Decision Support Systems: An Interdisciplinary Geospatial Perspective to Tornado Warning Forecast Areas

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A.) Motivation

Between 2007 and 2014, the continental United States experienced 9,928 tornadoes amounting to over $24 billion dollars in damages and property loss [1]. Despite timely radar scans and advanced weather models, causalities still occurred. Unfortunately, this means that people may not be responding to warnings appropriately. This project will look at how people respond to variations in weather forecasts. It will provide decision-makers with specific physical and social attributes of their forecast area

B.) Research Questions

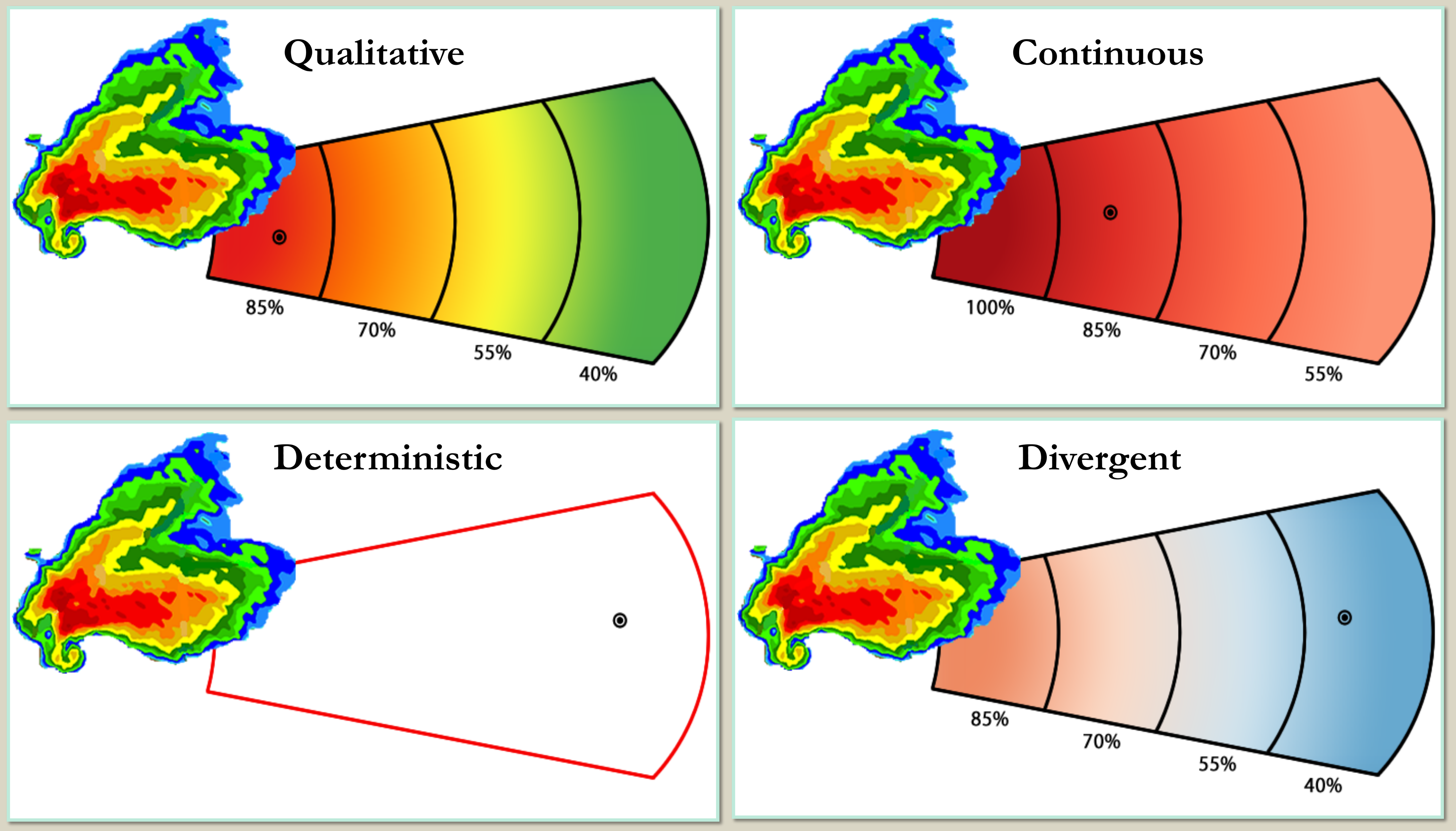
What are the geographic factors that influence public response to tornado warnings?

