

Putting spatial data to work...

...for COVID-19 response and recovery

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Esri

ESIP
September 23, 2020

Our World Is in Trouble

We seem to be in the midst of a number of crises
Are Creating Uncertainty – All Interconnected

Climate Crisis

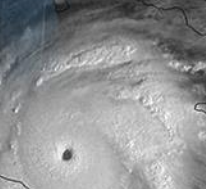


Massive Unemployment

Overpopulation



Natural Disasters

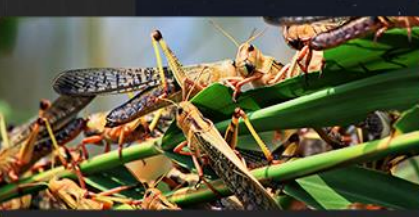


Loss of Biodiversity



Unconstrained Development

Locust Plague



Loss of Nature



Racial Injustice



Water



Pollution



Social Conflict



Resource Shortages



COVID-19 Pandemic

Congested Cities



... Addressing These Issues Is Challenging

Overcoming These Challenges

Requires Better Understanding, Communication and Collaboration . . .

Our Best . . .

. . . *Science*

. . . *Technology*

. . . *and Problem-Solving Capabilities*

Geography & GIS

. . . and the Geospatial Community
Are Essential

Creating
Geospatial Literacy





Geography Is the Science of Our World

... Providing a Way to Organize and Integrate Our Knowledge

Helping Us **Interconnect** Every Science and Discipline

GIS Provides the Technology for Abstracting Geography

and a Language for Organizing and Applying **Geographic Knowledge**

Bringing Together Virtually All Types of Content and Analytics

Connecting, Modeling and Visualizing Our World ...

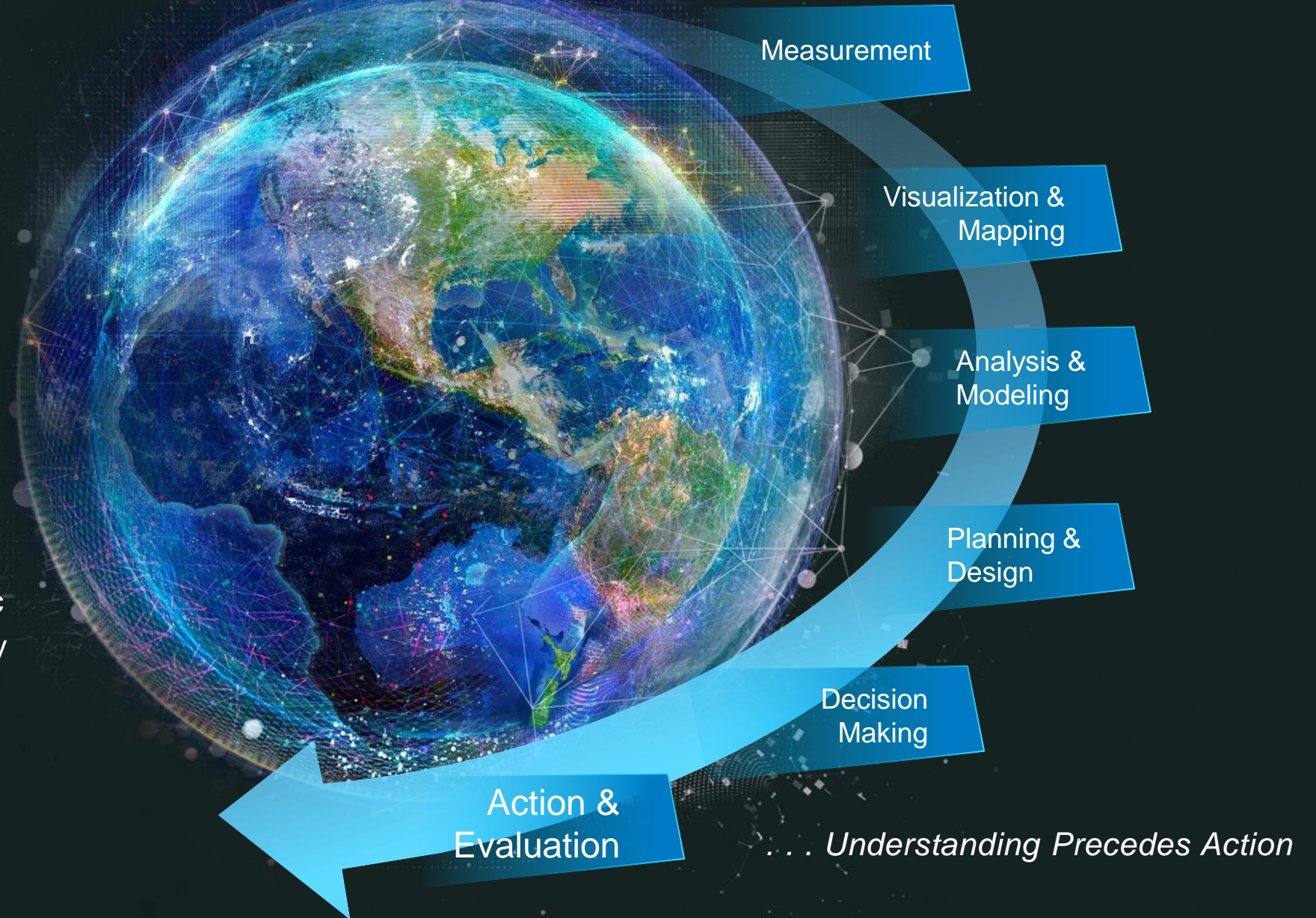
... a Platform for Understanding

... and Intelligent Action

GIS

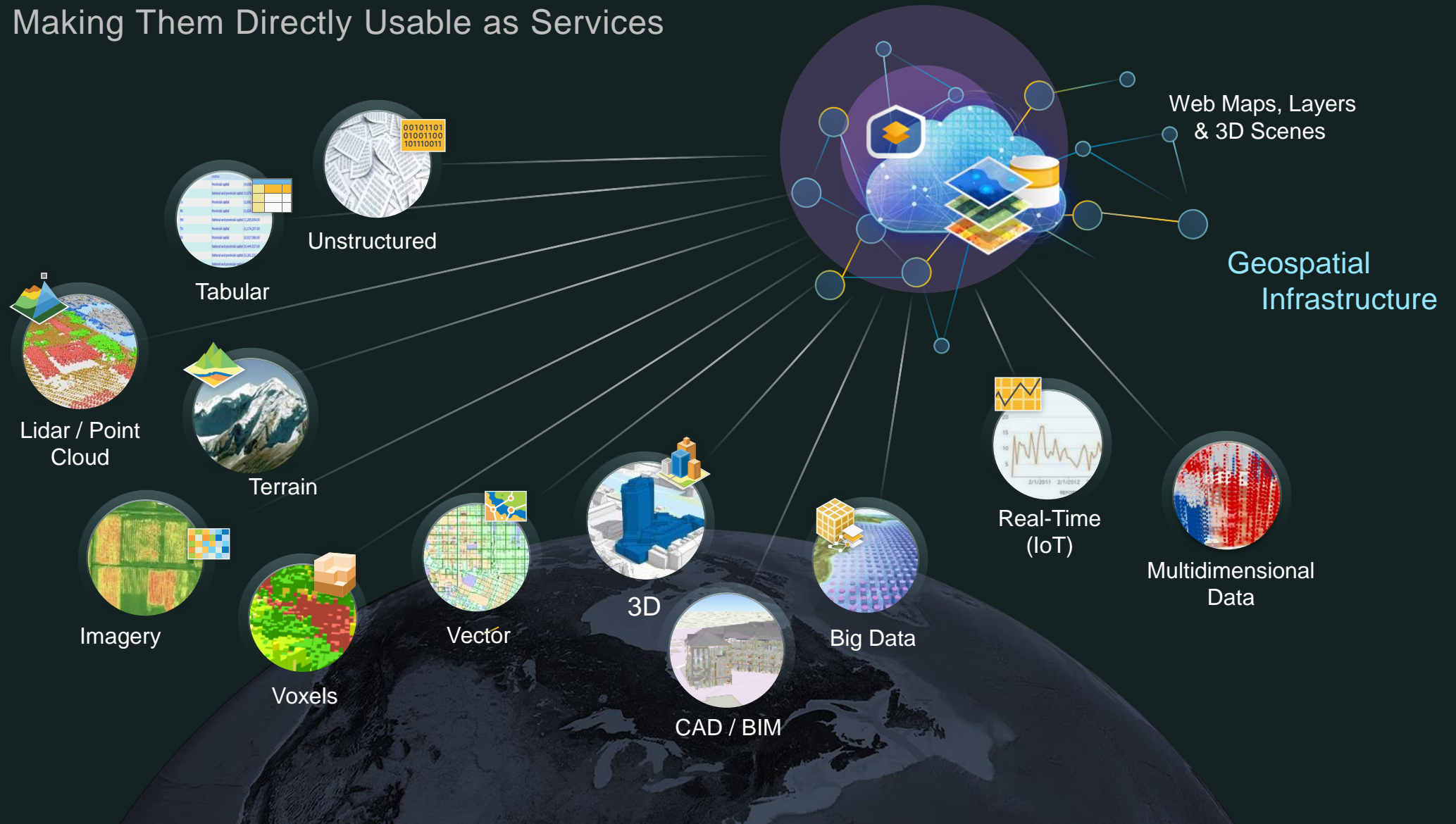
Provides a Framework
and a Process . . .

. . . for Creating and
Applying Geographic
Knowledge Widely



Integrating Every Type and Format of Data

... Making Them Directly Usable as Services



GIS & COVID-19

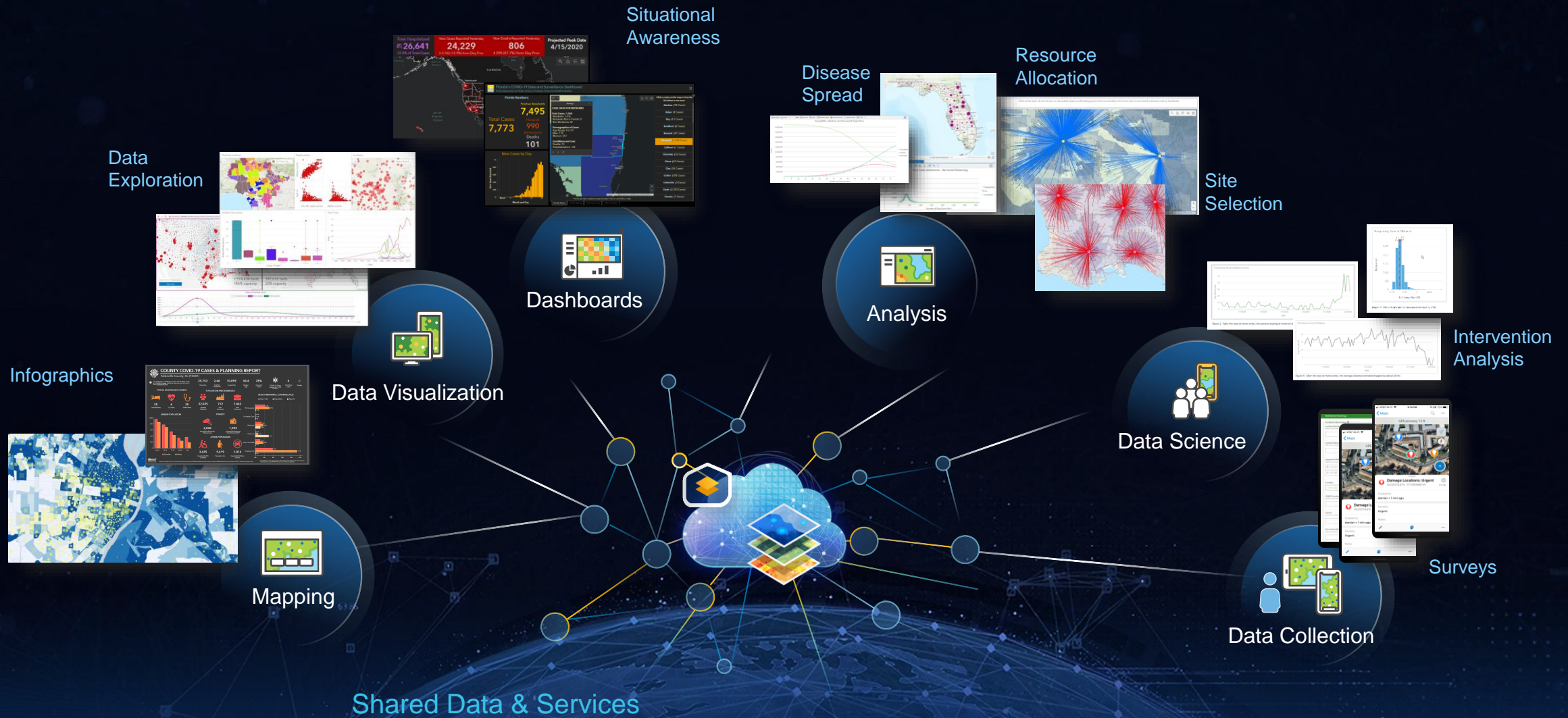
Used for Understanding and Responding to the Pandemic

Applications



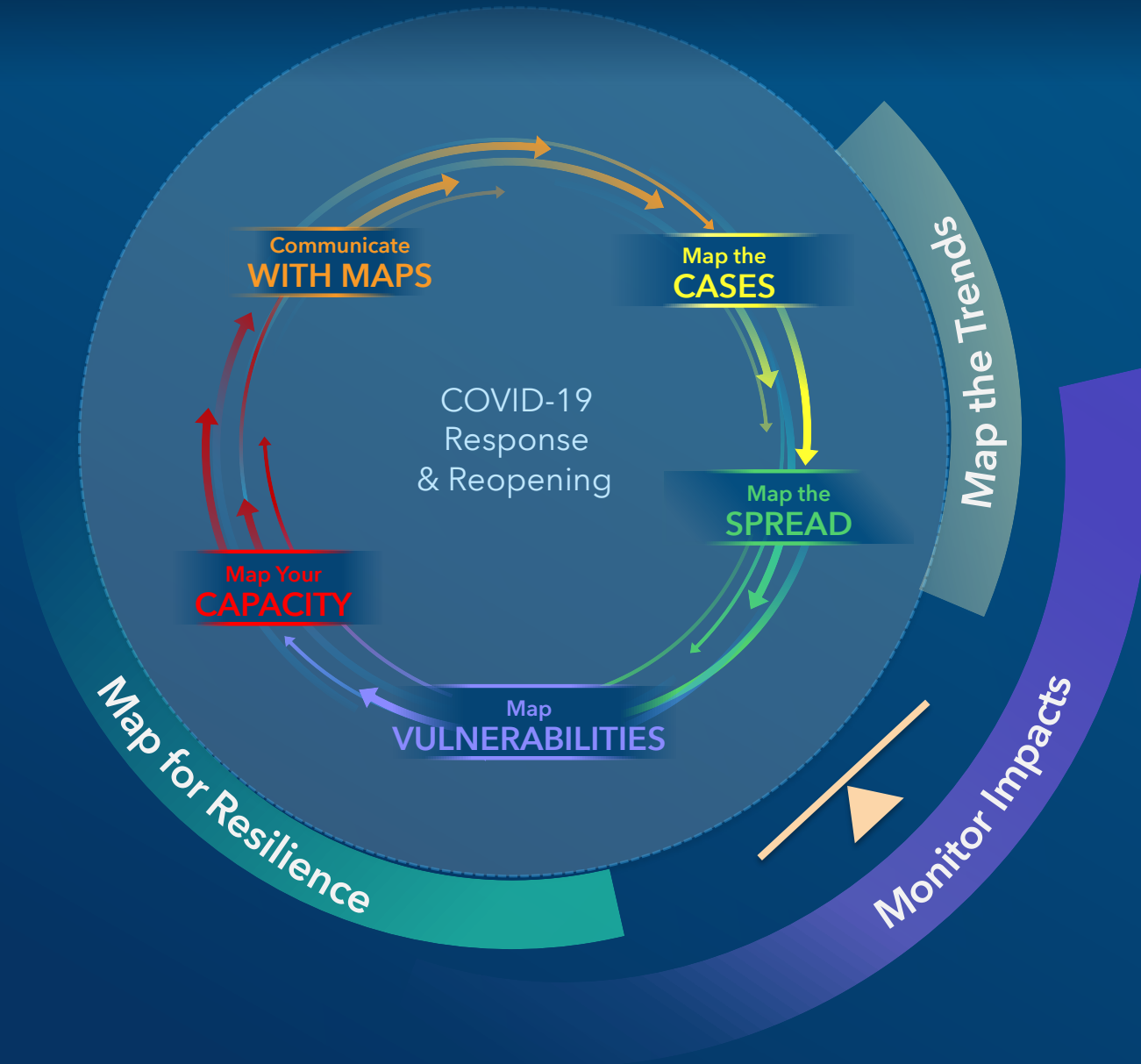
*Integrating All the Data, Activities and Missions . . .
... Empowering Collaborative Action*

