Spatial Relationships and Patterns: An Introduction

Miriam Schmidts

Nicholas M. Giner

July 13, 2017

Agenda

- What are spatial data and spatial relationships?
- Categories of spatial analysis
- Examples: Analyzing Distance
- Examples: Analyzing Coincidence and Containment
- Examples: Finding the best locations and paths
- Examples: Detecting and quantifying patters
- Examples: Making predictions

Spatial data

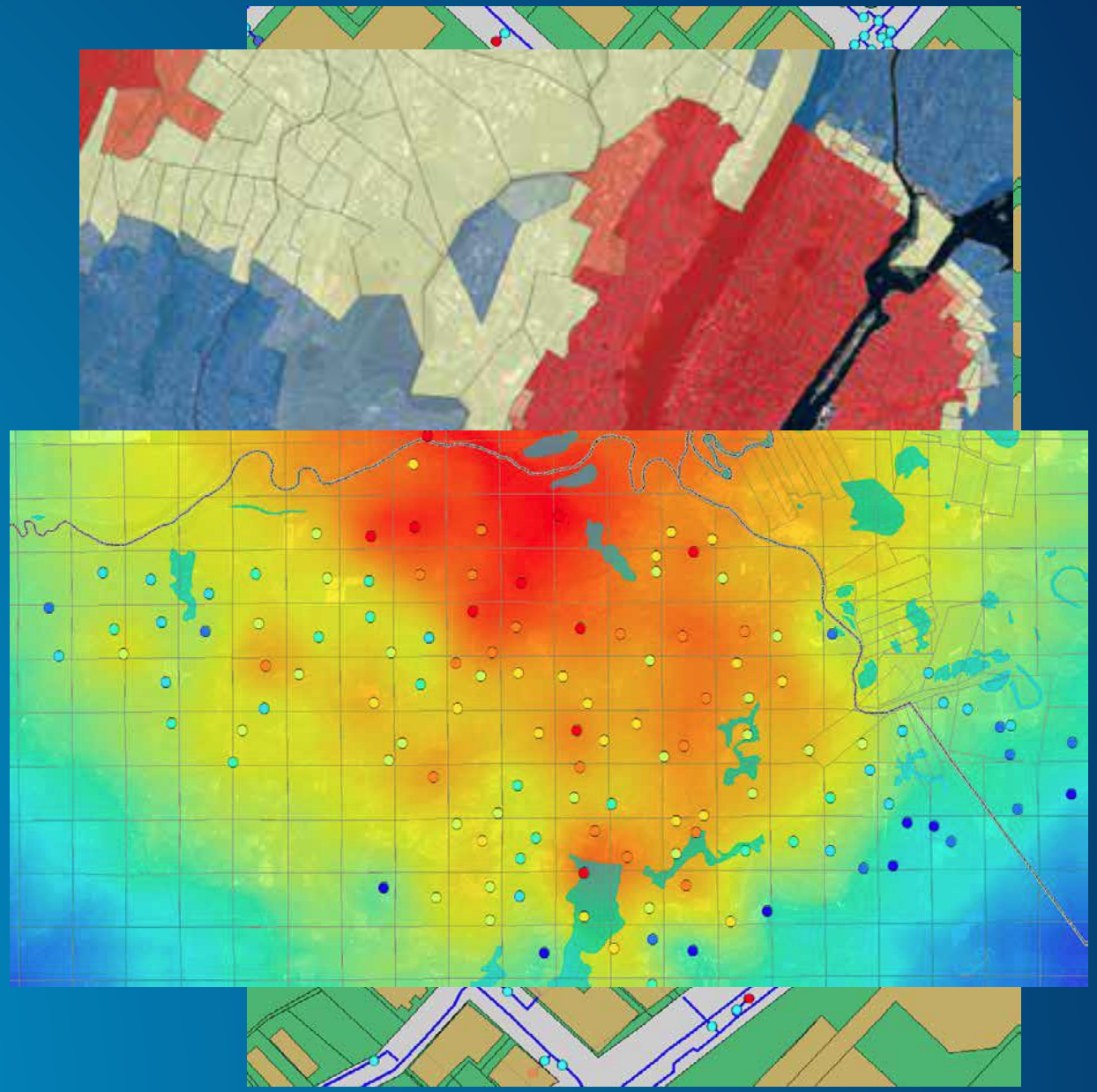
- Location information
  - Coordinates
  - Addresses
  - Place Names
- Place data on a map!
  - Features
  - Understand where features are
  - Understand how features relate to one another

Spatial Relationships

- Distance
- Connectivity
- Containment
- Adjacency
- Coincidence

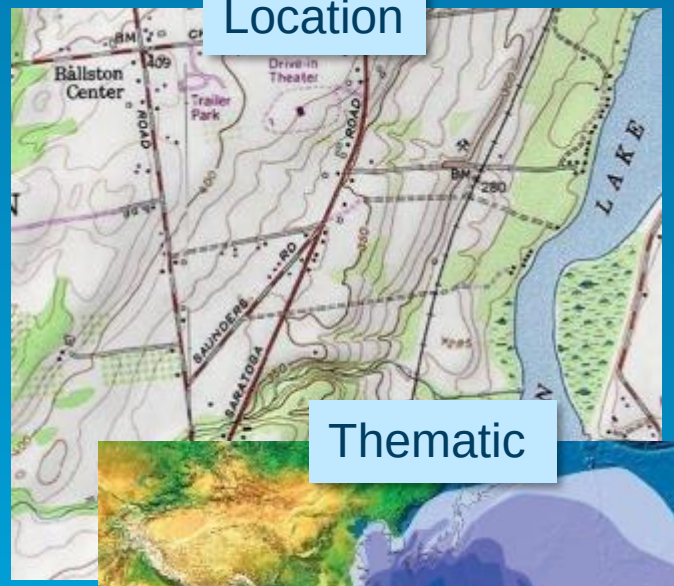
Categories of spatial analysis

- Understanding where
- Measuring size, shape and distribution
- Determining how places are related
- Finding the best locations and paths
- Detecting and quantifying patterns
- Making predictions



