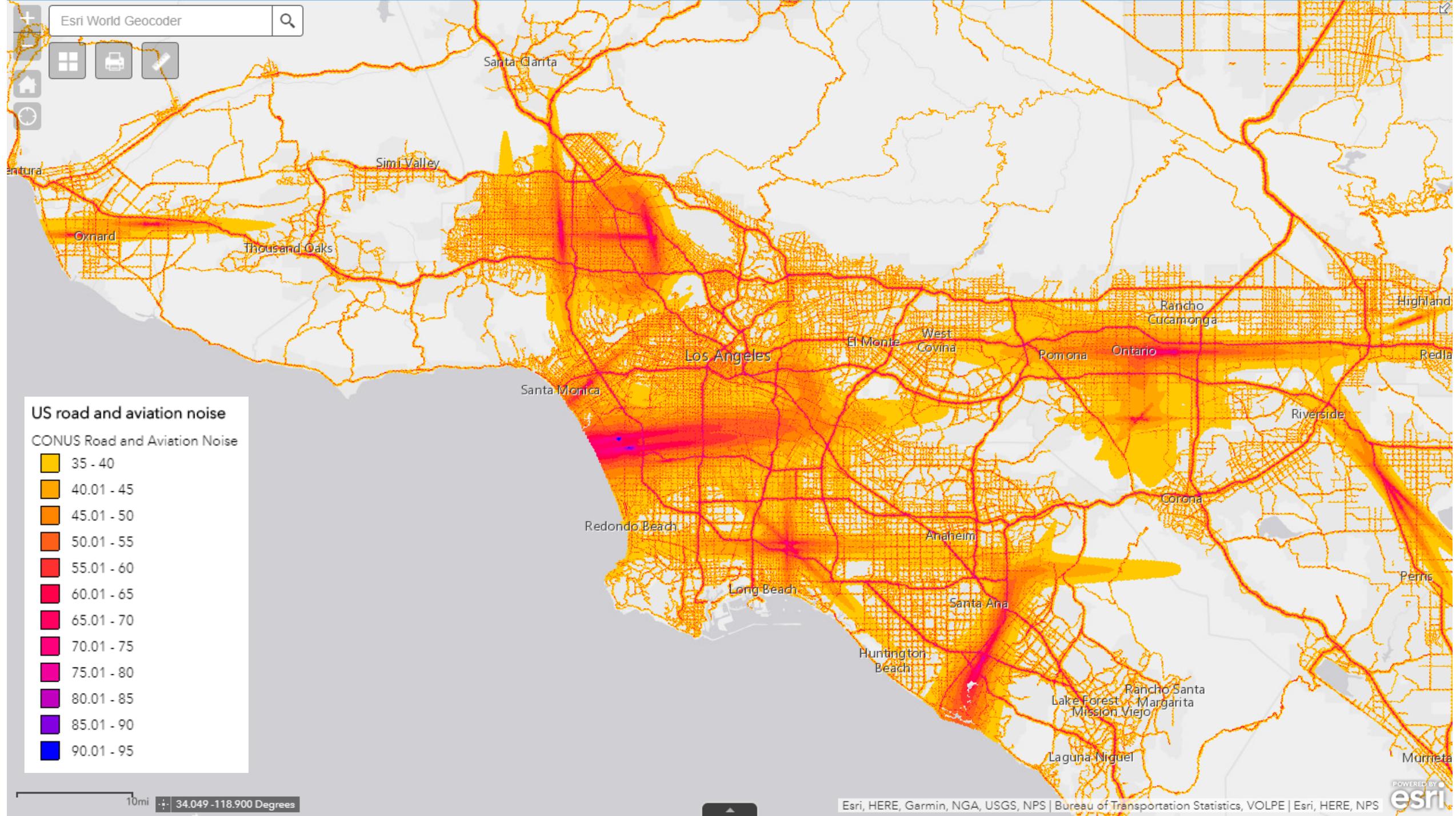
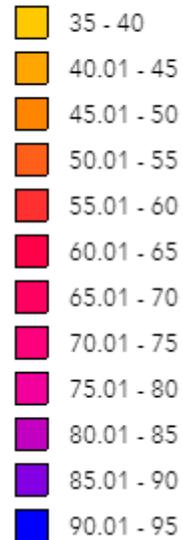
How are the data distributed?

