# Informationist Perspectives on Data Reuse: Lessons Learned from Developing a Spatial Approach for Toxic Transferal from Industrial and Vacant Land Uses to Green Infrastructure

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# Partnering with libraries: The Research Informationist

Davidoff F, Florance V. The informationist: a new health profession? Ann Intern Med. 2000 Jun 20;132(12):996-8. doi: 10.7326/0003-4819-132-12-200006200-00012. PMID: 10858185.

Rankin, J. A., Grefsheim, S. F., & Canto, C. C. (2008). The emerging informationist specialty: a systematic review of the literature. Journal of the Medical Library Association : JMLA, 96(3), 194–206. https://doi.org/10.3163/1536-5050.96.3.005

**Awards for NLM Administrative Supplements for Informationist Services in NIH-funded Research Projects (Admin Supp)**

**(See //www.nlm.nih.gov/ep/AdminSupp.html)**

Informationists are information specialists, usually health sciences librarians, who have graduate training and practical experience that provides them with disciplinary background in biomedical, behavioral or biological sciences and in library and information sciences/informatics. Their cross training provides informationists with a unique perspective on the acquisition, synthesis, management and use of information in research. Informationists work as team members with research scientists and health professionals, and are sometimes called in-context information specialists for that reason. The awards bring informationists into research settings and measure the value of their contributions to the research. The Supplement provides funding for up to 2 years to an active NIH-funded researcher, in order to bring needed information expertise into the research team.

**Fiscal Years**

- 2017
- 2015
- 2014
- 2012

# F.A.I.R. Data-Related Informationist Collaborations

Data Documentation

- Metadata standards/Metadata application profiles
- Controlled vocabularies
- Ontologies
- Persistent identifiers (DOIs/ORCiDs/RRIDs)
- Authority control
- Provenance, Versioning, Rights & Licenses

Research Data Management (RDM)

- Data formats/documentation/organization
- Data dissemination/attribution
- Data archiving

Reproducibility/Methods replication/Data Reuse/Data Repurposing

- Protocol registry/README
- Preservation

# “Rich metadata” (contextual information) that includes identifiers

| | |
|---|---|
| **Dataset Persistent ID** | doi:10.7910/DVN/QHKPAI |
| **Publication Date** | 2020-08-03 |
| **Title** | San Diego business location data, 1958, from Polk's San Diego City Directory |
| **Author** | Marlow, Thomas (Brown University) - ORCID: 0000-0003-3989-6775<br>Frickel, Scott (Brown University) - ORCID: 0000-0002-7368-885X |
| **Contact** | Use email button above to contact.<br><br>Brown Library Research Data Management Services (Brown University) |
| **Description** | This dataset contains parsed, extracted, and geocoded historical business and manufacturing data from Polk's San Diego City Directory using the open source directoreadr software. Images used for data extraction can be found at https://www.sandiego.gov/digitalarchives/collections/specialcollections/citydirectories. (2020-06-01) |
| **Subject** | Earth and Environmental Sciences |
| **Keyword** | Environmental health (MeSH) https://id.nlm.nih.gov/mesh/D004782.html<br>Cities (MeSH) https://id.nlm.nih.gov/mesh/D002947.html<br>Industry (MeSH) https://id.nlm.nih.gov/mesh/D007221.html<br>Manufacturing industry (MeSH) http://id.nlm.nih.gov/mesh/D066192<br>California--San Diego (FAST) http://id.worldcat.org/fast/1205232<br>California--San Diego County (FAST) http://id.worldcat.org/fast/1204290 |
| **Related Publication** | Polk's San Diego (San Diego County, Calif.) City Directory 1958 Including La Jolla .R. L. POLK & COo, Publishers 120 East 8th Street, Los Angeles 14, Calif. purl: 1136988096 http://www.worldcat.org/oclc/1136988096 |
| **Language** | English |
| **Grant Information** | Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health (NIH): P42 ES013660-14S1 |

“Metadata and data should be easy to find for both humans and computers”
(Machine-readable)

{"@context":"http://schema.org","@type":"Dataset","@id":"https://doi.org/10.7910/DVN/QHKPAI","identifier":"https://doi.org/10.7910/DVN/QHKPAI","name":"San Diego business location data, 1958, from Polk's San Diego City Directory","creator":[{"name":"Marlow, Thomas","affiliation":"Brown University","@id":"https://orcid.org/0000-0003-3989-6775","identifier":"https://orcid.org/0000-0003-3989-6775"},{"name":"Frickel, Scott","affiliation":"Brown University","@id":"https://orcid.org/0000-0002-7368-885X","identifier":"https://orcid.org/0000-0002-7368-885X"}],"author":[{"name":"Marlow, Thomas","affiliation":"Brown University","@id":"https://orcid.org/0000-0003-3989-6775","identifier":"https://orcid.org/0000-0003-3989-6775"},{"name":"Frickel, Scott","affiliation":"Brown University","@id":"https://orcid.org/0000-0002-7368-885X","identifier":"https://orcid.org/0000-0002-7368-885X"}],"datePublished":"2020-08-03","dateModified":"2020-08-14","version":"1","description":["This dataset contains parsed, extracted, and geocoded historical business and manufacturing data from Polk's San Diego City Directory using the open source directoreadr software. Images used for data extraction can be found at https://www.sandiego.gov/digitalarchives/collections/specialcollections/citydirectories."],"keywords":["Earth and Environmental Sciences","Environmental health","Cities","Industry","Manufacturing industry","California--San Diego","California--San Diego County"],"citation":[{"@type":"CreativeWork","text":"Polk's San Diego (San Diego County, Calif.) City Directory 1958 Including La Jolla .R. L. POLK & COo, Publishers 120 East 8th Street, Los Angeles 14, Calif.","@id":"http://www.worldcat.org/oclc/1136988096","identifier":"http://www.worldcat.org/oclc/1136988096"}],"license":{"@type":"Dataset","text":"CC0","url":"https://creativecommons.org/publicdomain/zero/1.0/"},"includedInDataCatalog":{"@type":"DataCatalog","name":"Harvard Dataverse","url":"https://dataverse.harvard.edu"},"publisher":{"@type":"Organization","name":"Harvard Dataverse"},"provider":{"@type":"Organization","name":"Harvard Dataverse"},"funder":[{"@type":"Organization","name":"Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health (NIH)"}],"distribution":[{"@type":"DataDownload","name":"FOutput_geocoded.tab","fileFormat":"text/tab-separated-values","contentSize":2790348,"@id":"https://doi.org/10.7910/DVN/QHKPAI/MMLJ0M","identifier":"https://doi.org/10.7910/DVN/QHKPAI/MMLJ0M","contentUrl":"https://dataverse.harvard.edu/api/access/datafile/4002447"}]}

# Foundational RDM Practices Covered in DMPs

- Document your methods and use a metadata standard, where possible
- Save copy of files in open data formats
- Name files and folders using a naming convention and use it consistently
- Version files to keep track of latest and past versions (ISO8601 YYYYMMDD)
- Backup files: 3-2-1 rule (3 copies = 2 separate local - 1 remote/cloud)
- Secure participants' data (data classifications/encryption/limit access/PWs)
- Assign a license allowing for data reuse (Creative Commons)
- Deposit data and code in long-term repositories for public access (Re3data)
- Cite the location of data and code in publications for others to locate
- Plan for any files that need to be retained and preserved after a project ends

# “Collections as Data”

“Collections as data development aims to encourage computational use of digitized and born digital collections”

“Shared documentation helps others find a path to doing the work”

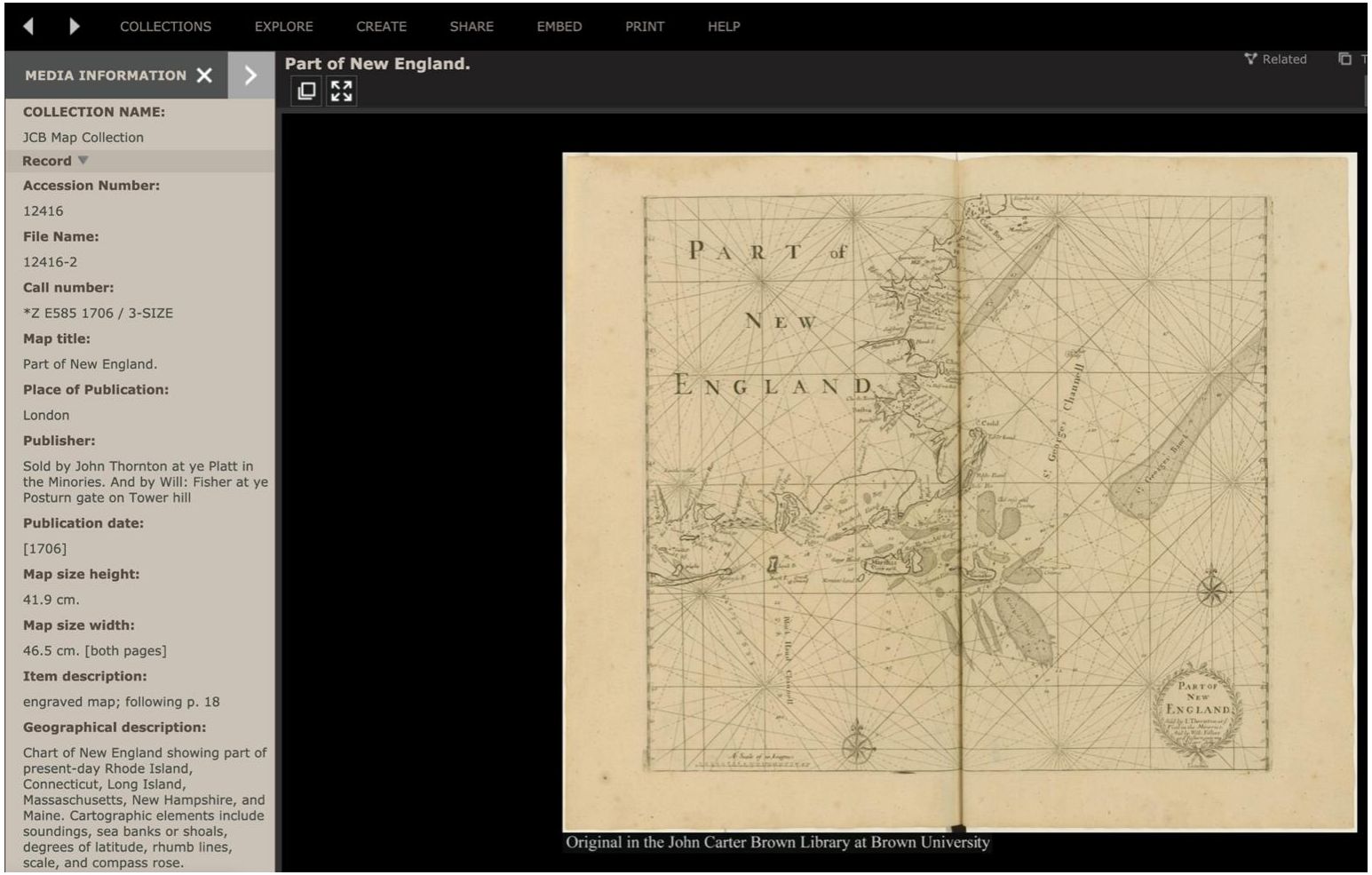
“Collections as data development values interoperability”

“Data as well as the data that describe those data are considered in scope.”

