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# Using GIS for Modeling Regional Capabilities

## 2018

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**Abstract**: The Capability Development Framework (CDF) was originally created by the Center for Study of Terrorism at the University of Maryland to analyze the vulnerabilities of different regions within the United States to terrorists and nuclear threats. The project transitioned to Sandia National Laboratories in late 2017. Sandia is broadening CDF to incorporate other types of assessments including visually representing resources that mitigate the risks of Chemical, Biological, Radioactive, and Nuclear (CBRN) threats. The regional discrepancies between vulnerabilities and resources reveal capability gaps. CDF provides data collection, storage, and analysis tools which enable federal, state, and local officials to develop potential solutions to bridge these gaps. For prototype development, the CDF team is using publicly available data sets to emulate CBRN threats.

**Data Input:** CDF allows the user to import an external data set. For example, a spreadsheet containing metrics and results from a risk assessment analysis. This data set can then be used to generate visualizations and perform further analyses.



Fig. 1 demonstrates the web form for data input along with a sample of population and land area data.

**Data-Streaming:** The development team is currently working on incorporating live data-streaming. For example, regions with active weather alerts are highlighted on the CDF map; clicking on a highlighted region provides additional information.
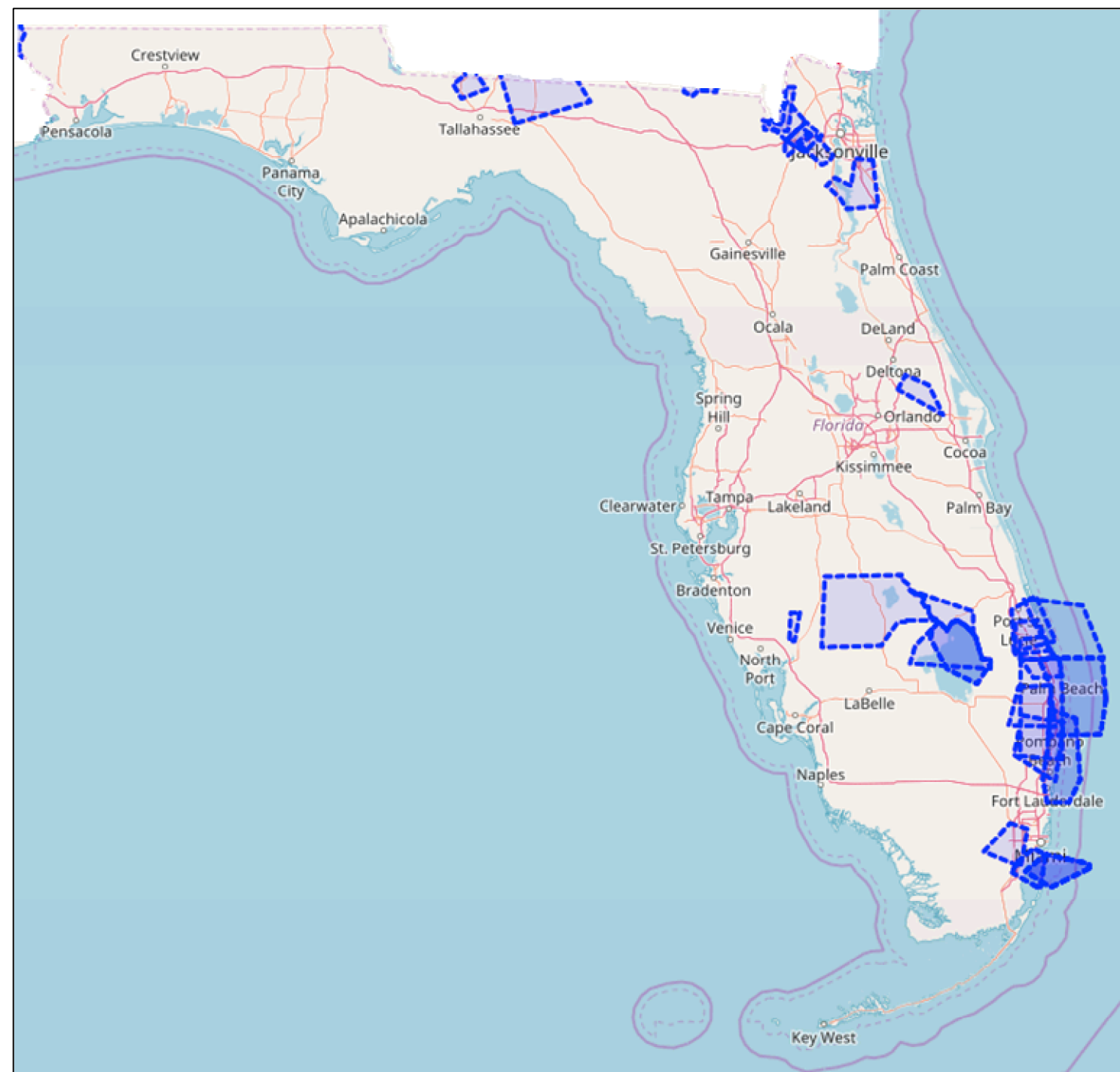