Powerful Capabilities for Pandemic Response

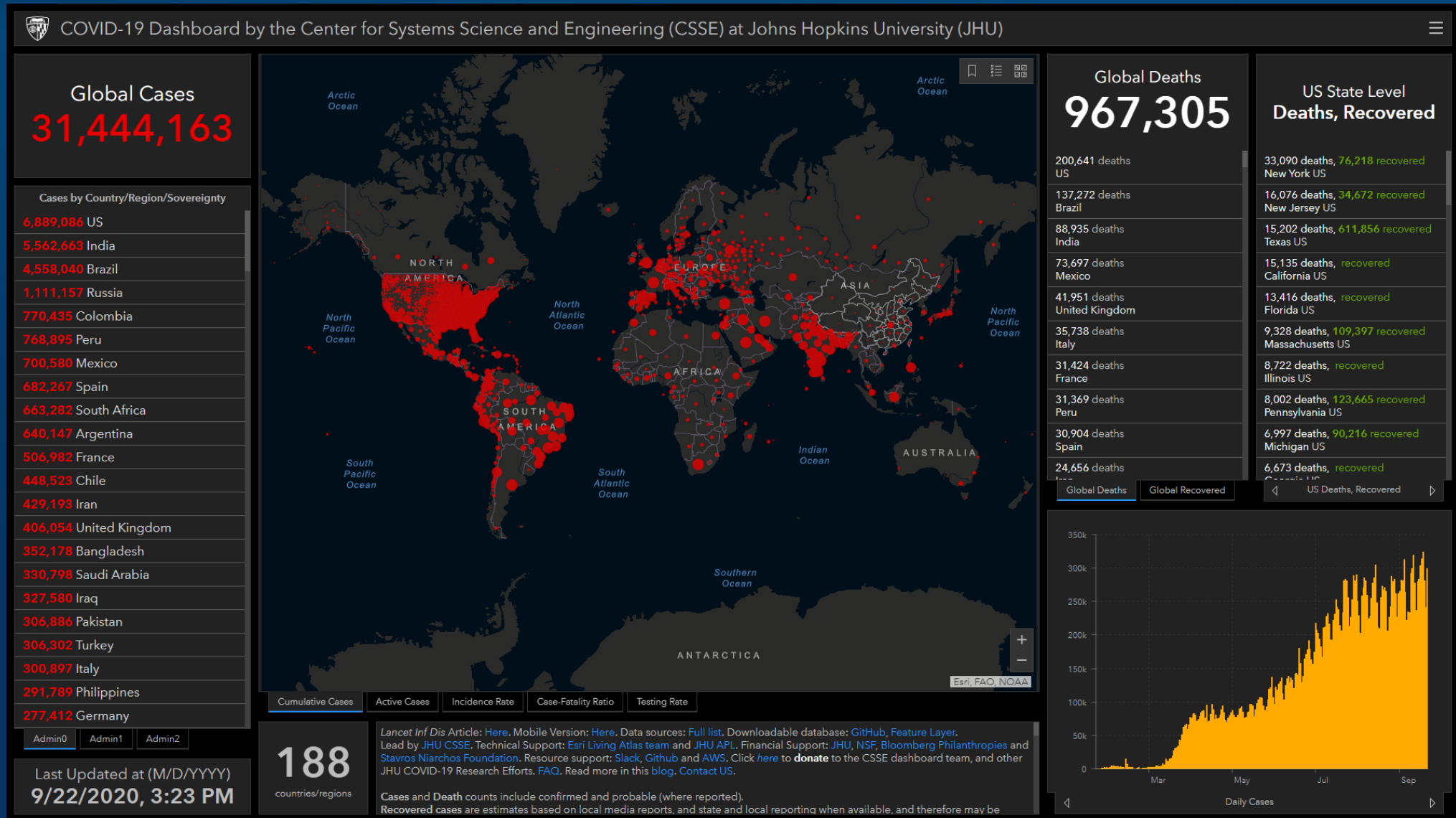


*Interconnecting the Information. . .
... Creating an Integrated Approach*

COVID-19 Approach with GIS



Map the Cases | Dashboards provide situational awareness



Map the Cases | Dashboards provide situational awareness



Department of Health and Human Services Secretary's Operations Center at ASPR

Map the Cases | Dashboards provide situational awareness



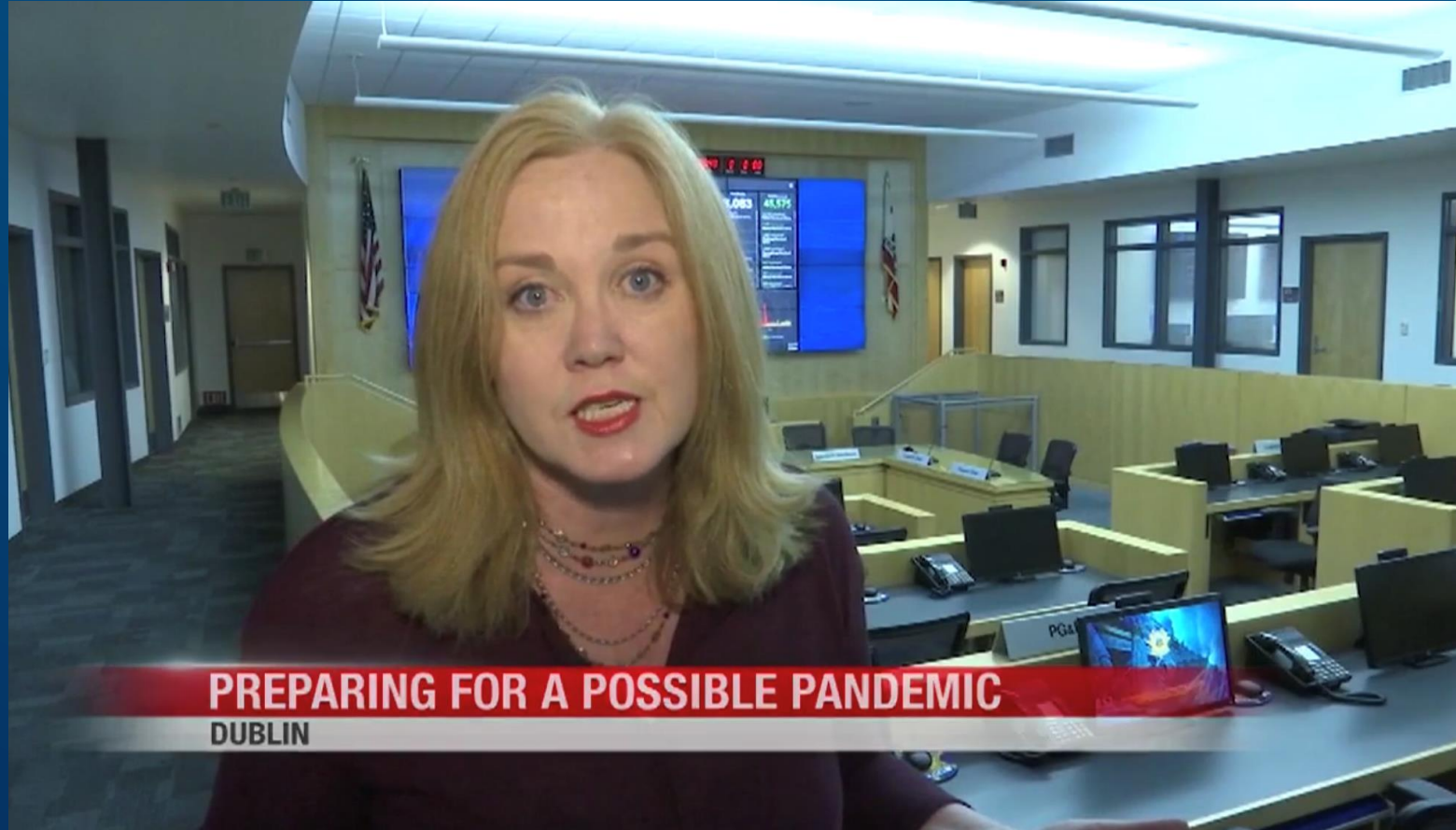
Members of Germany's emergency task force sit down for a coronavirus briefing

Map the Cases | Dashboards provide situational awareness



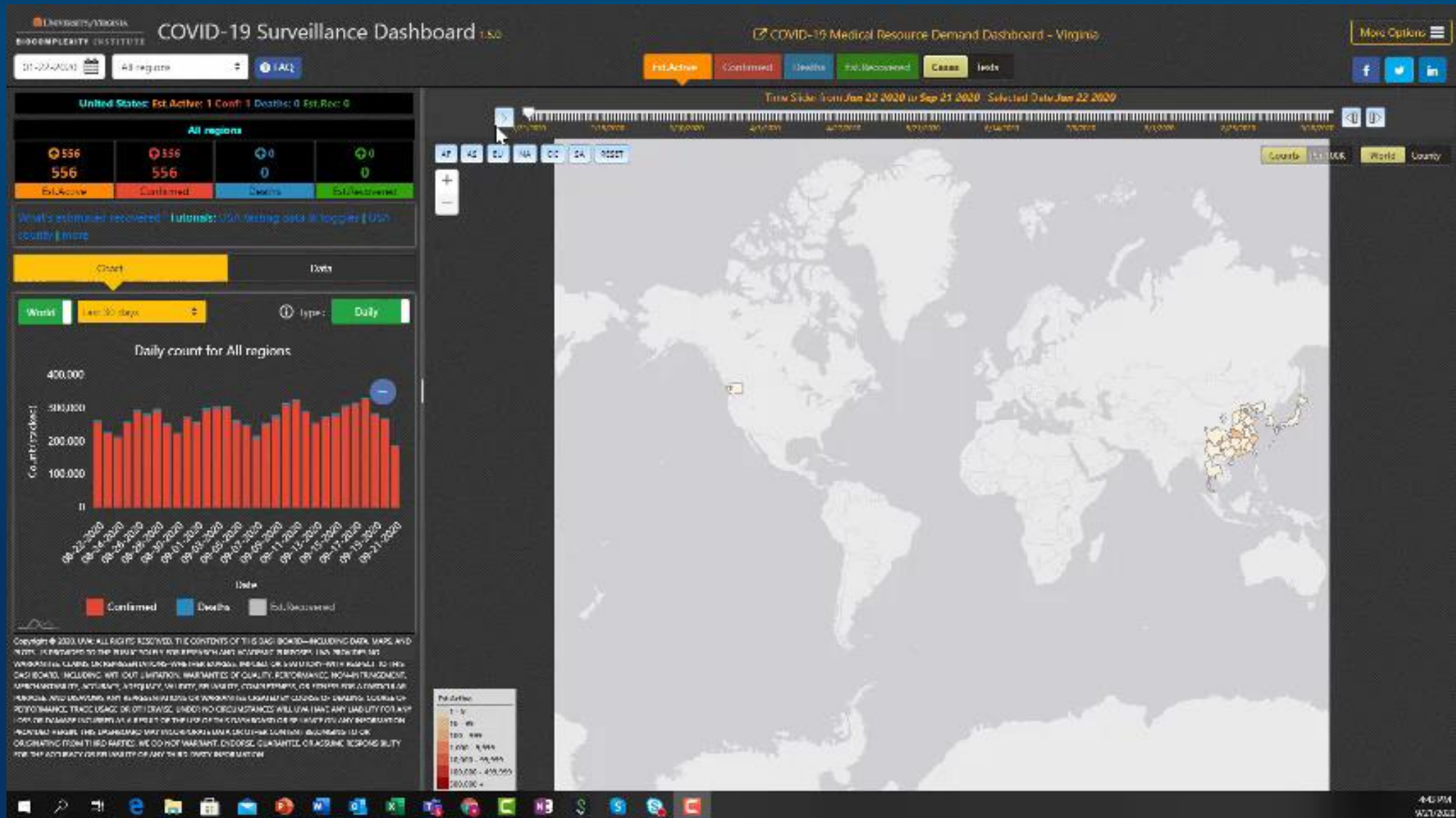
Coronavirus briefing in Italy

Map the Cases | Dashboards provide situational awareness

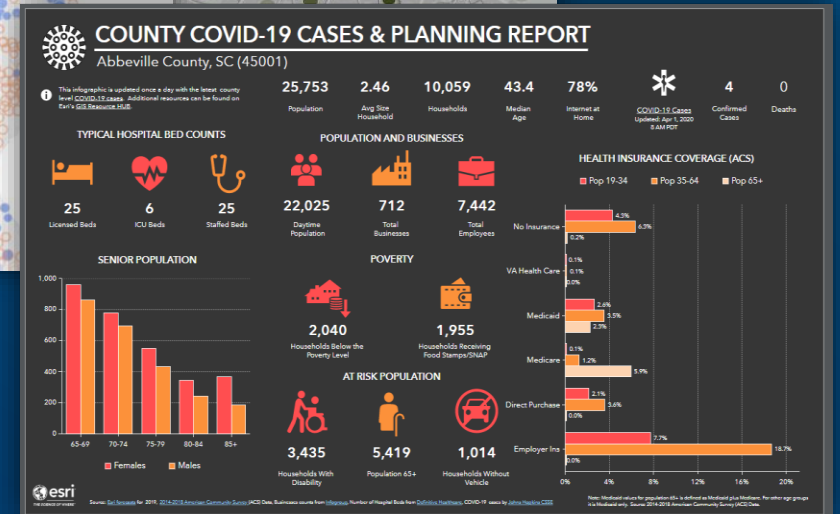
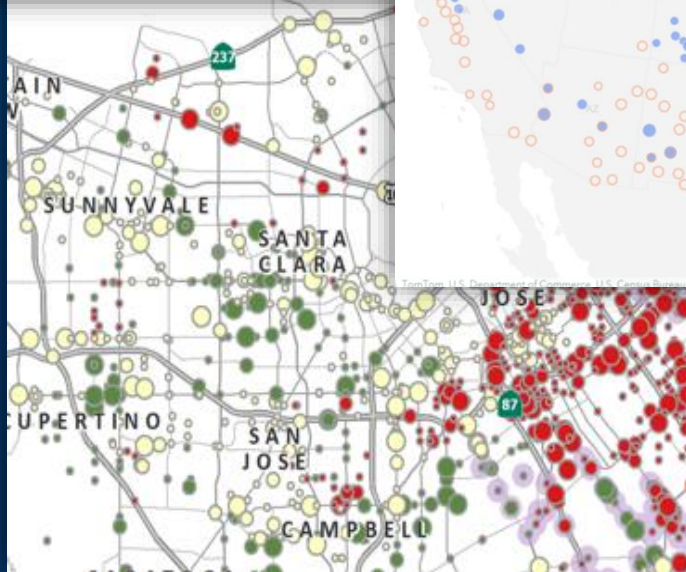
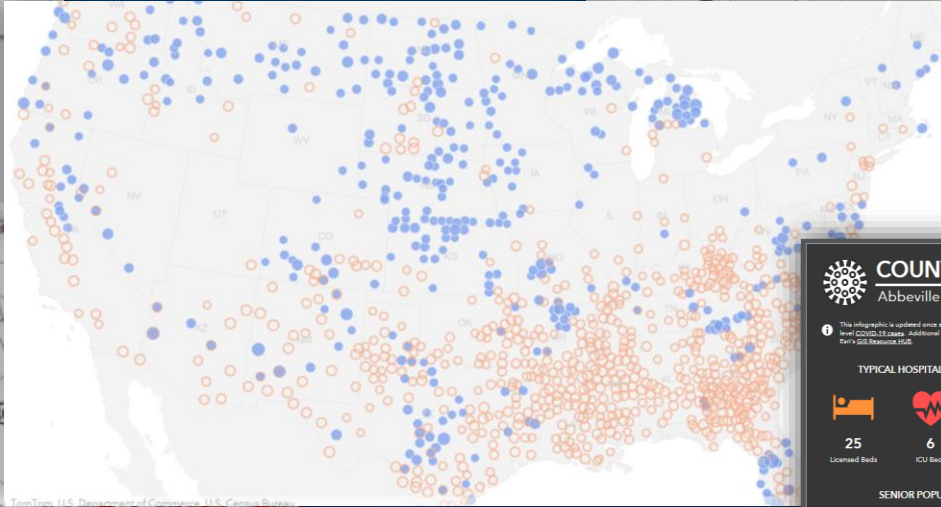
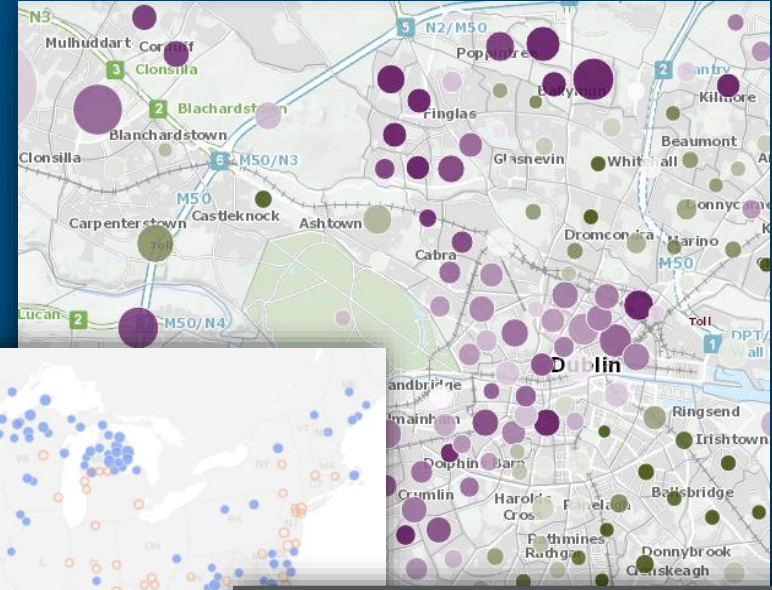
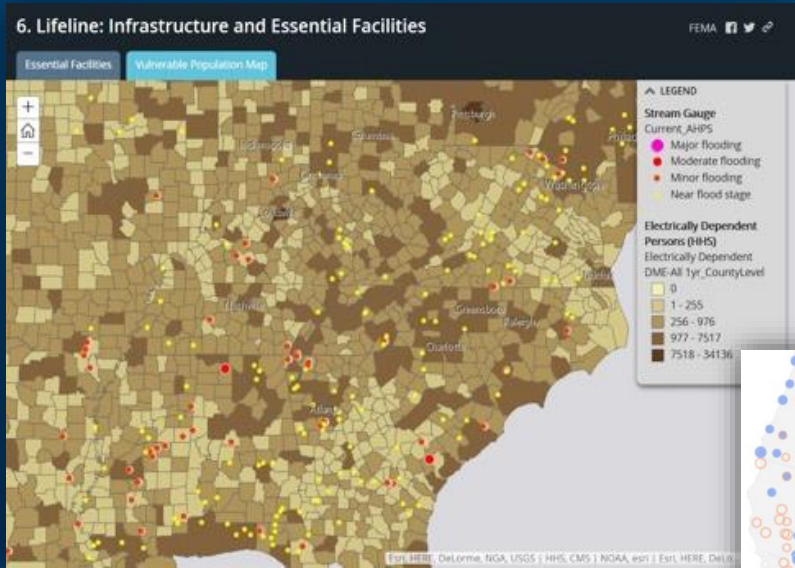


