Penn Libraries
UNIVERSITY of PENNSYLVANIA

# ASPECTS OF MAPPING AND GIS SERVICE IN A HIGHER EDUCATION LIBRARY

## PENN LIBRARIES

Research Data and Digital Scholarship

IU Bloomington GIS Day
Nov. 20, 2020

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# Objective

- Based on my experience at the Penn Libraries, I will explore the landscape of Mapping and GIS services at higher education institutions, and the role and core competency of the GIS librarian in promoting spatial literacy on campus through presentation of several examples.
- The examples cover applications across various disciplines from the Social sciences, humanities, health sciences, and physical sciences.

# Example Projects

- Penn Map Room/Map Table
- COVID Twitter Sentiment Dashboard
- Accessibility Mapping Project (Crowd Sourcing Web App)
- Mapping the Mughal Empire
- Miscellaneous consultation
  - Land Suitability Analyses, Population Diversity Index, Water Pollution Externality, COVID vs Redlining, Philadelphia 1939 Social Base Map, Landuse crowd sourcing web app

# Map Room/Map Table

- Collaborative mapping where people draw their lived experience and their own unique perspectives on a basic map. Then various layers of  civic data are projected on to it to gain further insight.
- The idea came about as the Price Lab for Digital Humanities and the Penn Program in Environmental Humanities were planning a a day long symposium on Community Mapping and Civic Data
- The objective of the event was to “stimulate thought and conversation about how humanists might approach data and mapping not as simply analytical representations of reality but as products that emerge from relationships of power and, simultaneously, as tools for imagination and storytelling.”
- We were asked if we might consider hosting a map room activity
- We drew inspiration from St. Louis Map Room
- and spoke with the creator, Jer Thorp, from the Office for Creative Research (a New York based Non- Profit).

# St. Louis Map Room
# Community mapping in action


"If mapping is a source of power, people can claim power by making maps of their community that reflect them as they are, or that communicate what they'd like them to be."

People draw their lived experience and their own unique perspectives on a basic analog map.


"Interactive projections allowed viewers to overlay these community maps with census data, historic city-planning maps, live policing data, and more, to understand how the community has been shaped by acts of mapping."


# Map Room/Map Table

[Designing process](#)


- We drew inspiration from St. Louis Map Room to develop something similar but that would be flexible for our purpose - a mobile map room that we plan to re-deploy over time around Philadelphia, across disciplines, and in a variety of contexts and locations.
- A truss rig, short throw projector, and table.

# Our First Map Room/Map Table Event


Image Credit: David Toccafondi

Video credit: Paul Farber

Image credit: Girmaye Misgna

## Mapping disparity in Philadelphia

On July 23, 2019, TRL hosted a Map Room event for Prof. Krystal Strong's *Re/Member Black Philadelphia Project*, which brought undergraduates and graduate students from Penn and students from the School District of Philadelphia into conversation about maps, resource disparity, and Philadelphia. The mapping workshop was taught by myself and Girmaye Misgna, the Mapping and Geospatial Data Librarian.

[Mapping disparity in Philadelphia]

## From urban renewal to today, tracking the struggles of America's cities

Equipped with SEPTA Key cards, Brent Cebul's students are taking a deep dive into Philadelphia's history, looking into the past and present challenges facing cities.

After going on a walking tour of West Philadelphia, students marked what they observed on huge maps of the neighborhood.

It's standing room only in an electronic classroom in the Van Pelt-Dietrich Library, and clusters of students are gathered around large maps of West Philadelphia. Each group is adding landmarks they saw while on a recent assignment to walk around the neighborhood and collect observations.

The obvious entries—the Market-Frankford Line, schools, churches, Clark and Malcolm X parks—go up first. Pacing around the room, Brent Cebul, an assistant professor of history, challenges the students to dig a little deeper. Create a key, he advises them. Mark the interesting,

CREDITS
Gwyneth K. Shaw
Writer

Eric Sucar
Photographer

DATE
February 27, 2019

SUBTOPICS
West Philadelphia,
Undergraduate Students,
Demography,

[Featured classroom story on PennToday]

Cebul drew on the resources of the Penn Libraries, including this digital classroom, to help his students understand how to map data.

Cebul encouraged students to list what they saw on their walk, not just the typical landmarks, on their maps.

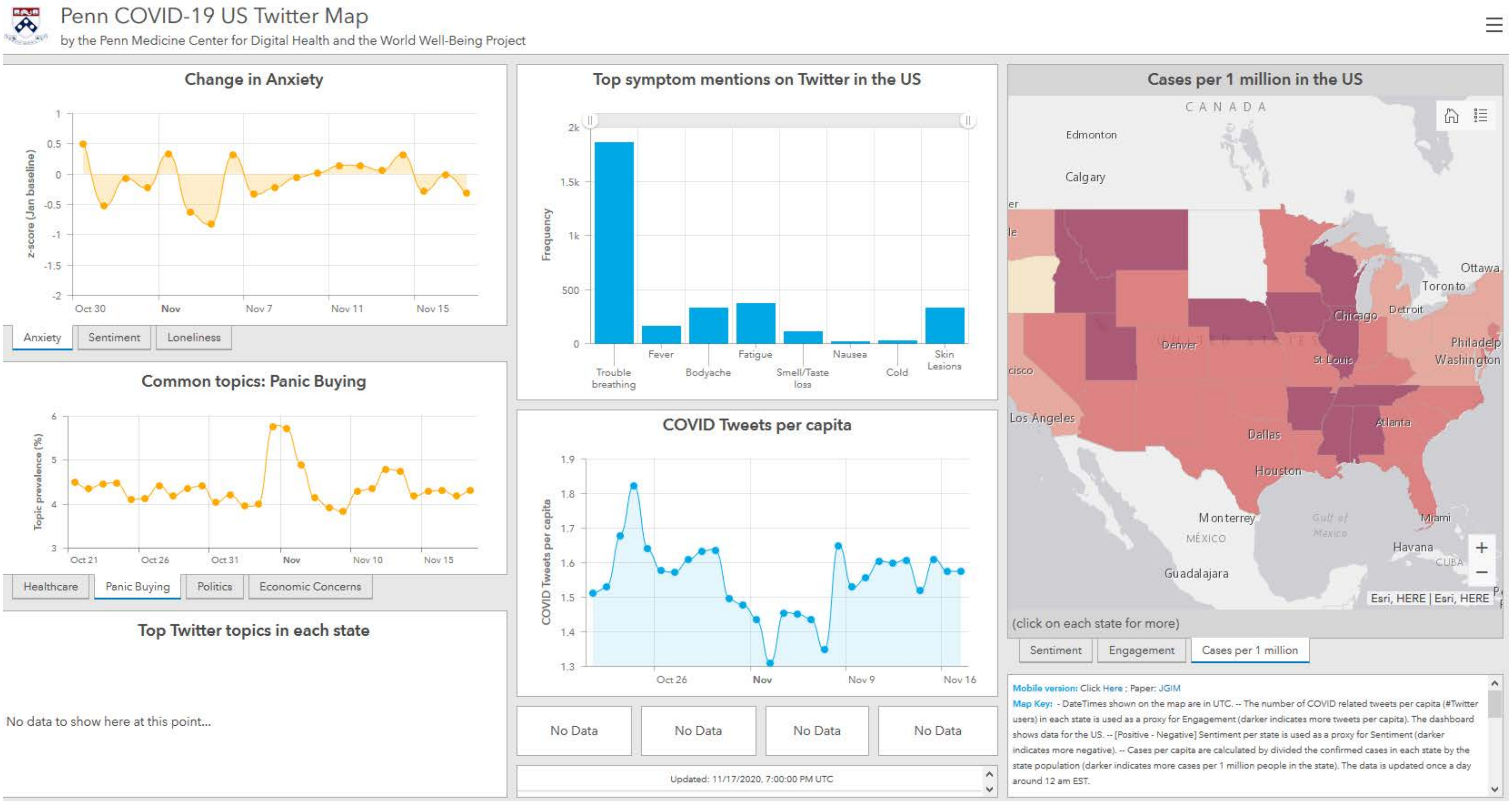
Images Credit: Eric Sucar, University Communications