Fig. 2 shows weather alerts from the National Weather Service (api.weather.gov) in the state of Florida.

**Creating Regions:** CDF can visualize custom regions on a map. This is accomplished through drawing the region with GIS software, combining existing regions such as states into federal regions, or directly inputting the geometric coordinates of a new region.
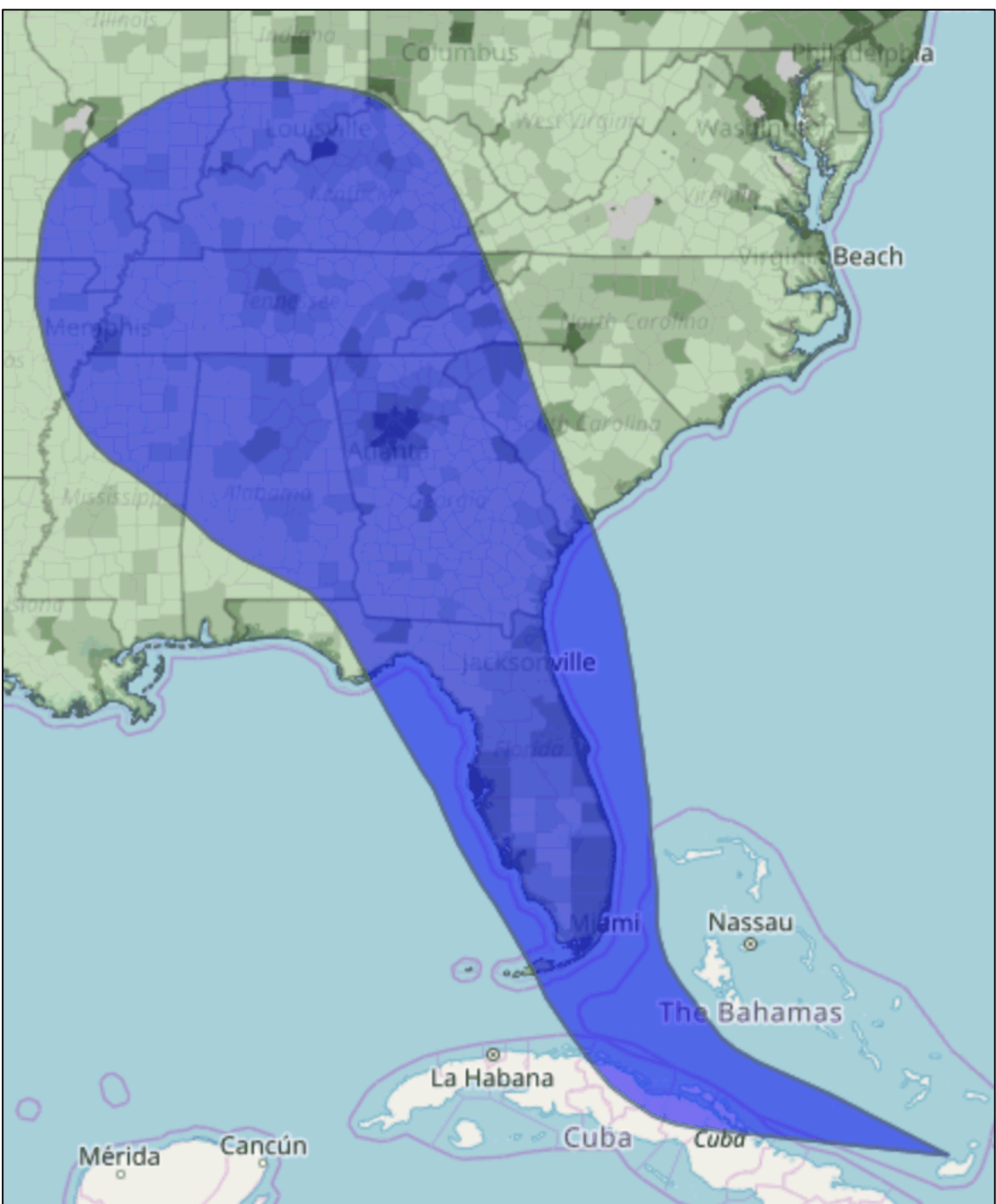