News in Dublin, Ireland

Map the Spread | Focus on pace and direction of disease movement

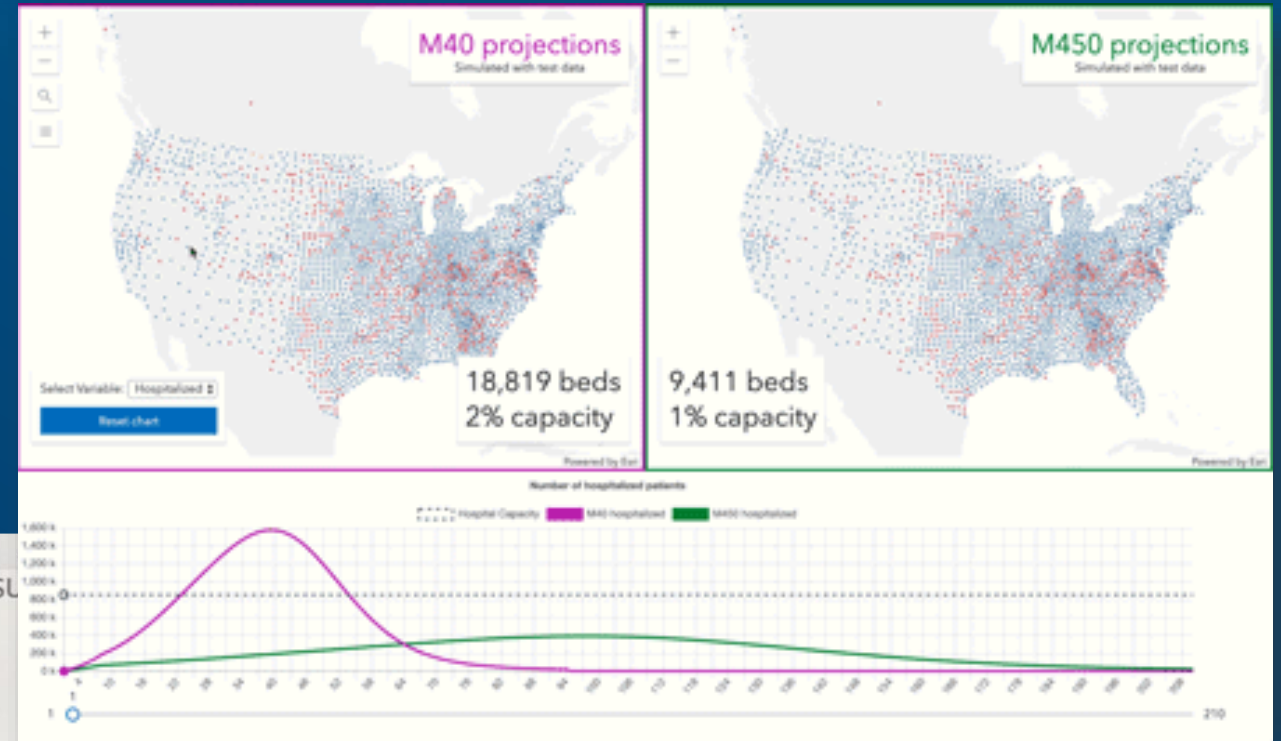
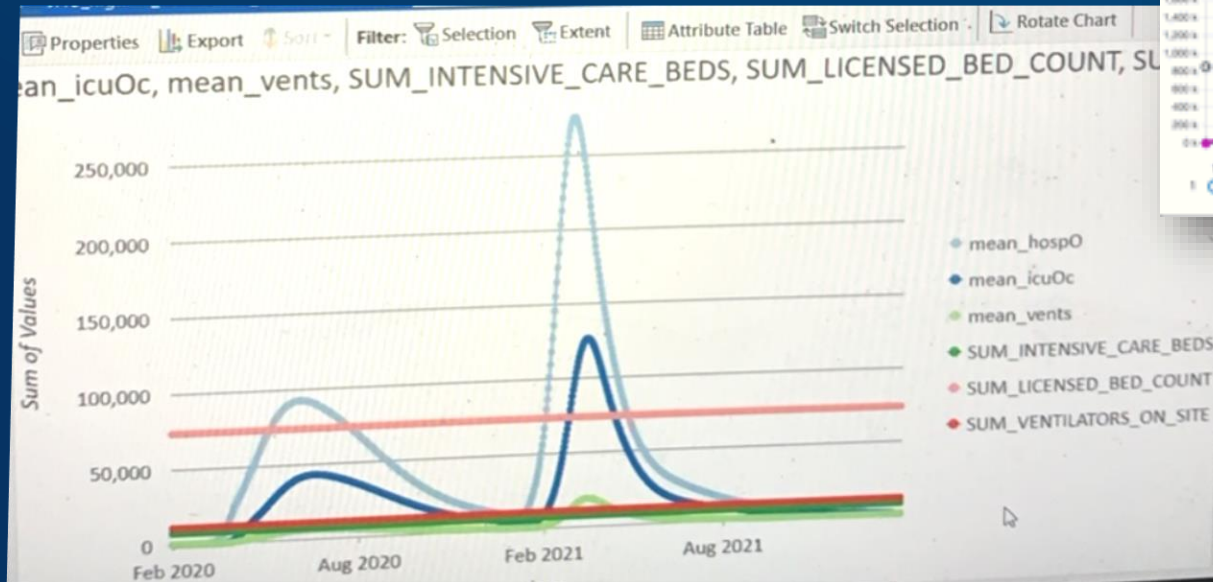


Map Vulnerable Populations| Promoting health equity for all

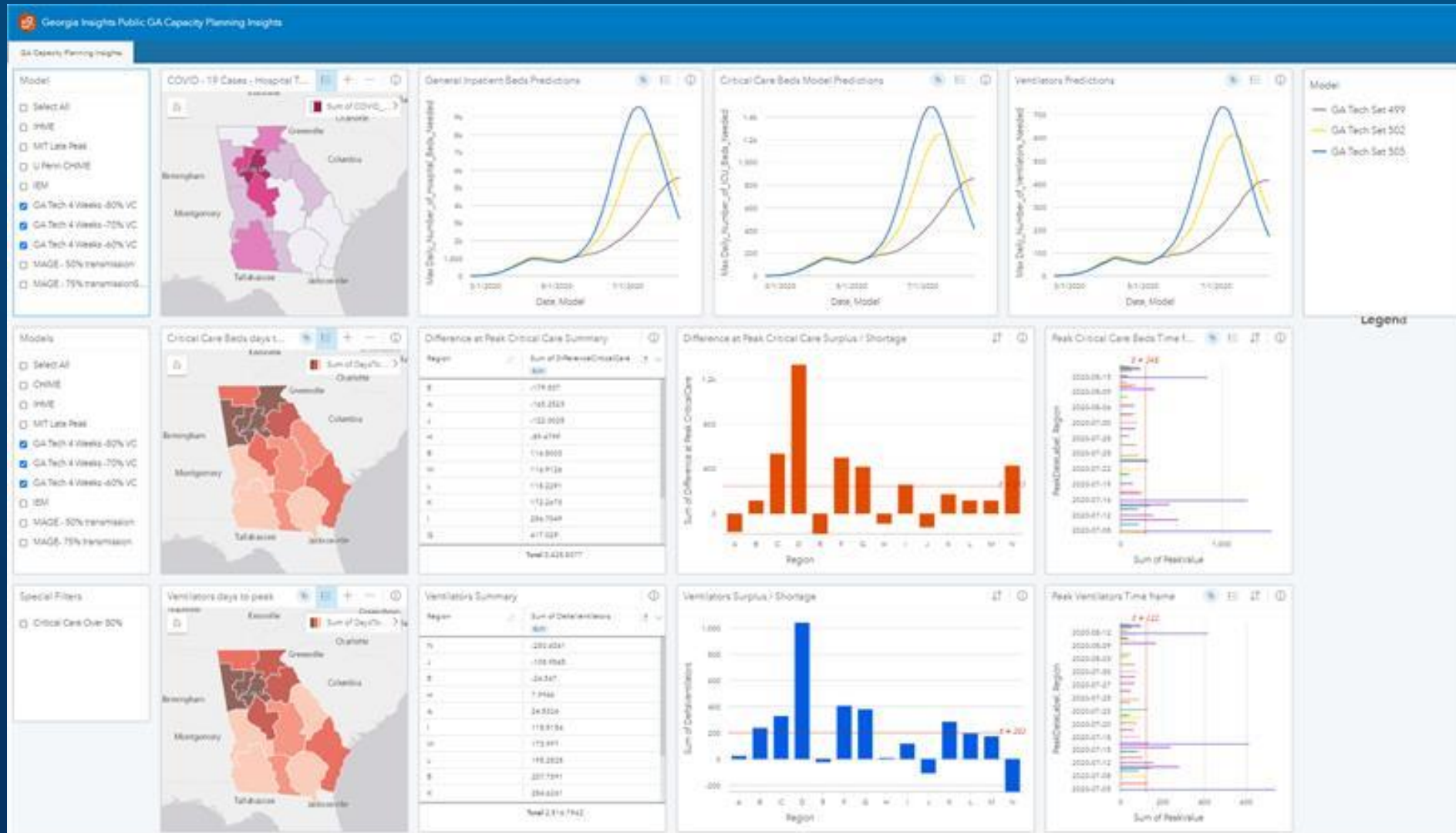


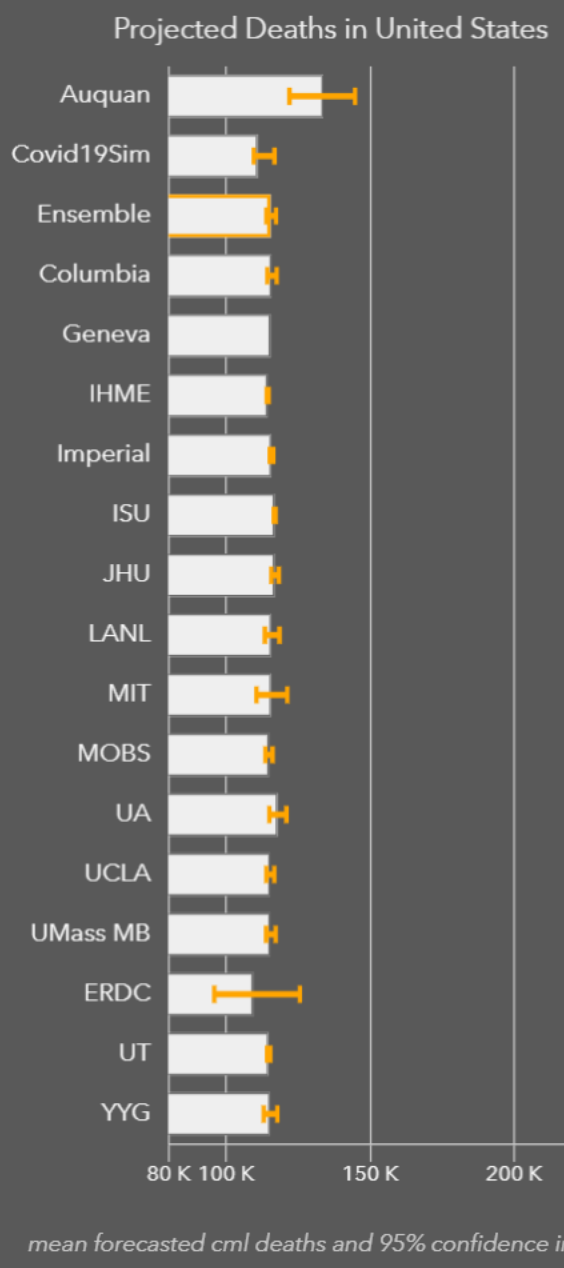
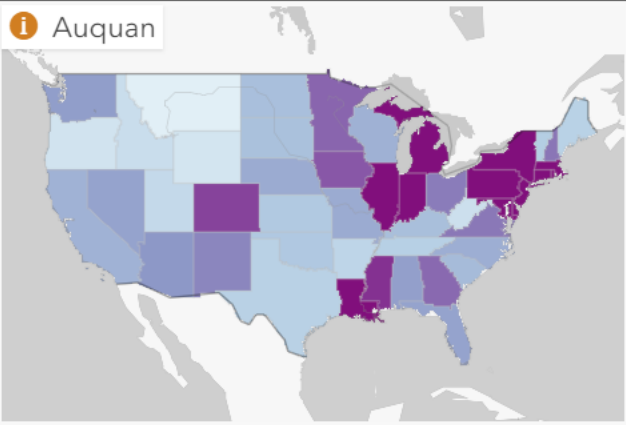
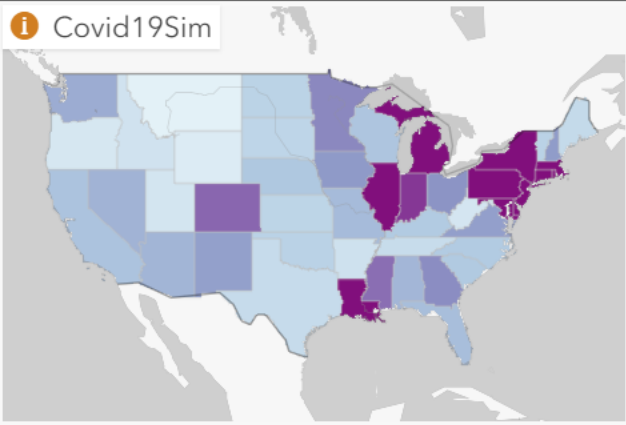
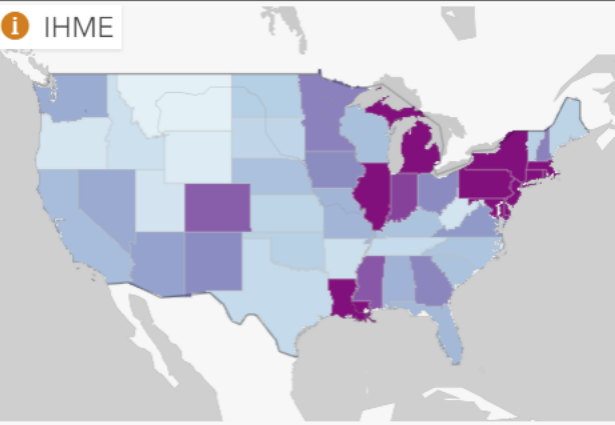
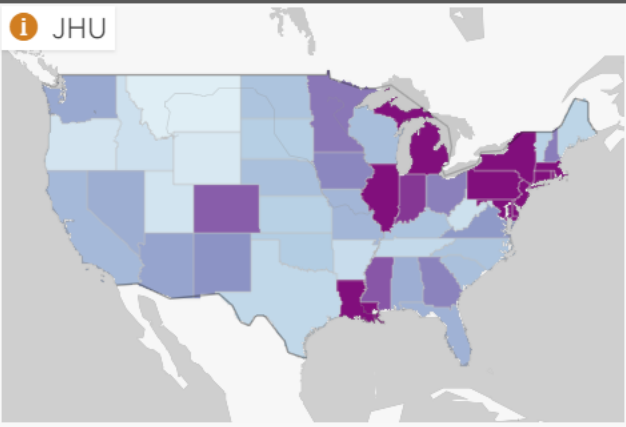
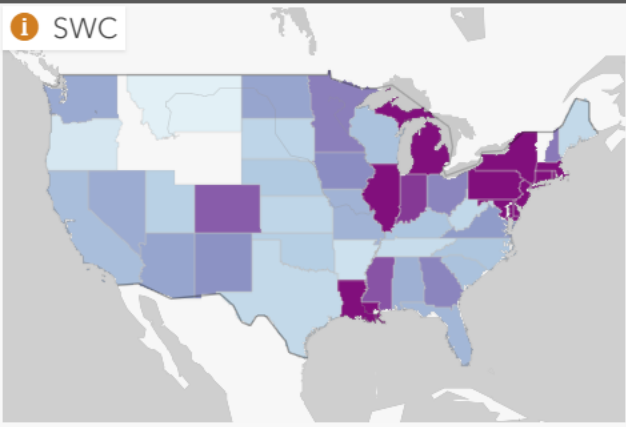
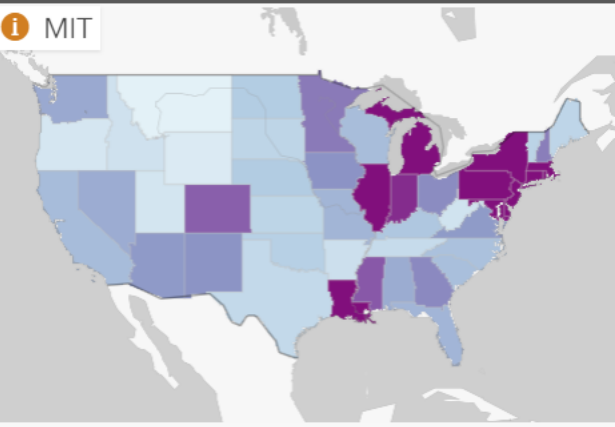
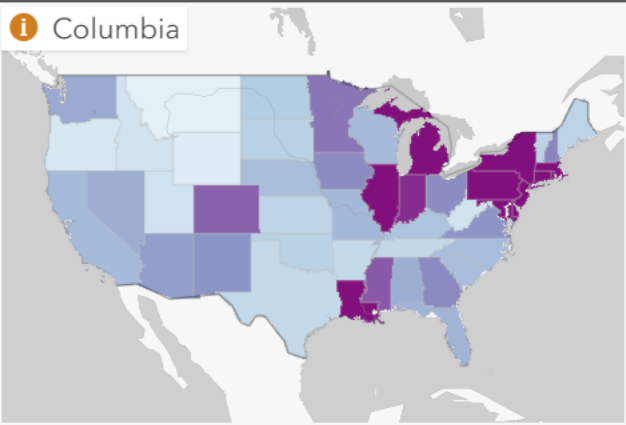
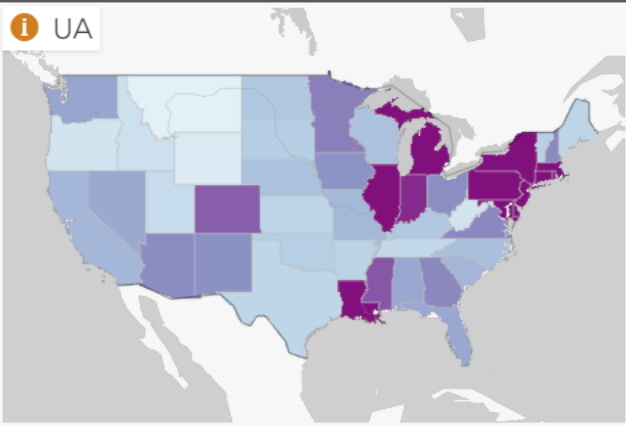
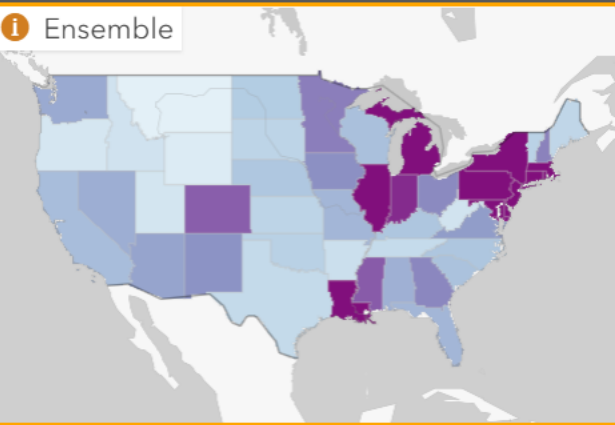
Map Your Capacity | Determine your ability to respond

Predicting Spread and
Impacts on Hospitals



Map Your Capacity | Compare multiple models

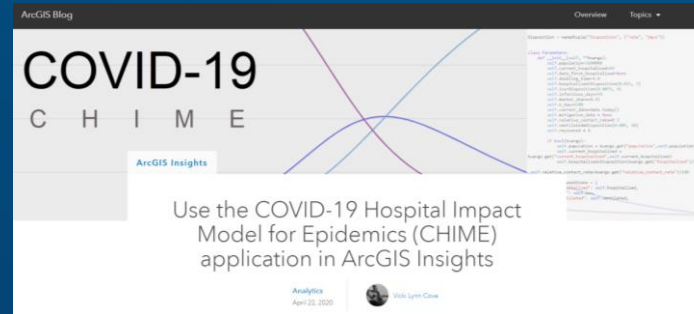




Map Your Capacity | Learn more about COVID-19 Forecasting



<https://www.esri.com/arcgis-blog/products/arcgis-pro/analytics/understanding-what-it-takes-to-flatten-the-curve/>



<https://www.esri.com/arcgis-blog/products/insights/analytics/use-chime-arcgis-insights/>



<https://www.esri.com/about/newsroom/blog/models-maps-explore-covid-19-surges-capacity/>

Survey123 for ArcGIS

Hospitalization and PPE Report

Select your facility and report the status of hospitalization and personal protective equipment on a regularly defined interval.

Name of Facility *

EDWARD HOSPITAL

Hospitalization

Enter the total number of beds, ventilators, and COVID-19 hospitalizations.