Currently integrated into an Urban History class curriculum

In collaboration with the Architectural Archives, School of Design, we did a map room event at the Free Library of Philadelphia as part of the Archives Month Philly event at the Central Branch.

# COVID Twitter Sentiment Dashboard

- Penn Medicine Center for Digital Health and the World Well-Being Project
- Collects tweets about the coronavirus and plots their location across the country on a rapid build timeline.
- Between four million and five million coronavirus-related tweets a day and analyze them for positive or negative sentiment
- Maps changes in language about stress, anxiety, and overall sentiment of the pandemic; common topics people are discussing like health care, panic buying, politics, and economic concerns; COVID-19 symptoms; and tweets per capita by state.
- Helps physicians and health officials identify new hotspots for the virus and track how the pandemic is evolving.
- Featured story on PennToday

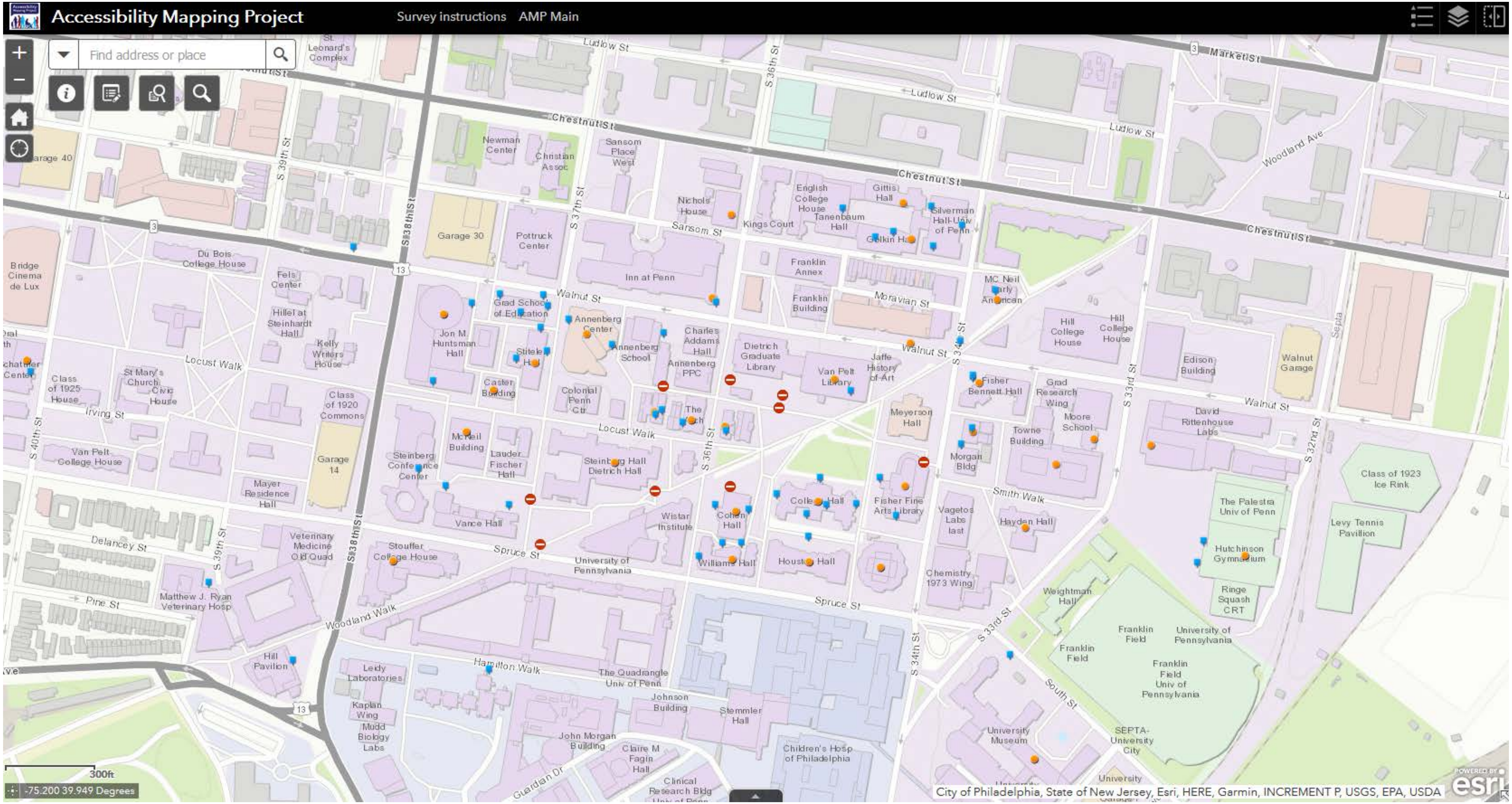



[COVID Twitter Map](#)

# Accessibility Mapping Project

Crowd Sourcing Web App

- Graduate and Professional Student Assembly  (GAPSA)
- Digital interface for mapping the emergence of physical and social barriers at Penn.
- The AMP uses crowdsourced data to illustrate both existing and desired features of access on campus in real-time.
- https://web.sas.upenn.edu/access-map/who-we-are/