Fig. 3 visualizes the path of hurricane Irma as a custom layer.

**Database Upgrade:** The framework was originally designed so that each user is able to manage only one region. This is intended for local officials and first responders to be able to monitor and input data to analyze their region. The team is restructuring the database to allow a user to manage multiple regions. For example, this feature enables a FEMA official to coordinate disaster relief efforts in multiple regions.
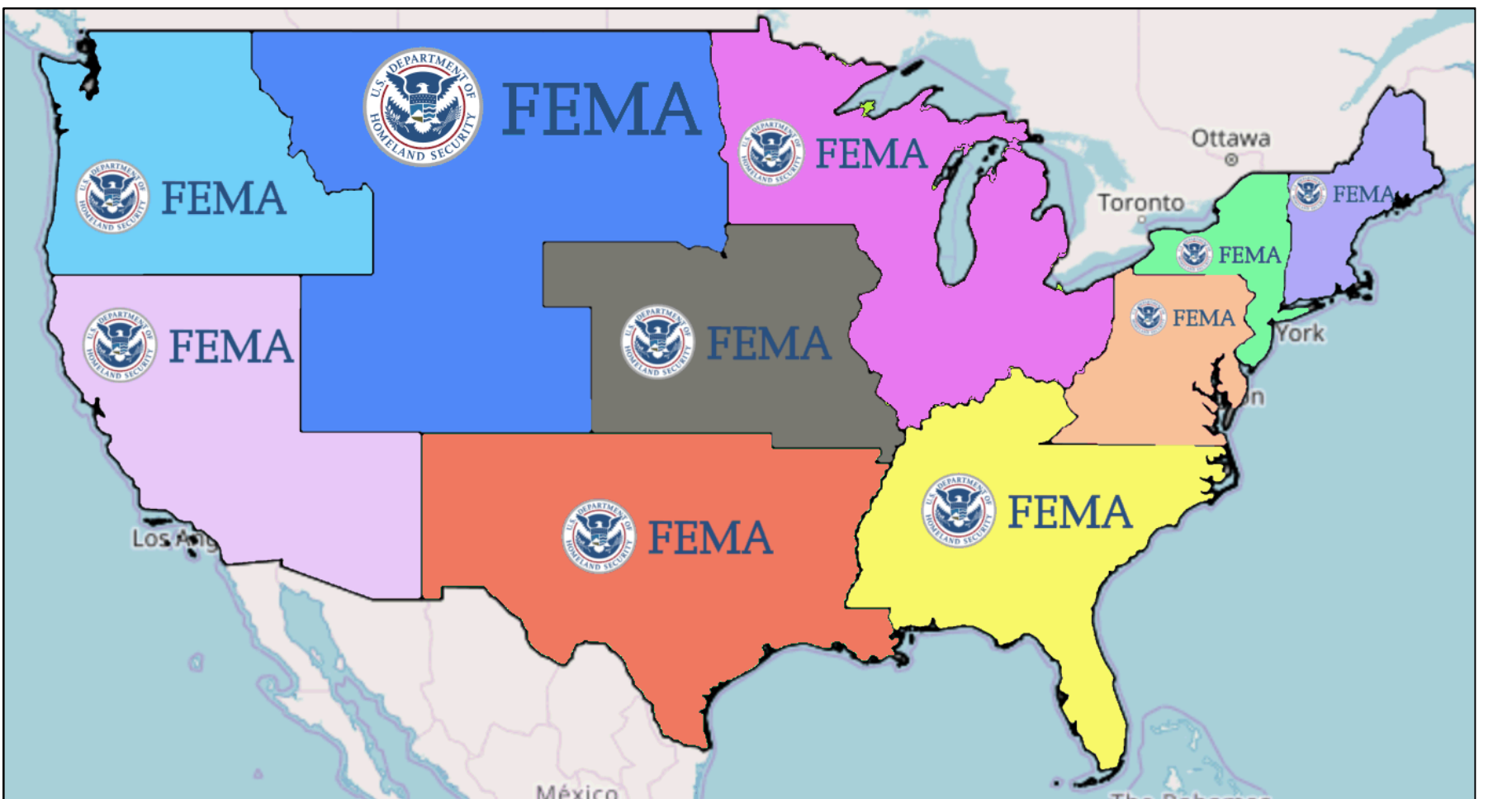