► Beds and Ventilators

► COVID-19 Hospitalizations

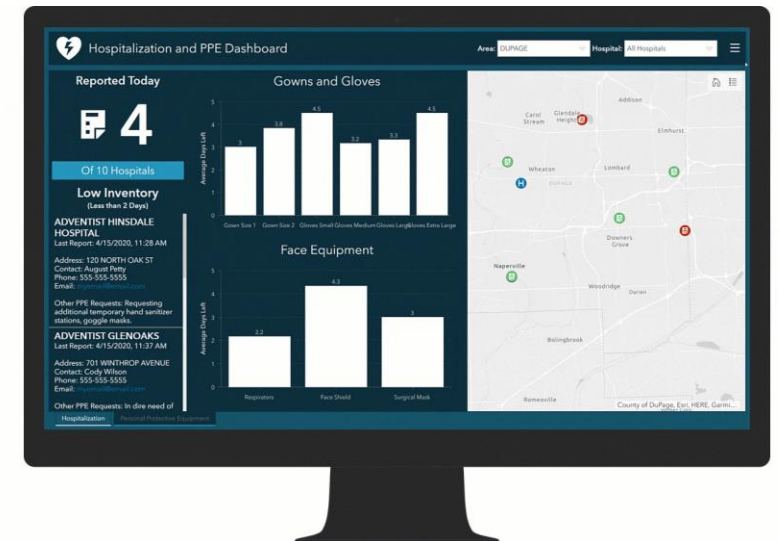
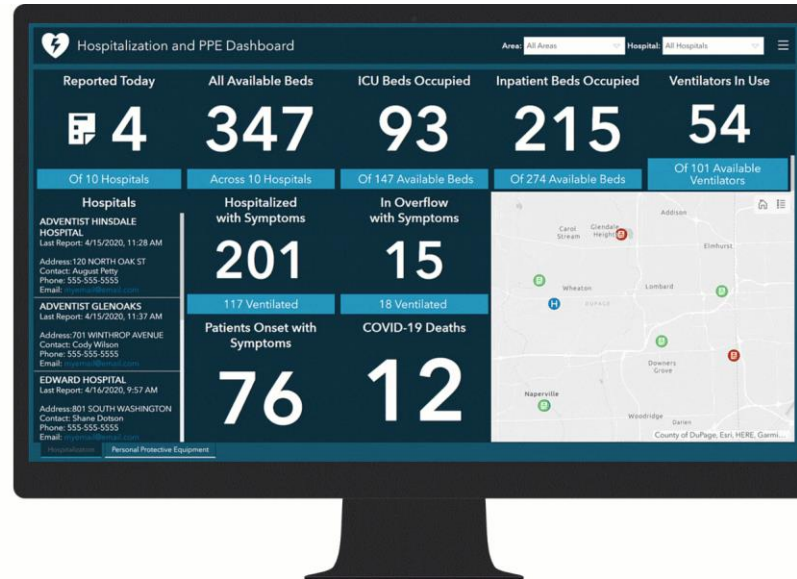
▼ Personal Protective Equipment (PPE)

Enter the number of days left for each piece of Personal Protective Equipment.

► Gowns and Gloves

► Respirators and Face Equipment

Other PPEs or equipment tracked or needed.



Map Your Capacity | Monitor and adjust as needed

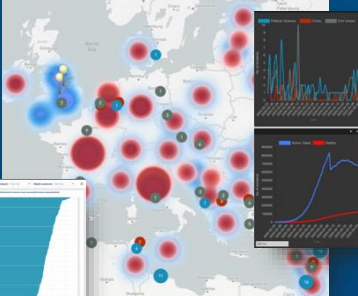
Communicate with Maps | Build trust through transparency

Executive Decision Support



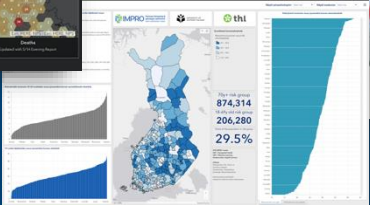
City of Baton Rouge and Parish of East Baton Rouge Louisiana

Pandemic and Civil Unrest



HawkSight Europe

Vulnerable Populations



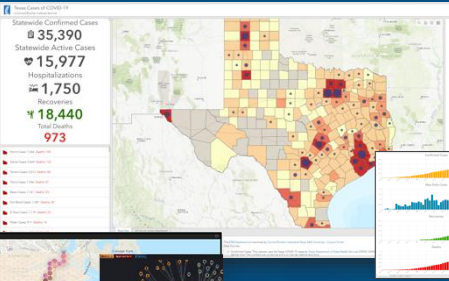
University of Eastern Finland Finland

Cases, Deaths and Recovered



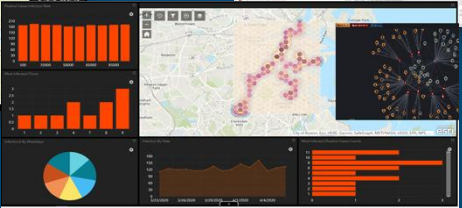
Mike Vatter Michigan

Cases and Deaths



Texas A&M University Texas

Contact Tracing



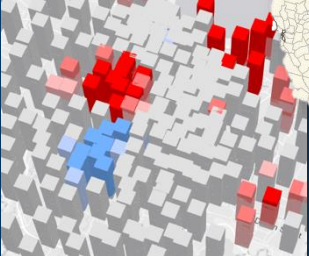
Khatib & Alami

Hospital Admissions and Patient Status



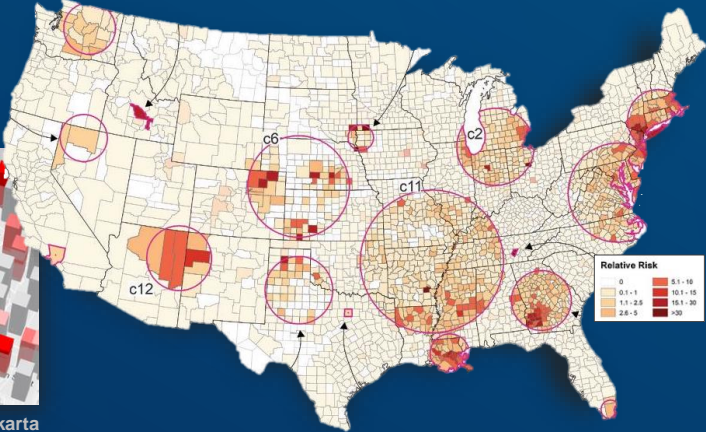
Aeroterra Argentina

Space-Time Cube Hot Spot Analysis



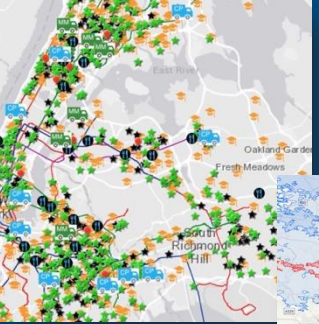
Jakarta

Statistical Analysis of Space-Time Clusters



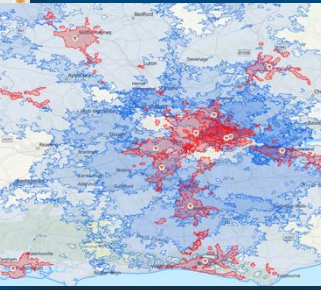
Johns Hopkins Bloomberg School of Public Health US

Emergency Food Distribution



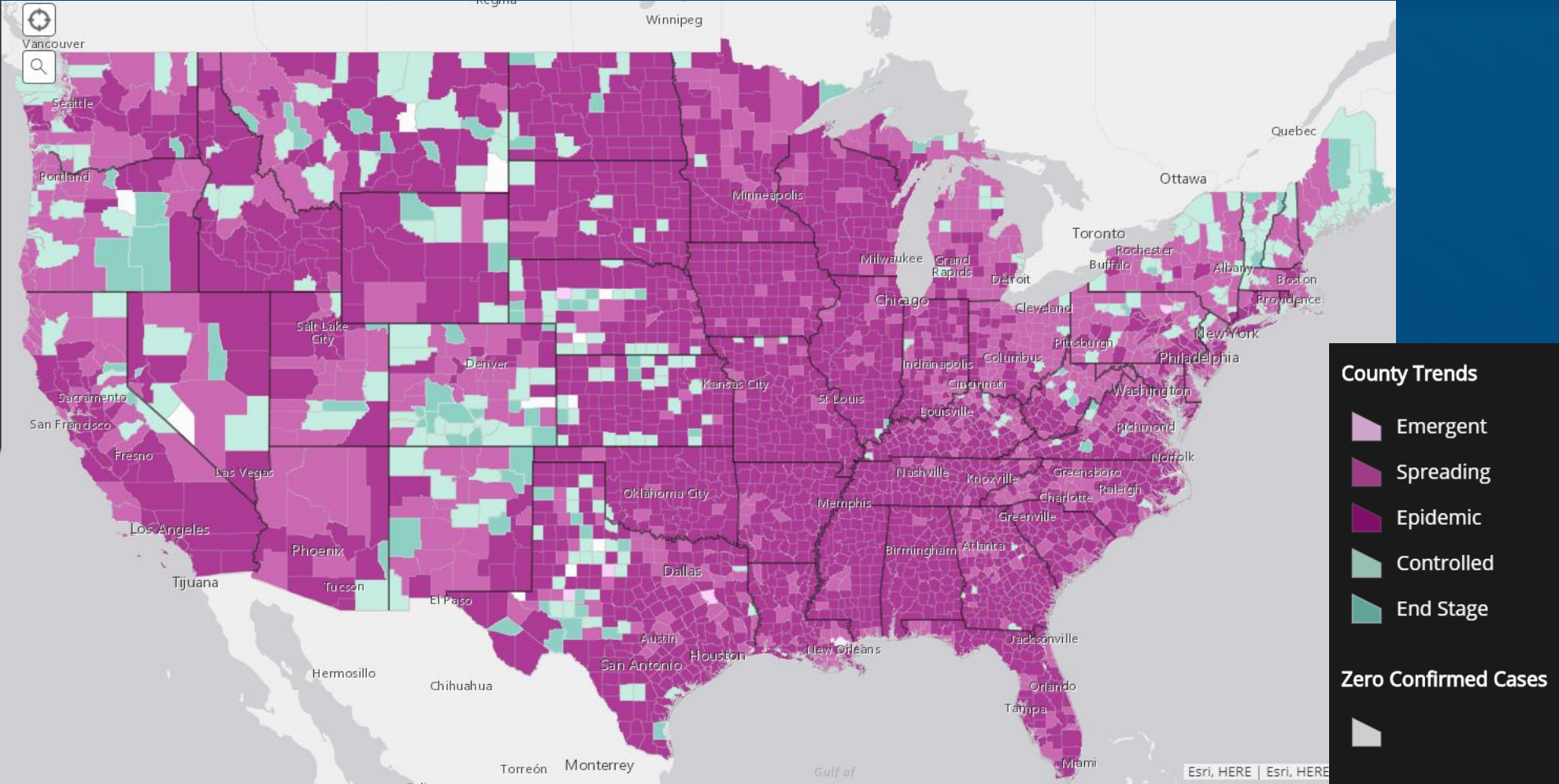
City Harvest New York

Testing Sites and Travel Time

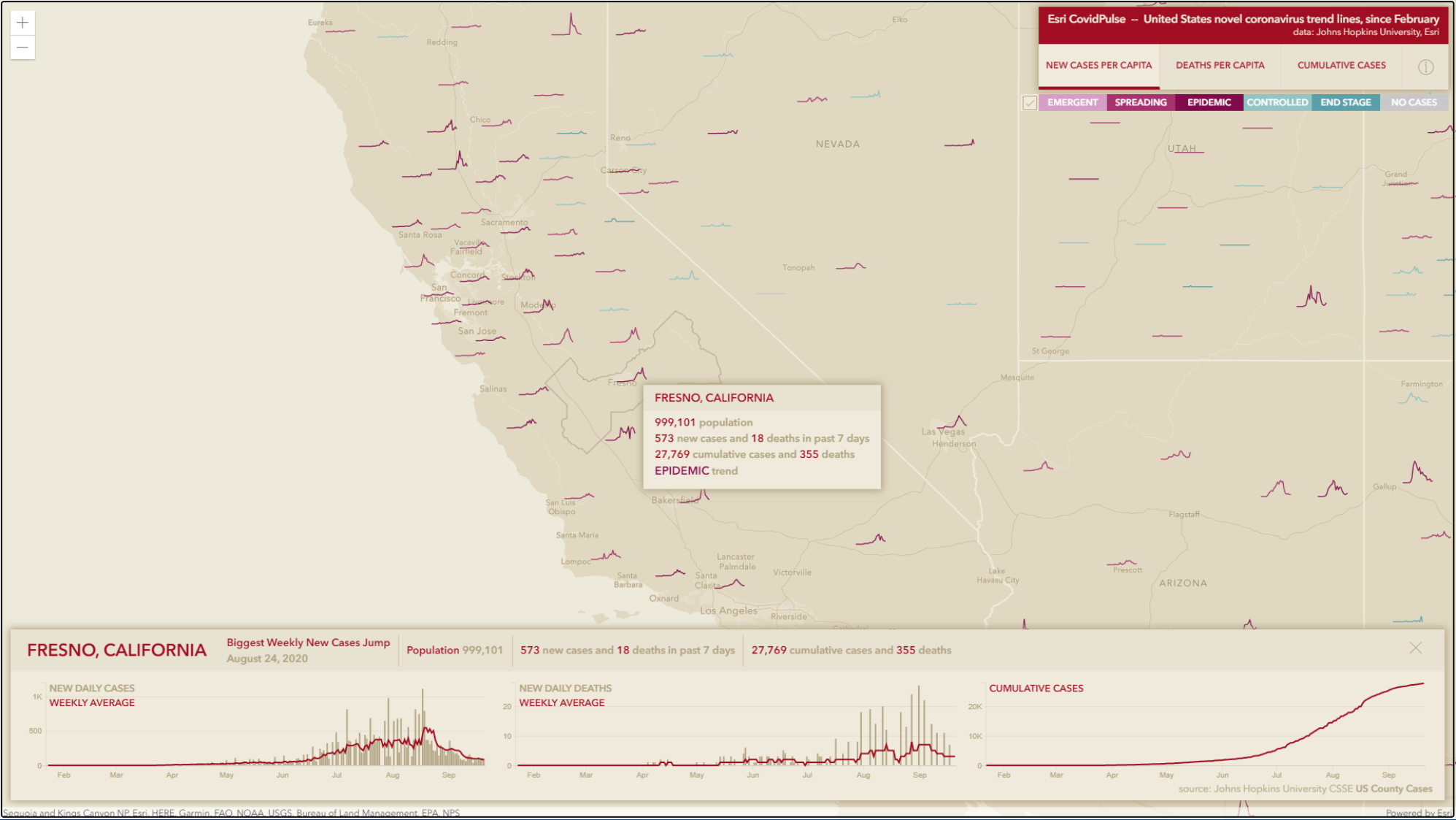


TravelTime England

Map the Trends | Current trends and trends over time (County Trends)

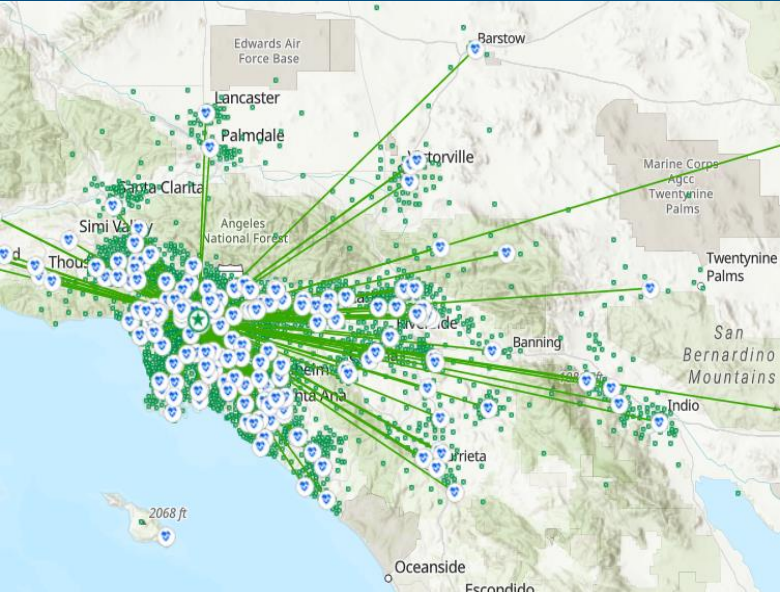


Map the Trends | Current trends and trends over time (COVIDPulse)



[Map for Community Resilience](#) | [Site new resources](#)