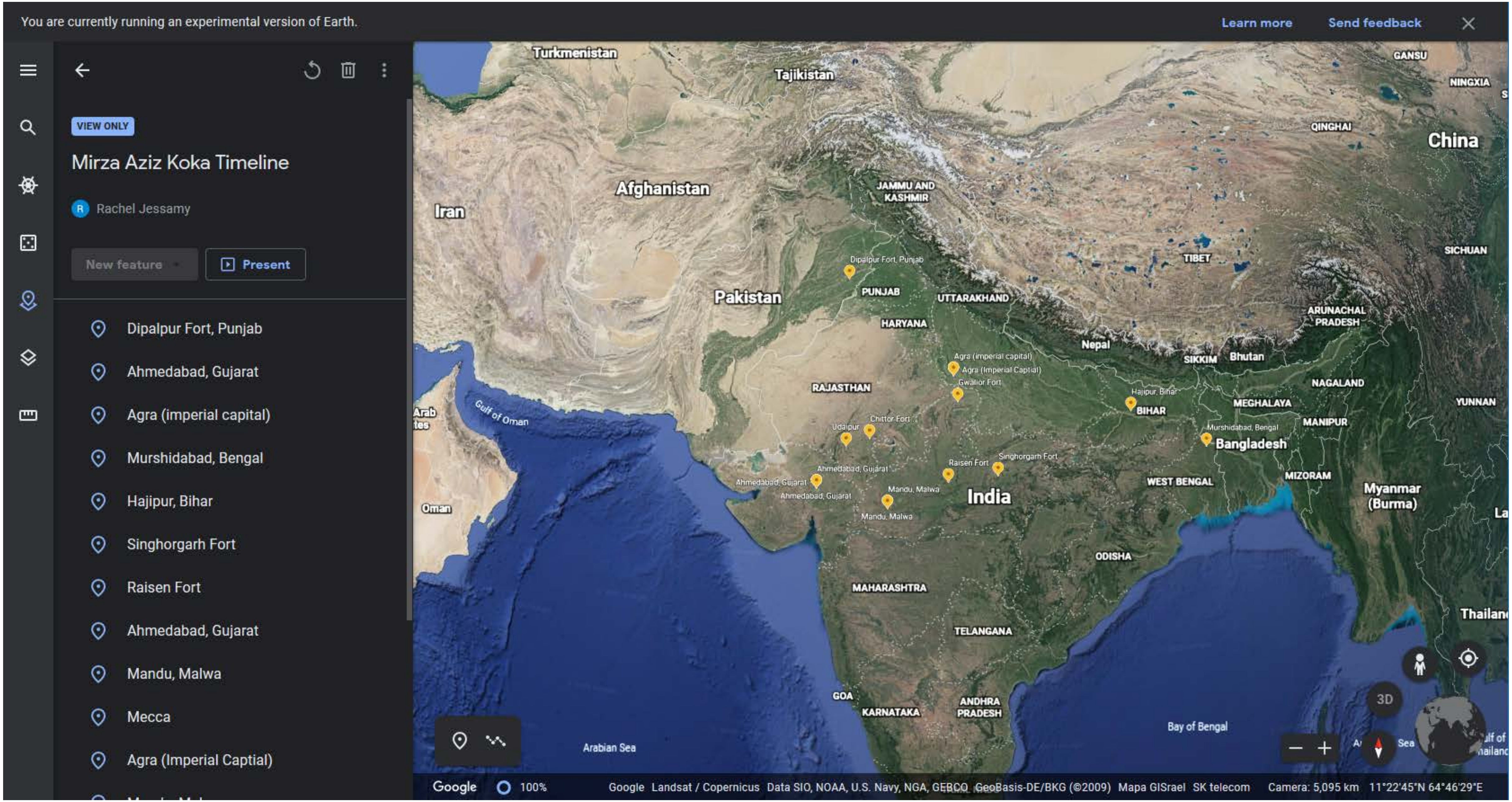

Accessibility Mapping Project
Survey instructions
AMP Main
Find address or place
Ludlow St
Market St
Chestnut St
Sansom St
Walnut St
Locust Walk
Spruce St
Smith Walk
Moravian St
Irving St
Delancey St
Pine St
Woodland Walk
Woodland Ave
Hamilton Walk
Guardian Dr
South St
S 40th St
S 39th St
S 38th St
S 37th St
S 36th St
S 34th St
S 33rd St
S 32nd St
Newman Center
Christian Assoc
Sansom Place West
Garage 30
Pottruck Center
Du Bois College House
Bridge Cinema de Lux
Fels Center
Hillel at Steinhardt Hall
Kelly Writers House
Class of 1925 House
St Mary's Church
Civic House
Class of 1920 Commons
Garage 14
Van Pelt College House
Mayer Residence Hall
Jon M. Huntsman Hall
Grad School of Education
Annenberg Center
Annenberg School
Stiteler Hall
Caster Building
Colonial Penn Ctr
McNeil Building
Lauder Fischer Hall
Steinberg Conference Center
Steinberg Hall Dietrich Hall
Vance Hall
Veterinary Medicine Old Quad
Stouffer College House
Matthew J. Ryan Veterinary Hosp
University of Pennsylvania
Wistar Institute
Cohen Hall
Williams Hall
Houston Hall
College Hall
Fisher Fine Arts Library
Charles Addams Hall
Annenberg PPC
Dietrich Graduate Library
Van Pelt Library
Jaffe History of Art
Meyerson Hall
Nichols House
Kings Court
English College House
Tanenbaum Hall
Gittis Hall
Silverman Hall-Univ of Penn
Golkin Hall
Inn at Penn
Franklin Annex
Franklin Building
MC Neil Early American
Hill College House
Edison Building
Walnut Garage
Fisher Bennett Hall
Grad Research Wing
Moore School
Towne Building
Morgan Bldg
David Rittenhouse Labs
Vagelos Labs
Hayden Hall
Chemistry 1973 Wing
Class of 1923 Ice Rink
The Palestra Univ of Penn
Levy Tennis Pavilion
Hutchinson Gymnasium
Ringe Squash CRT
Weightman Hall
Franklin Field
University of Pennsylvania
Franklin Field Univ of Pennsylvania
Hill Pavilion
Leidy Laboratories
Kaplan Wing
Mudd Biology Labs
The Quadrangle Univ of Penn
Johnson Building
Stemmler Hall
John Morgan Building
Claire M Fagin Hall
Clinical Research Bldg
Children's Hosp of Philadelphia
University Museum
SEPTA-University City
300ft
-75.200 39.949 Degrees
City of Philadelphia, State of New Jersey, Esri, HERE, Garmin, INCREMENT P, USGS, EPA, USDA
POWERED BY esri