Fig. 4 is an example of an organization (www.fema.gov) managing multiple regions.

### Exploring Data Visualization
The CDF team is exploring the integration of GIS and data visualization technologies.



Fig. 5 shows a heatmap depicting high earthquake activity areas (www.openlayers.org).
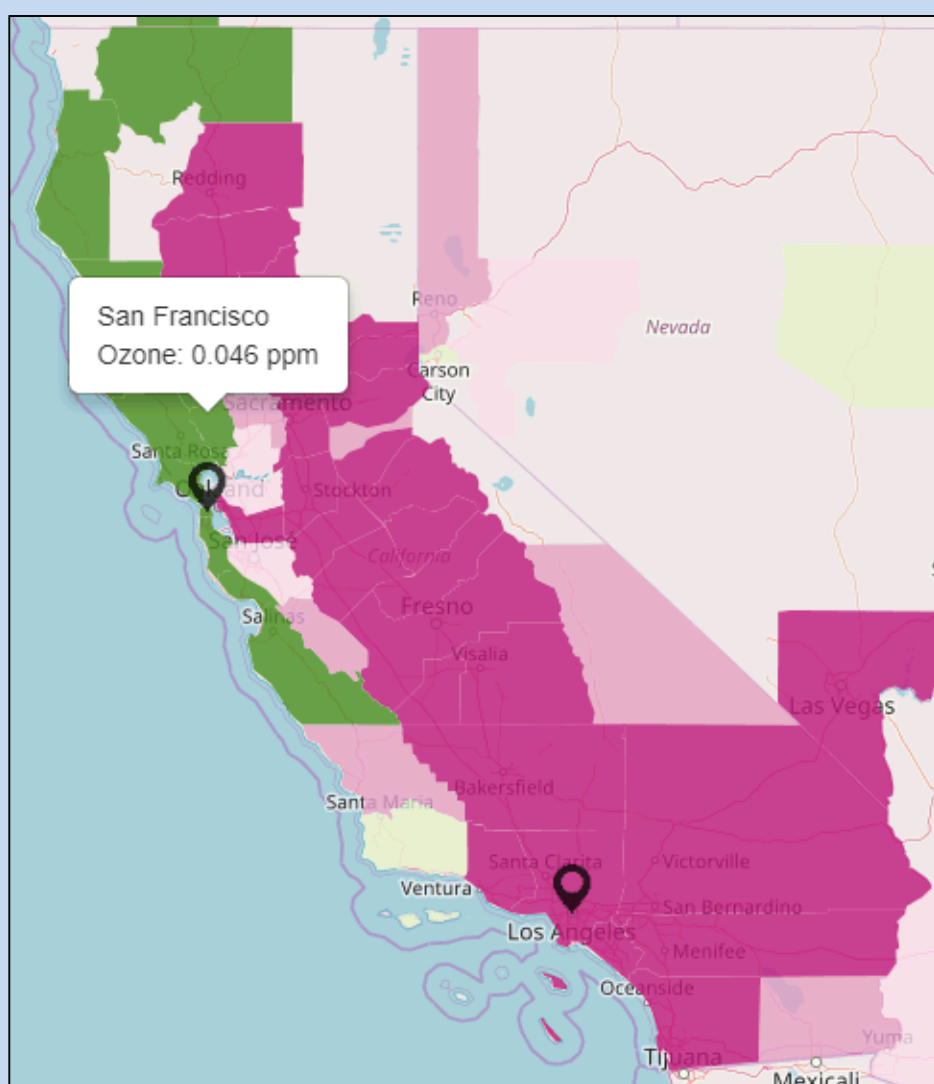