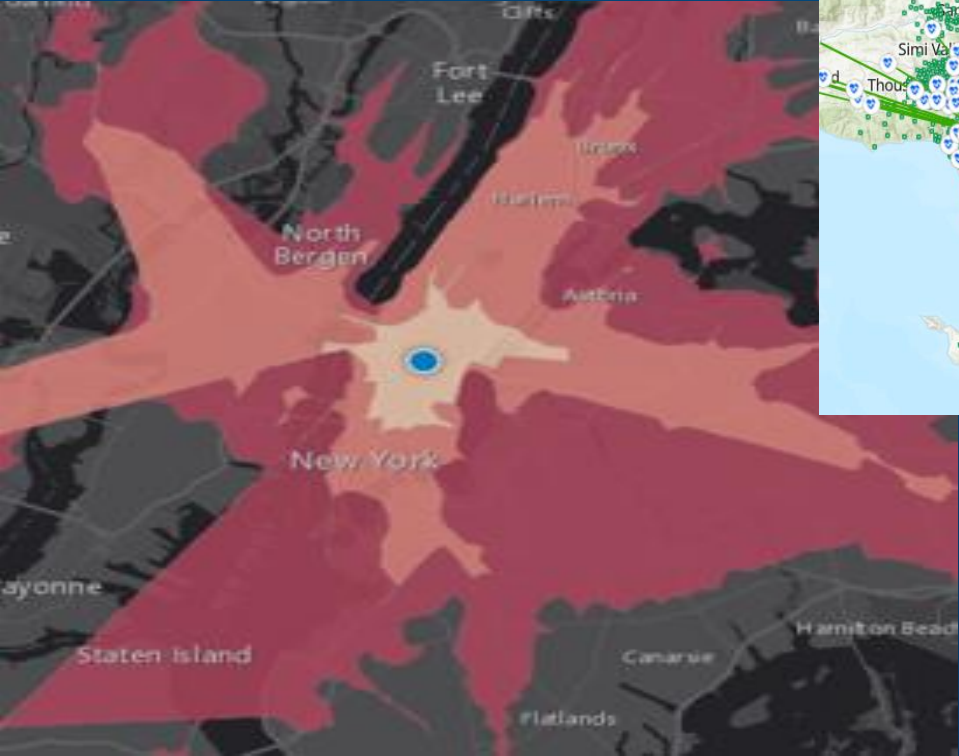
Allocation of Critical Resources



Selecting Centers



Access to Care



Map for Community Resilience | Augment or create new services



Testing Sites

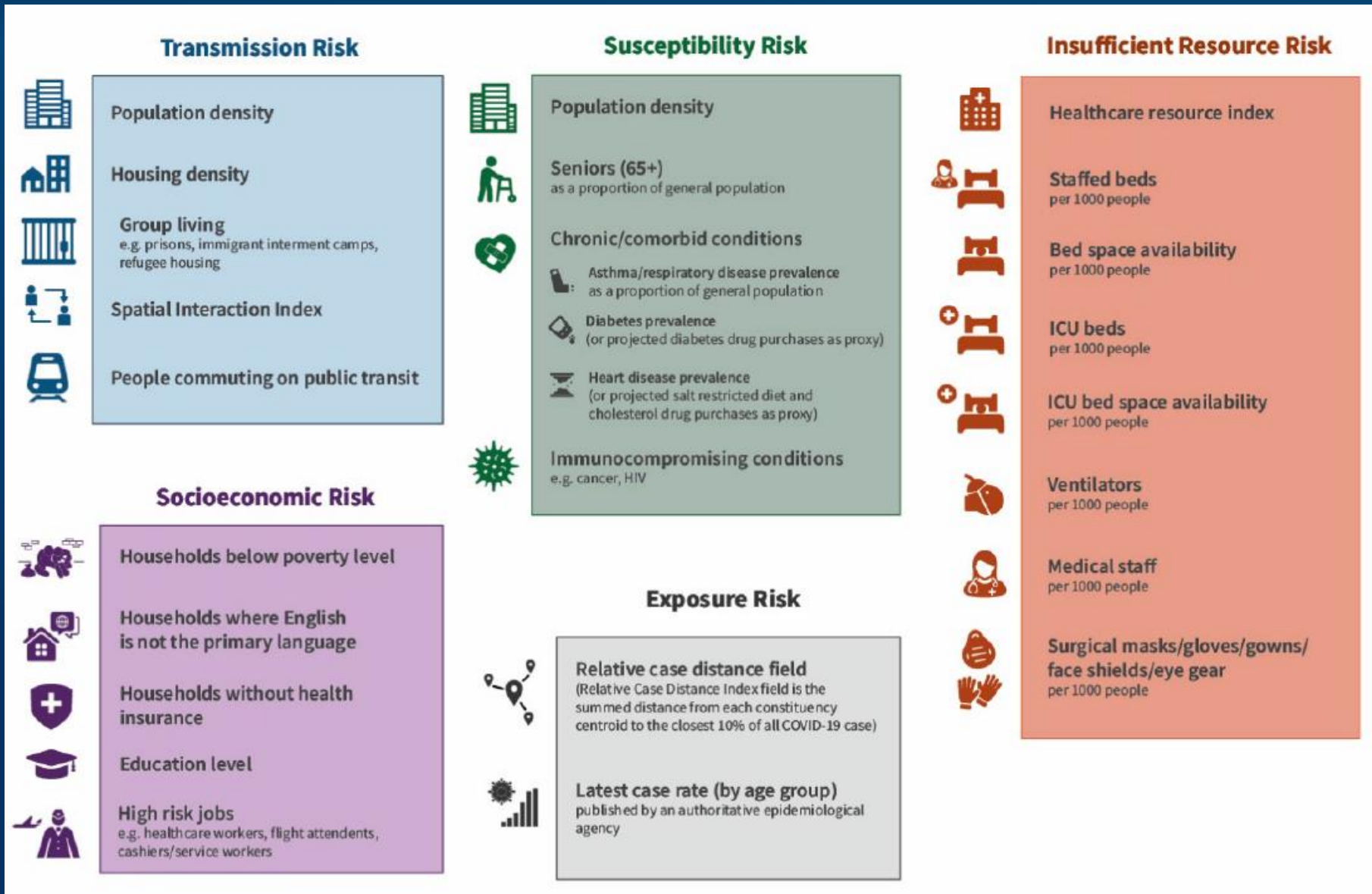


Treatment Sites



Food Distribution
Sites

Map for Community Resilience | Calculate population demand/need

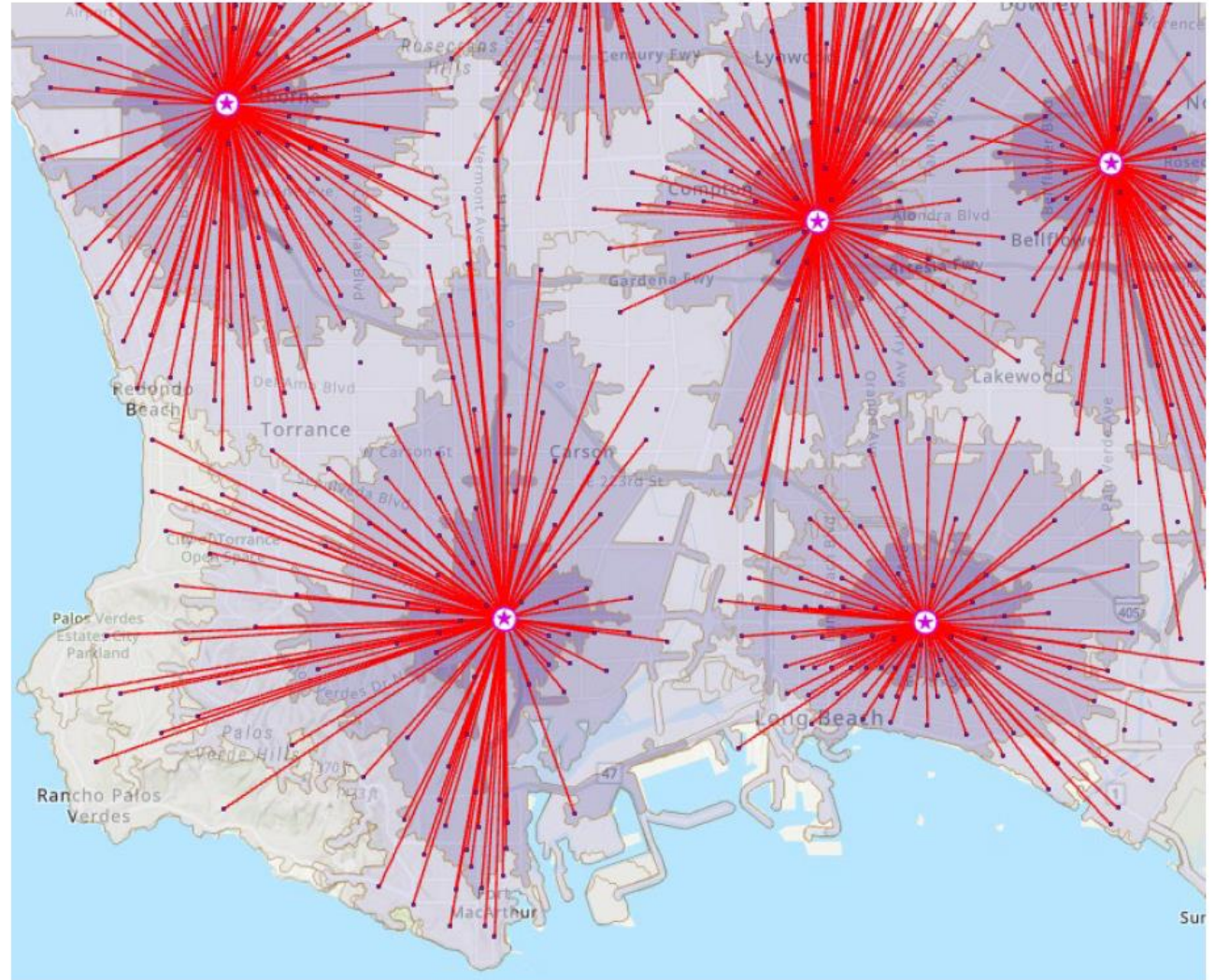


(learn how [here](#))

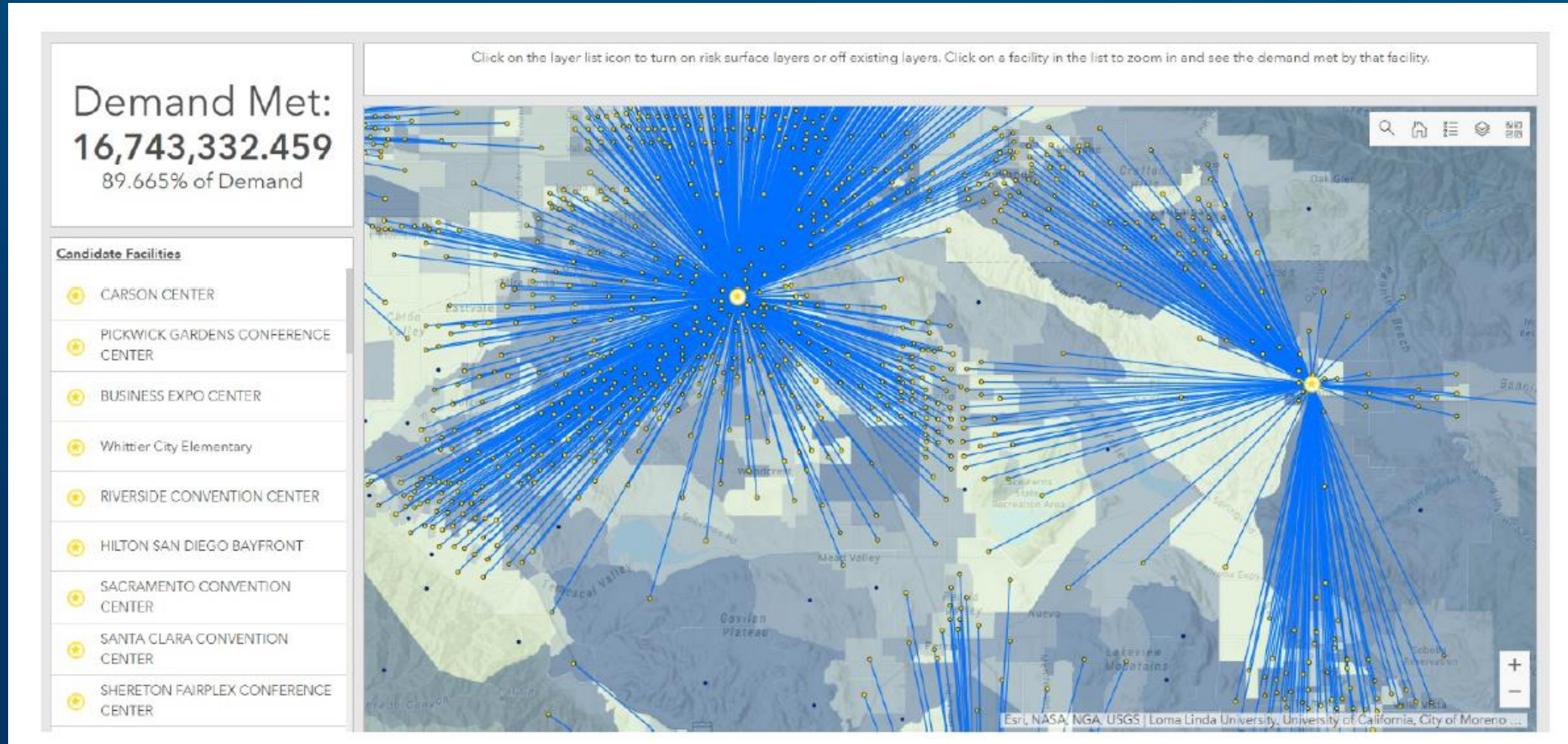
Map for Community Resilience | Perform location-allocation

Tutorial

<https://pro.arcgis.com/en/pro-app/help/analysis/networks/location-allocation-tutorial.htm>



Map for Community Resilience | Evaluate Outcomes



Map for Community Resilience | Contact Tracing

HUMAN TO HUMAN TRANSMISSION

Traditional Contact Tracing



Map for Community Resilience | People move



Map for Community Resilience | Community Contact Tracing

COMMUNITY TRANSMISSION

Community Contact Tracing



Map for Community Resilience | The process

HOW-TO STEPS



01

**COLLECT & MANAGE
DATA**

02

PERFORM ANALYTICS

03

**EVALUATE & MAKE
DECISIONS**

Map for Community Resilience | Collect locations



Ask for Location During Your Case and Contact Interview

CDC 2019-nCoV ID:

.....PATIENT IDENTIFIER INFORMATION IS NOT TRANSMITTED TO CDC.....

Patient first name _____ Patient last name _____ Date of birth (MM/DD/YYYY): _____

.....PATIENT IDENTIFIER INFORMATION IS NOT TRANSMITTED TO CDC.....

  **Human Infection with 2019 Novel Coronavirus
Case Report Form**

Reporting Jurisdiction	Case state/local ID
Reporting Health Department	CDC 2019-nCoV ID
Contact ID ^a	NNDSS loc. rec. ID/Case ID ^b

^aOnly complete if case-patient is a known contact of prior source case-patient. Assign Contact ID using CDC 2019-nCoV ID and sequential contact ID, e.g., Confirmed case CA102034567-02. ^bFor NNDSS reporters, use GenV2 or NETSS patient identifier.

Interviewer Information

Name of Interviewer: Last:	First:	Telephone:	Email:
Affiliation/Organization:			

Case Classification and Identification

What is the current status of this person?
☐ Lab-confirmed case* ☐ Probable case

If probable, select reason for case classification:
☐ Meets clinical criteria AND epidemiologic evidence with no confirmatory lab testing*
☐ Meets presumptive lab evidence[‡] AND either clinical criteria OR epidemiologic evidence
☐ Meets vital records criteria with no confirmatory lab testing

*Detection of SARS-CoV-2 RNA in a clinical specimen using a molecular amplification detection test
[‡] Detection of specific antigen in a clinical specimen, OR detection of specific antibody in serum, plasma, or whole blood indicative of a new or recent infection

Under what process was the case first identified? (check all that apply)
☐ Clinical evaluation ☐ Routine surveillance
☐ Contact tracing of case patient ☐ Other, specify: _____
☐ EpiX notification of travelers. If yes, DGMQID: _____
☐ Unknown

Report date of case to CDC (MM/DD/YYYY): ____/____/____
Date of first positive specimen collection (MM/DD/YYYY): ____/____/____ ☐ Unknown ☐ N/A

Hospitalization, ICU, and Death Information

Was the patient hospitalized? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	If hospitalized, was a translator required? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	Was the patient admitted to an intensive care unit (ICU)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
If yes, admission date 1 ____/____/____ (MM/DD/YYYY) discharge date 1 ____/____/____	If yes, specify which language: _____	If yes, admission date 1 ____/____/____ (MM/DD/YYYY) discharge date 1 ____/____/____
Did the patient die as a result of this illness? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	If yes, date of death (MM/DD/YYYY): ____/____/____ <input type="checkbox"/> Unknown date	

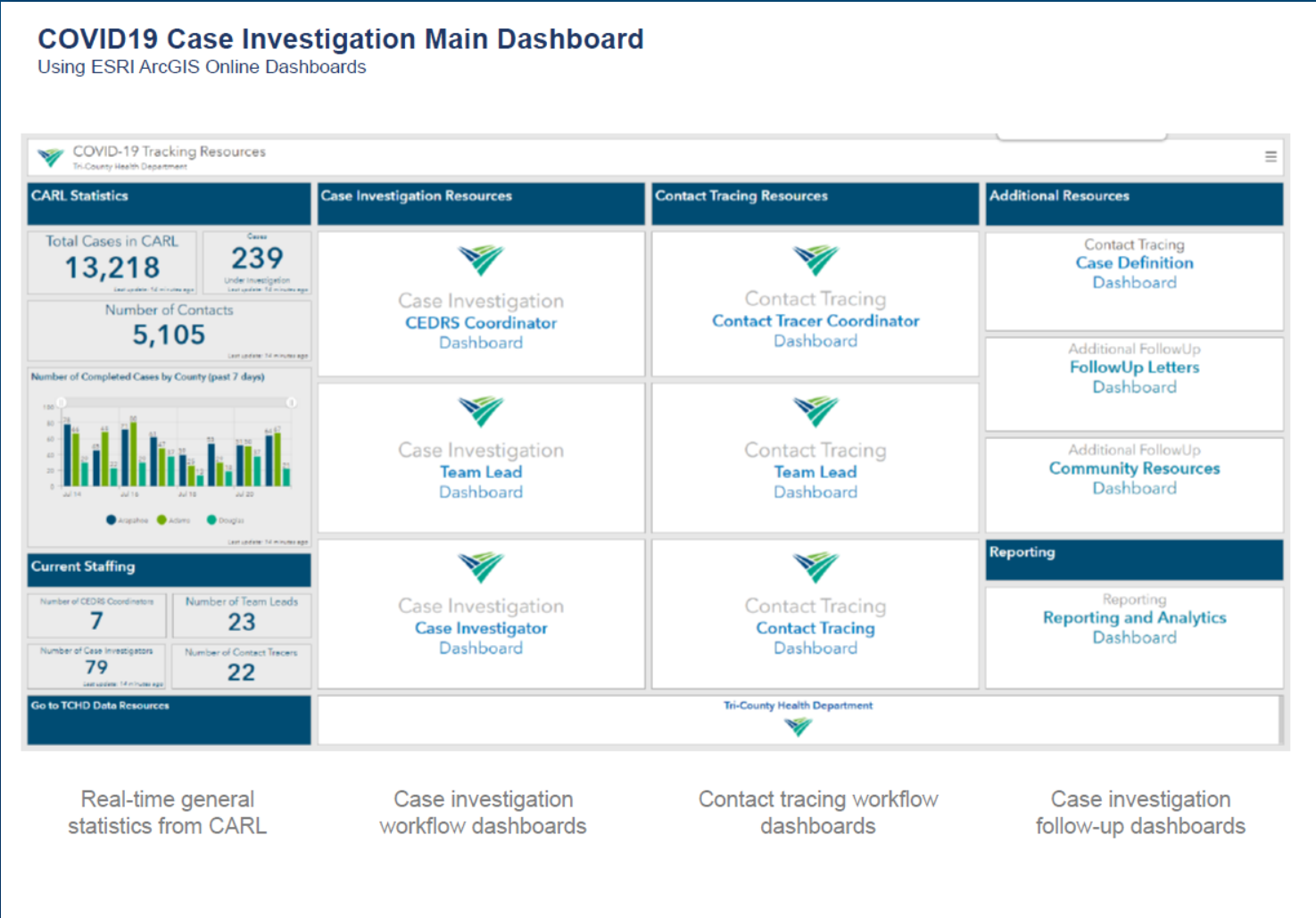
Exposure Information

In the 14 days prior to illness onset, did the patient have any of the following exposures (check all that apply)

- ☐ Domestic travel (outside state of normal residence). Specify state(s): _____
- ☐ International travel. Specify country(s): _____
- ☐ Cruise ship or vessel travel as passenger or crew member. Specify name of ship: _____
- ☐ Workplace
If yes, is the workplace critical infrastructure (e.g., healthcare setting, grocery store)?
☐ Yes, specify workplace setting: _____ ☐ No ☐ Unknown
- ☐ Airport/airplane
- ☐ Adult congregate living facility (nursing, assisted living, or long-term care facility)
- ☐ School/university/childcare center
- ☐ Correctional facility
- ☐ Community event/mass gathering
- ☐ Animal with confirmed or suspected COVID-19. Specify animal: _____
- ☐ Other exposures, specify: _____
- ☐ Unknown exposures in the 14 days prior