*Always Already Computational: Collections as Data project team (2017; v2). The Santa Barbara Statement on Collections as Data. https://collectionsasdata.github.io/statement/*

# Collections-based data: Visiting the archives

- Historical maps
- Image/text-based data
- Diaries
- Inventories
- Herbaria
- Industrial directories



# *Abies balsamea* (L.) Mill.

Overview Full Metadata

**Catalog No.**
PBRU00052545

**Family**
Pinaceae

**Collector**
H. P. Sartwell

**Date Collected**

**State/Province**
New York

**Country**
United States of America

**Locality**

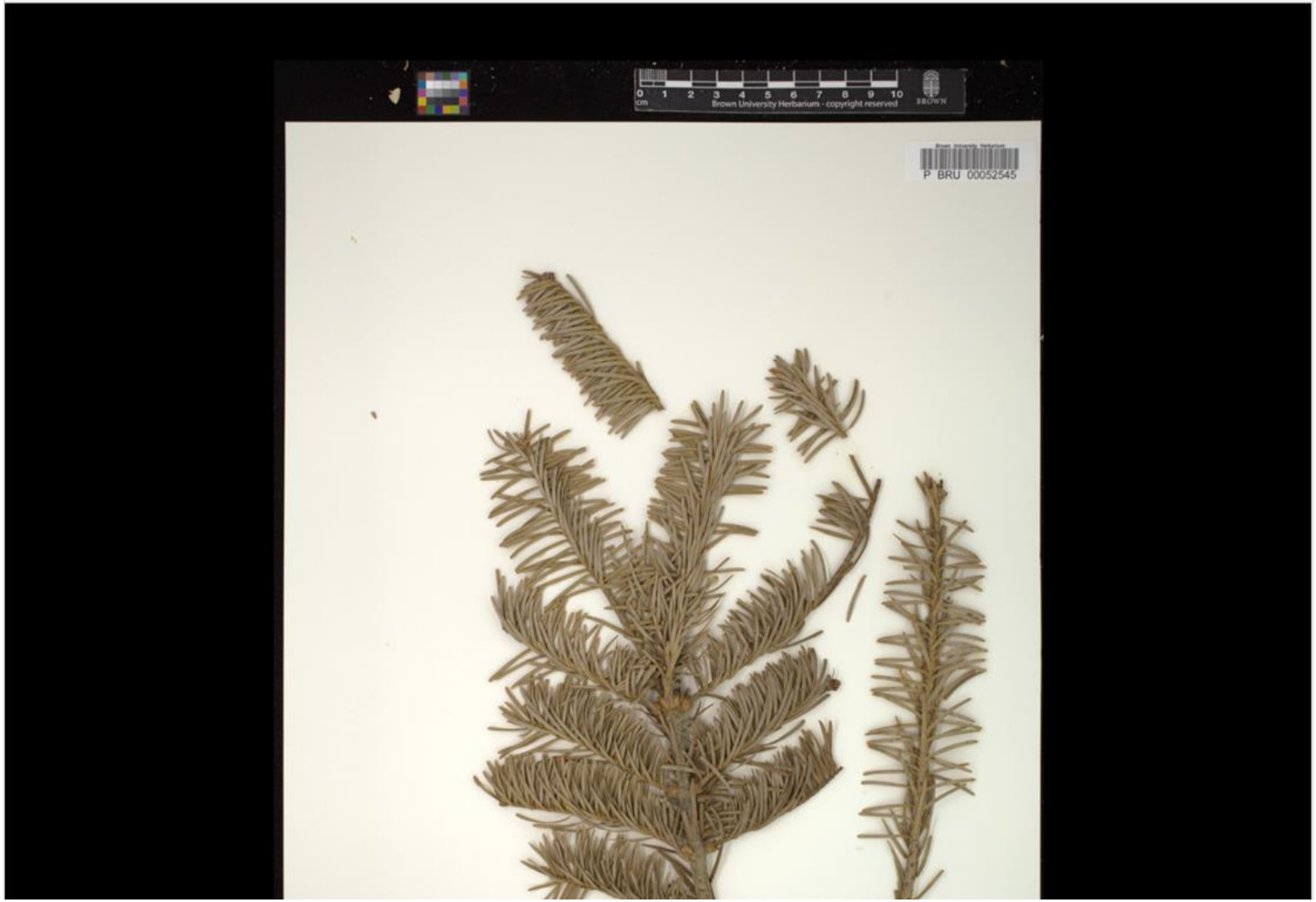
Files

DWC

DIGITAL-NEGATIVE

JP2

Content Views | Files



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    <dwc:scientificNameAuthorship>(L.) Mill.</dwc:scientificNameAuthorship>
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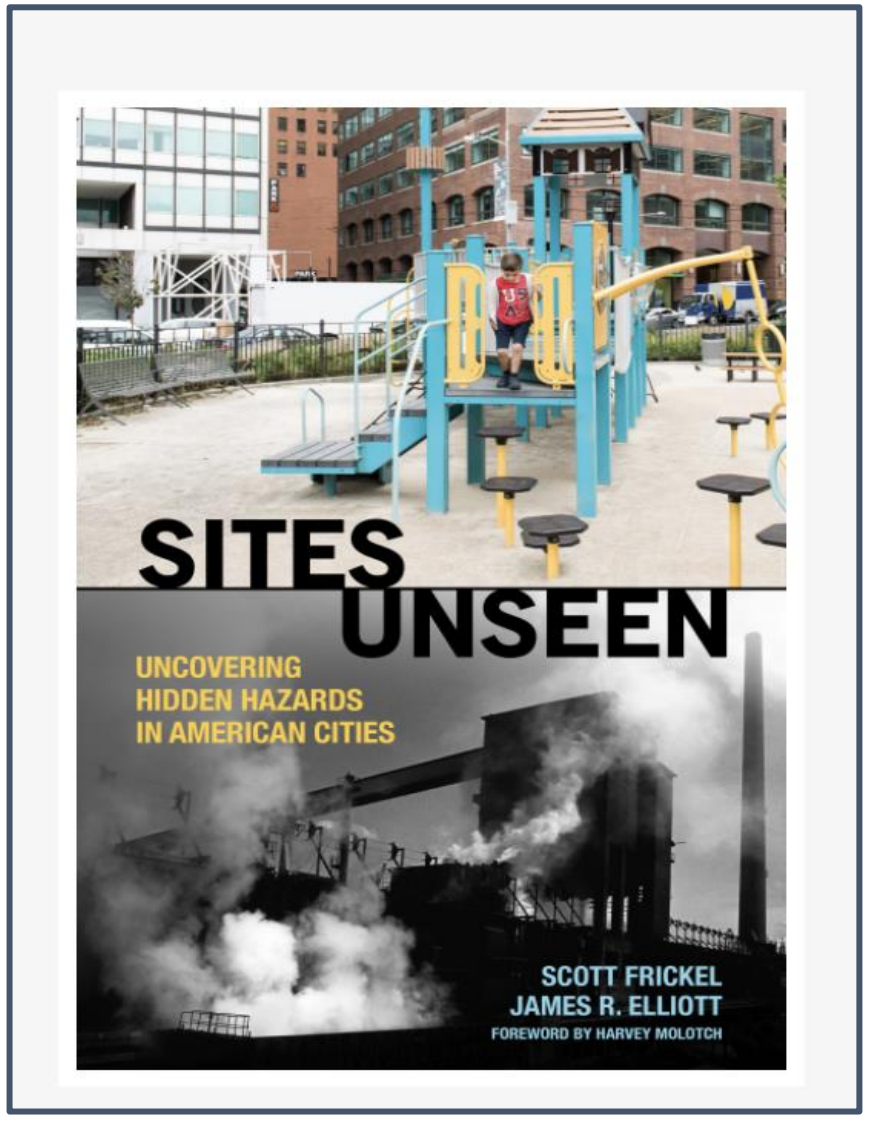
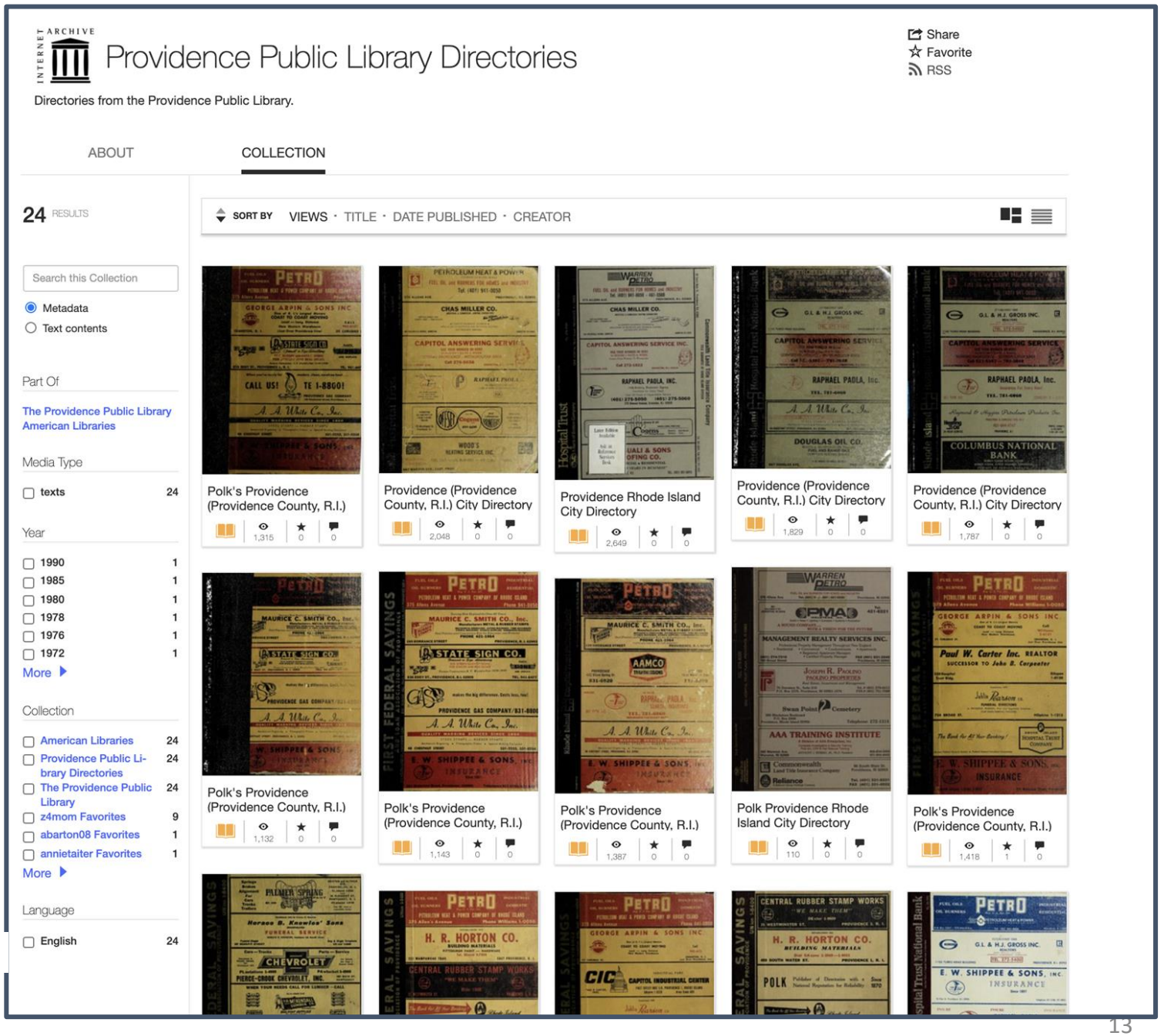