Examples: Understanding where

Location

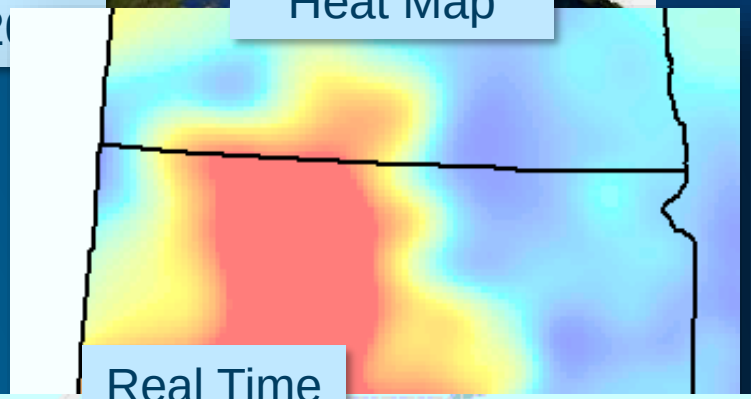


Comparative

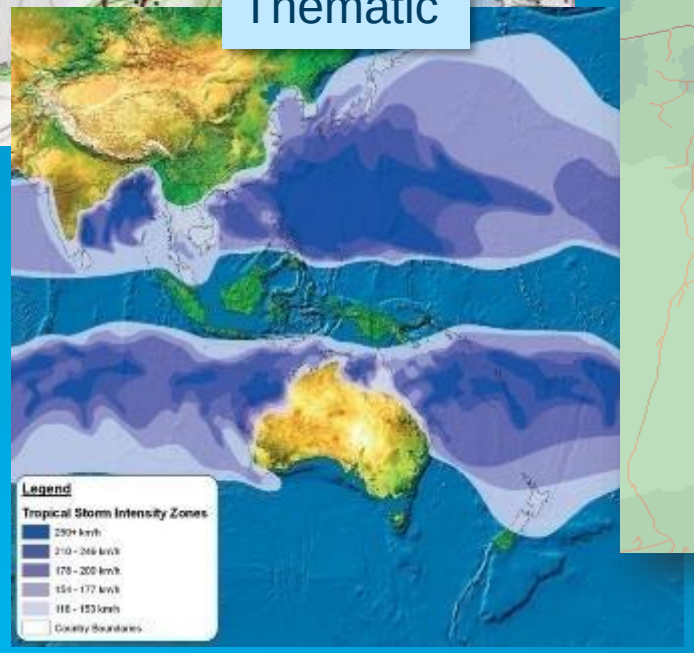
1980

2

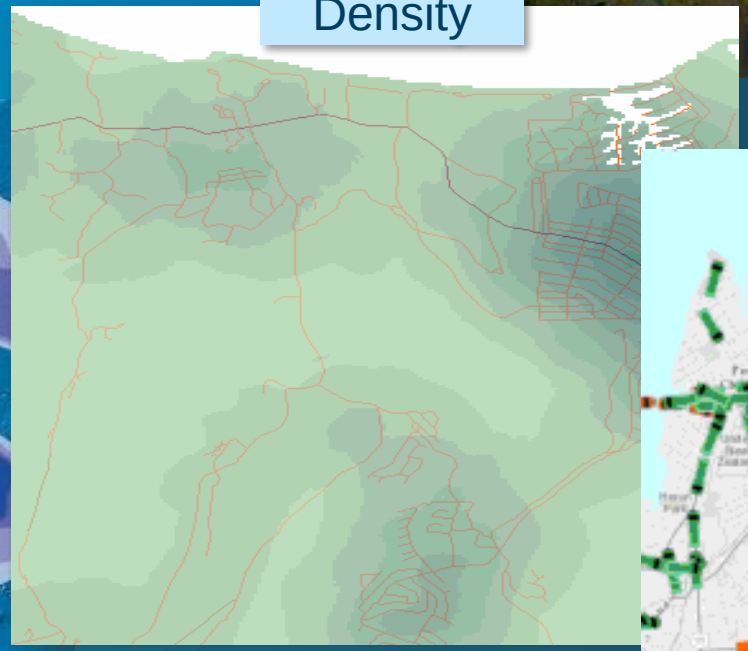
Heat Map



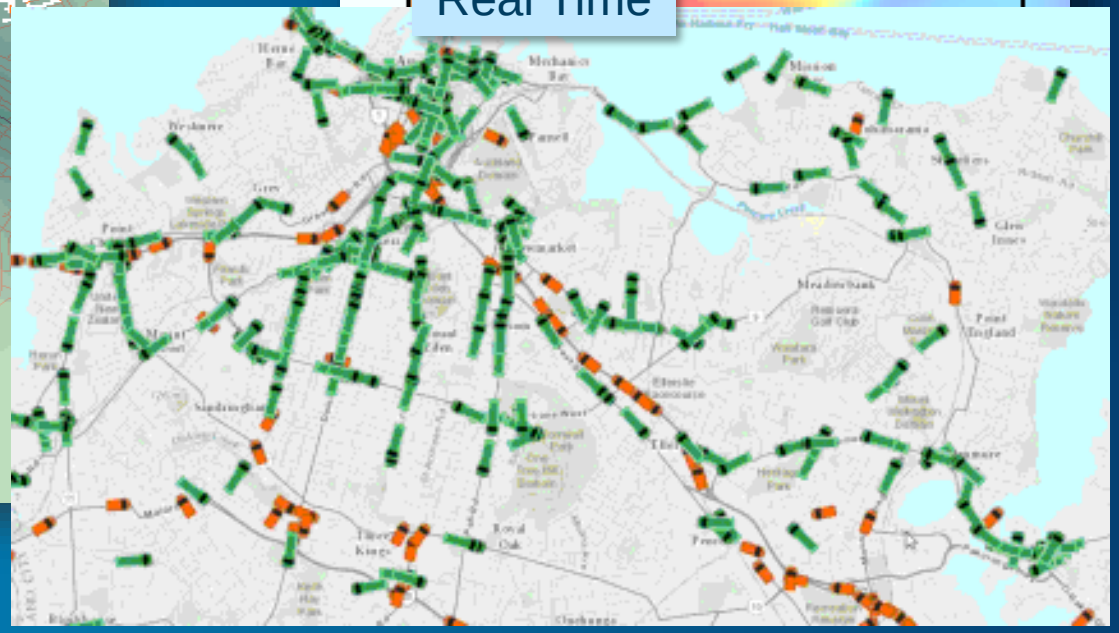
Thematic



Density



Real Time

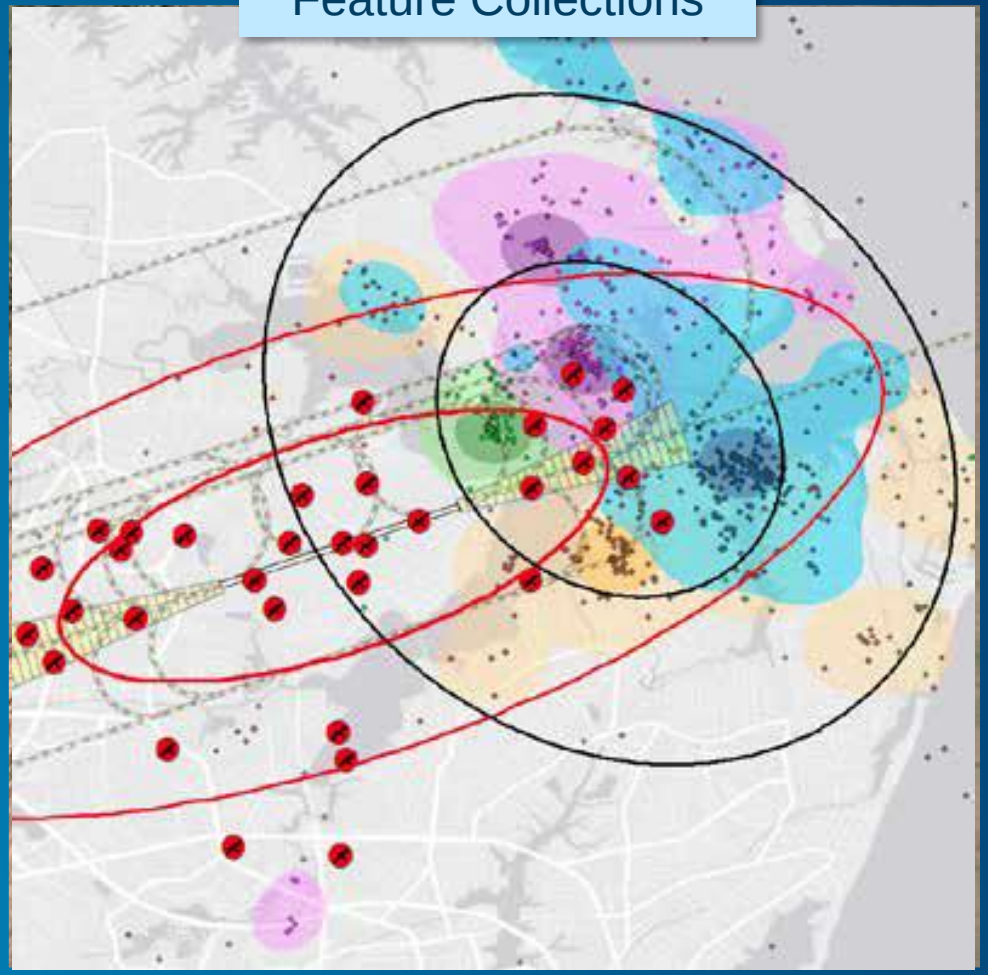


Demo: Maps - Understanding where

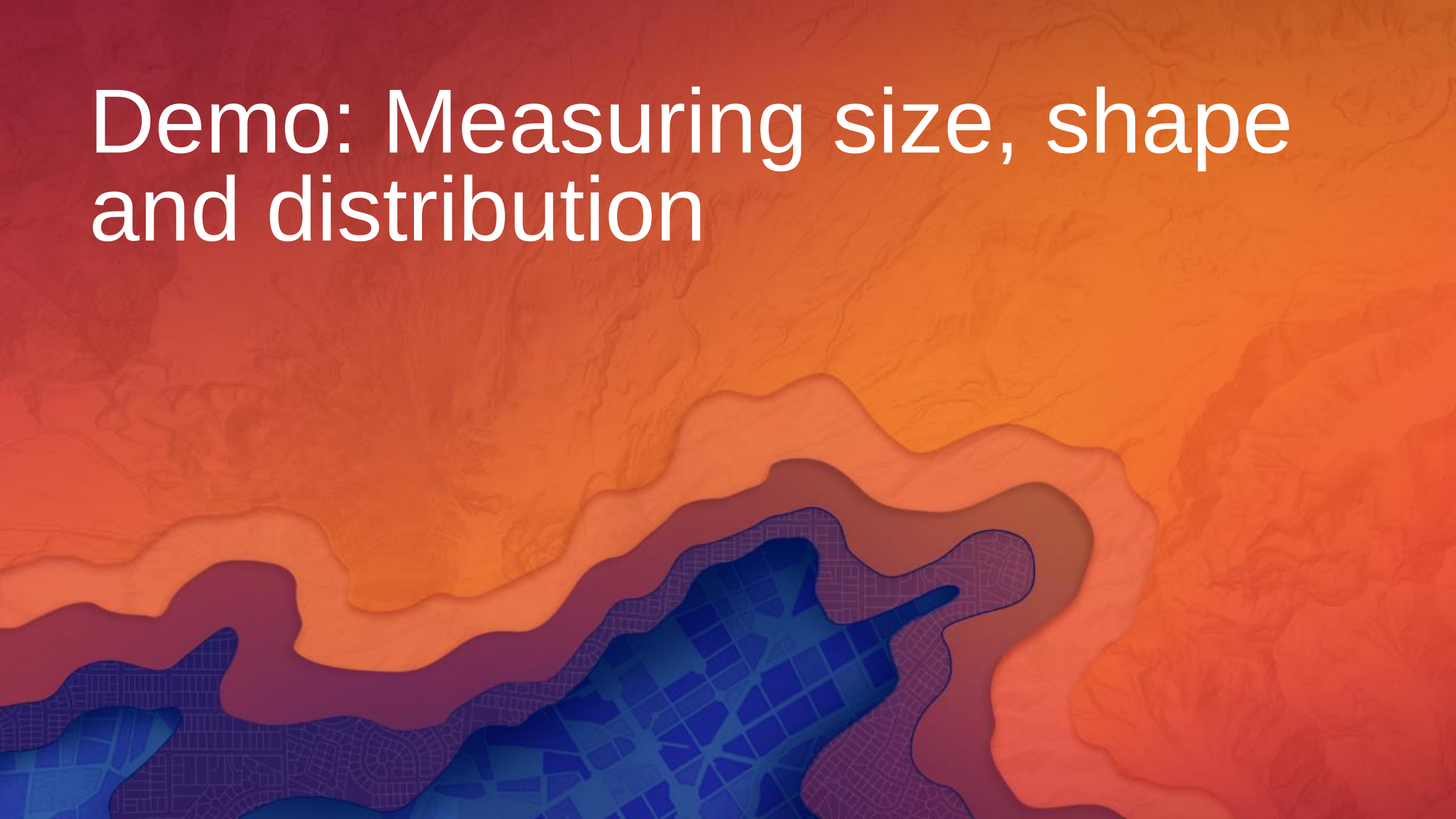
Examples: Calculating size, shape and distribution