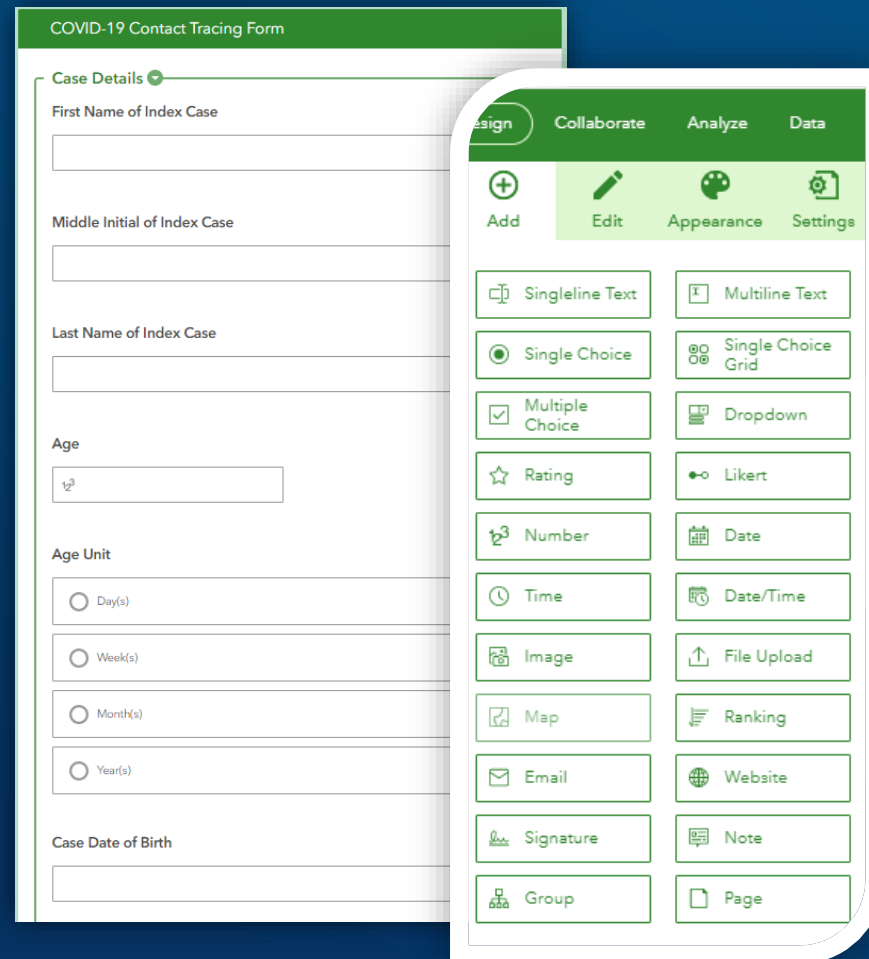
Map for Community Resilience | Collect & Manage Data

The case of Tri-County Health Department in Colorado



Map for Community Resilience | Modernize data collection

Digitize and Streamline the Interview Process



The image displays a digital form titled "COVID-19 Contact Tracing Form" with a green header. The form is divided into sections: "Case Details" (with fields for First Name, Middle Initial, and Last Name of Index Case), "Age" (with a text input and a unit selector), "Age Unit" (with radio buttons for Day(s), Week(s), Month(s), and Year(s)), and "Case Date of Birth" (with a text input). Overlaid on the form is a design tool interface with a green header containing tabs: "Design", "Collaborate", "Analyze", and "Data". The "Design" tab is active, showing a toolbar with icons for "Add", "Edit", "Appearance", and "Settings". Below the toolbar is a grid of 20 form element options, each with an icon and a label: Singleline Text, Multiline Text, Single Choice, Single Choice Grid, Multiple Choice, Dropdown, Rating, Likert, Number, Date, Time, Date/Time, Image, File Upload, Map, Ranking, Email, Website, Signature, Note, Group, and Page.

COVID-19 Contact Tracing Form

Case Details

First Name of Index Case

Middle Initial of Index Case

Last Name of Index Case

Age

Age Unit

Case Date of Birth

Design Collaborate Analyze Data

Add Edit Appearance Settings

Singleline Text Multiline Text

Single Choice Single Choice Grid

Multiple Choice Dropdown

Rating Likert

Number Date

Time Date/Time

Image File Upload

Map Ranking

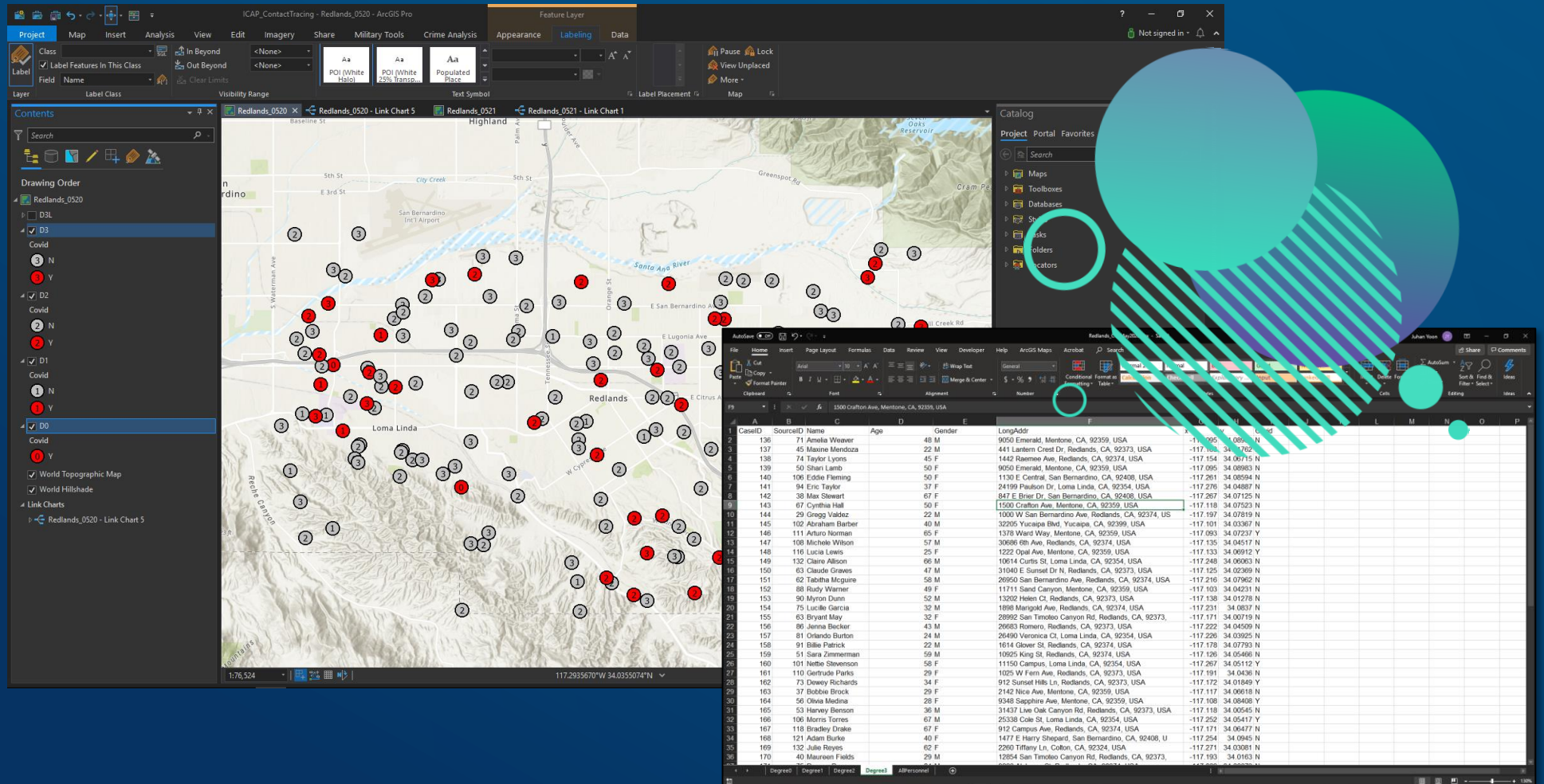
Email Website

Signature Note

Group Page

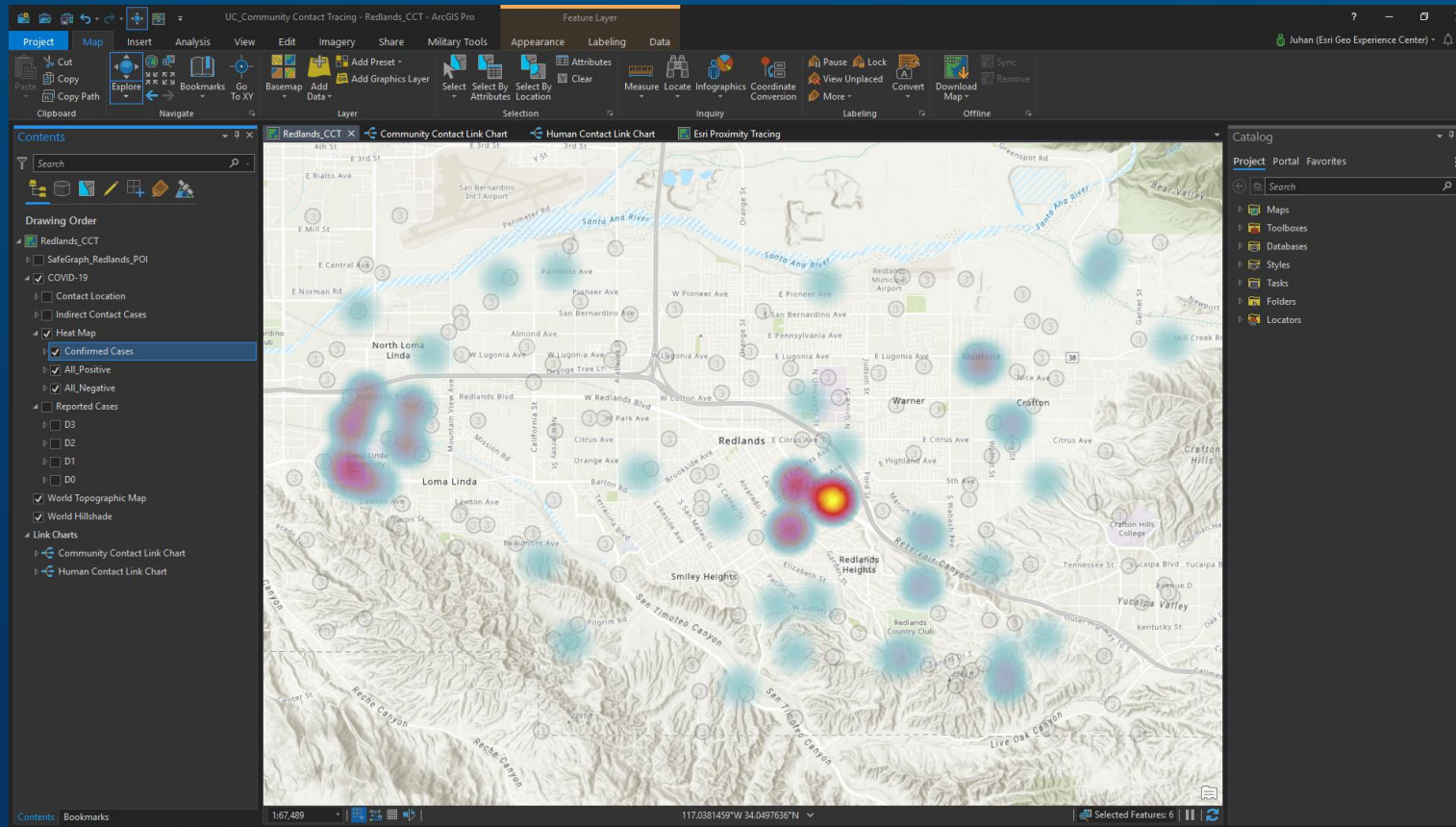
Map for Community Resilience | Visualize locations

Use Location Services to Geocode Addresses



Map for Community Resilience | Early Patterns

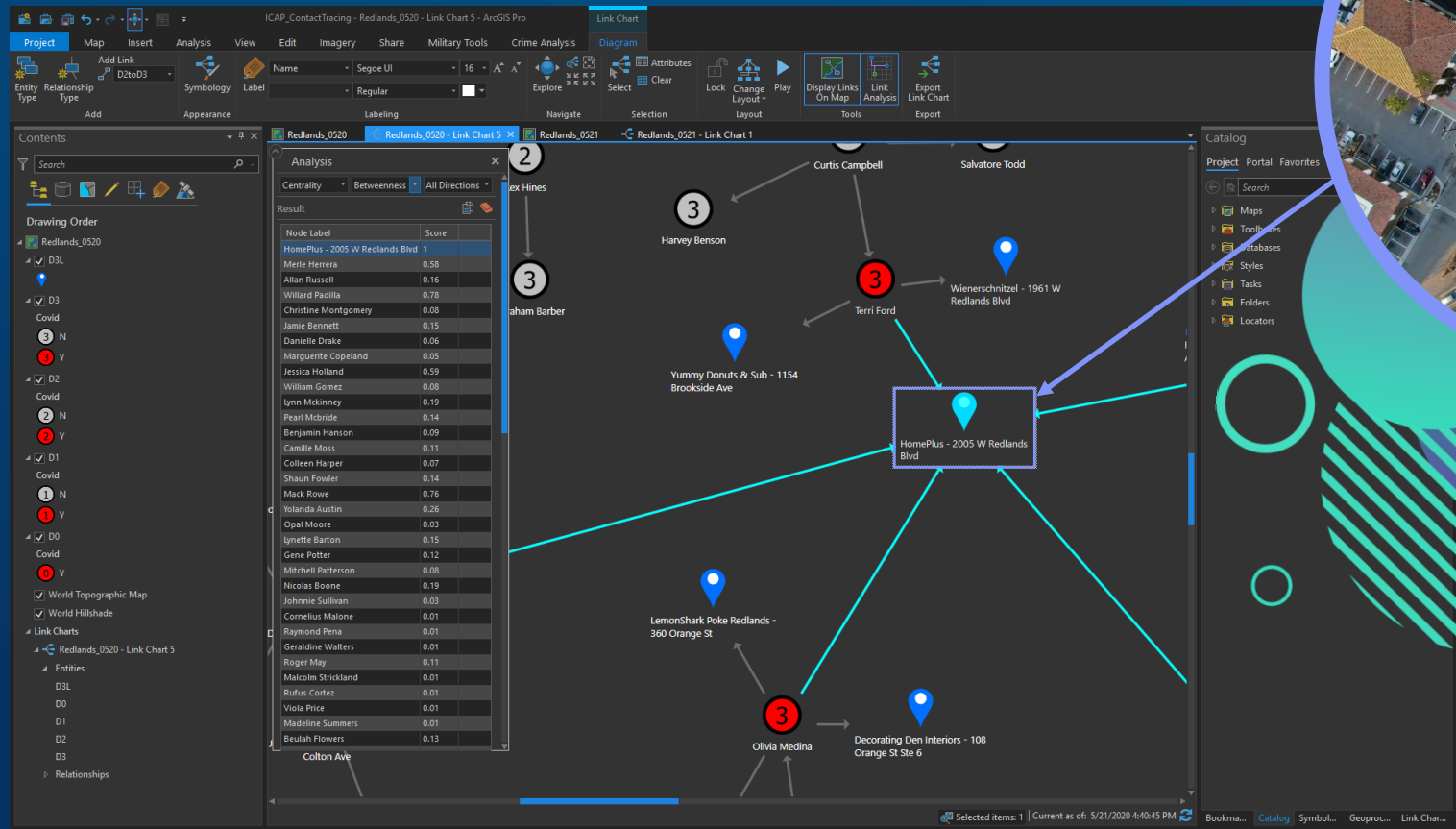
Identify High-Risk Areas In the Community



Showing Density of Cases

Map for Community Resilience | Analyze Connections

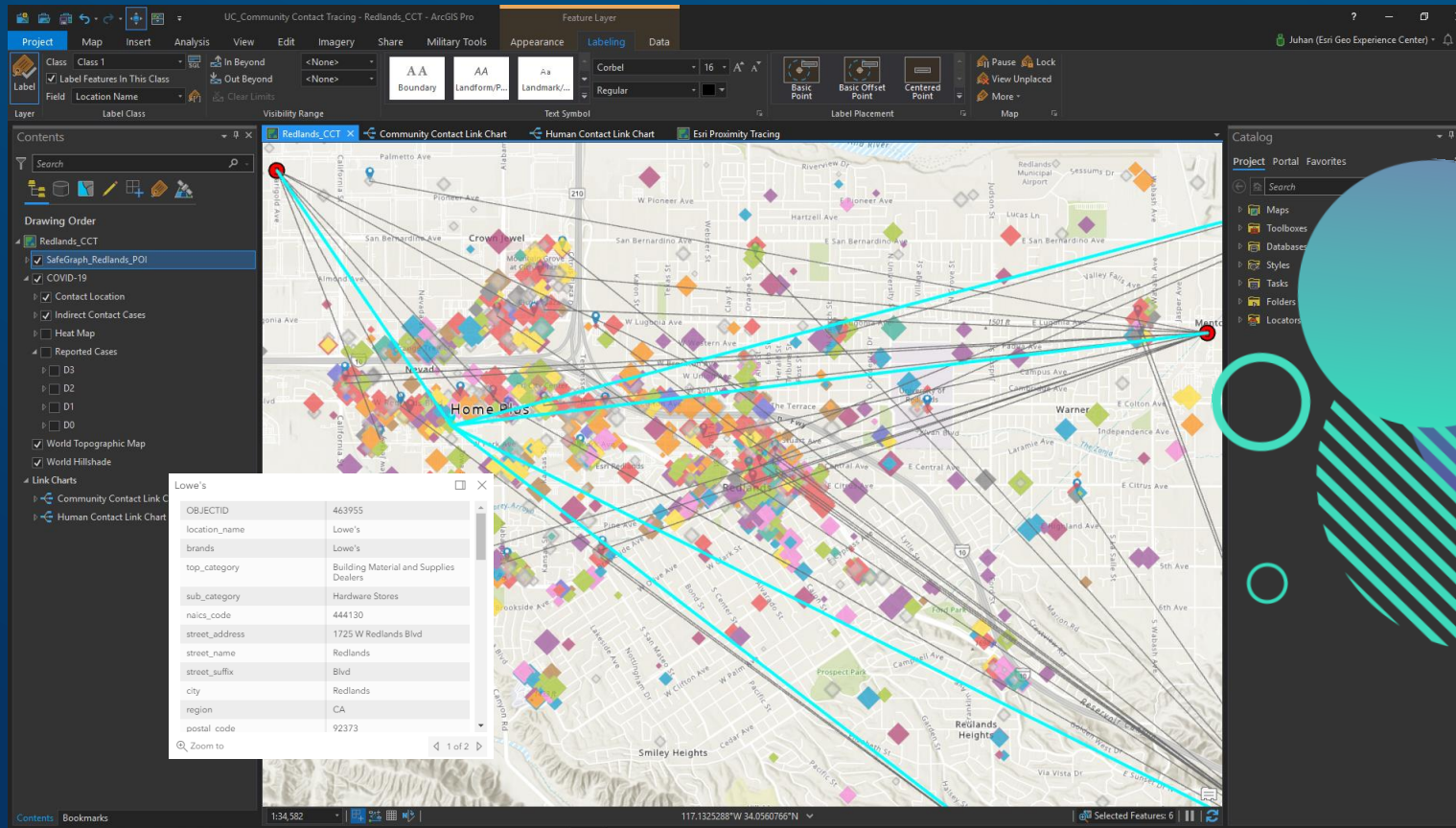
Perform Link Analysis & Apply Graph Theory