AMP Web App

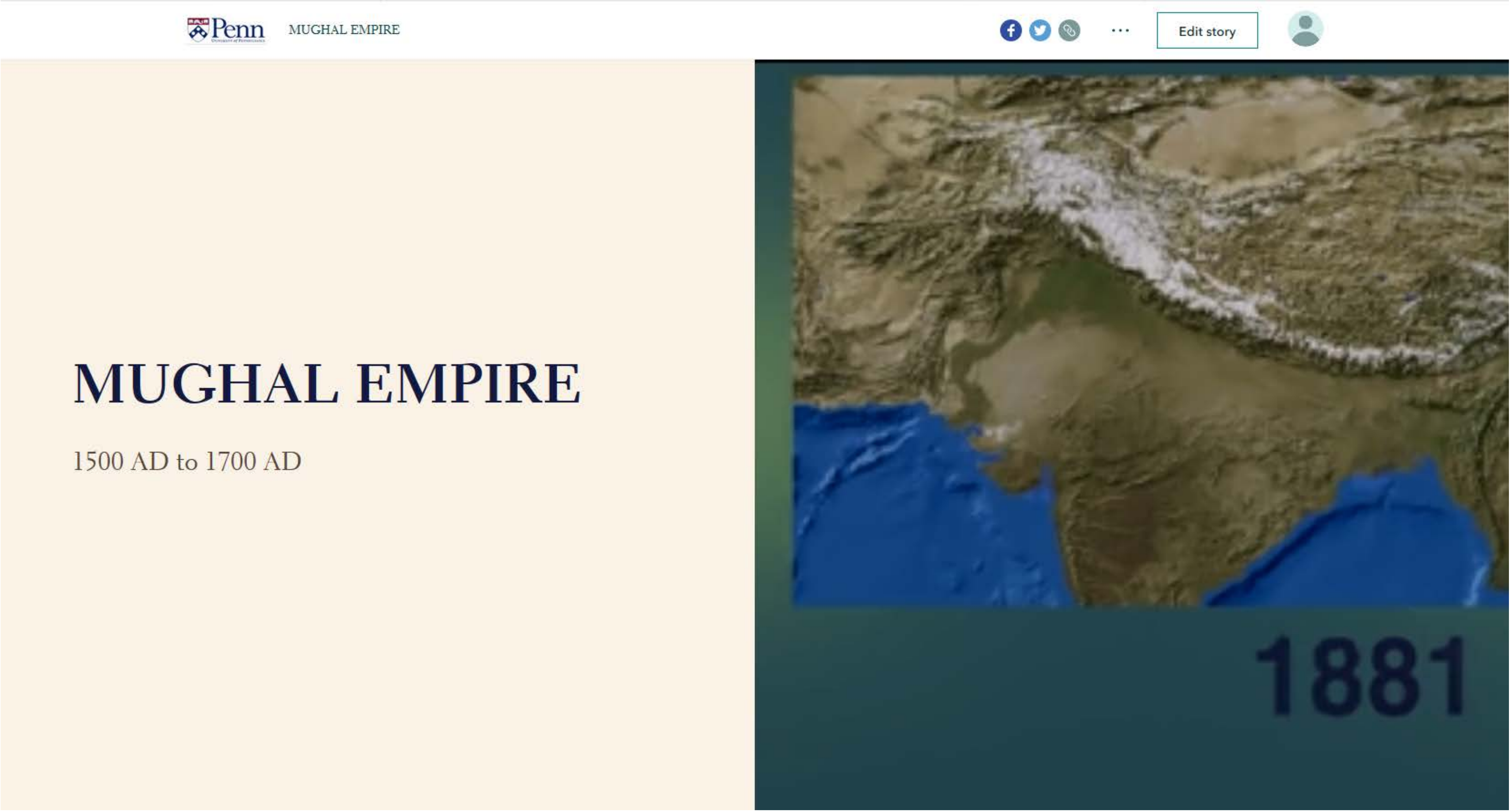
# Mapping the Mughal Empire

Penn Undergraduate Research Mentoring (PURM)

- Each year Penn supports undergraduate involvement in faculty research through the Penn Undergraduate Research Mentoring Program (PURM), which provides students completing their first or second undergraduate year the opportunity to spend a summer conducting research with a Penn faculty member.
- PURM Digital Humanity project using Deep Mapping method
- Has components of what deep mapping does. It's a huge temporal space. There are empires, language, migration, kinship, genealogy, and layers of experiences that have to be visualized and expressed through a diverse set of tools.
- Exemplifies collaboration: Research Data & Digital Scholarship Penn Libraries, South Asian Studies Subject Librarian, and PURM faculty
- Featured story on PennToday




[Mughal Empire Google Earth]




[Mughal Empire Story Map]

# Land Suitability Analyses

What is the potential to develop coffee production for export in the countries below?

- Madagascar
- Congo
- Bolivia
- Puerto Rico
- Myanmar
- Laos

| | | | | | | |
|---|---|---|---|---|---|---|
| Key question: | What is the potential to develop coffee production for export in the countries below? | | | | | |
| | | | | | | |
| Countries | Madagascar | Congo | Bolivia | Puerto Rico | Myanmar | Laos |
| | | | | | | |
| Supply chain | | | | | | |
| Physical infrastructure to move coffee from field to port: | | | | | | |
| -Roads | | | | | | |
| -Port locations and capabilities | | | | | | |
| -Export routes | | (most coffee will flow to European and US markets) | | | | |
| Production | | | | | | |
| Land availability | | (Actual agricultural area available for cultivation ) | | | | |
| Land accesability | | | | | | |
| | | (Proximity to physical infrastructure to move from field to port (eg, road, towns) | | | | |
| Existing production | | (Where are existing coffee plantations in the region?) | | | | |
| Climate conditions | | | | | | |
| Climate factors | Topography | Soil type | Elevation | | | |
| Rainfall | Slope | Depth | | | | |
| Temperature | | Drainage | | | | |
| Weather data | | Texture | | | | |
| Light intensity | | pH | | | | |
| | | Cation exchange capacity | | | | |
| | | Organic matter | | | | |
| | | Total porosities | | | | |
| | | Erodibility | | | | |
| | | | | | | |
| | | | | | | |

# Steps and Data

- Roughly the problem can be broken down into the following objectives and steps:1.