Individual geometries

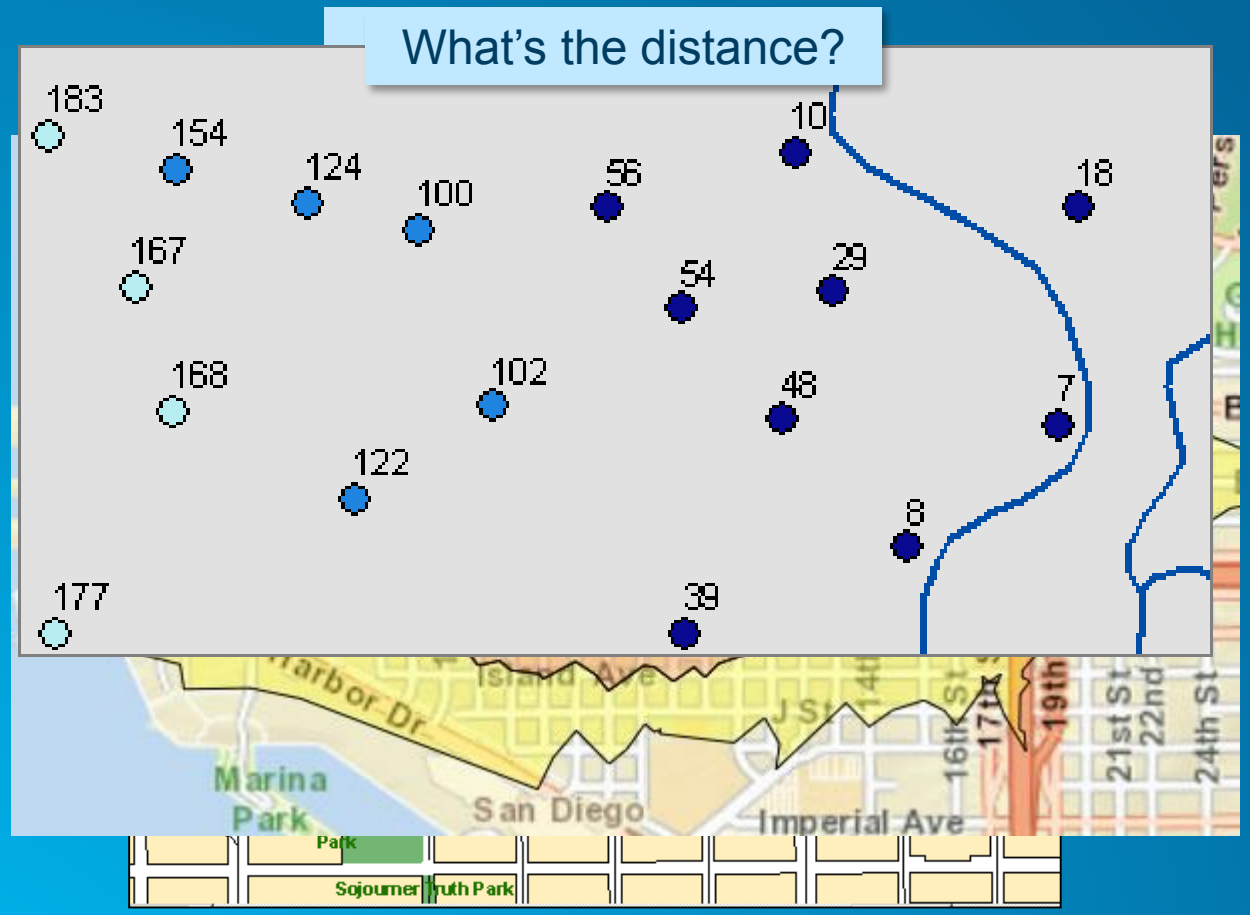
Feature Collections

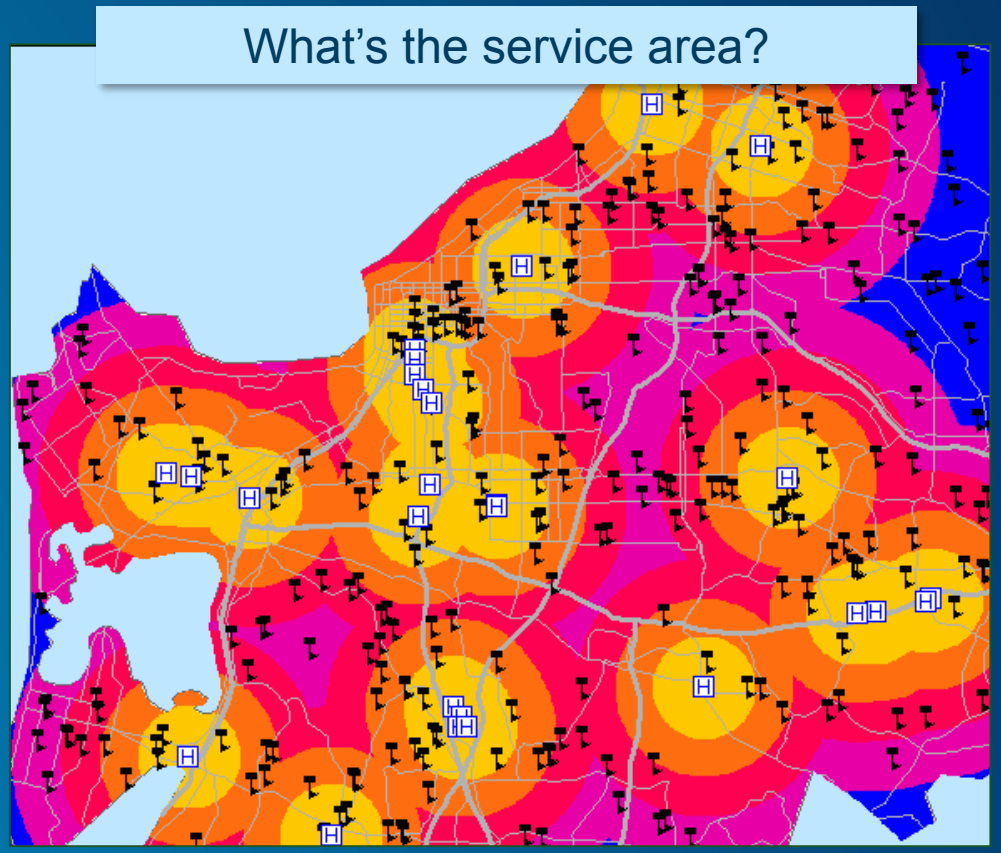


Demo: Measuring size, shape and distribution



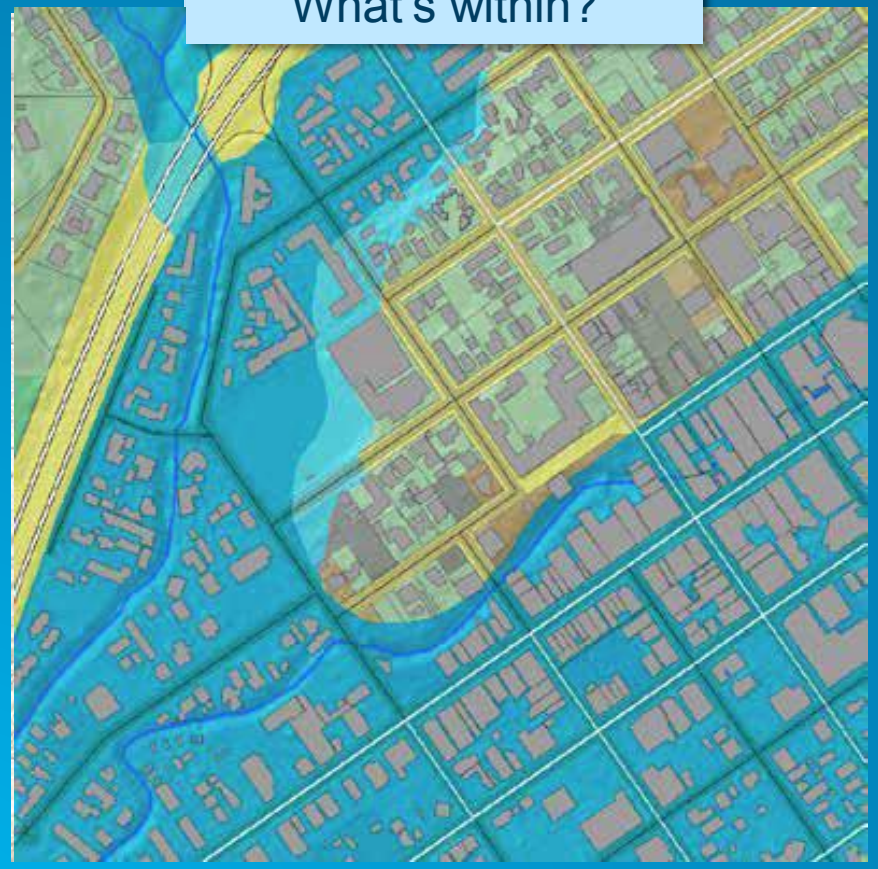