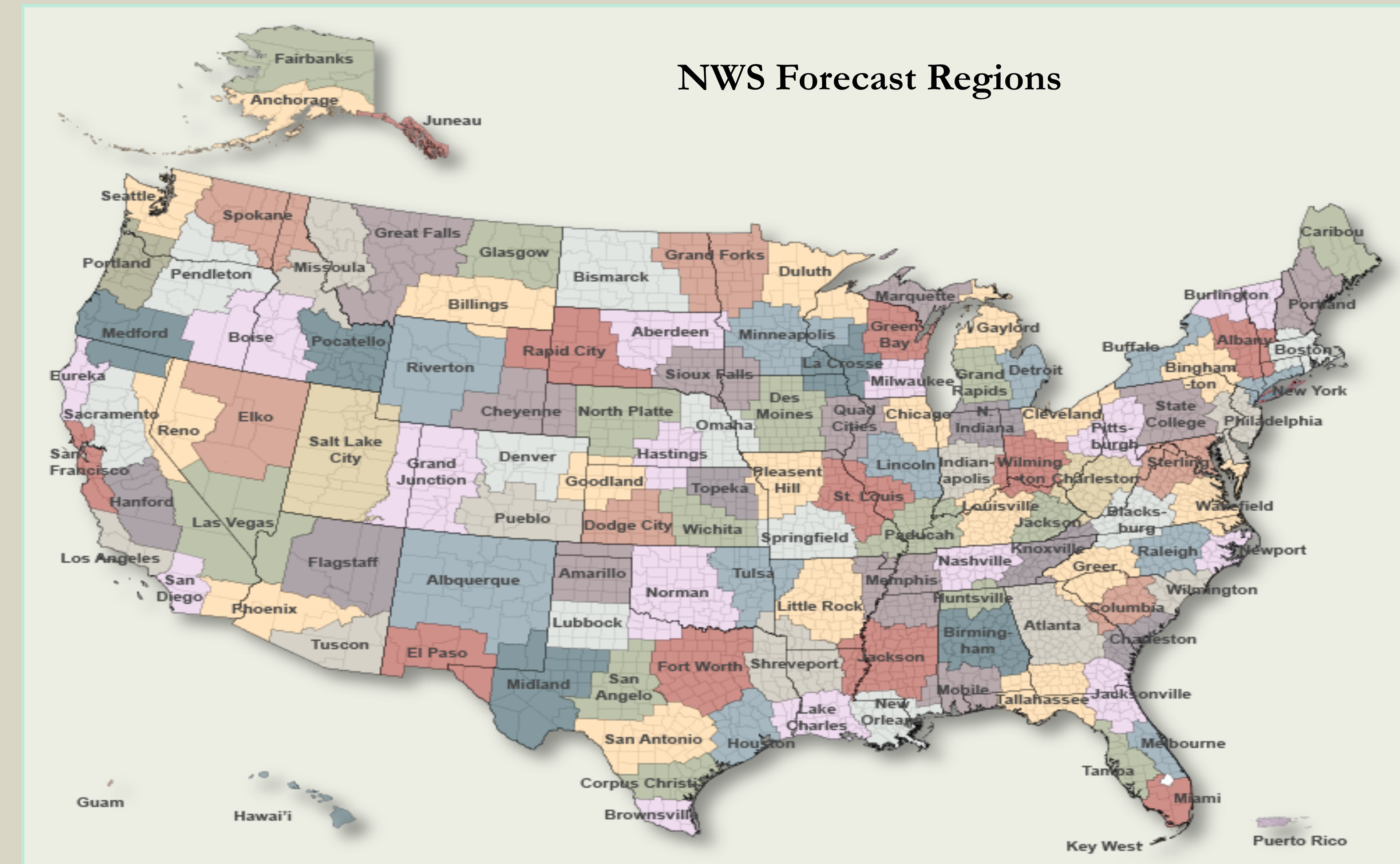
How can decision-makers use these factors to better inform the public?