Showing Person-to-Person-to-Place Connections

Map for Community Resilience | Dive Deeper

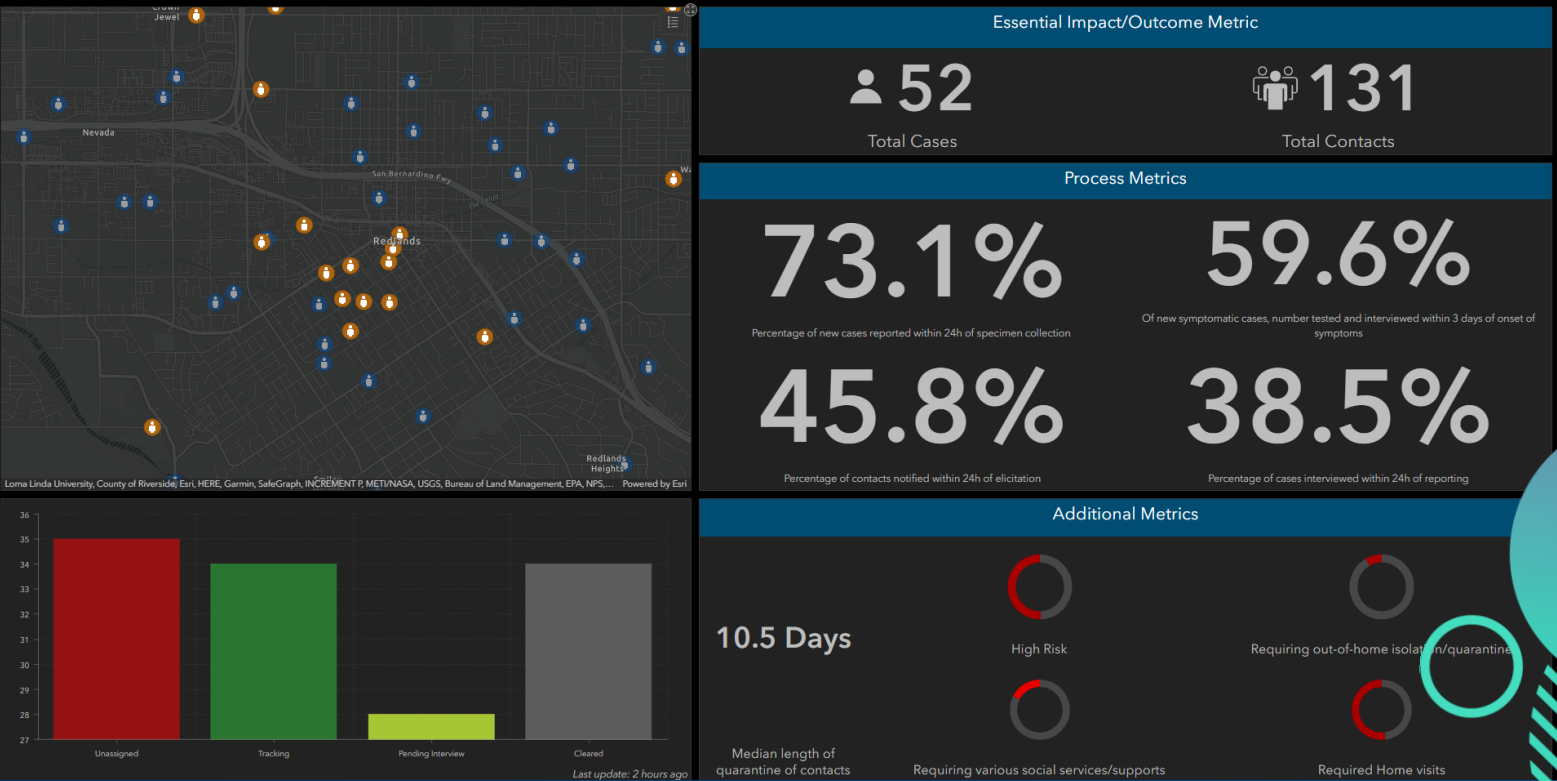
Improve Your Analysis With Data From *The Living Atlas*



Social Mobility Data From *The Living Atlas*

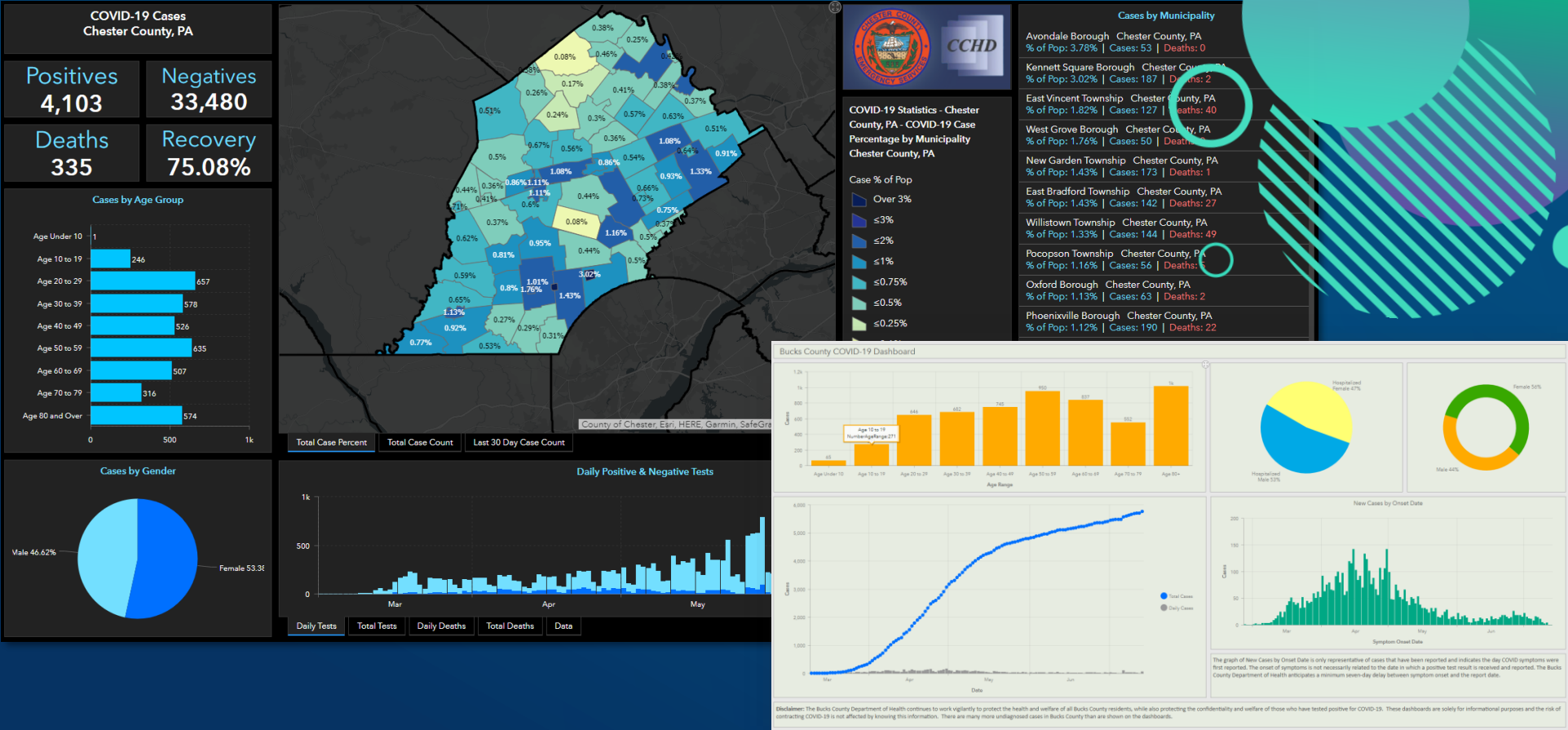
Map for Community Resilience | Evaluate Operations

Monitor Contact Tracing Activities



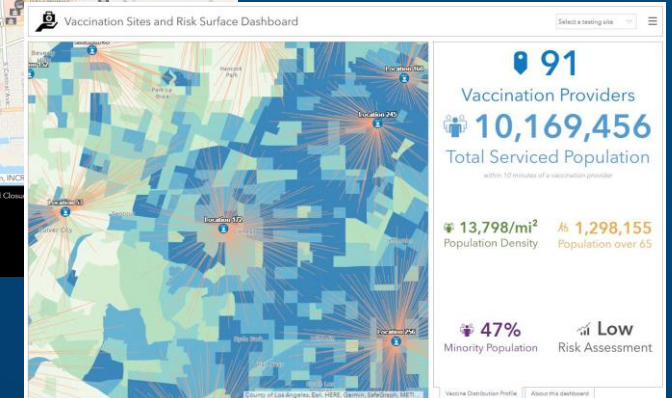
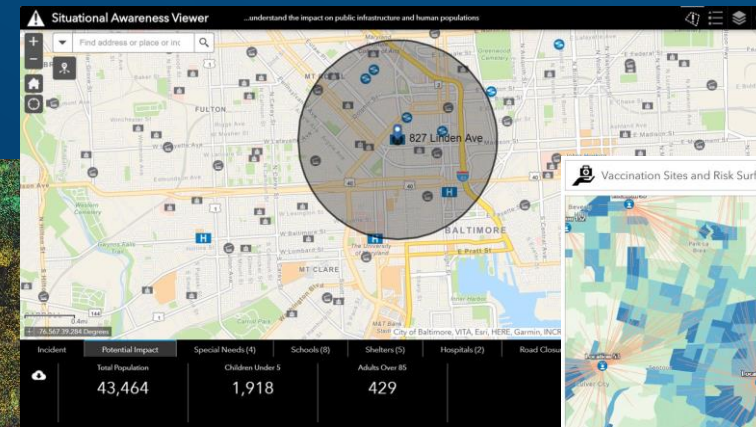
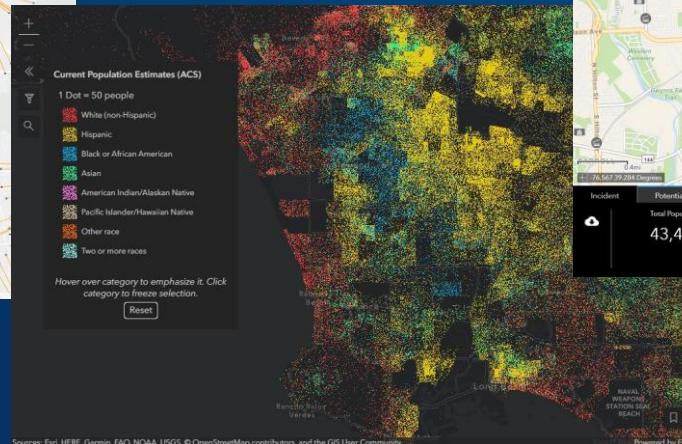
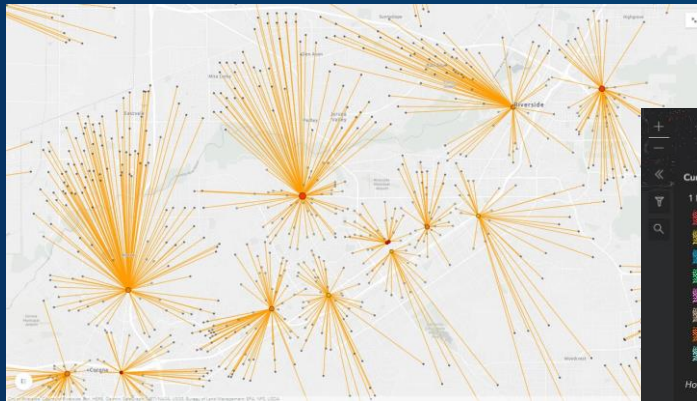
Map for Community Resilience | Improve Outcomes

Make Informed Decisions and Improve Outcomes



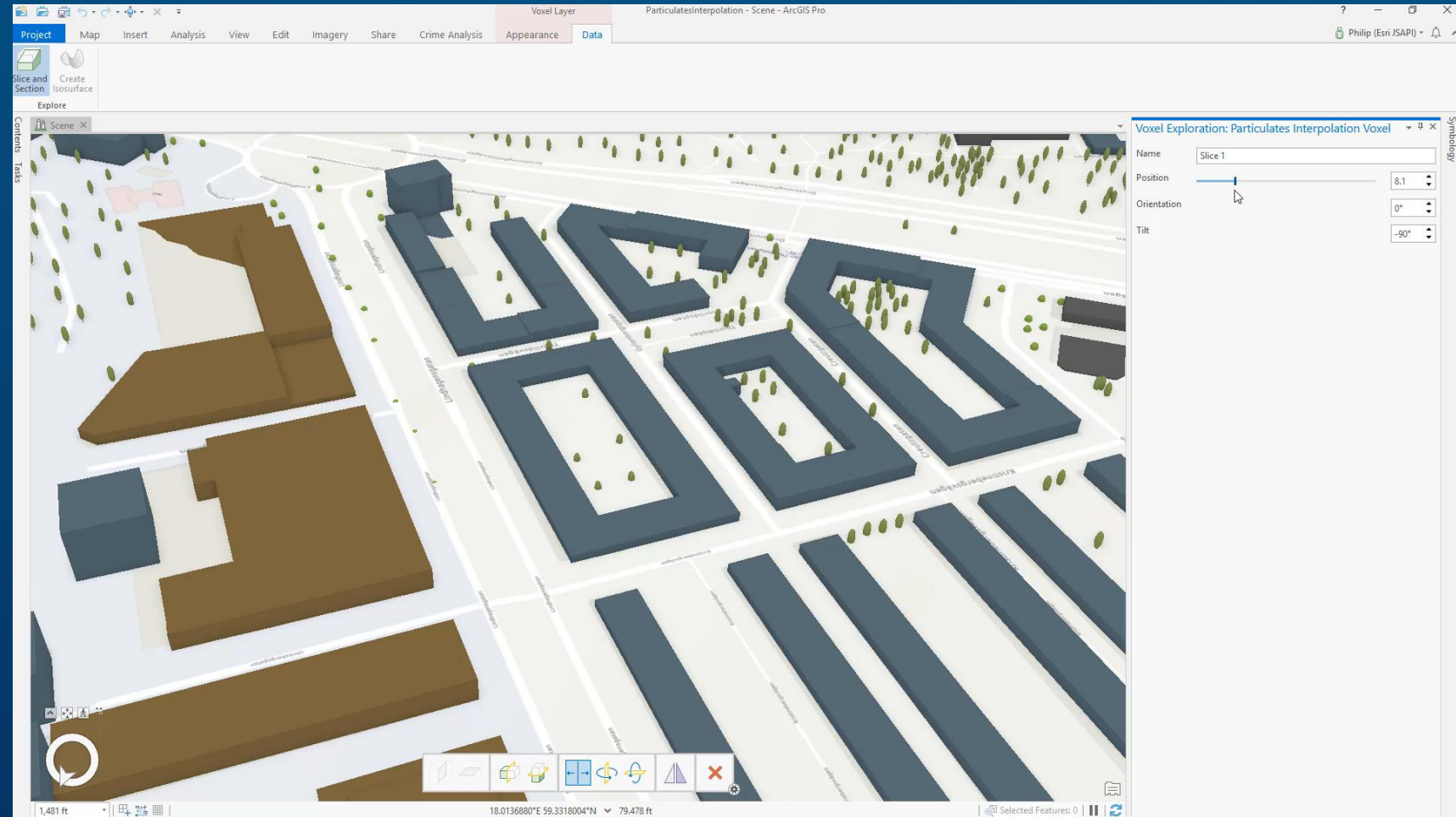
Map for Community Resilience | Efficient and Equitable Vaccines

1. Identify facilities capable of storing and distributing vaccine
2. Identify and prioritize critical populations
3. Identify gaps in access and formulate alternative distribution options
4. Implement a vaccine management and inventory system
5. Provide transparency and accurate communication

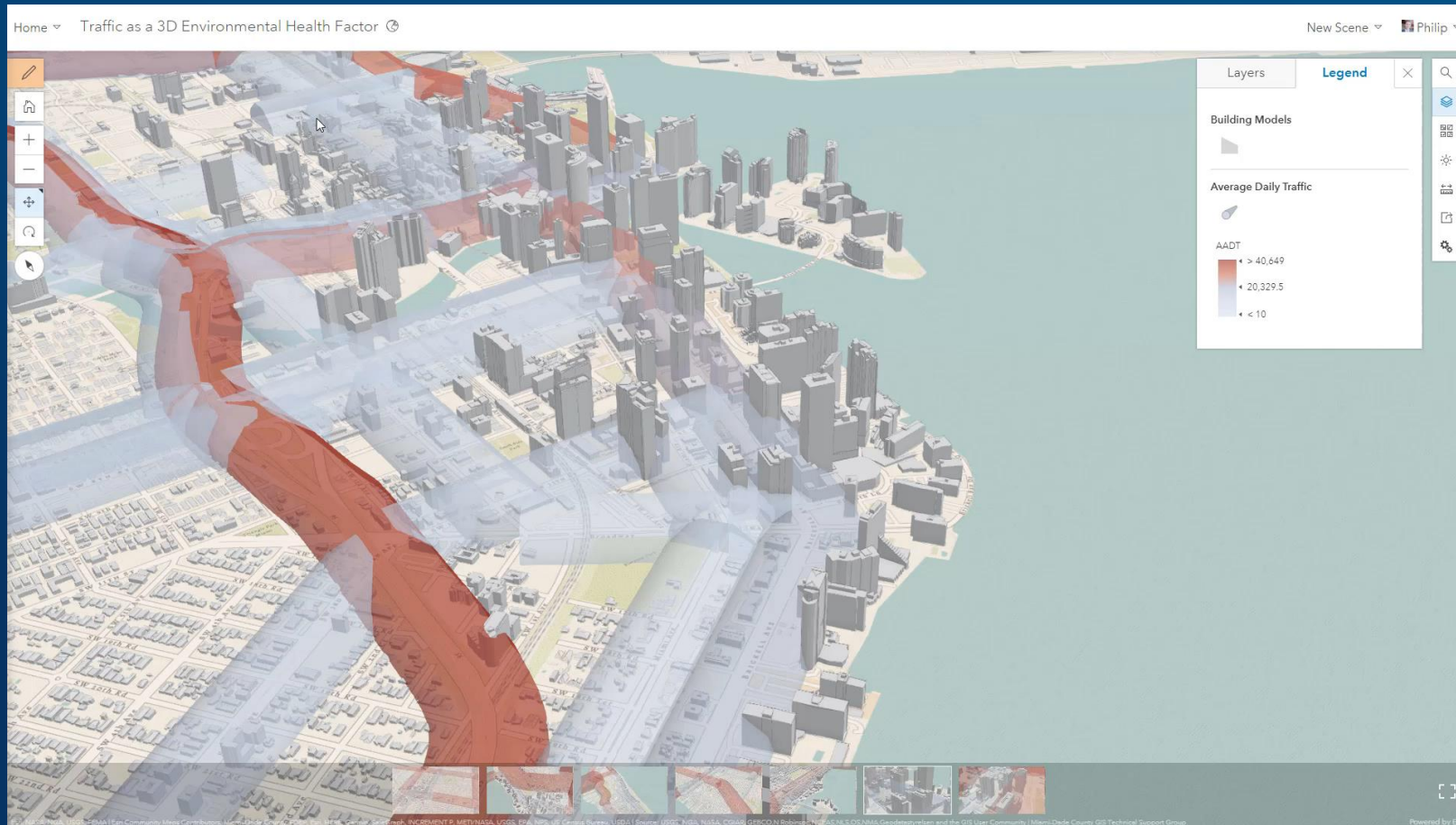


Map for Community Resilience | Interpolated particulates as voxels

- Voxels can store and display large volumes of 3D continuous data
- Interpolate readings in 3D with 3D Empirical Bayesian Kriging
- Slice, Section and create Isosurfaces of the Voxel Layer
- Visualize data with new symbology options