Determining how places are related - Distance



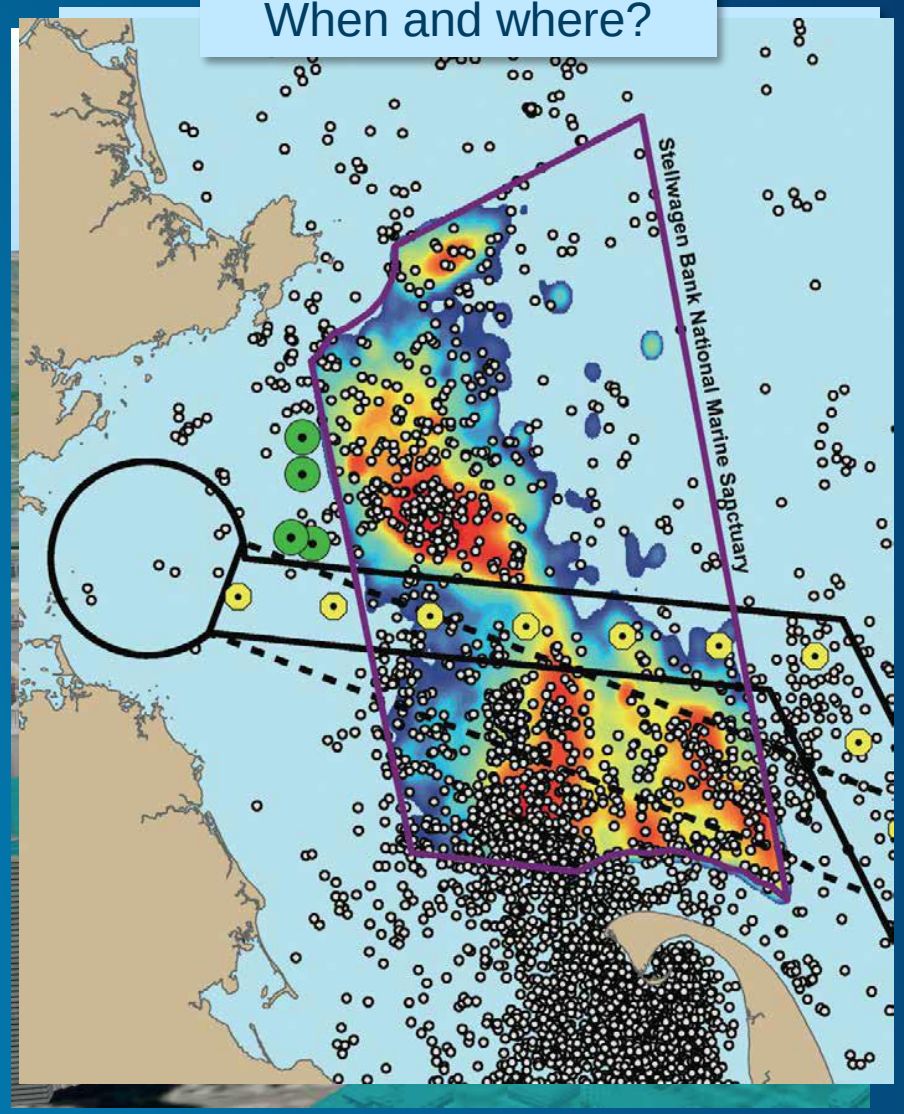


Determining how places are related – Coincidence and Containment

What's within?



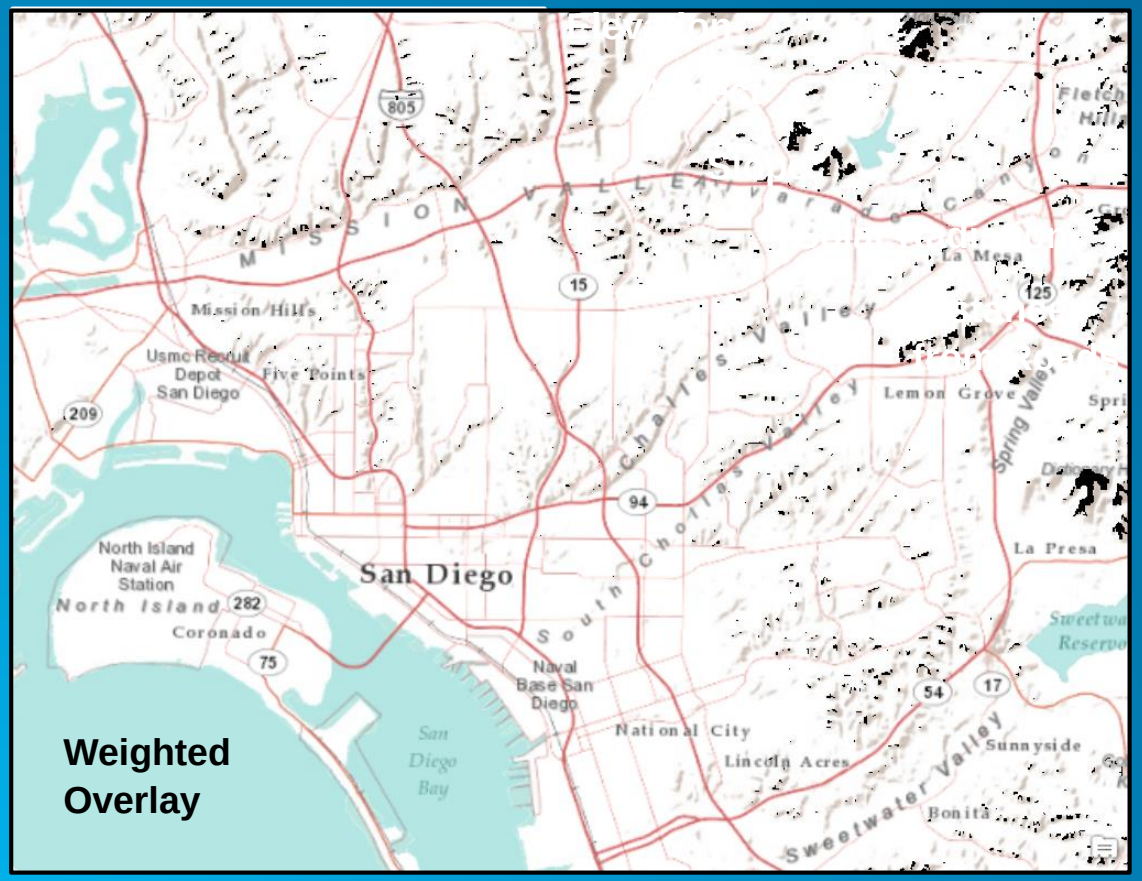
When and where?