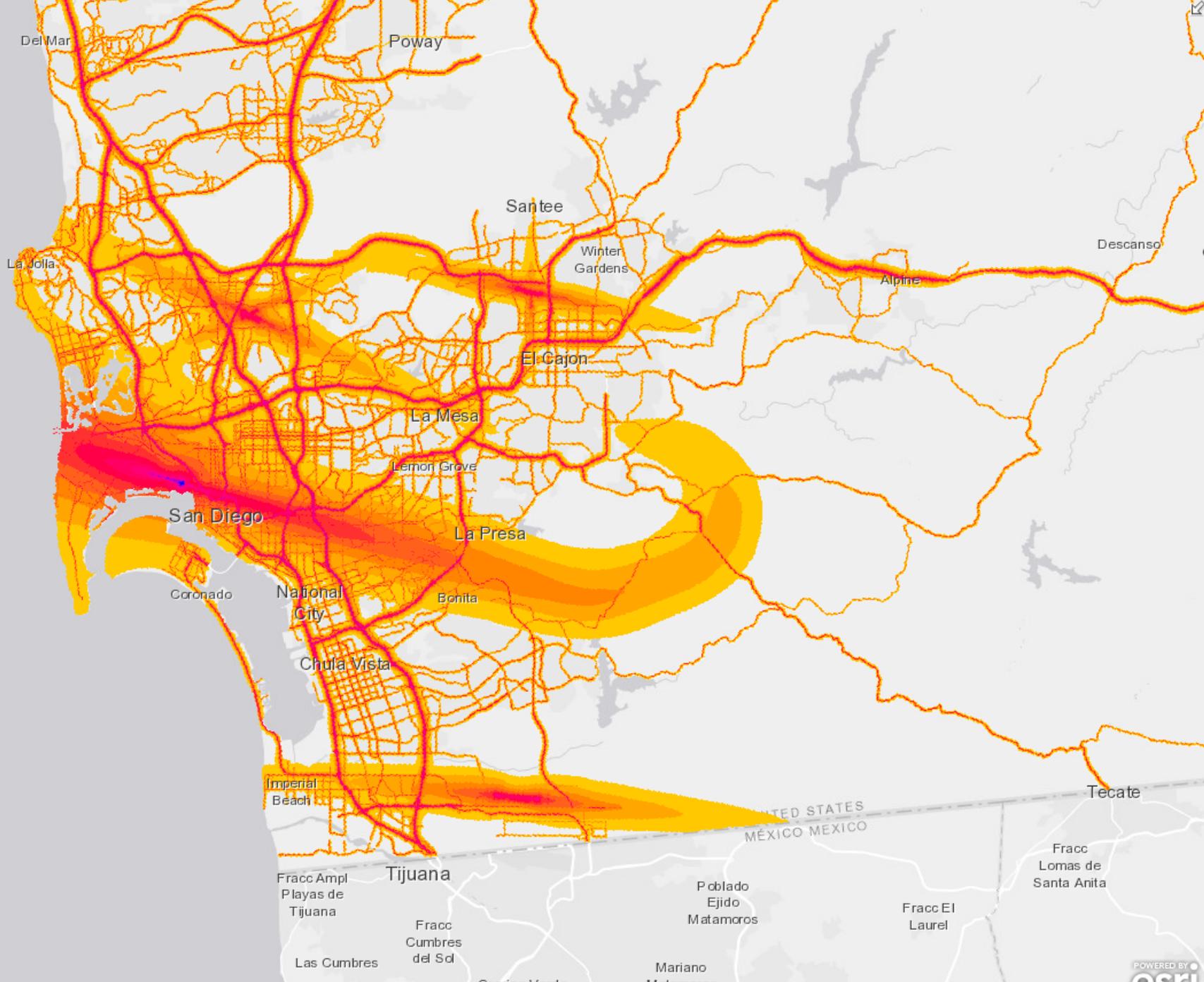
Why is the data distributed that way?