Frickel, S., Elliott, J., & Molotch, H. (2018). *Sites Unseen: Uncovering Hidden Hazards in American Cities*. New York: Russell Sage Foundation. doi:10.7758/9781610448734



# Mining Spatio-temporal Data on Industrialization from Historical Registries

David Berenbaum, Dwyer Deighan, Thomas Marlow, Ashley Lee, Scott Frickel, Mark Howison

Despite the growing availability of big data in many fields, historical data on socioevironmental phenomena are often not available due to a lack of automated and scalable approaches for collecting, digitizing, and assembling them. We have developed a data-mining method for extracting tabulated, geocoded data from printed directories. While scanning and optical character recognition (OCR) can digitize printed text, these methods alone do not capture the structure of the underlying data. Our pipeline integrates both page layout analysis and OCR to extract tabular, geocoded data from structured text. We demonstrate the utility of this method by applying it to scanned manufacturing registries from Rhode Island that record 41 years of industrial land use. The resulting spatio-temporal data can be used for socioenvironmental analyses of industrialization at a resolution that was not previously possible. In particular, we find strong evidence for the dispersion of manufacturing from the urban core of Providence, the state's capital, along the Interstate 95 corridor to the north and south.

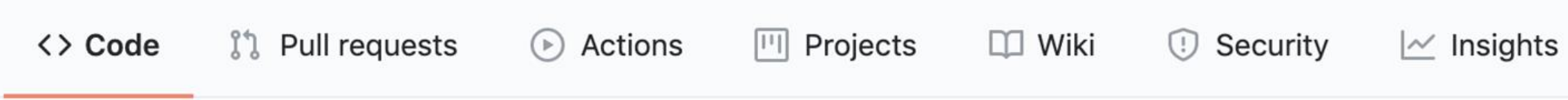
| | |
|---|---|
| Subjects: | **Computer Vision and Pattern Recognition (cs.CV)**; Information Retrieval (cs.IR) |
| Journal reference: | Journal of Environmental Informatics 34(1): 28-34 (2019) |
| DOI: | 10.3808/jei.201700381 |
| Cite as: | arXiv:1612.00992 **[cs.CV]** |
| | (or arXiv:1612.00992v1 **[cs.CV]** for this version) |

## Submission history

From: Mark Howison [view email]
**[v1]** Sat, 3 Dec 2016 17:54:03 UTC (1,962 KB)