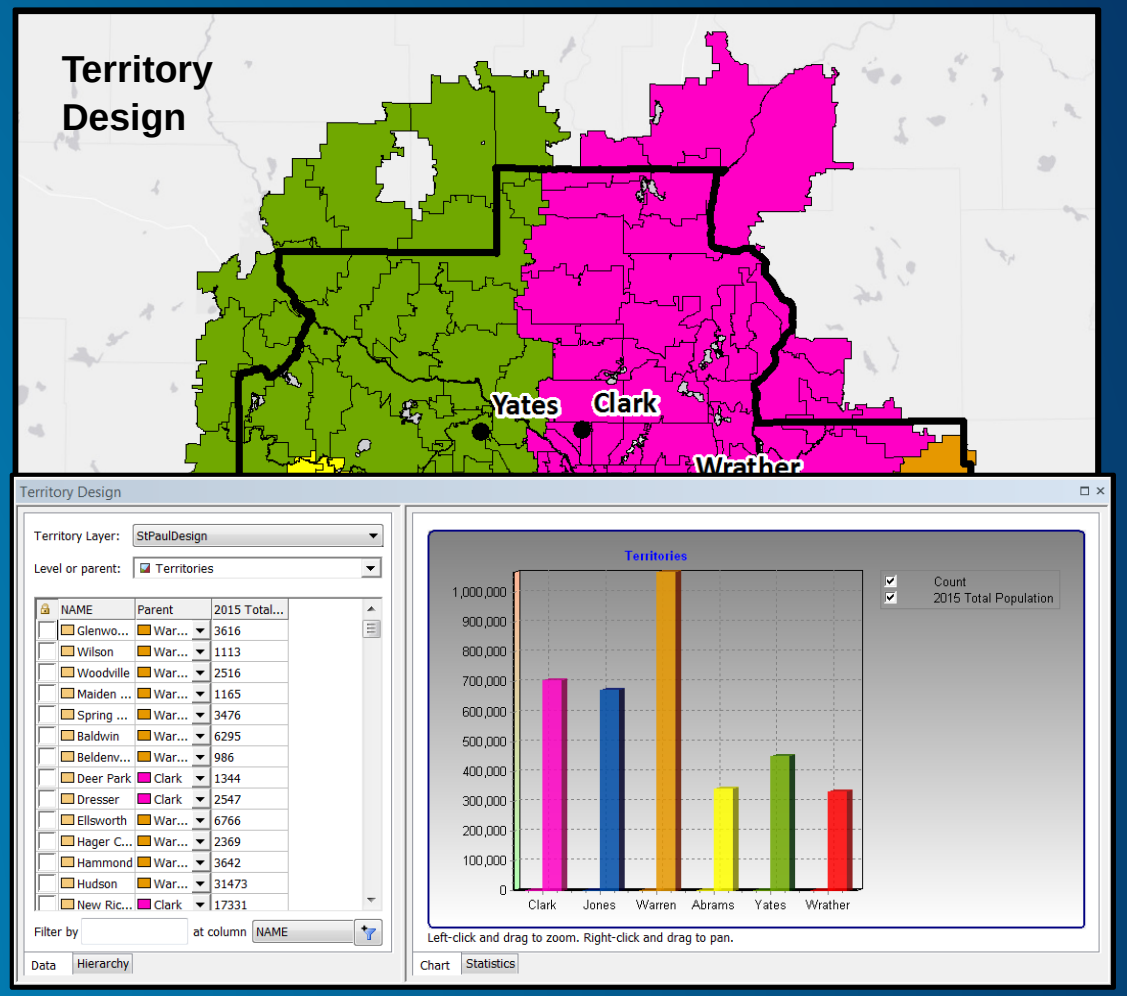
Demo: Determining how places are related