Fig. 6 depicts ozone levels (www.epa.gov) by county. Mouseovers display ozone in parts per million (ppm).
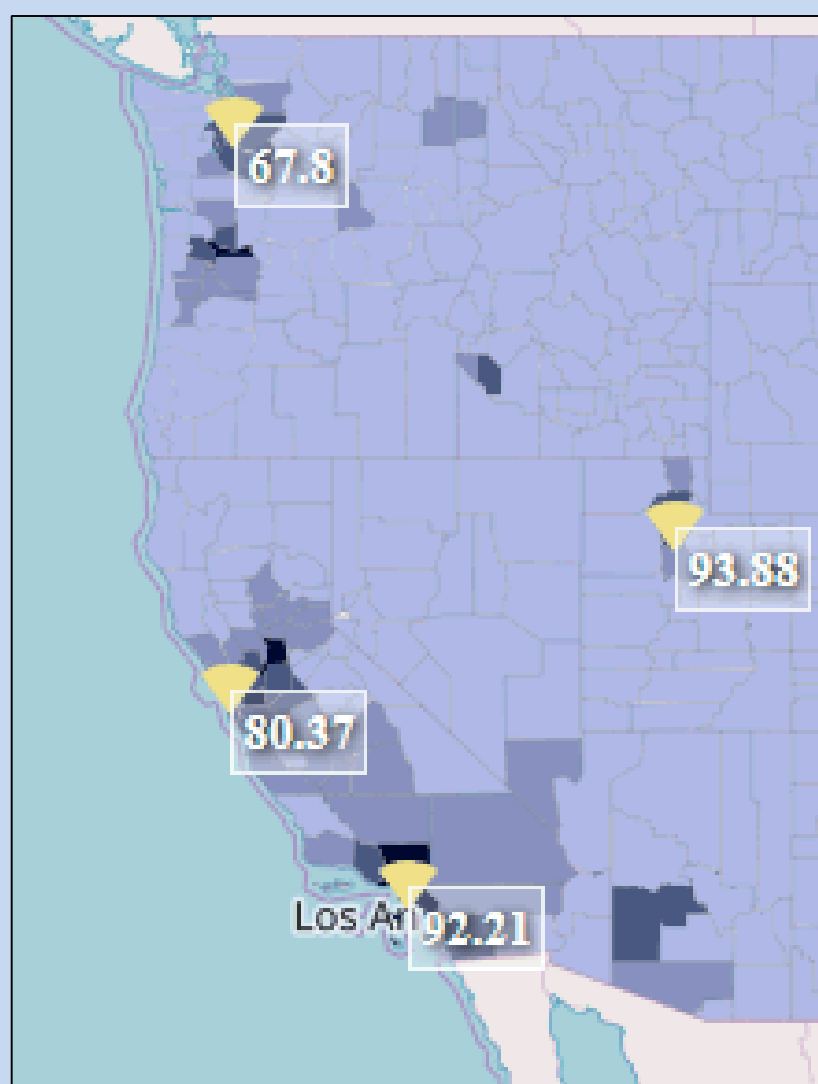