brown-ccv / directoreadr

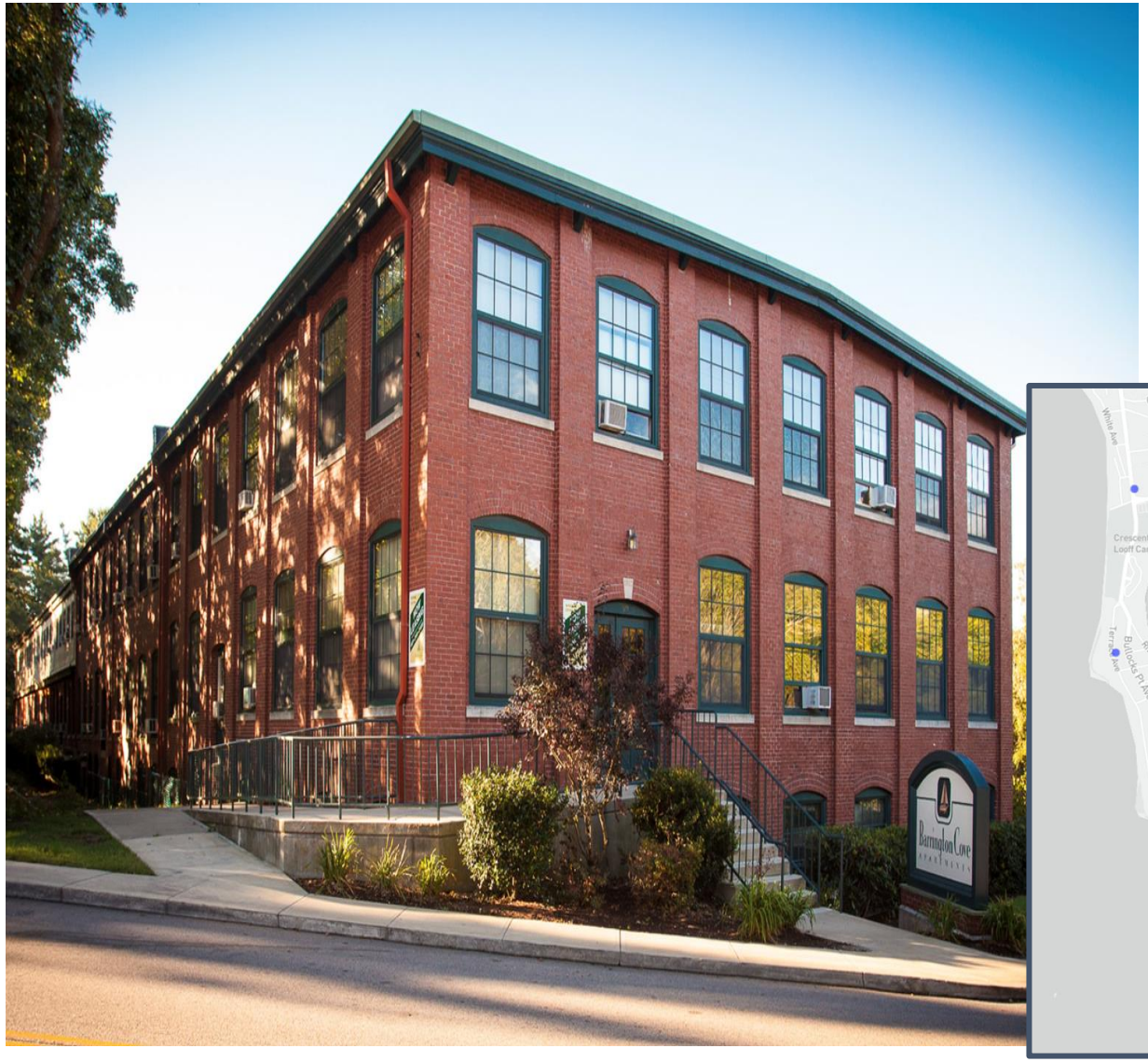
forked from samwbell/directoreadr

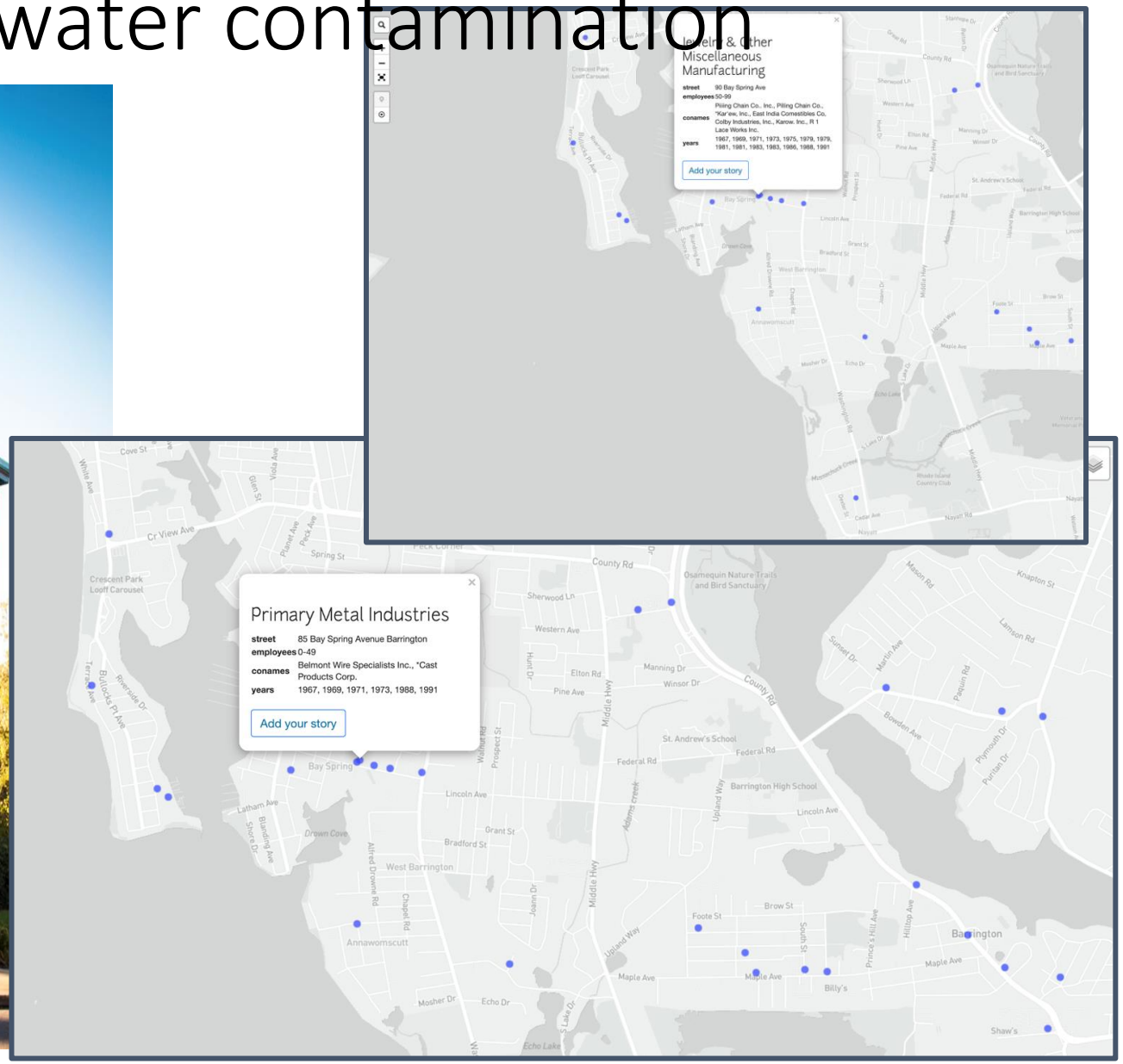


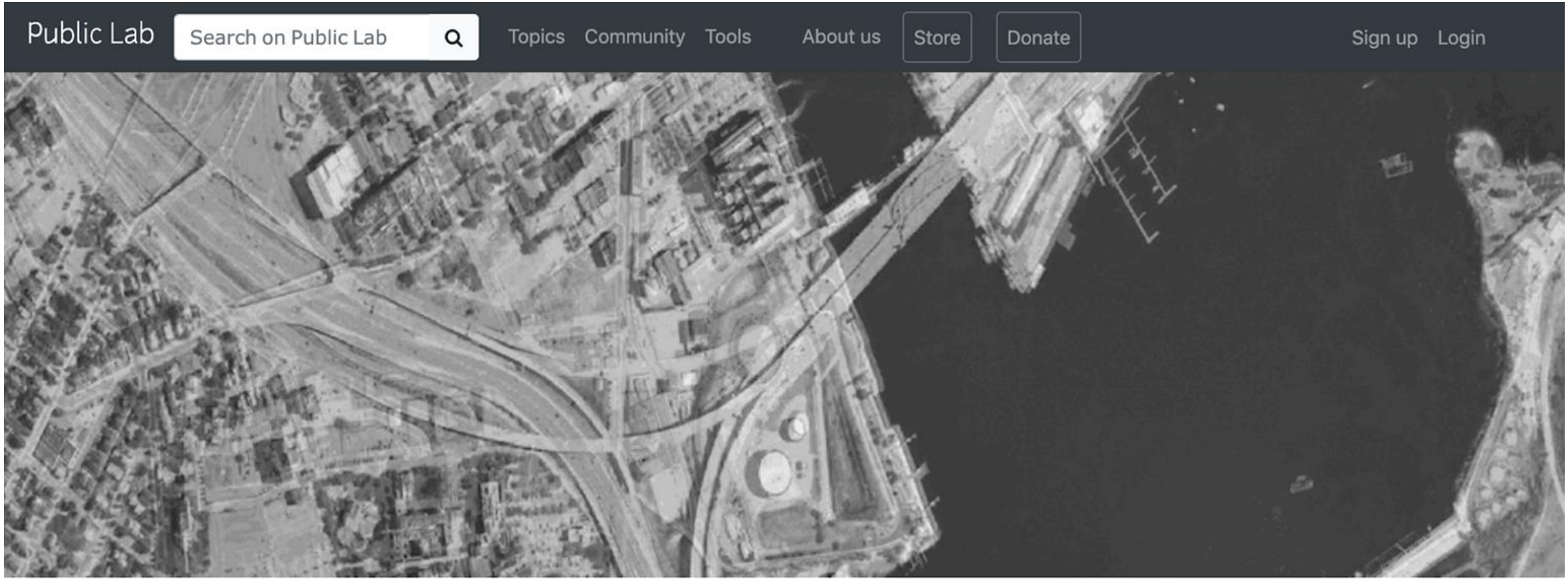
Authors of primers include archivists and data librarians who attended the 2018-2020 Specialized Data Curation Workshops presented by the Data Curation Network (IMLS RE-85-18-0040-18).

| | |
|---|---|
| **Acrobat PDF Primer** | Creators: Peace Ossom-Williamson, Nicole Contaxis, Margaret Lam and Adam Kriesberg<br>Mentor: Jake Carlson |
| **ATLAS.ti Primer** | Creator: Margarita Corral<br>Affiliated contributor: Hannah Hadley<br>Mentor: Dave Fearon |
| **Confocal Microscopy Image Primer** | Creators: Susan Ivey, Amy Koshoffer, Gretchen Sneff and Huajin Wang<br>Mentor: Lisa Johnston |
| **Consent Forms Primer** | Creators: Shanda Hunt, Alicia Hofelich Mohr and Rachel Woodbrook |
| **Databases Primer** | Creator: Xuying Xin<br>Mentor: Dave Fearon |
| **Geodatabase Primer** | Creators: Andrew Battista, Tom Brittnacher, Zenobie Garrett, Jennifer Moore and Carrie Pirmann<br>Mentor: Mara Blake |

# Maps of Historical Industrial Activity and Brownfields
# Potential sites of soil and water contamination






# Unearthing Providence

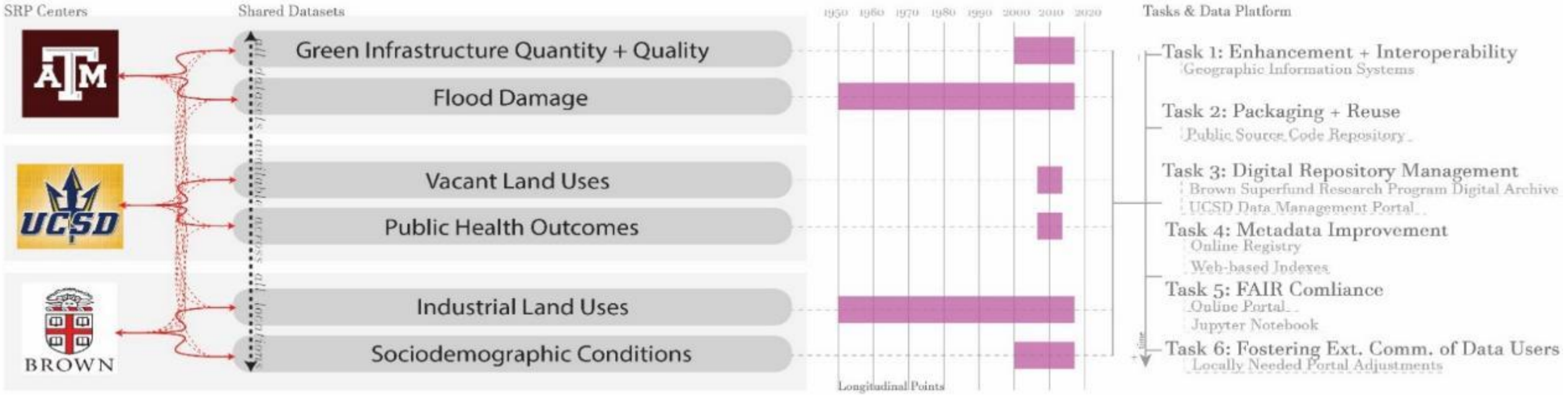
**A platform for historical data-driven analyses of industrial land use, story-mapping, and community organizing.**

Add a location

Learn about location privacy

# Recommendations for Integrated SRP Data: Outcomes of the SRP External Use Cases

- Title: **Developing a Spatial Approach for Toxic Transferal from Industrial and Vacant Land Uses to Green Infrastructure**
- Research Question:
  - *How do vacant and industrial land uses impact green infrastructure conditions often presumed to enhance community resilience and public health?*

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# Inputs and Actions

- Locations
  - Harris County, TX
  - San Diego County, CA
  - State of Rhode Island

| Dataset | Year | Source | Reference | Scale |
|---|---|---|---|---|
| **Green Infrastructure** | 2016 | https://data.tnris.org/ | USGS | US Census tract |
| **Vacant Addresses** | 2016 | https://www.huduser.gov/portal/usps/index.html | HUD | US Census tract |
| **Public Health (14 factors)** | 2016 | https://www.cdc.gov/500cities/index.htm | CDC | US Census tract |
| **Social Vulnerability** | 2016 | https://svi.cdc.gov/data-and-tools-download.html | CDC | US Census tract |
| **Industrial Land Uses** | 2016 | Multiple (created from land use data) | Local | US Census tract |
| **Flood Plain** | 2016 | https://www.fema.gov/faq-details/GIS-Data | FEMA | US Census tract |

San Diego business location data, 1958, from Polk's San Diego City Directory: https:/doi.org/10.7910/DVN/QHKPAI
Vacant land time series (1986 – 2018), from San Diego Association of Governments, based on parcel-level data

Data Discovery Studio

Search | Collection | Contribute | About | Help

Search... Search

Information Search

Map (Intersects / Within)

find a place

Search Using MapExtent

Bounding Box

Publication Date

Location Keyword

Original Keyword

AI Keywords

Cited Authors

Cited Organizations

Temporal Extent (text)

Temporal Extent (slider)

Metadata Properties

Metadata Type

Metadata Collection

Filters

**http://datadiscoverystudio.org/**

Results — By Relevance — 1,669,856 items — 10 — « < 1 of >10k Pages >

**Yasur Volcano Crater DEM, Republic of Vanuatu, Oct 2016**
Publication: 2019-07-22 Source: OpenTopography (U) Last Modified: 2020-06-18
DEM of the crater of Yasur Volcano, Vanuatu
Studio Get Data Item Details Add to Collection

**Palmerston North, Manawatu-Whanganui, New Zealand 2018**
Publication: 2020-02-27 Source: OpenTopography (U) Last Modified: 2020-06-18
Lidar was captured for Palmerston North City Council by AAM New Zealand between August and September 2018. The dataset was generated by AAM New Zealand and their subcontractors. The survey area includes city of Palmerston North, Ashhurst, Longburn and the surrounding area. Data management and distribution is by Land Information New Zealand. Prepared DEM and DSM files are available through the LINZ Data Service: Palmerston North, Manawatu-Whanganui, New Zealand 2018 Digital Elevation Model Palmerston North, Manawatu-Whanganui, New Zealand 2018 Digital Surface Model Palmerston North, Manawatu-Whanganui, New Zealand 2018 Raster Tile Index
Studio Get Data Item Details Add to Collection

**Christchurch and Ashley River, Canterbury, New Zealand 2018**
Publication: 2020-02-26 Source: OpenTopography (U) Last Modified: 2020-06-18
Lidar was captured for Environment Canterbury Regional Council by Aerial Surveys between July 2018 to March 2019. The dataset was generated by Aerial Surveys and their subcontractors. The survey area includes Christchurch City and the Ashley River, as well as the surrounding area. Data management and distribution is by Land Information New Zealand. Prepared DEM and DSM files are available through the LINZ Data Service: Christchurch and Ashley River, Canterbury, New Zealand 2018 Digital Elevation Model Christchurch and Ashley River, Canterbury, New Zealand 2018 Digital Surface Model Christchurch and Ashley River, Canterbury, New Zealand 2018 Raster Tile Index
Studio Get Data Item Details Add to Collection

**Huntly, Waikato, New Zealand 2015-2019**
Publication: 2020-02-10 Source: OpenTopography (U) Last Modified: 2020-06-18
Lidar was captured for Waikato Regional Council by Aerial Surveys between February 2015 to January 2019. The dataset was generated by Aerial Surveys and their subcontractors. The survey areas include Huntly, Port Waikato, and the Hauraki Plains. Data management and distribution is by Land Information New Zealand.
Studio Get Data Item Details Add to Collection