Finding the best locations and paths

11. Finding the best locations that satisfy a set of criteria

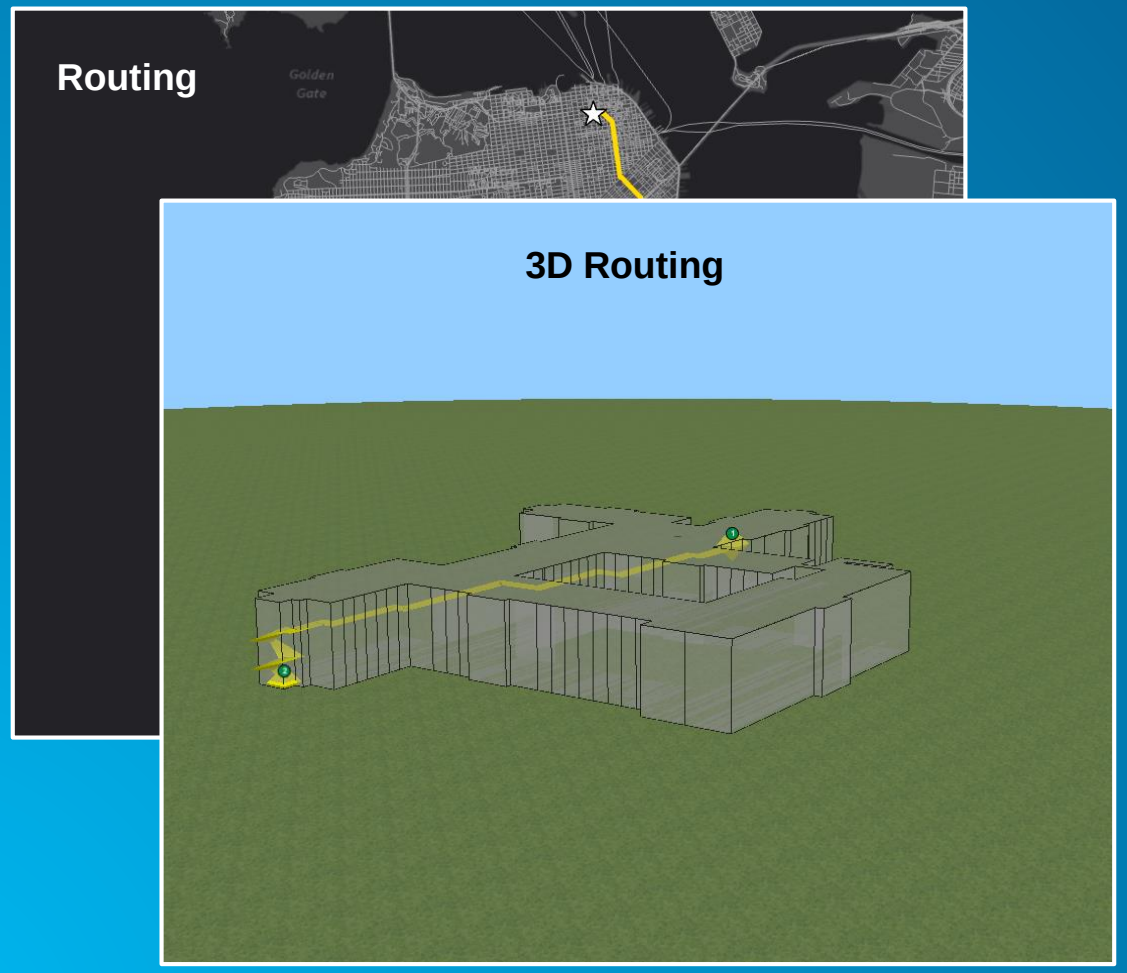


12. Allocating resources to geographic areas



Finding the best locations and paths

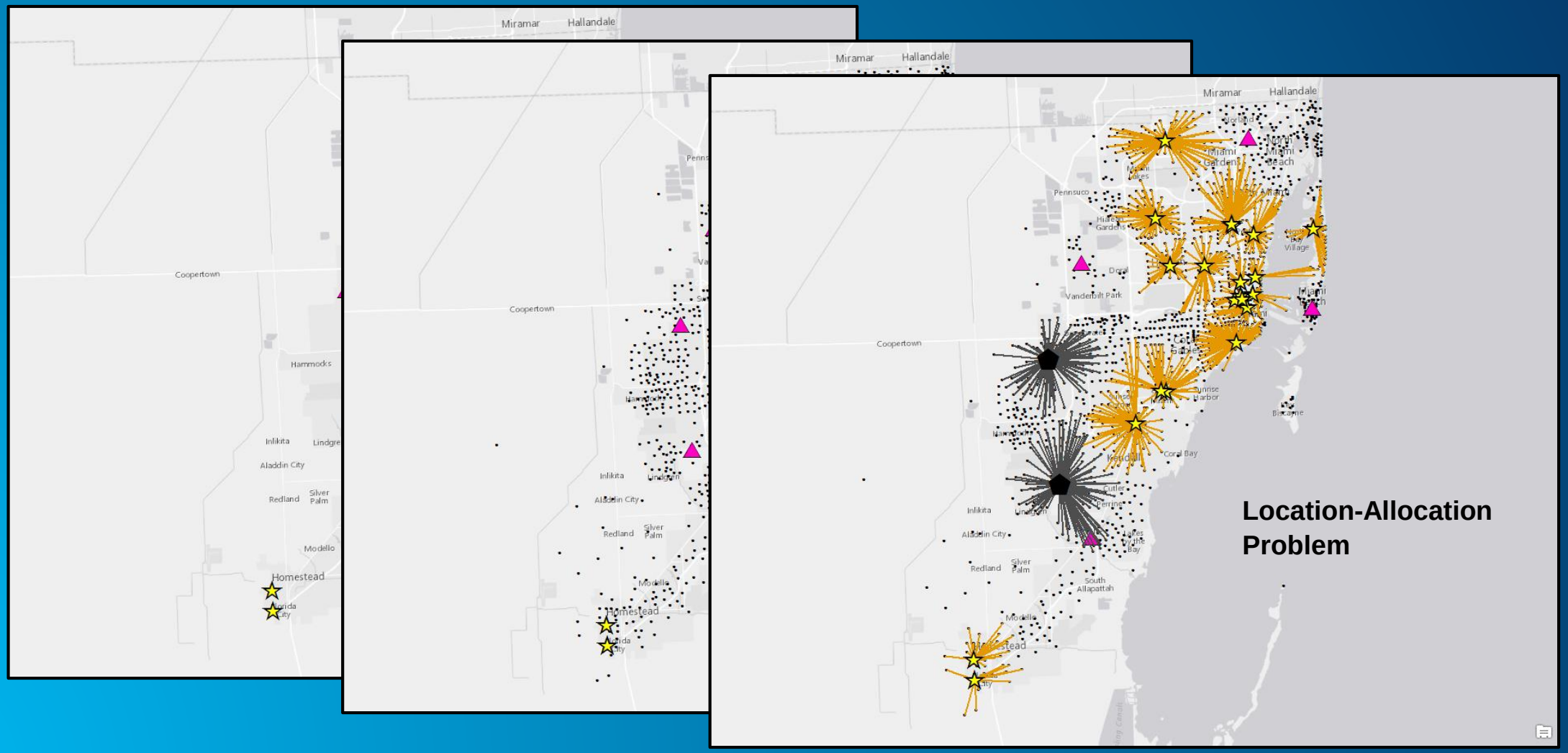
13. Finding the best route, path, or flow along a network



14. Finding the best route, path, or corridor over a terrain

Finding the best locations and paths

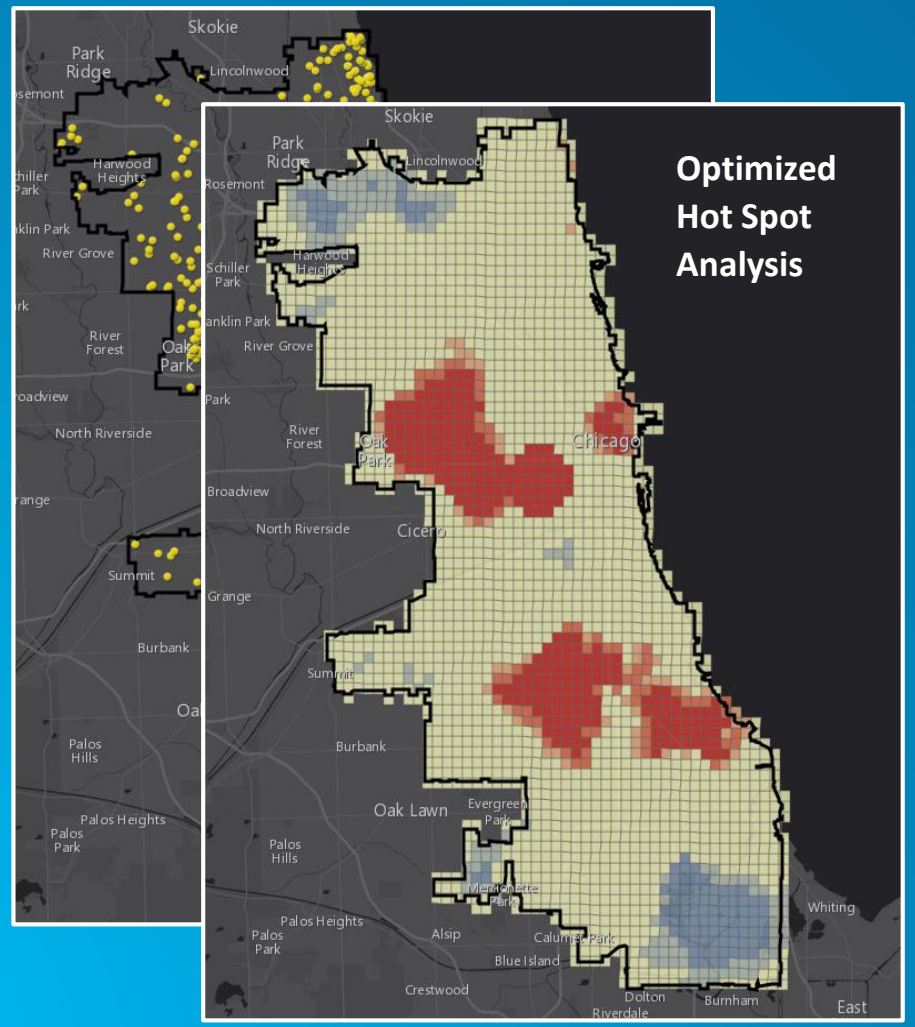
15. Finding the best supply locations given demand and travel network



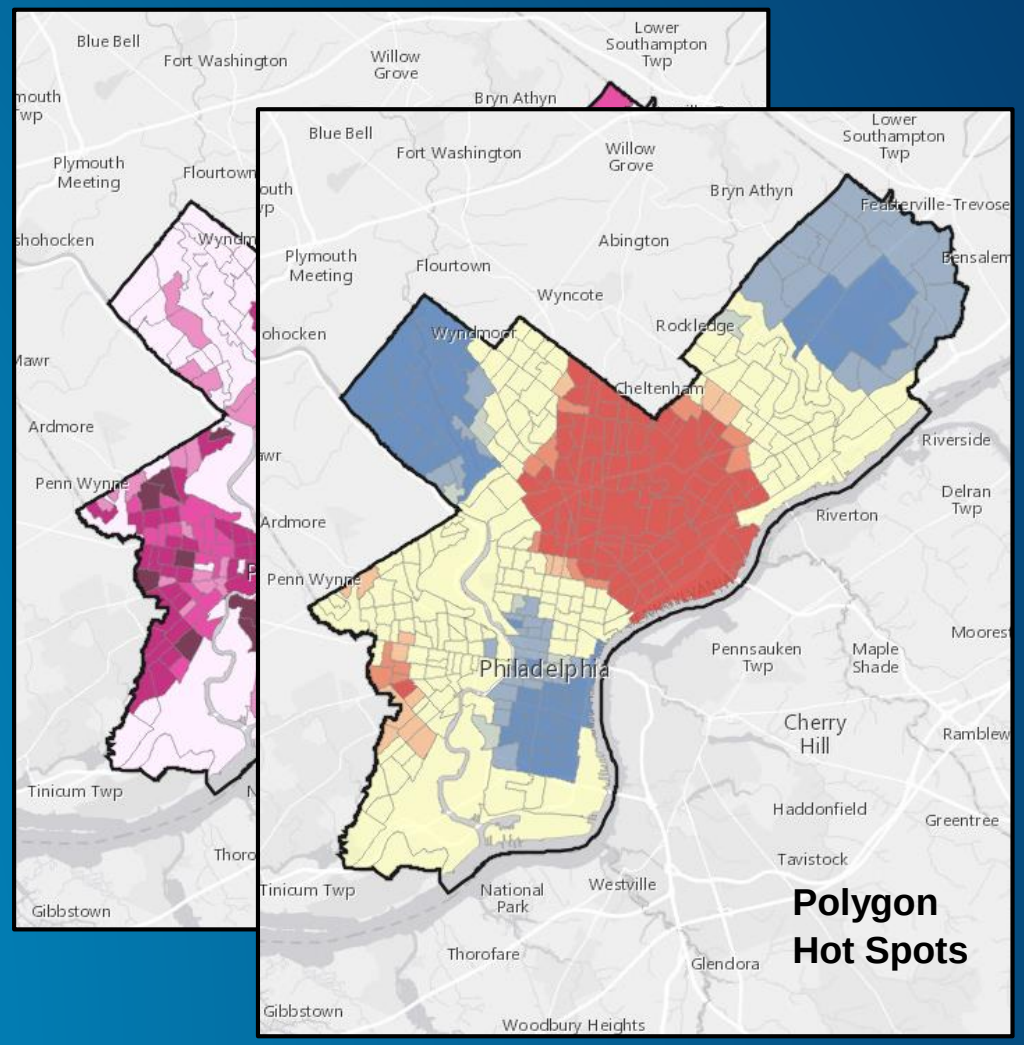
Demo: Finding the best locations - Routing