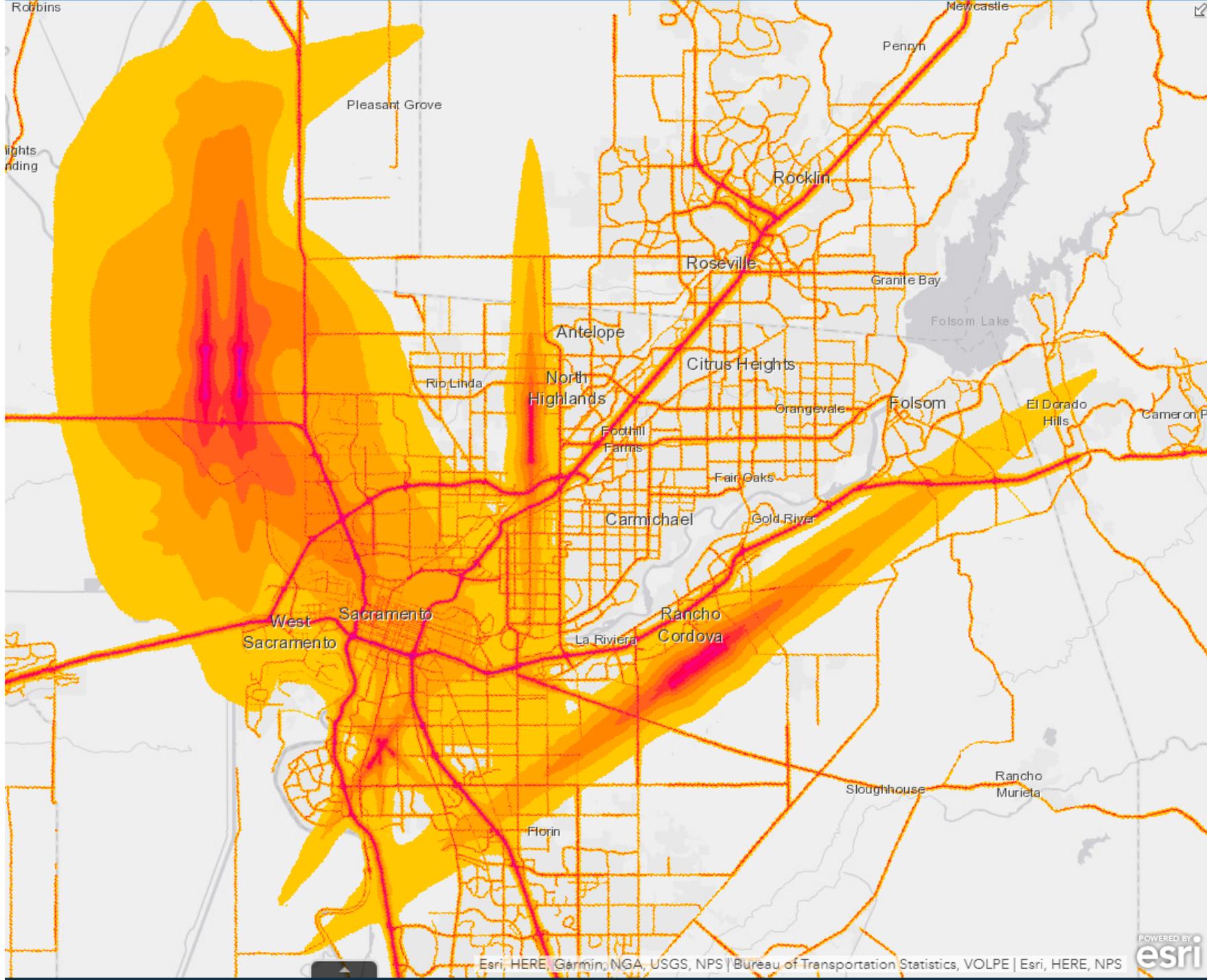


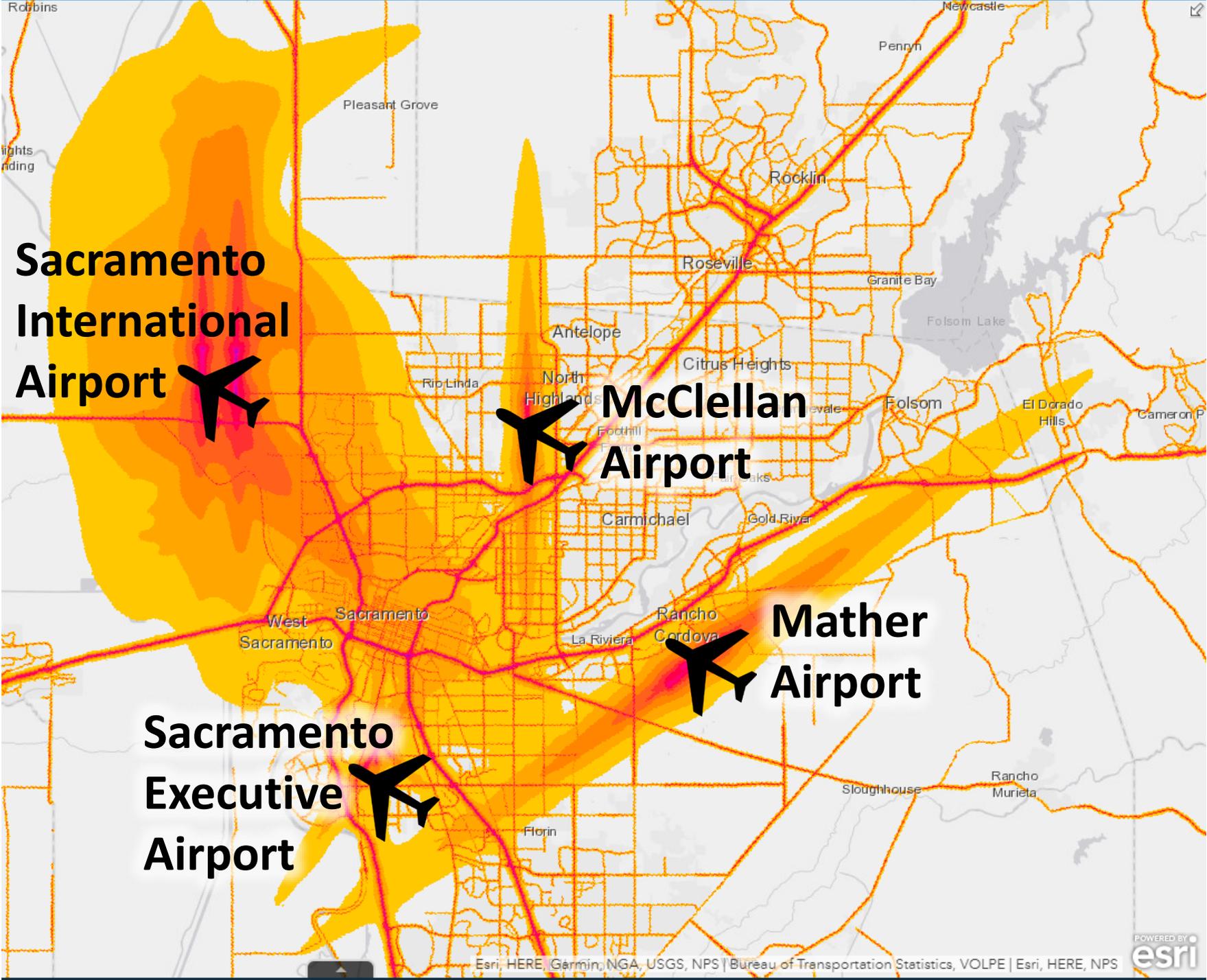
US road and aviation noise

CONUS Road and Aviation Noise









**Sacramento
International
Airport**



**McClellan
Airport**



**Mather
Airport**

**Sacramento
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Airport**