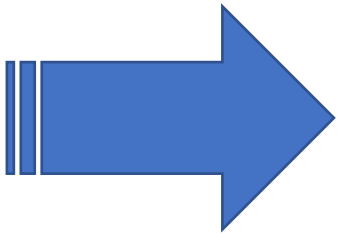
**2019 Ridgecrest, CA Post-Earthquake Lidar Collection**
Publication: 2020-01-28 Source: OpenTopography (U) Last Modified: 2020-06-18
Airborne lidar survey of surface ruptures and ground failure features associated with the 4 and 5 July 2019 Ridgecrest Earthquake sequence. For additional information about this dataset see: Hudnut, K.W., B. Brooks, K. Scharer, J.L. Hernandez, T.E. Dawson, M.E. Oskin, R. Arrowsmith, C.A. Goulet, K. Blake, M.L. Boggs, S. Bork, C.L. Glennie, J.C. Fernandez-Diaz, A. Singhania, D. Hauser, S. Sorhus (2020), Airborne Lidar and Electro-Optical Imagery Along Surface Ruptures of the 2019 Ridgecrest Earthquake Sequence, Southern California, in press, Seismological Research Letters (preprint available upon request)
Studio Get Data Item Details Add to Collection

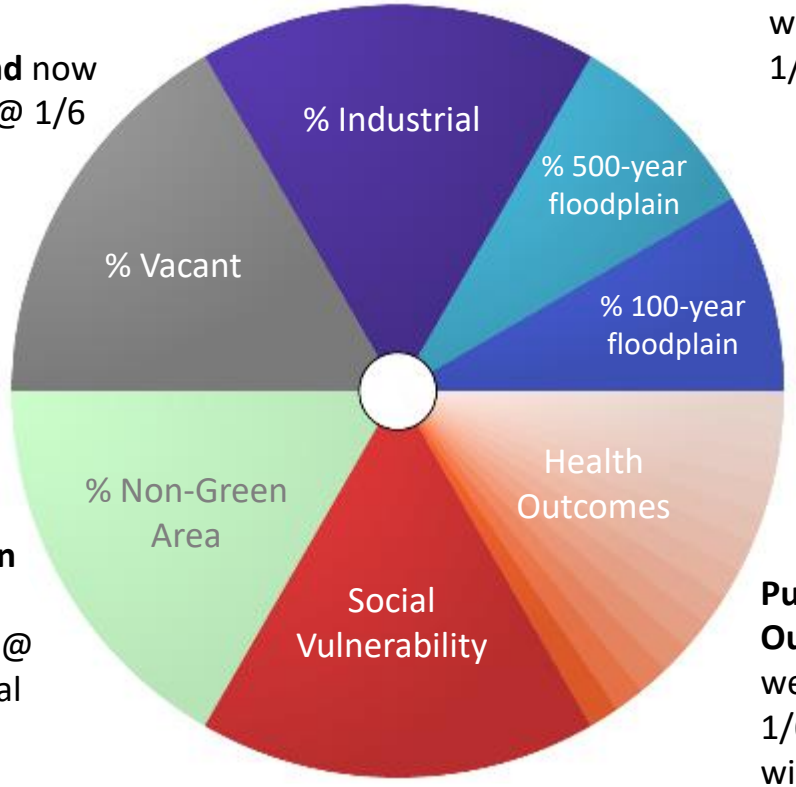
**Auckland South, New Zealand 2016**
Publication: 2020-01-13 Source: OpenTopography (U) Last Modified: 2020-06-18
Lidar was captured for Auckland Council by AAM New Zealand between September 2016 through to June 2017. The original dataset was generated by AAM New Zealand and their subcontractors. The survey area covers the southern Auckland suburbs and regions. Data management and distribution is by Land Information New Zealand.
Studio Get Data Item Details Add to Collection

**Lake Isabella Lidar Collection, CA 2015**
Publication: 2019-12-23 Source: OpenTopography (U) Last Modified: 2020-06-18
Airborne LiDAR data was acquired by CRREL on 21 August 2015 over Lake Isabella and the Lake Isabella Dam, California as part of a coincident regional study. These data were collected using an airborne laser scanning (ALS) system comprised of a Riegl Q680i full-waveform LiDAR sensor, an Applanix POS AV INS system, and custom designed hardware and aircraft integration components. The system was installed in a Partenavia P.68, with an average collection AGL of 2,600' and airspeed of 90 knots. A total of 19-flight-lines were collected during a single flight, with 50% overlap of laser swath coverage, given a 60 deg across track field-of-view.
Studio Get Data Item Details Add to Collection

**Kern Canyon Lidar Collection, CA 2008**
Publication: 2019-12-06 Source: OpenTopography (U) Last Modified: 2020-06-18
Between September 2008 and September 2009, data were collected along the Kern Canyon fault starting south-east of Bakersfield and extending north to the southern end of Kings Canyon National Park. This

# ToxPi Setup






**Industrial land** now weighted @ 1/6 of total

**Floodplains** weighted @ 1/6 of total

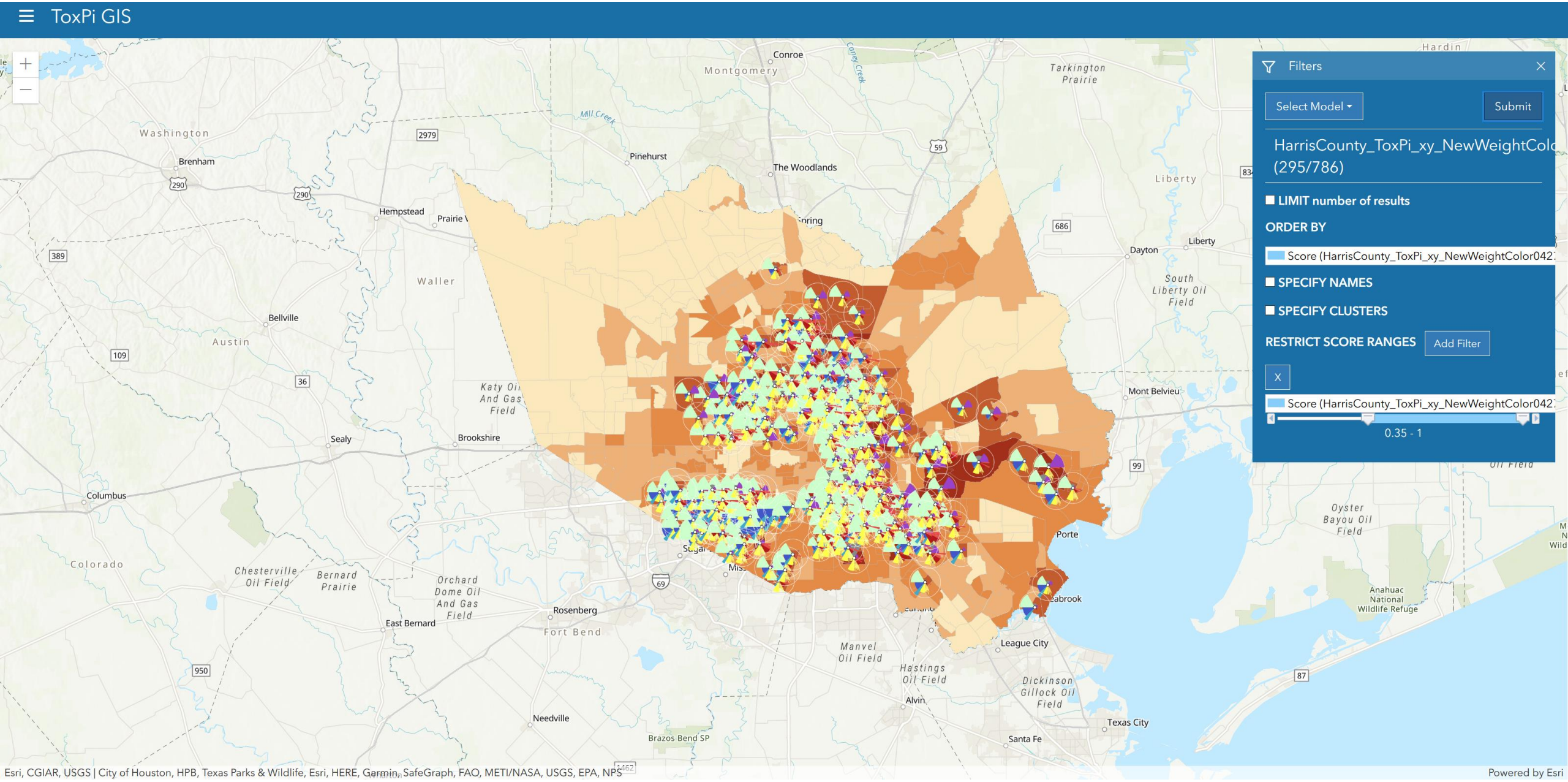
**Vacant land** now weighted @ 1/6 of total

**Non-green area** now weighted @ 1/6 of total

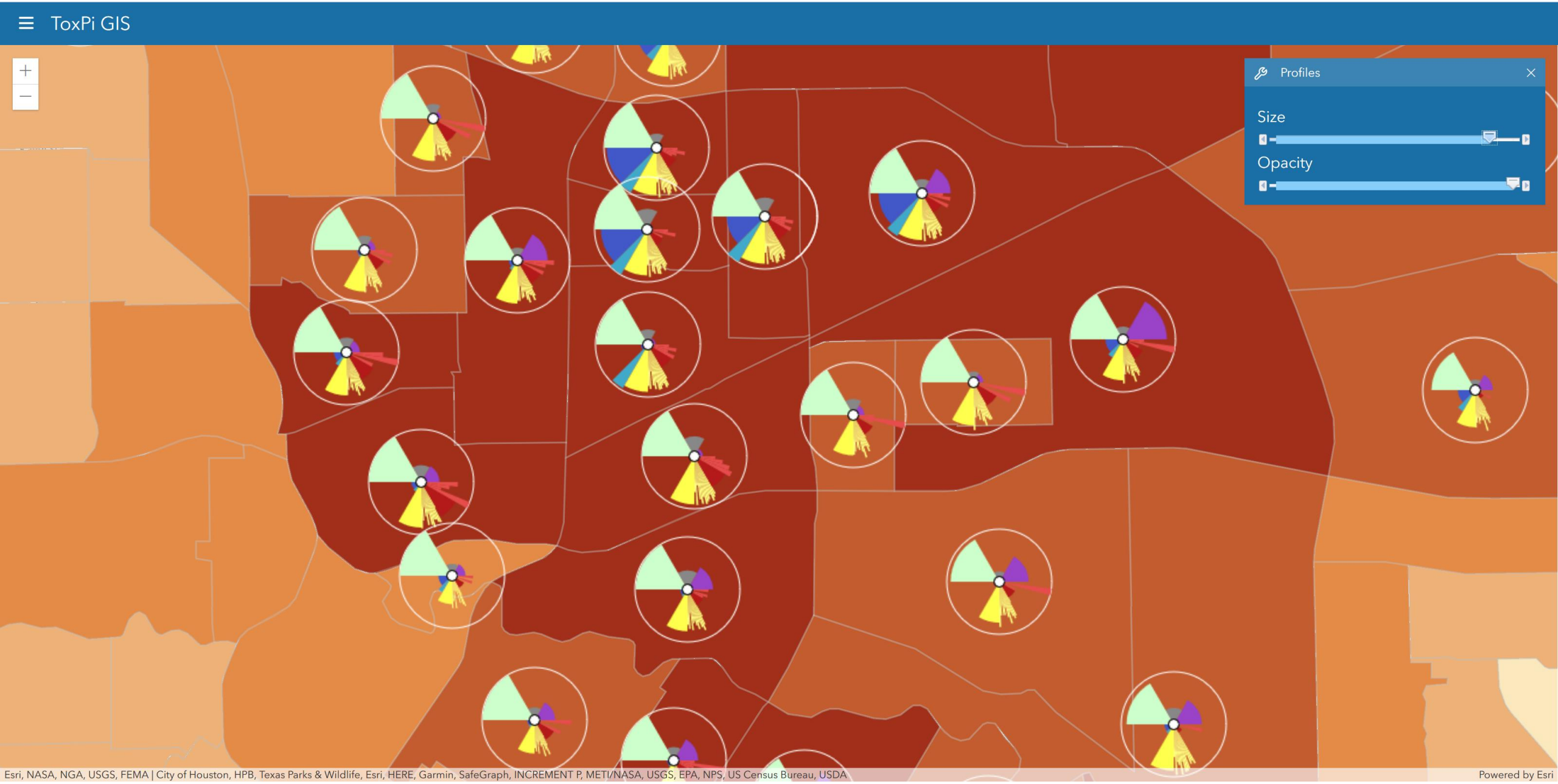
**Public Health Outcomes** weighted @ 1/6 of total with 14 factors (each @ 1/78)