Detecting and quantifying patterns

16. Where are the significant hot spots, anomalies, and outliers?



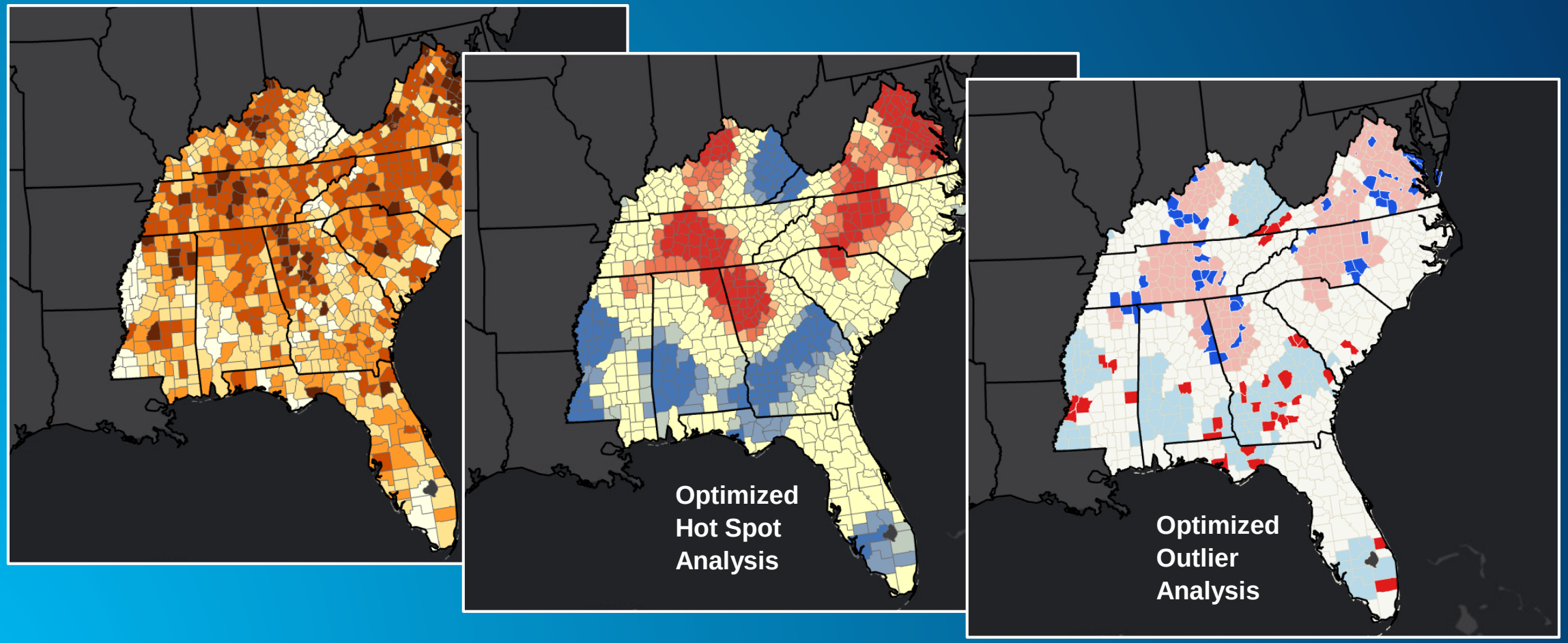
17. Where are the local, regional, and global trends?



Detecting and quantifying patterns

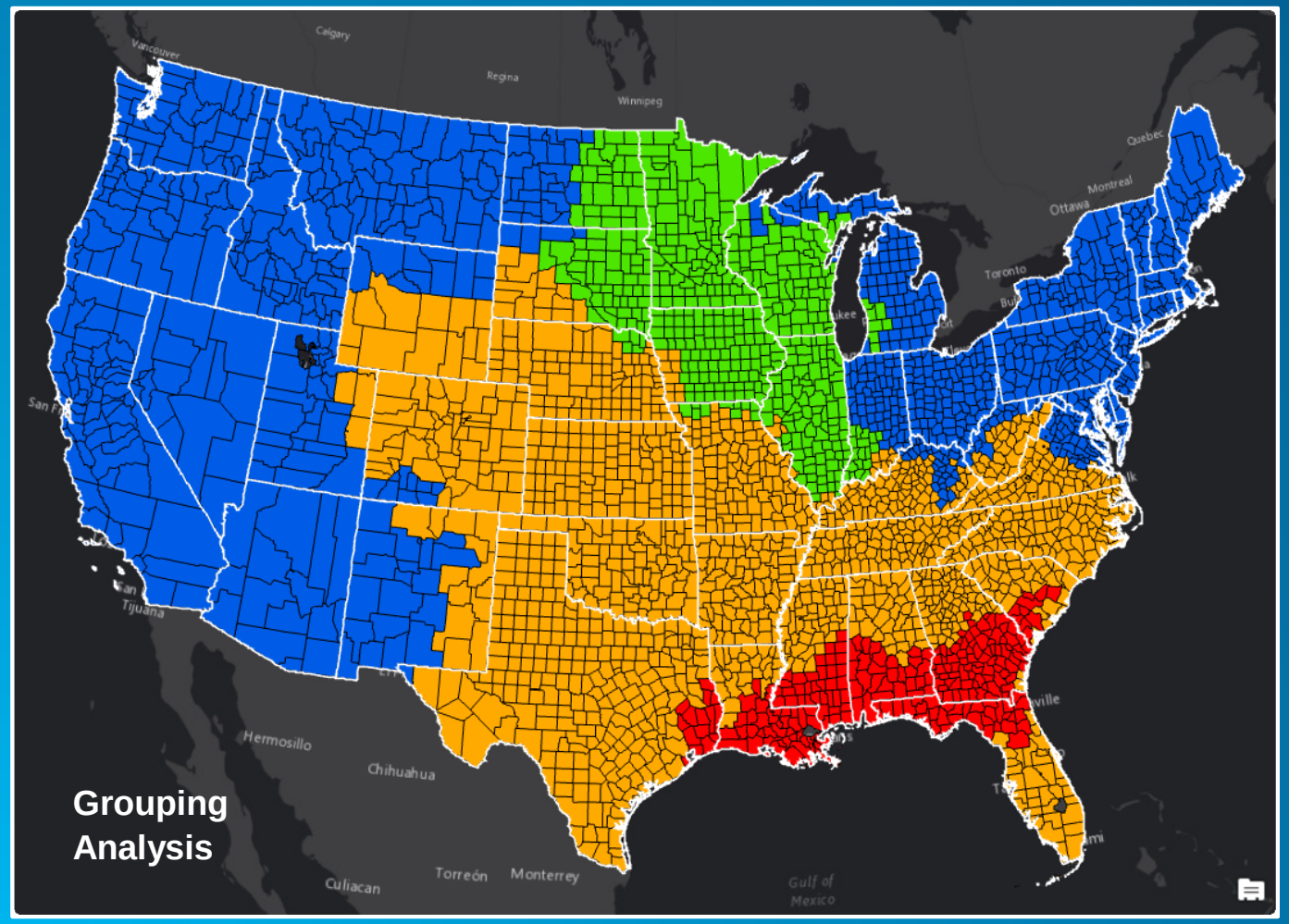
16. Where are the significant hot spots, anomalies, and outliers?