C.) Background

The National Weather Service (NWS) is the only federal agency with a mandate to issue warnings for weather directly to the public [3]. Each weather forecast office follows standard forecasting procedures without much flexibility. The forecasts are then communicated through a variety of methods: visually, verbally, and with textual support, but we still do not understand how individuals respond to these specific communication methods. Further, response habits of people and their knowledge of severe weather impacts varies geographically and socially [3, 4]. The literature calls for additional insight to the spatial variation of public decision-making during the onset of severe weather [5,6].

Samples of tornado warning graphic color schemes surveyed to participants.





D.) Data

Survey participant data was collected through a Tornado Simulation Experiment survey by Klockow, 2013. The experiment was a simulated decision-making platform, where respondents were asked to make decisions based on the hypothetical role of airport managers. They were given a visualizations of a storm warning with forecast impact area. (See images above).

- N=5,564
- ~50 respondents per state
- Generalizes to decision-makers in tornado warning scenarios
- Can be clustered according to the 122 NWS forecast regions. (See map in upper right.)
- Limitations
- The survey was an online experiment that may not necessarily translate to behavior. We do not have the exact location of participants, only zip code.

E.)Methods

Test the following variables at each of the NWS forecast regions

- Socioeconomic status, Tornado vulnerability, Ages of participants, Proximity to urban area, Population, Physical geographic attributes, Scale - Dimension of geographic area

Analytics

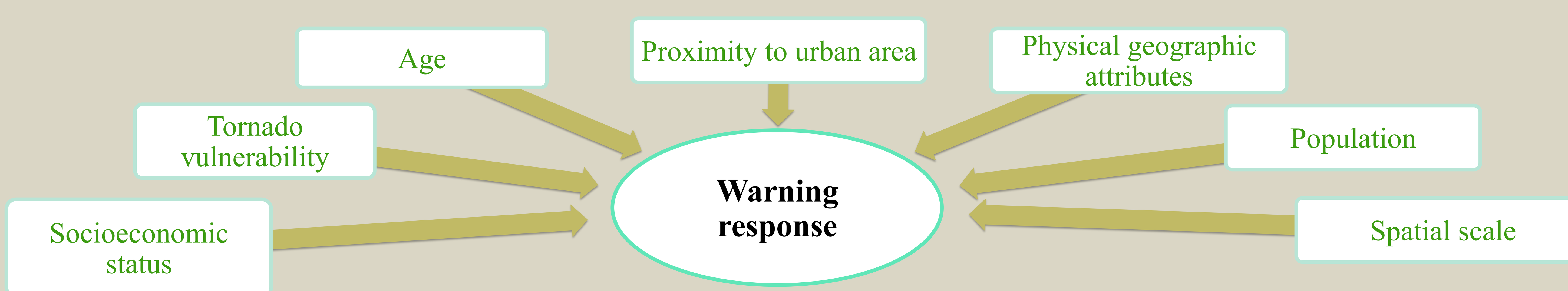
- Principal Component Analysis (PCA)
- Hotspot analysis
- Geo-processing

E.) Broader Impacts

The research results will be integrated into efforts to enhance warning graphics through the National Weather Service.

Deliverables will include a set of digital maps that visualize response rate by population, tornado vulnerability, etc. These maps will be useful to forecasters for understanding the choices made by individuals in their forecast regions.

Also, the completed digital map will be optimized for additional data integration or information that may extend beyond the scope of this project.