**Social Vulnerability** now weighted @ 1/6 of total or 4 categories (each @ 1/24)

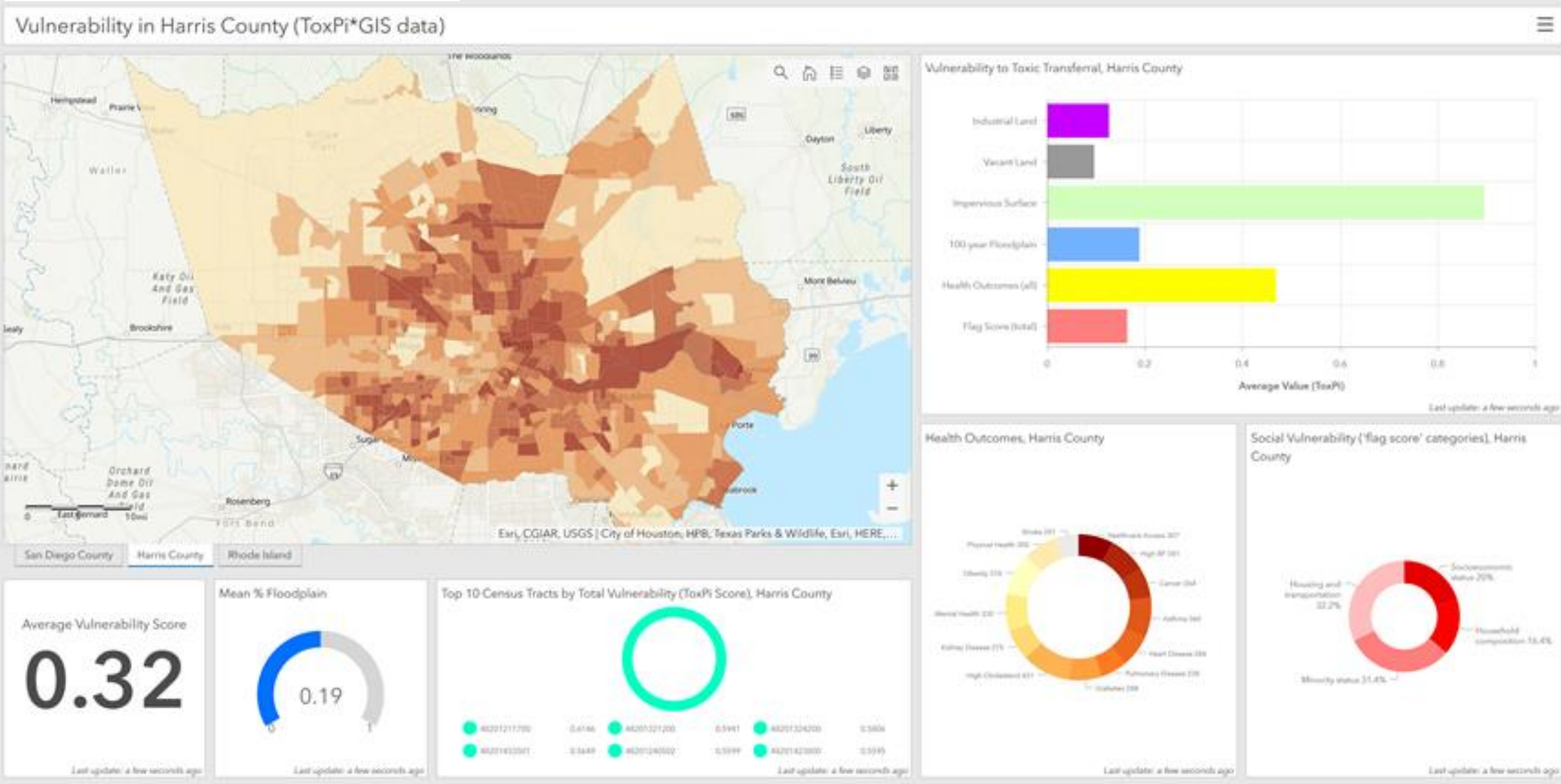
# ToxPi Interface



# ToxPi Interface

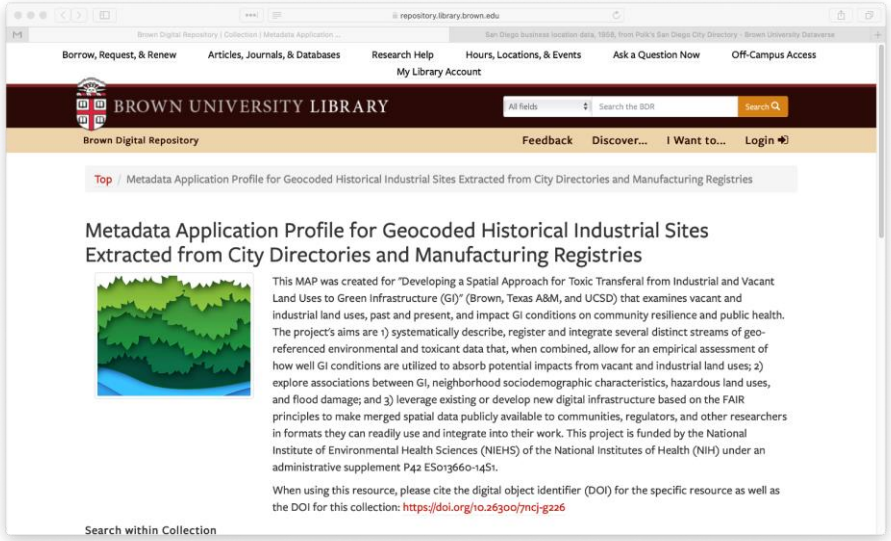


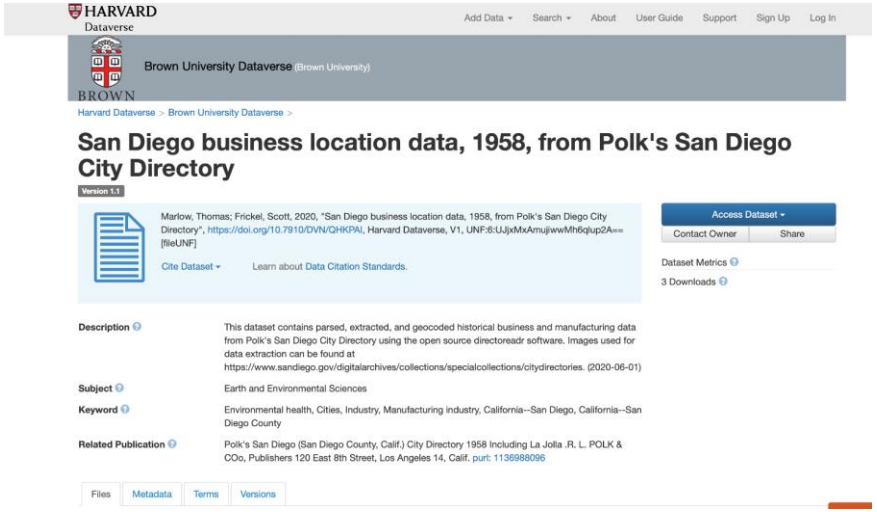
# [Interactive Online Dashboard]

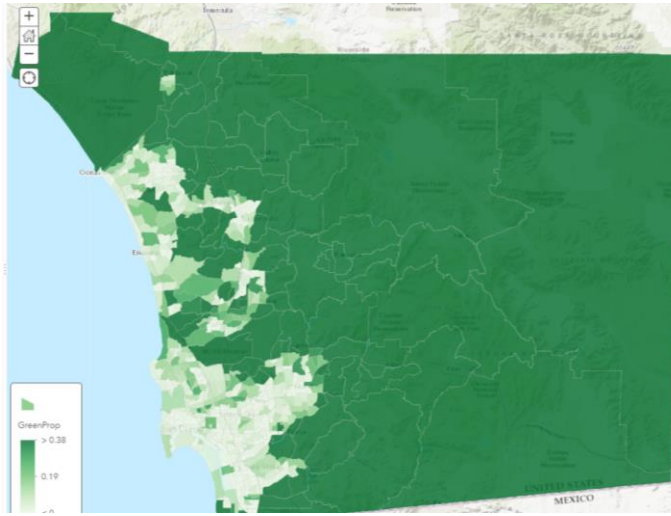


# Making these datasets F.A.I.R.

- **Registries and repositories in which the data are shared already**: Dataverse, ArcGIS Online, Brown Digital Repository, Data Discovery Studio
- **Metadata standards used**: ISO 19115/19139, schema.org
- **Data formats and services**: shapefiles, feature services, CSV
- **Vocabularies**: CINERGI Ontology (automated metadata enhancement), domain vocabularies (NAICS)
- **Identifiers**: DOIs
- **Demonstrated access, interoperability and reuse**: Jupyter notebooks, dashboards