❖ 1. Objective 1:

  - Identify suitable coffee production sites in each country using the land-use, climate, topography, slope, elevation, soil criteria (criteria can also be weighed). Identify interactions between the criteria (example: what are the suitable factors for coffee growth in terms of the specified criteria). Slope < x, Soil = type x or PH < x, Land not urban or forest, elevation < x, precipitation and temperature in a certain range, etc.
  - Steps: Use the suitability analysis tool and model builder in ArcGIS (detailed process modeling steps can be constructed).
  - Data: Global land cover, climate (temperature, precipitation), elevation (DEM), slope (derive from DEM), soil cover

❖ 2. Objective 2:

  - Calculate and rate the identified coffee production areas in terms of accessibility, size (production estimate), supply chain, export route, and other relevant factors. Close to a transportation road network, short distance to a port, etc.
  - Steps: Use tools in ArcGIS to calculate the distance to roads and ports, and land area suitable for coffee production.
  - Data: Roads network, Ports, supply chain and export route information.

❖ 3. Objective 3:

  - Build a scorecard for each country based on the results of the above two steps and perform the evaluation.
  - Steps: Use Multicriteria Evaluation tool in EXCEL or another platform to conduct the evaluation.
  - Data: gather and collate values from outputs of the previous steps into a table.

❖ 4. Verify results

# Population Diversity Index Map

- A quantitative measure that reflects how many different types (such as species) there are in a dataset (a community), and simultaneously takes into account how evenly the basic entities (such as individuals) are distributed among those types. (Wikipedia)
- When used in a population-diversity-by-race context, the index Shows the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups.
- Simpson's Diversity index: Commonly used in biodiversity studies. Adapted here to measure population diversity by race.
- The value ranges from 0 to 1 and higher value represents greater diversity.

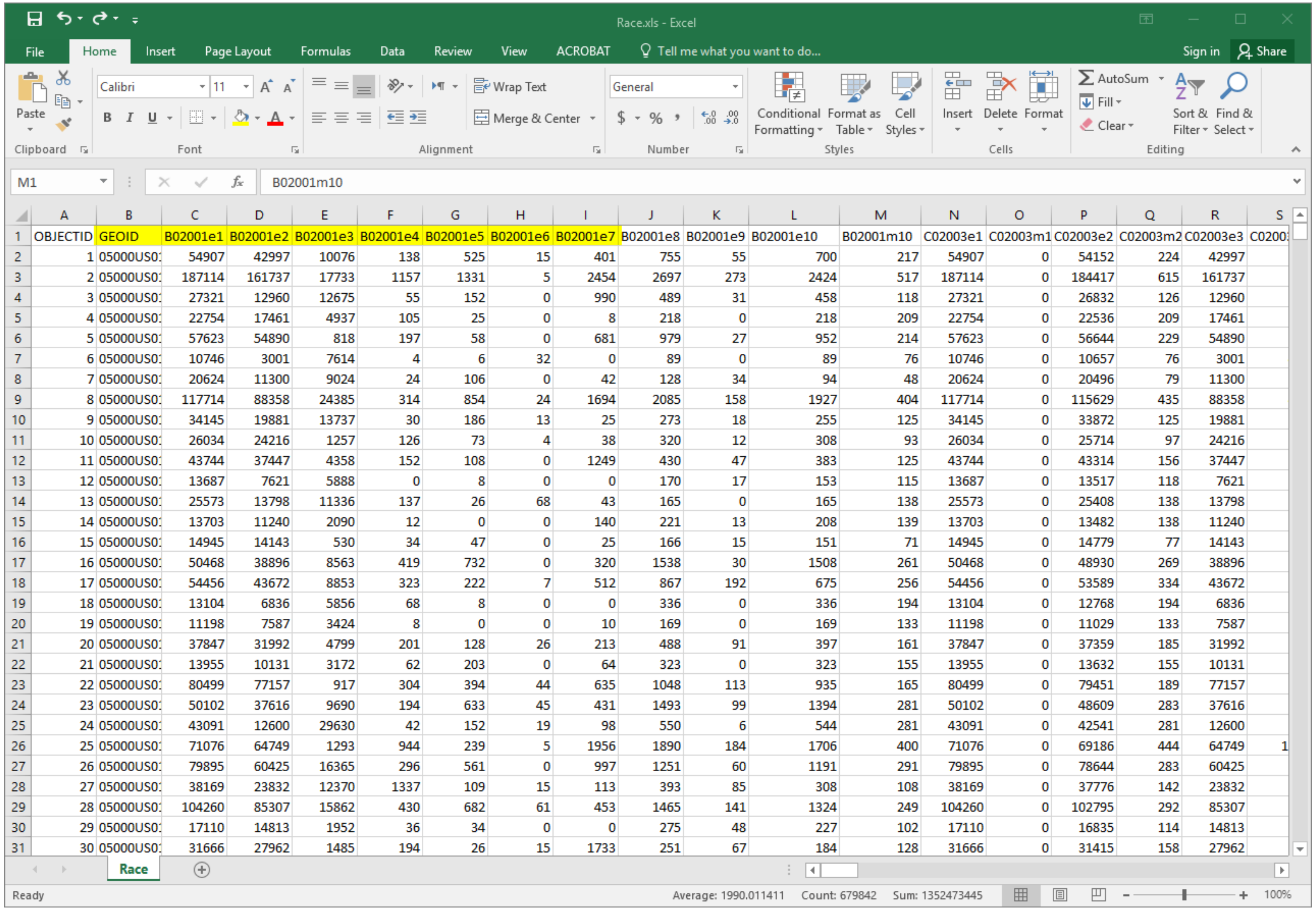
## Calculations

$$D = 1 - \frac{\Sigma n(n-1)}{N(N-1)}$$

Where:

- n = number of individuals of each species
- N = total number of individuals of all species