Literature Cited

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(Golden and Adams, 2000)
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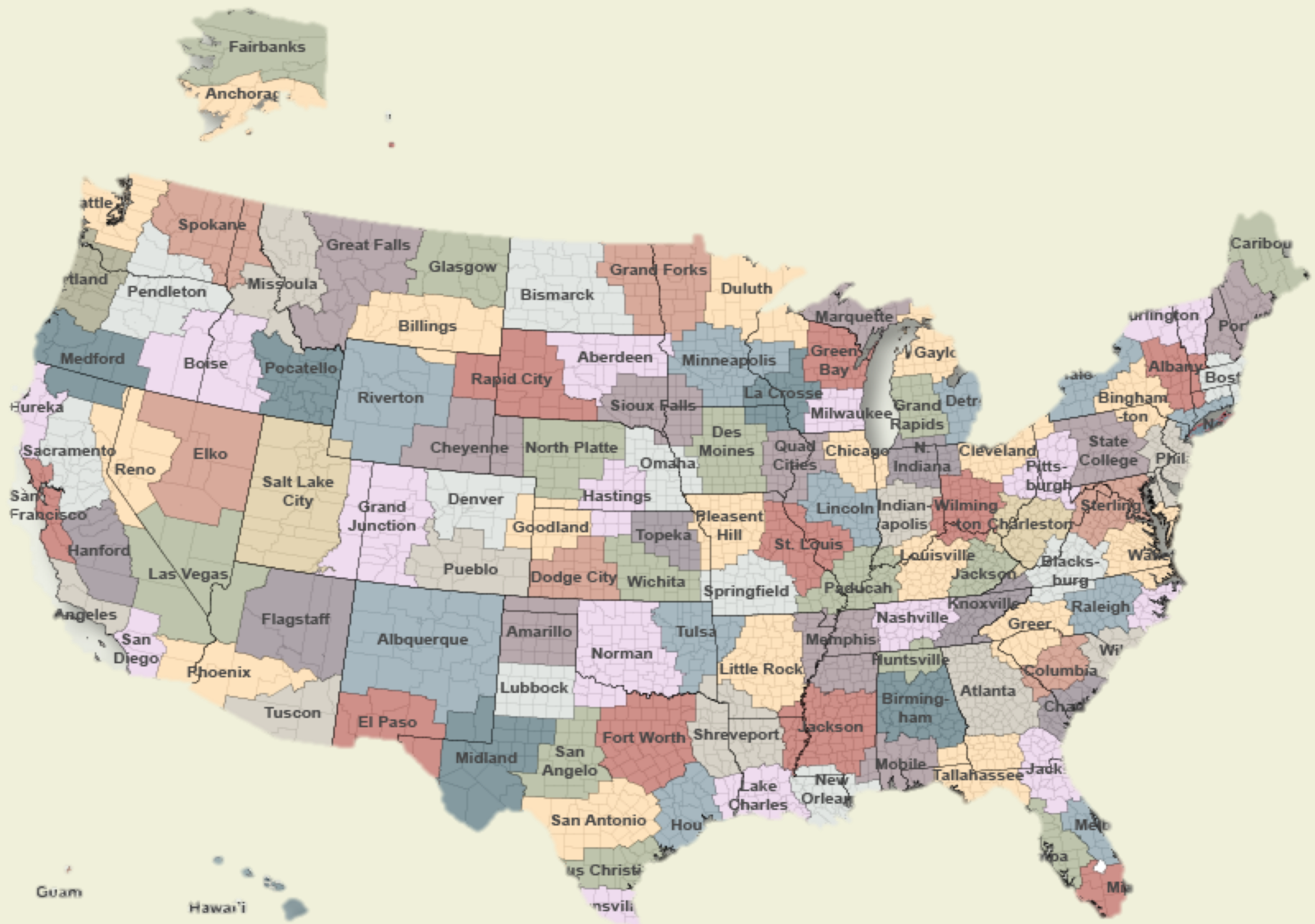
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