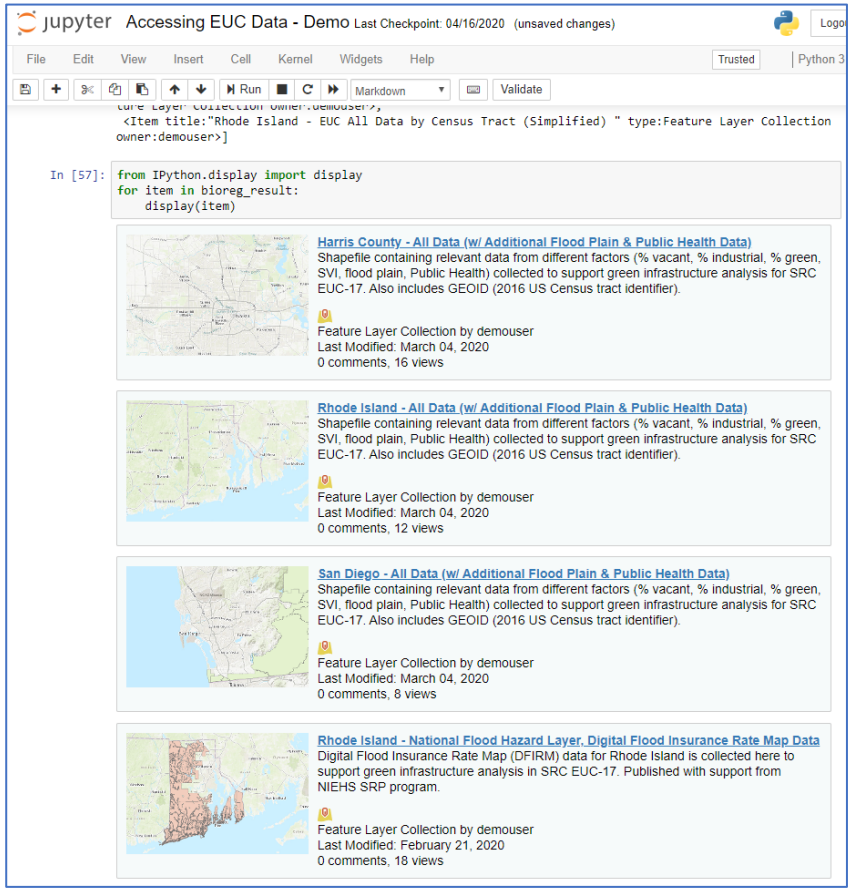
# FAIR Checklist + Jupyter Notebooks

- All registered datasets can be found through ArcGIS Online based on their metadata, via online user interface or via Python code in a Jupyter Notebook
- The datasets can be loaded in notebooks for additional analysis

FAIR Checklist

| Dataset | Source | Registered in | Data accessible via | Interoperable | Reusable |
|---|---|---|---|---|---|
| Green Infrastructure | TNRIS | AGOL, DDS; with respective GUIDs | Download, web services; ISO-19115 metadata accessible | Shapefiles, feature services, CSV; CINERGI ontology, schema.org/ Json-LD generated | Provenance; domain standards compliant, rich metadata |
| Vacant Addresses | USPS | Same as above | Same as above | Same as above | Same as above |
| Public Health (14 factors) | CDC | Same as above | Same as above | Same as above | Same as above |
| Social Vulnerability | CDC | Same as above | Same as above | Same as above | Same as above |
| Industrial Land Uses | local | Same as above | Same as above | Same as above | Same as above |
| Floodplain | FEMA | Same as above | Same as above | Same as above | Same as above |
| Vacant Lands | SANDAG | Same as above | Same as above | Same as above | Same as above |
| San Diego historical business locations | City of San Diego | AGOL, DDS, Brown, Dataverse; DOIs, GUIDs | Download; ISO 19115 metadata | Shapefiles, CSV; NAICS codes | Same as above |

Jupyter Notebook



# Vocabularies:

- *CINERGI Ontology*
  - Developed in OWL using Protégé
  - Accessible via website: http://hydro10.sdsc.edu/cinergi_ontology/
  - Archived in Github: https://github.com/CINERGI/ontologies
  - Semantic services via Scigraph: http://ec-scigraph.sdsc.edu:9000/scigraph/docs/

- NAICS (North American Industry Classification System) codes

# Public Repositories:

- Harvard/Brown Dataverse
  - Library-hosted repositories
- ArcGIS Online (for spatial data)
- Using data from sources hosted in
  - Socrata (CDC)
  - ArcGIS Enterprise server
  - Local Government web sites

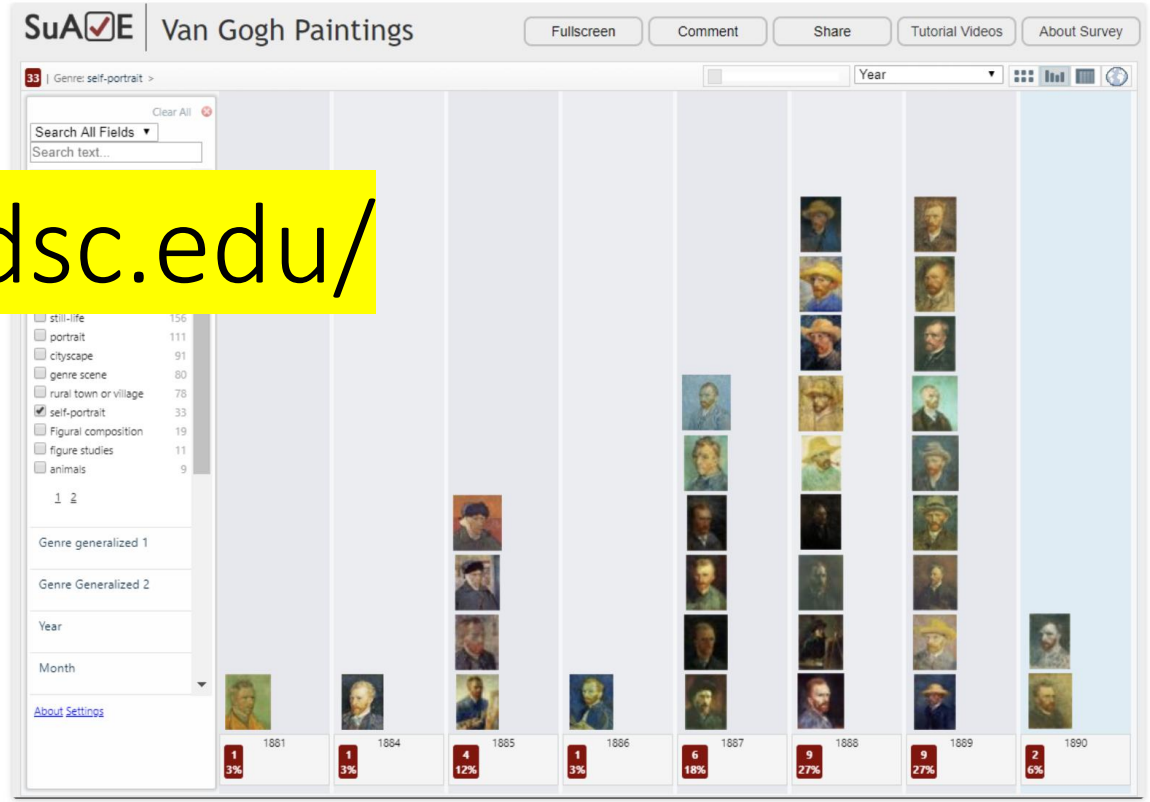
# Software/GitHub:

- Managing and sharing code for extracting data from business directories
- Sharing ontology
- Archive in Zenodo/Integrate with Binder
- ReproZip (NYU)

http://suave.sdsc.edu/

SuAVE

HOME GALLERY TEACHING TUTORIALS BLOG CONTACT MY SURVEYS LOG IN

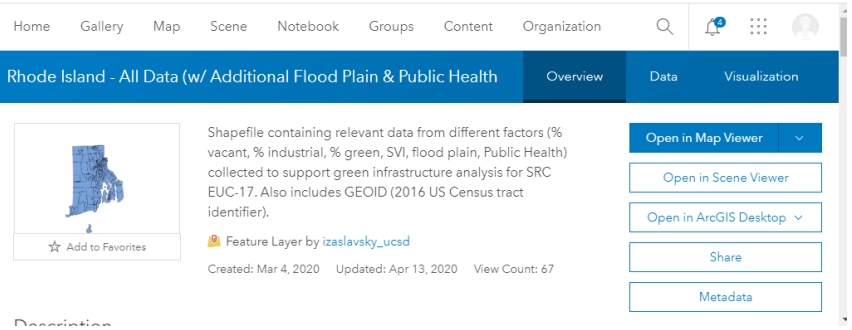


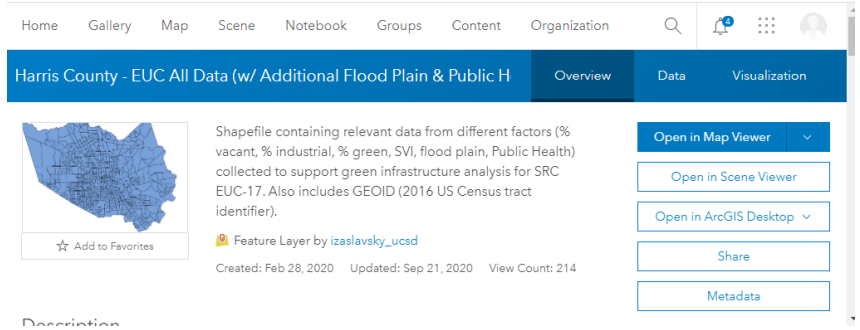

**SuAVE: Survey Analysis via Visual Exploration.**

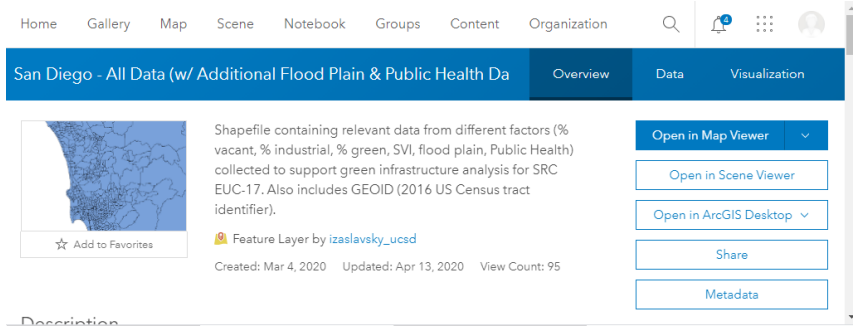
SuAVE is a new online platform for visual exploratory analysis of surveys and image collections. It integrates visual, statistical and cartographic analyses and lets users annotate and share images and distribution patterns. It also provides a gateway into advanced data science and machine learning tools by integrating with R and Jupyter notebooks.