# Race demographic data by county,  from Census Bureau



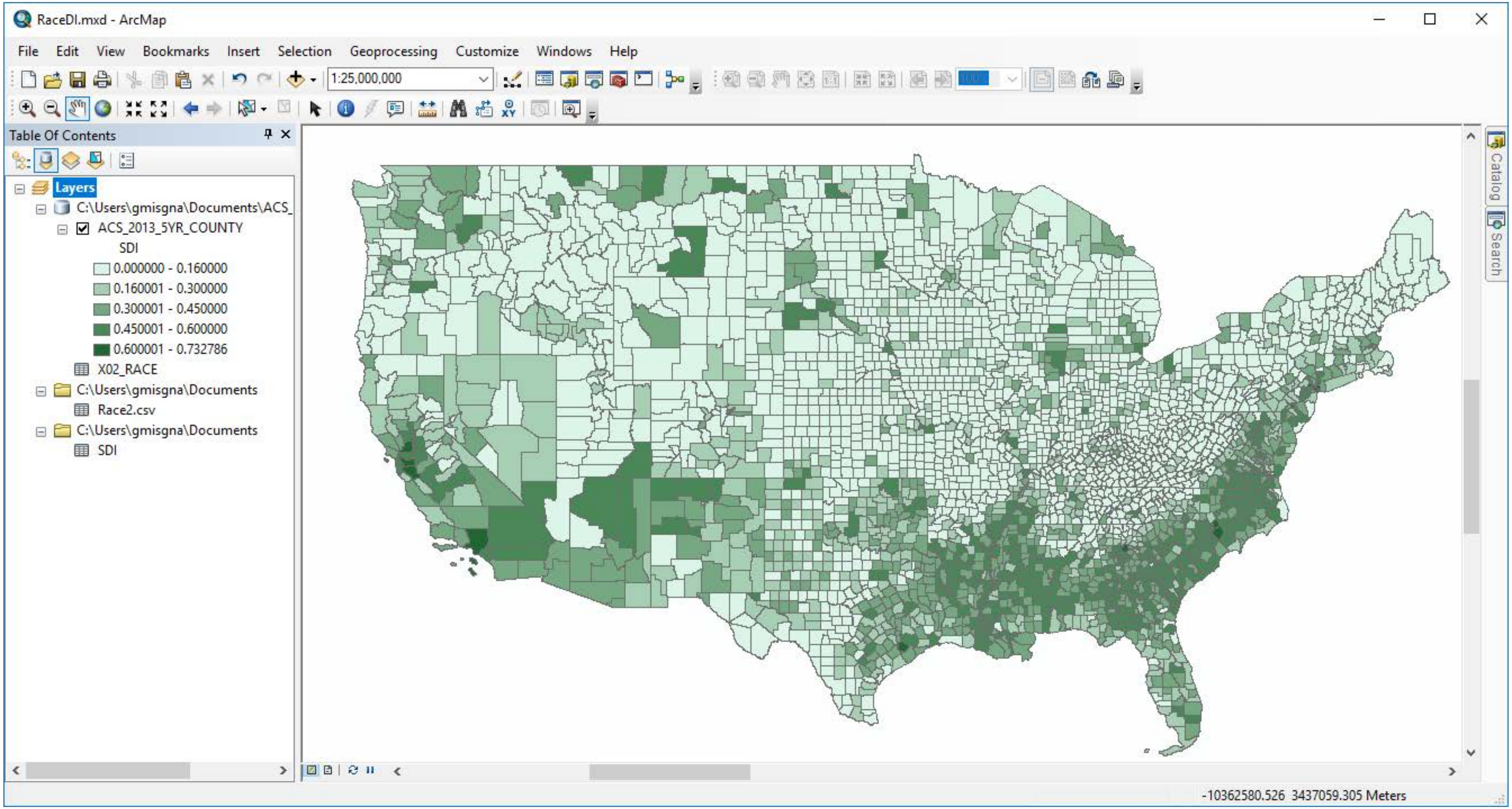


| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | OBJECTID | GEOID | B02001e1 | B02001e2 | B02001e3 | B02001e4 | B02001e5 | B02001e6 | B02001e7 | B02001e8 | B02001e9 | B02001e10 | B02001m10 | C02003e1 | C02003m1 | C02003e2 | C02003m2 | C02003e3 | C0200 |
| 2 | 1 | 05000US0 | 54907 | 42997 | 10076 | 138 | 525 | 15 | 401 | 755 | 55 | 700 | 217 | 54907 | 0 | 54152 | 224 | 42997 | |
| 3 | 2 | 05000US0 | 187114 | 161737 | 17733 | 1157 | 1331 | 5 | 2454 | 2697 | 273 | 2424 | 517 | 187114 | 0 | 184417 | 615 | 161737 | |
| 4 | 3 | 05000US0 | 27321 | 12960 | 12675 | 55 | 152 | 0 | 990 | 489 | 31 | 458 | 118 | 27321 | 0 | 26832 | 126 | 12960 | |
| 5 | 4 | 05000US0 | 22754 | 17461 | 4937 | 105 | 25 | 0 | 8 | 218 | 0 | 218 | 209 | 22754 | 0 | 22536 | 209 | 17461 | |
| 6 | 5 | 05000US0 | 57623 | 54890 | 818 | 197 | 58 | 0 | 681 | 979 | 27 | 952 | 214 | 57623 | 0 | 56644 | 229 | 54890 | |
| 7 | 6 | 05000US0 | 10746 | 3001 | 7614 | 4 | 6 | 32 | 0 | 89 | 0 | 89 | 76 | 10746 | 0 | 10657 | 76 | 3001 | |
| 8 | 7 | 05000US0 | 20624 | 11300 | 9024 | 24 | 106 | 0 | 42 | 128 | 34 | 94 | 48 | 20624 | 0 | 20496 | 79 | 11300 | |
| 9 | 8 | 05000US0 | 117714 | 88358 | 24385 | 314 | 854 | 24 | 1694 | 2085 | 158 | 1927 | 404 | 117714 | 0 | 115629 | 435 | 88358 | |
| 10 | 9 | 05000US0 | 34145 | 19881 | 13737 | 30 | 186 | 13 | 25 | 273 | 18 | 255 | 125 | 34145 | 0 | 33872 | 125 | 19881 | |
| 11 | 10 | 05000US0 | 26034 | 24216 | 1257 | 126 | 73 | 4 | 38 | 320 | 12 | 308 | 93 | 26034 | 0 | 25714 | 97 | 24216 | |
| 12 | 11 | 05000US0 | 43744 | 37447 | 4358 | 152 | 108 | 0 | 1249 | 430 | 47 | 383 | 125 | 43744 | 0 | 43314 | 156 | 37447 | |
| 13 | 12 | 05000US0 | 13687 | 7621 | 5888 | 0 | 8 | 0 | 0 | 170 | 17 | 153 | 115 | 13687 | 0 | 13517 | 118 | 7621 | |
| 14 | 13 | 05000US0 | 25573 | 13798 | 11336 | 137 | 26 | 68 | 43 | 165 | 0 | 165 | 138 | 25573 | 0 | 25408 | 138 | 13798 | |
| 15 | 14 | 05000US0 | 13703 | 11240 | 2090 | 12 | 0 | 0 | 140 | 221 | 13 | 208 | 139 | 13703 | 0 | 13482 | 138 | 11240 | |
| 16 | 15 | 05000US0 | 14945 | 14143 | 530 | 34 | 47 | 0 | 25 | 166 | 15 | 151 | 71 | 14945 | 0 | 14779 | 77 | 14143 | |
| 17 | 16 | 05000US0 | 50468 | 38896 | 8563 | 419 | 732 | 0 | 320 | 1538 | 30 | 1508 | 261 | 50468 | 0 | 48930 | 269 | 38896 | |