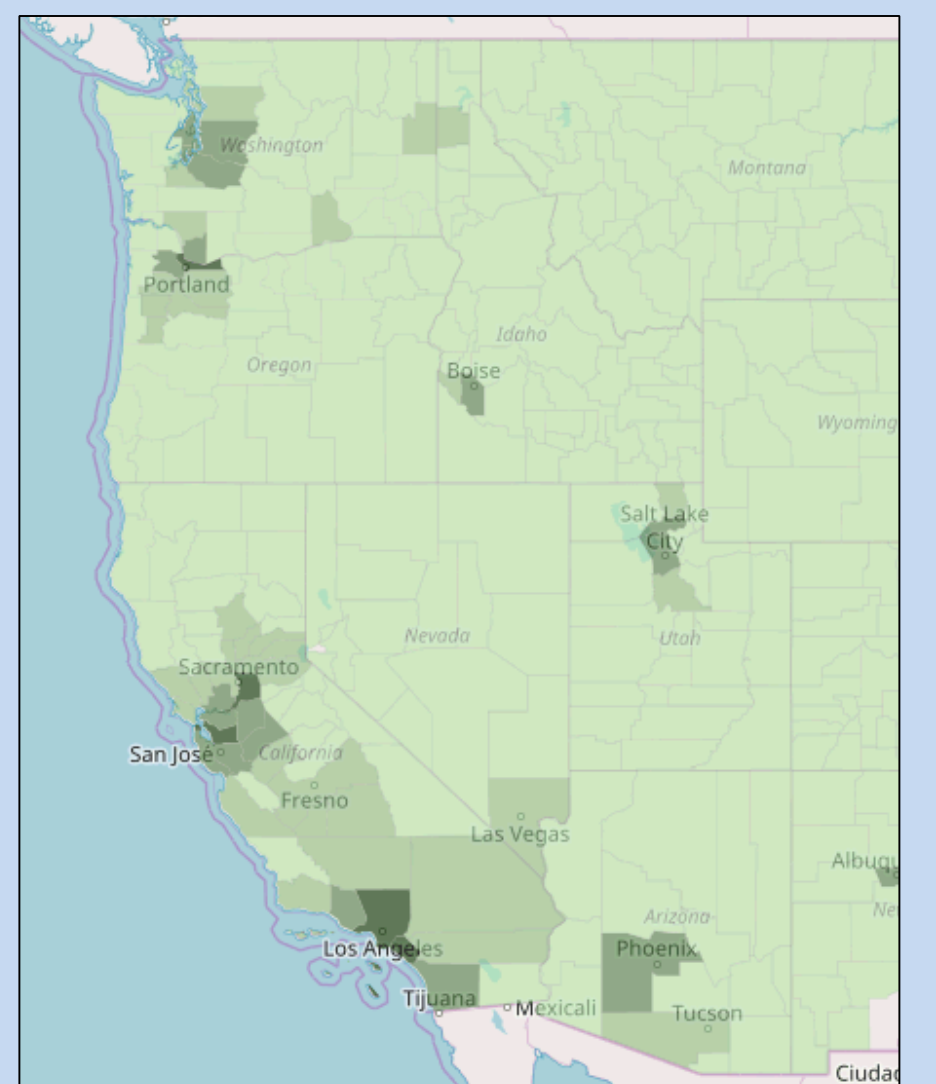Fig. 7 depicts real-time temperature data (www.openweathermap.org) for major metropolitan cities.



Fig. 8 shows population density (www.census.gov) by county.

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