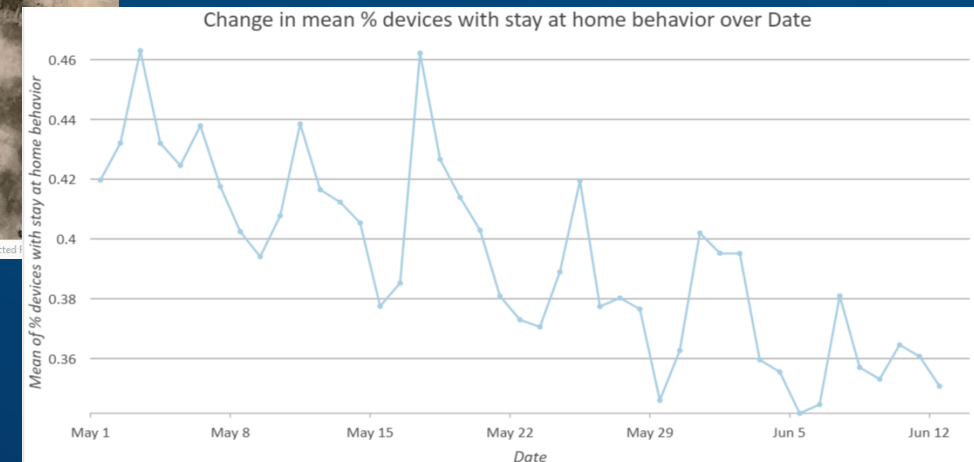
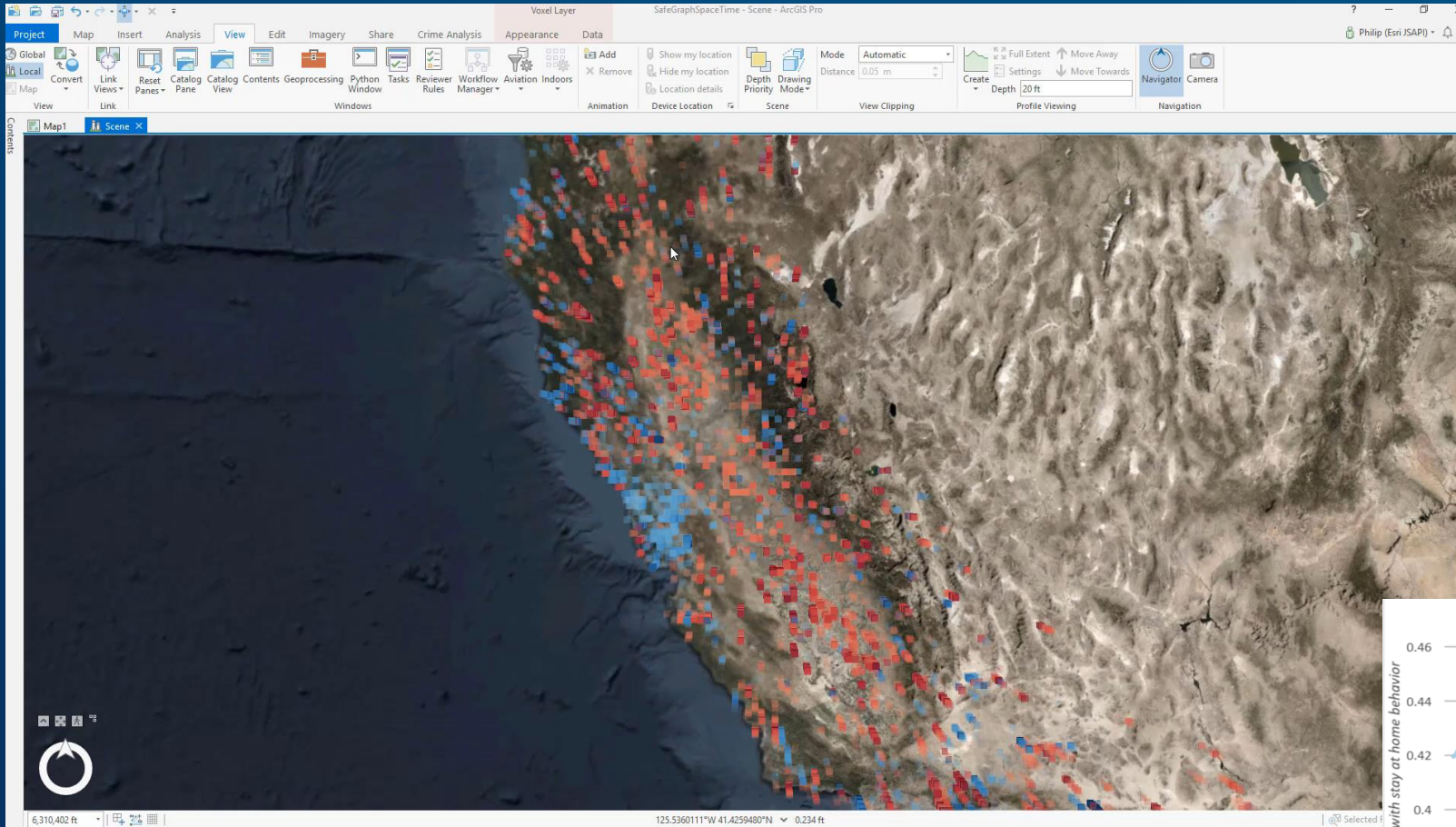
Map for Community Resilience | Traffic impact on urban environs



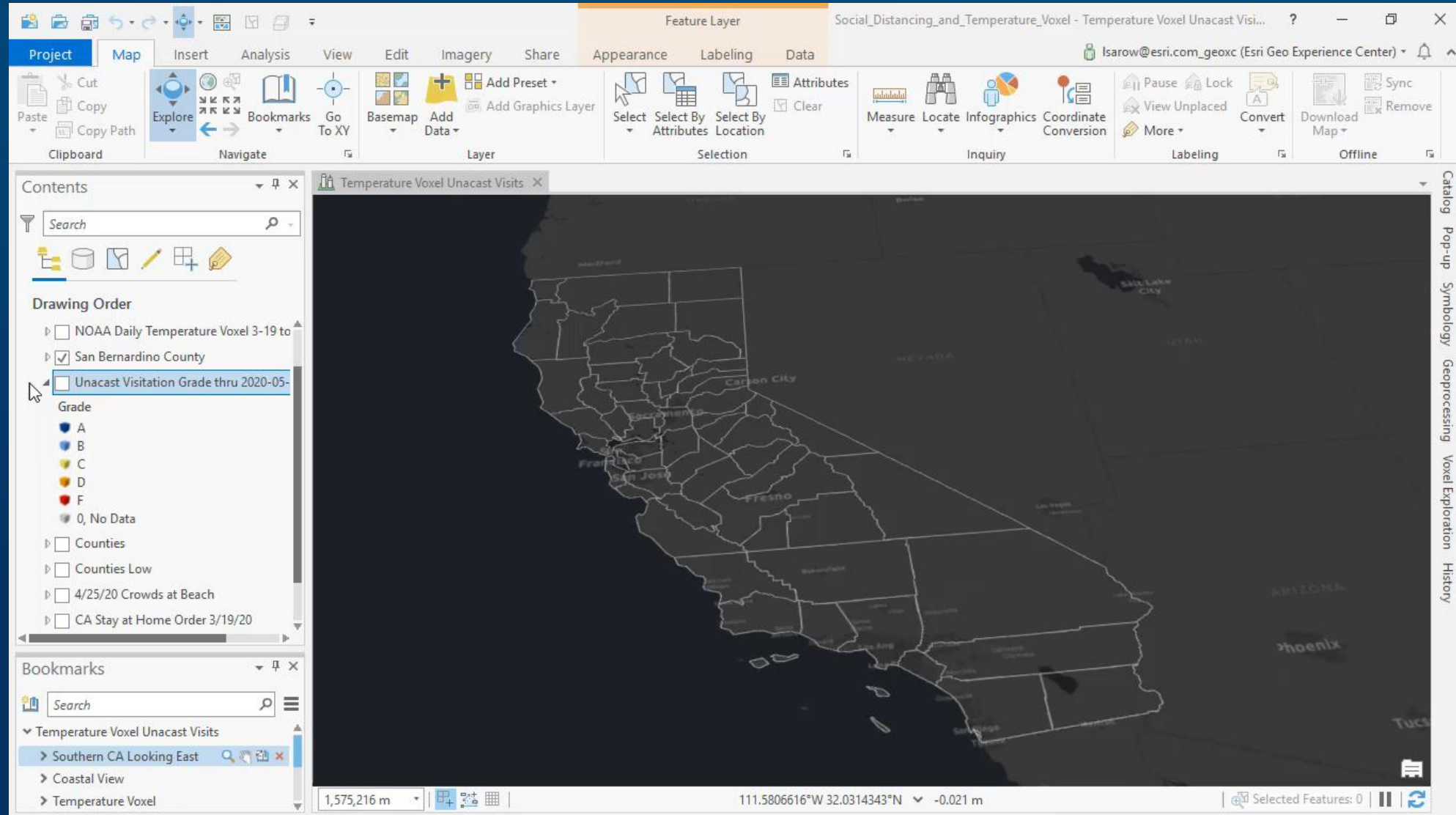
- Symbolize traffic volume by color
- Represent 200m from traffic source in 3D
- Understand impacted inhabitants in 3D

Map for Community Resilience | Social distancing, space time cubes

- 2 months of SafeGraph Social Distancing Data (May and June 2020)
- High Stay-at-home percentage in **Blue**, low in **Red**
- Identify statistically-significant trends and guide policy with response measures



Map for Community Resilience | Social distance, weather, cases

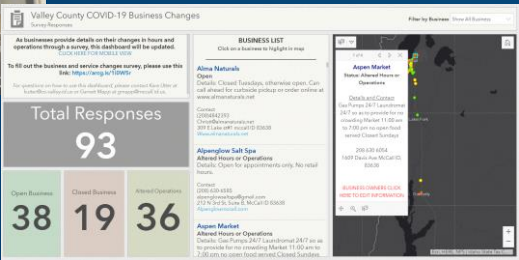
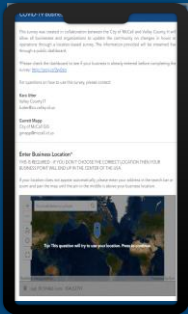


Map for Organizational Resilience| Promote business continuity

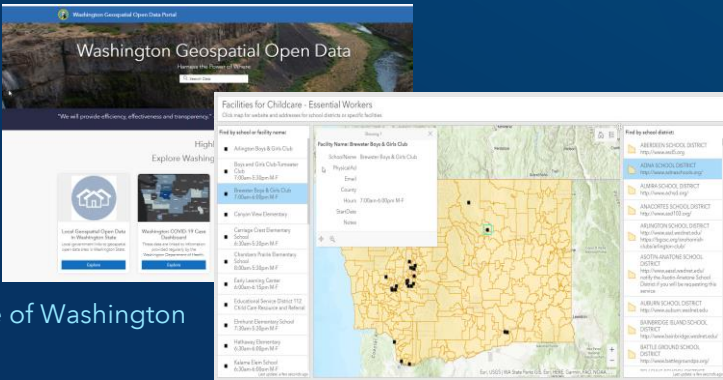
Surveying
Impact on Business



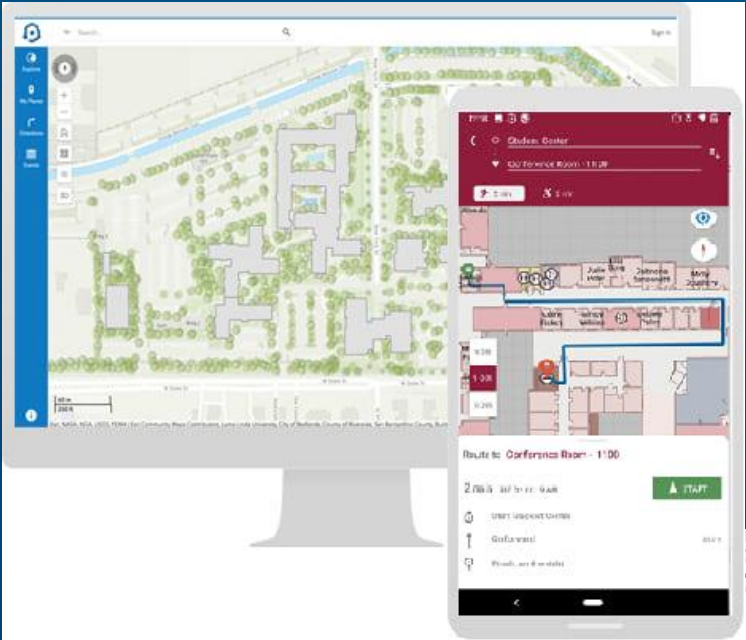
Valley County, ID



Workforce Support



State of Washington



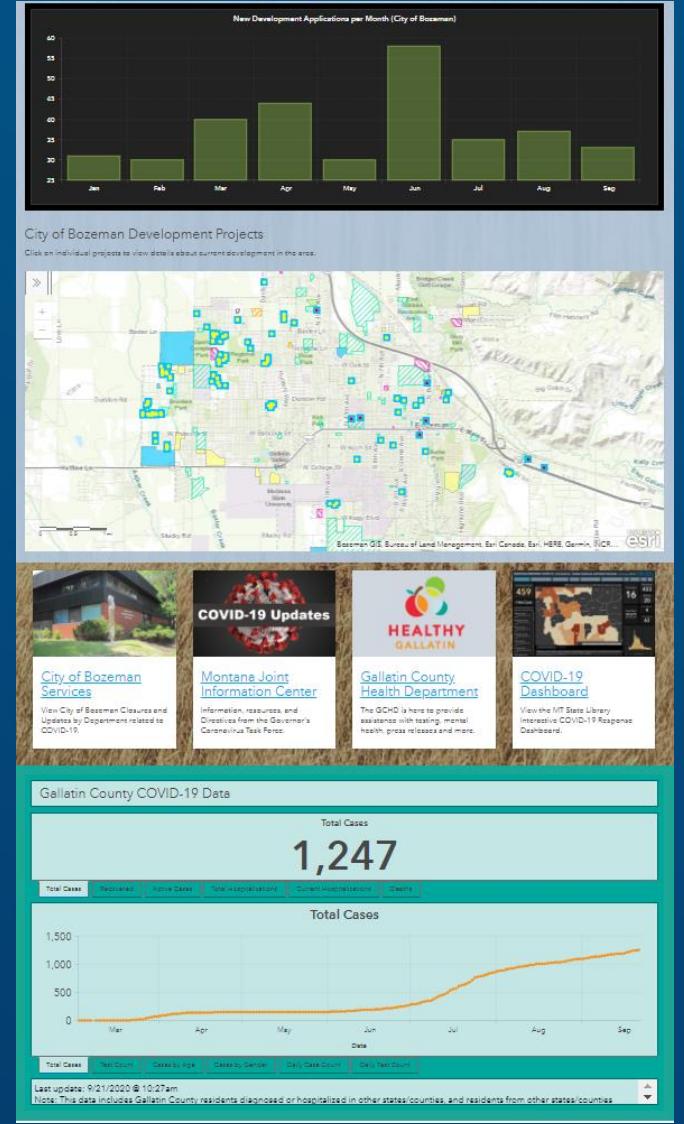
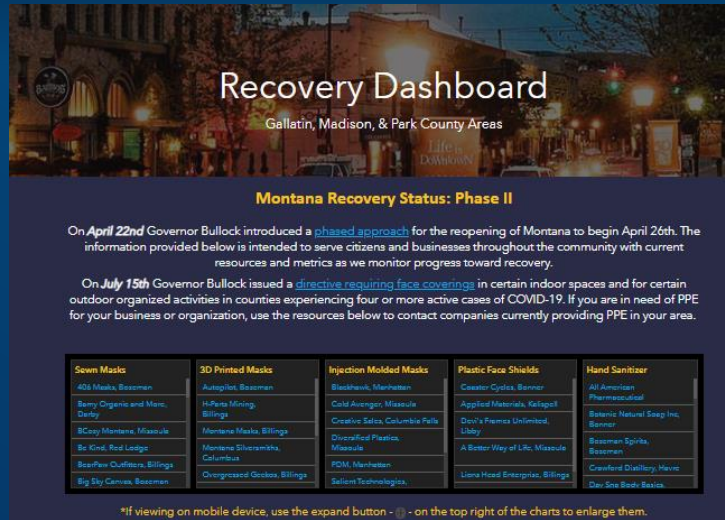
Facility Mapping & Space Management

Re-thinking social
distancing at the
workplace



Indoor / Outdoor Location Tracking

Map the Impacts | Keep health and economy in balance



City of Bozeman Development Projects

Click on individual projects to view details about current development in the area.

COVID-19 Updates

Information, resources, and directives from the Governor's Coronavirus Task Force.

HEALTHY GALLATIN

The GHCD is here to provide assistance with testing, mental health, group releases and more.

COVID-19 Dashboard

View the MT State Library Interactive COVID-19 Response Dashboard.

Gallatin County COVID-19 Data

Total Cases: 1,247

Last update: 9/21/2020 @ 10:27am
Note: This data includes Gallatin County residents diagnosed or hospitalized in other states/counties, and residents from other states/counties.

New Series: [ArcGIS Dashboards Training Videos](#)

COVID-19 GIS Hub

Get maps, datasets, applications, and more for coronavirus disease 2019 (COVID-19).

Check back often—these resources will be updated with new information as it becomes available.

[Request GIS assistance](#)

<https://coronavirus-resources.esri.com>