| 18 | 17 | 05000US0 | 54456 | 43672 | 8853 | 323 | 222 | 7 | 512 | 867 | 192 | 675 | 256 | 54456 | 0 | 53589 | 334 | 43672 | |
| 19 | 18 | 05000US0 | 13104 | 6836 | 5856 | 68 | 8 | 0 | 0 | 336 | 0 | 336 | 194 | 13104 | 0 | 12768 | 194 | 6836 | |
| 20 | 19 | 05000US0 | 11198 | 7587 | 3424 | 8 | 0 | 0 | 10 | 169 | 0 | 169 | 133 | 11198 | 0 | 11029 | 133 | 7587 | |
| 21 | 20 | 05000US0 | 37847 | 31992 | 4799 | 201 | 128 | 26 | 213 | 488 | 91 | 397 | 161 | 37847 | 0 | 37359 | 185 | 31992 | |
| 22 | 21 | 05000US0 | 13955 | 10131 | 3172 | 62 | 203 | 0 | 64 | 323 | 0 | 323 | 155 | 13955 | 0 | 13632 | 155 | 10131 | |
| 23 | 22 | 05000US0 | 80499 | 77157 | 917 | 304 | 394 | 44 | 635 | 1048 | 113 | 935 | 165 | 80499 | 0 | 79451 | 189 | 77157 | |
| 24 | 23 | 05000US0 | 50102 | 37616 | 9690 | 194 | 633 | 45 | 431 | 1493 | 99 | 1394 | 281 | 50102 | 0 | 48609 | 283 | 37616 | |
| 25 | 24 | 05000US0 | 43091 | 12600 | 29630 | 42 | 152 | 19 | 98 | 550 | 6 | 544 | 281 | 43091 | 0 | 42541 | 281 | 12600 | |
| 26 | 25 | 05000US0 | 71076 | 64749 | 1293 | 944 | 239 | 5 | 1956 | 1890 | 184 | 1706 | 400 | 71076 | 0 | 69186 | 444 | 64749 | 1 |
| 27 | 26 | 05000US0 | 79895 | 60425 | 16365 | 296 | 561 | 0 | 997 | 1251 | 60 | 1191 | 291 | 79895 | 0 | 78644 | 283 | 60425 | |
| 28 | 27 | 05000US0 | 38169 | 23832 | 12370 | 1337 | 109 | 15 | 113 | 393 | 85 | 308 | 108 | 38169 | 0 | 37776 | 142 | 23832 | |
| 29 | 28 | 05000US0 | 104260 | 85307 | 15862 | 430 | 682 | 61 | 453 | 1465 | 141 | 1324 | 249 | 104260 | 0 | 102795 | 292 | 85307 | |
| 30 | 29 | 05000US0 | 17110 | 14813 | 1952 | 36 | 34 | 0 | 0 | 275 | 48 | 227 | 102 | 17110 | 0 | 16835 | 114 | 14813 | |
| 31 | 30 | 05000US0 | 31666 | 27962 | 1485 | 194 | 26 | 15 | 1733 | 251 | 67 | 184 | 128 | 31666 | 0 | 31415 | 158 | 27962 | |

- B02001e2 (White)
- B02001e3 (Black-AA)
- B02001e4 (AI-AN)
- B02001e5 (Asian)
- B02001e6 (HA-PA)
- B02001e7 (Other)

https://www2.census.gov/geo/tiger/TIGER_DP/2013ACS/Metadata/County_and_Place_Metadata_2013.txt

# Diversity Index Map



# Historical Landuse Crowd Sourcing Application

- GIS project to collect global land use data in the past.
- The data will be entered by a number of different researchers spread across the world.
- Historical Landuse crowd sourcing Web App