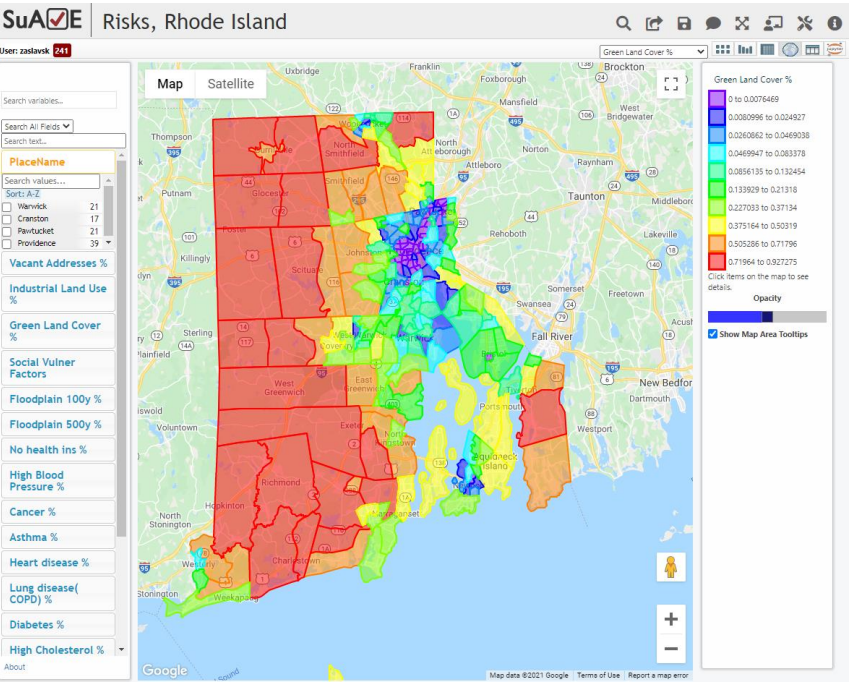
# From FAIR Representation to Comparative Analysis

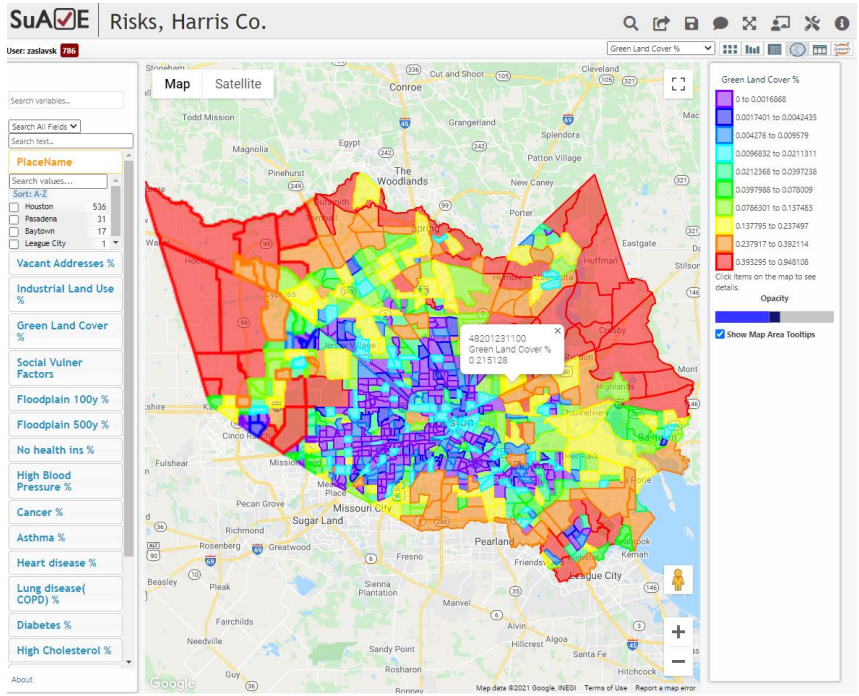
## *Green Land Cover, %%*

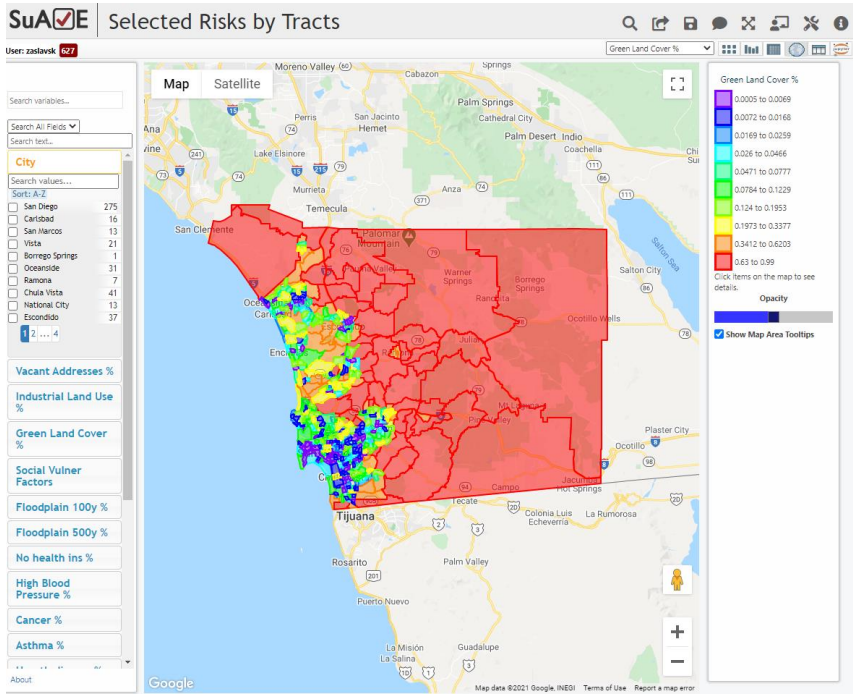


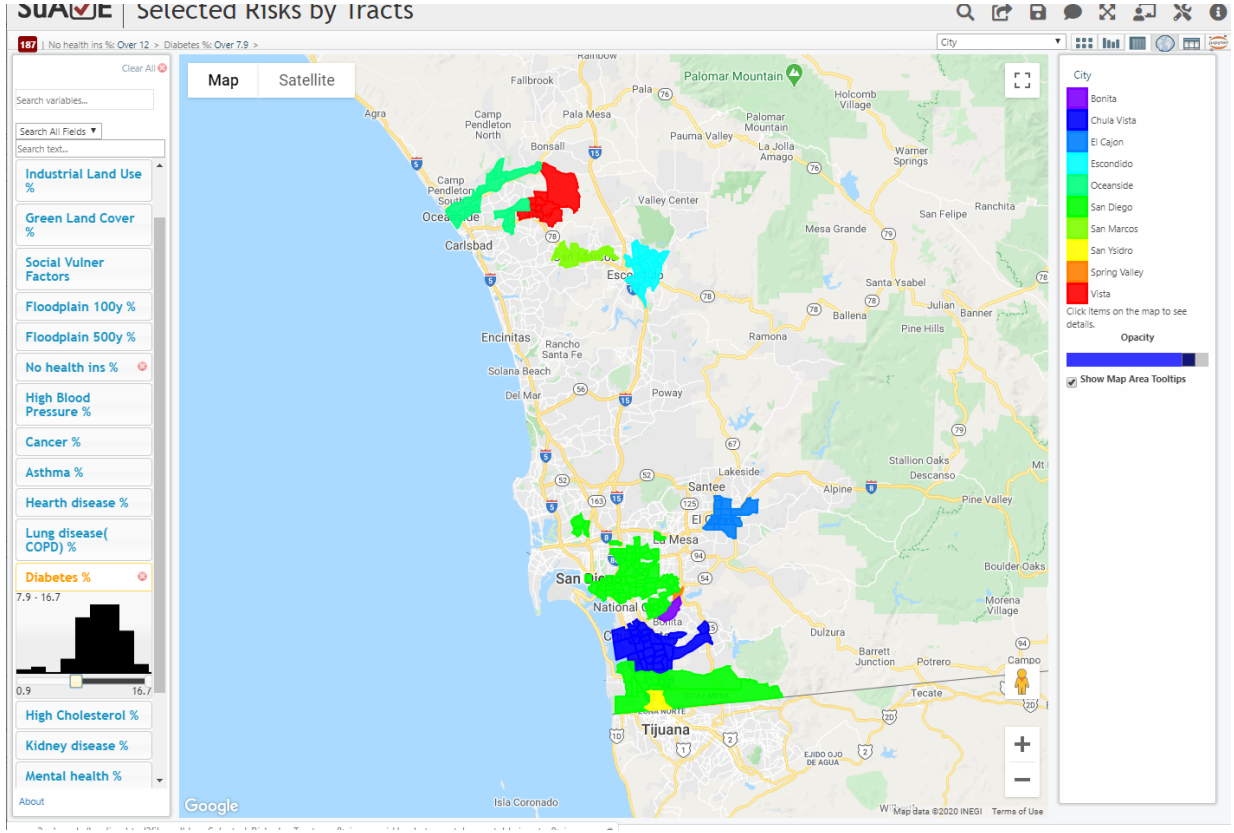

http://suave2.sdsc.edu/main/file=zaslavsk_Risks__Rhode_Island.csv&view=map

http://suave2.sdsc.edu/main/file=zaslavsk_Risks__Harris_Co__.csv&view=map

http://suave2.sdsc.edu/main/file=sdhhsa_Selected_Risks_by_Tracts.csv&view=map

# Communication Strategy

- Health outcomes and risk factors by census tracts used by San Diego County HHSA to examine spatial distribution of populations at risk by multiple indicators and develop strategies for COVID-19 pandemic response




Accessible from http://suave2.sdsc.edu/gallery/sdhhsa

Data are described in ArcGIS Online and available through ArcGIS Enterprise Server

# Lessons Learned & Recommendations

- It is important to quickly demonstrate benefits of FAIR data sharing, by developing online applications and services that show how the data can be accessed and used together
- For our data, following established data formats and using common repository platforms was the key. Due to diversity of data variables and hit-and-miss automatic semantic tagging, iterative improvement is essential.
- Sharing the data encouraged its use beyond the applications initially intended (e.g., in the context of COVID-19 analysis)
- Data interoperability and reuse issue; informing data management planning
- Following FAIR principles as in https://www.force11.org/group/fairgroup/fairprinciples or https://www.openaire.eu/how-to-make-your-data-fair is helpful

# Outputs and Outcomes: Products

**Short-Term:**

- Shared, online, searchable data downloads
- Interactive online dashboard
- “Green Infrastructure and Health Equity Improvement Zones" in underserved communities of San Diego

**Medium Term*:***

- *Presentations:*
  - Newman GD, Malecha ML, Karaye IM, Frickel S, Marlowe TW, Zaslavsky I, Pezzoli K. Comparing Regional Drivers of Toxics Transferal Risk: Applying the Toxics Mobility Vulnerability Index in San Diego County, CA; Harris County, TX; and the State of Rhode Island. NIEHS Superfund Research Center Annual Meeting December 2020 – *Winner of Superfund Meeting Poster Award*
- *Publications:*
  - Malecha ML, Kirsch KR, Karaye IM, Horney JA, Newman G. (2020) Advancing the Toxic Mobility Inventory: Development of a Toxics Mobility Vulnerability Index and application to Harris County, TX. *Sustainability: The Journal of Record*. 13(6): 282-291. DOI: 10.1089/sus.2020.0067.
  - Newman, G., & Malecha, M., “Integrating ToxPi Outputs with Arc GIS Dashboards to Identify Neighborhood Threat Levels of Contaminant Transferal During Flood Events.” In press at *Journal of Spatial Sciences*

**Long Term*:***

- *Future Funding:*
  - Future funding for green infrastructure from Biden Administration Options
  - Competitive supplemental funding for future activation of these systems (NSF Smart and Connected Communities)
- *Publications in Preparation:*
  - Comparative Regional Drivers of Toxics Transferal Risk: Applying a Modified/Updated *Toxics Mobility Vulnerability Index* in San Diego County, CA; Harris County, TX; and the State of Rhode Island, projected submission to *Journal of Environmental Infomatics*
  - Contaminants Linked to Longitudinal Industrial Land Uses across Multiple High-Risk Flood Zones, projected submission to *Journal of Urban History*

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