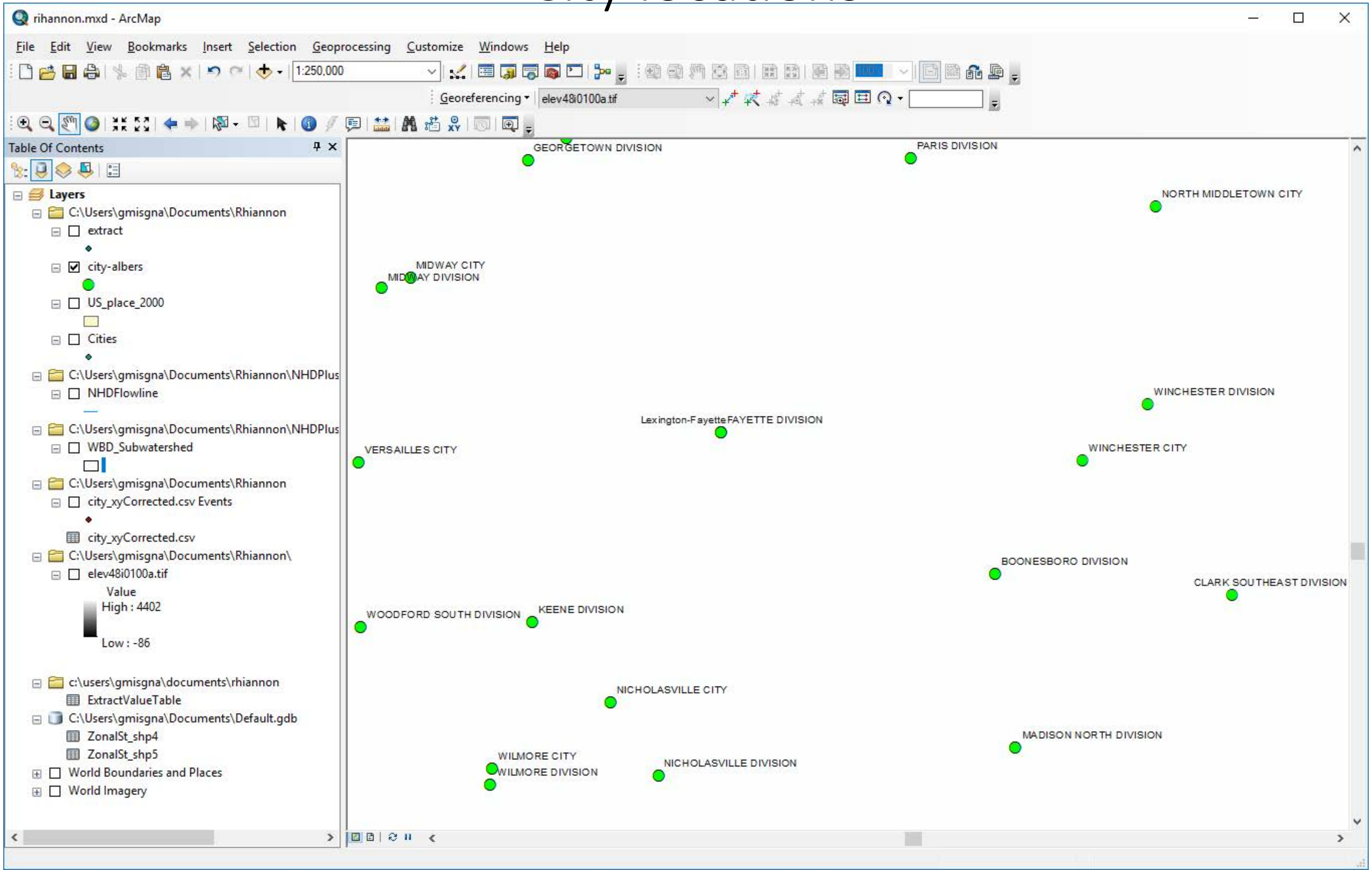
# Philadelphia 1939 Social Base Map

- Digitized and Georectified 1939 Philadelphia base map.
- Social Base webmap

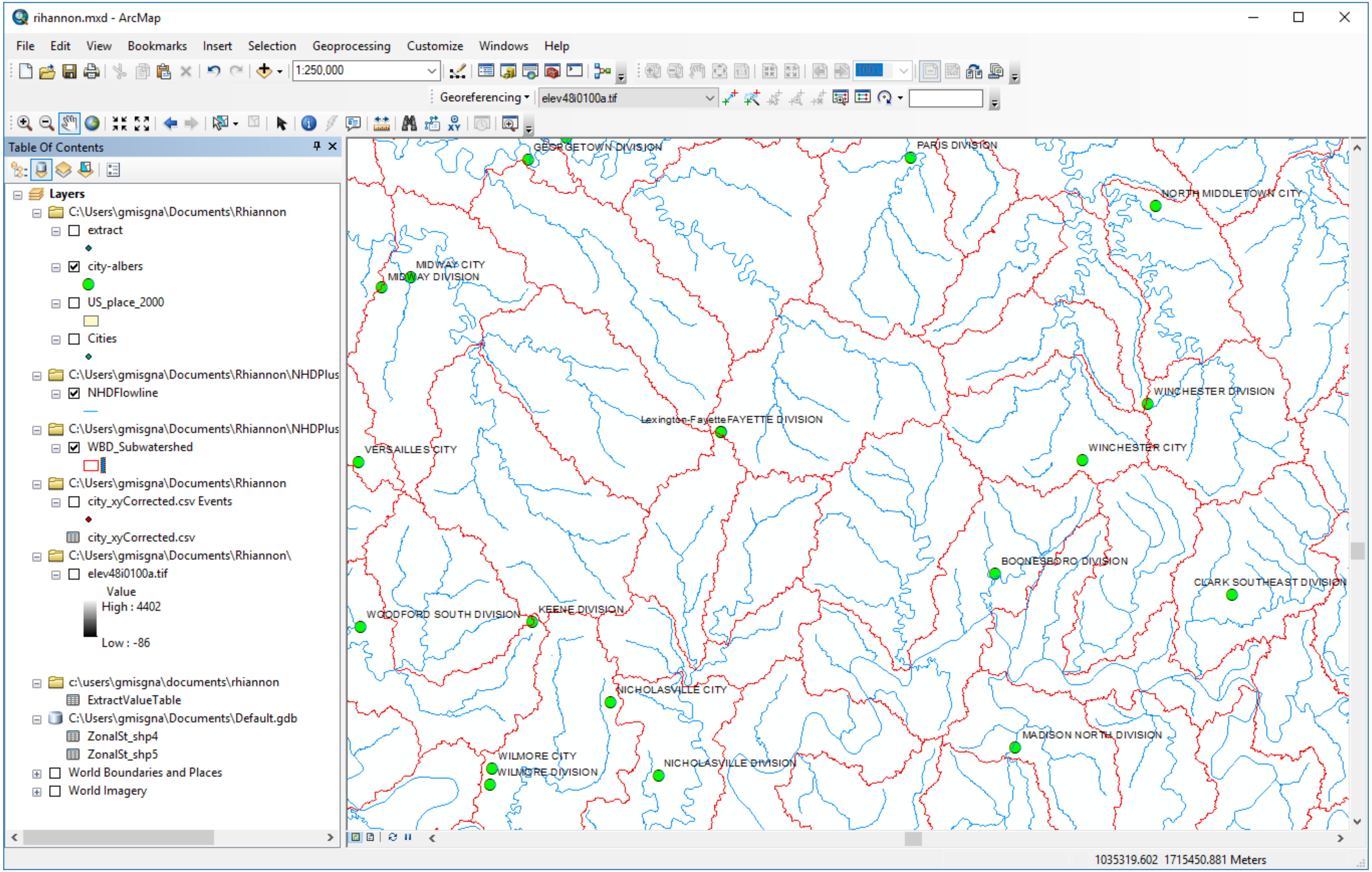
# Water Pollution Externality

- **Goal**: To identify cities that are most likely to impose a water pollution externality on their downstream neighbors.
- The overarching goal is to understand the determinants of wastewater treatment technology adoption in the mid-early 20th century.
- Some cities had proper wastewater technology long before the 1972 Clean Water Act regulations ("proper", meaning, the technology imposed under the 1972 CWA). Some cities did not.
- Trying to understand why some cities adopted the technology; and others did not.
- **Hypothesis** is that adoption of the proper technology has to do with pressure from downstream neighboring cities;

# City locations



# Streams and Watershed boundaries



# COVID vs Redlining

- Collaborating with Dr. Carmen Guerra, Penn Medicine
- Relationship between COVID-19 infections and the history of redlining.
- Systematic denial of various services by federal government and agencies by selective raising of prices. Affected high proportion of minority neighborhoods. Related to National Housing Act of 1934.
- Project to test the hypothesis that COVID-19 cases and death rates in Philadelphia has disproportionately affected redlined neighborhoods.
- variables on house holds below poverty level, house holds without vehicles, and households receiving food stamps.
- COVID Incident Map and Redlining