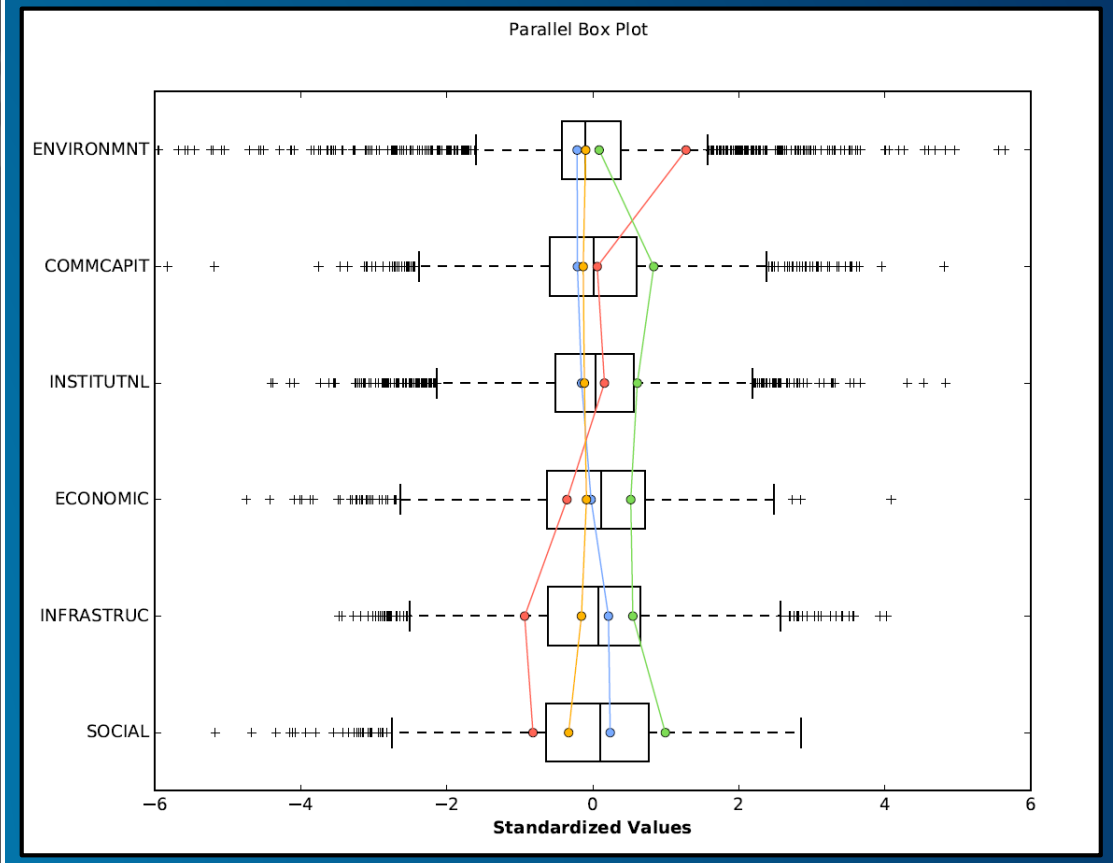
17. Where are the local, regional, and global trends?



Detecting and quantifying patterns

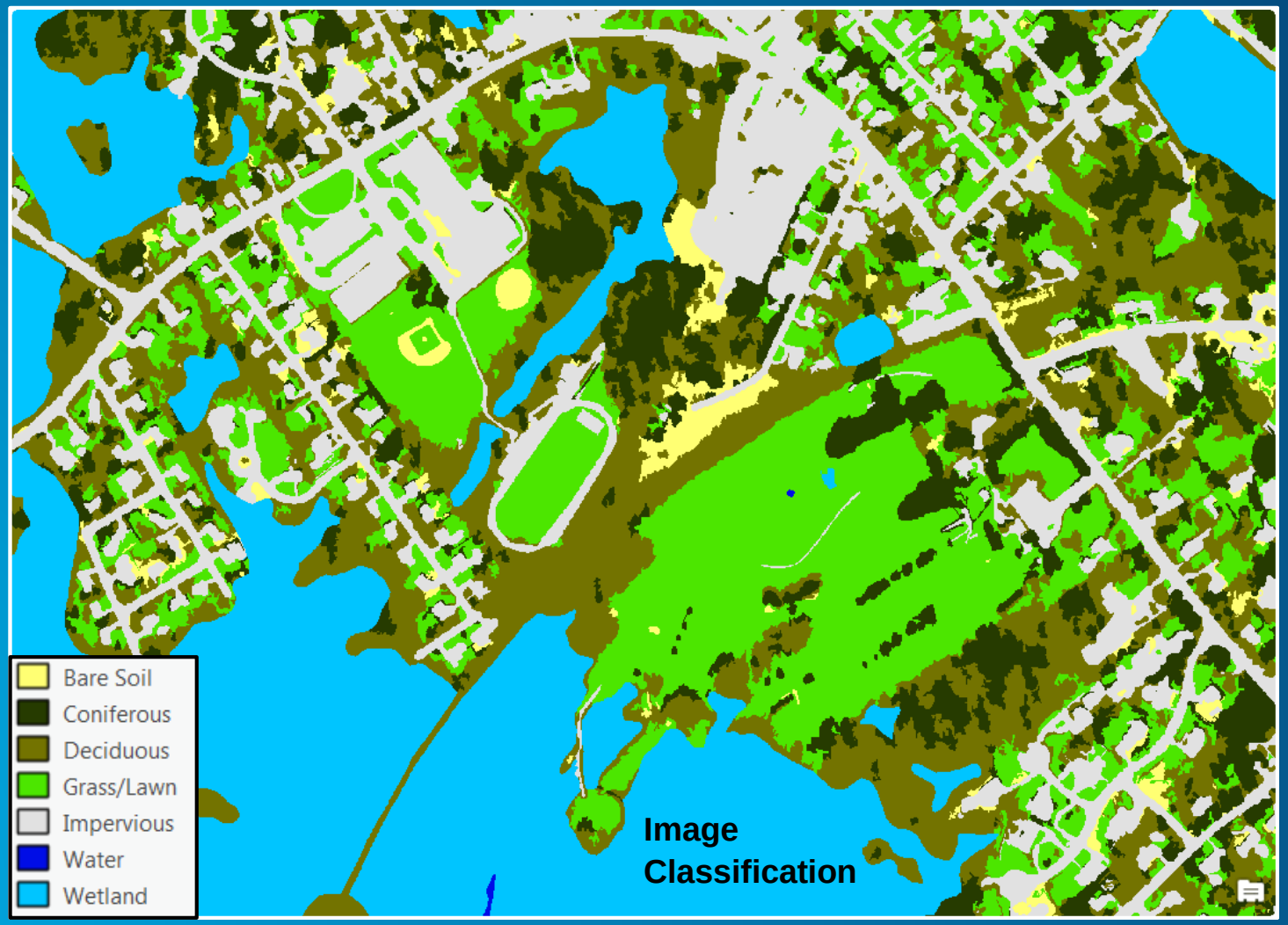
18. Which features are similar, and how can they be grouped together?





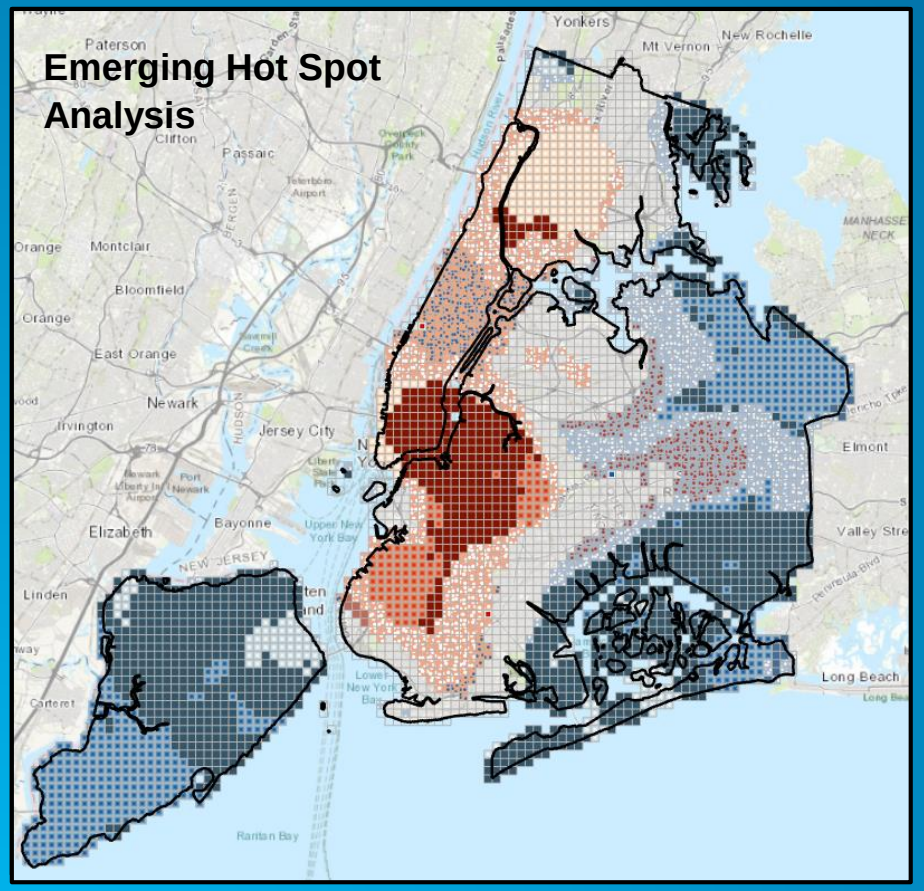
Detecting and quantifying patterns

18. Which features are similar, and how can they be grouped together?

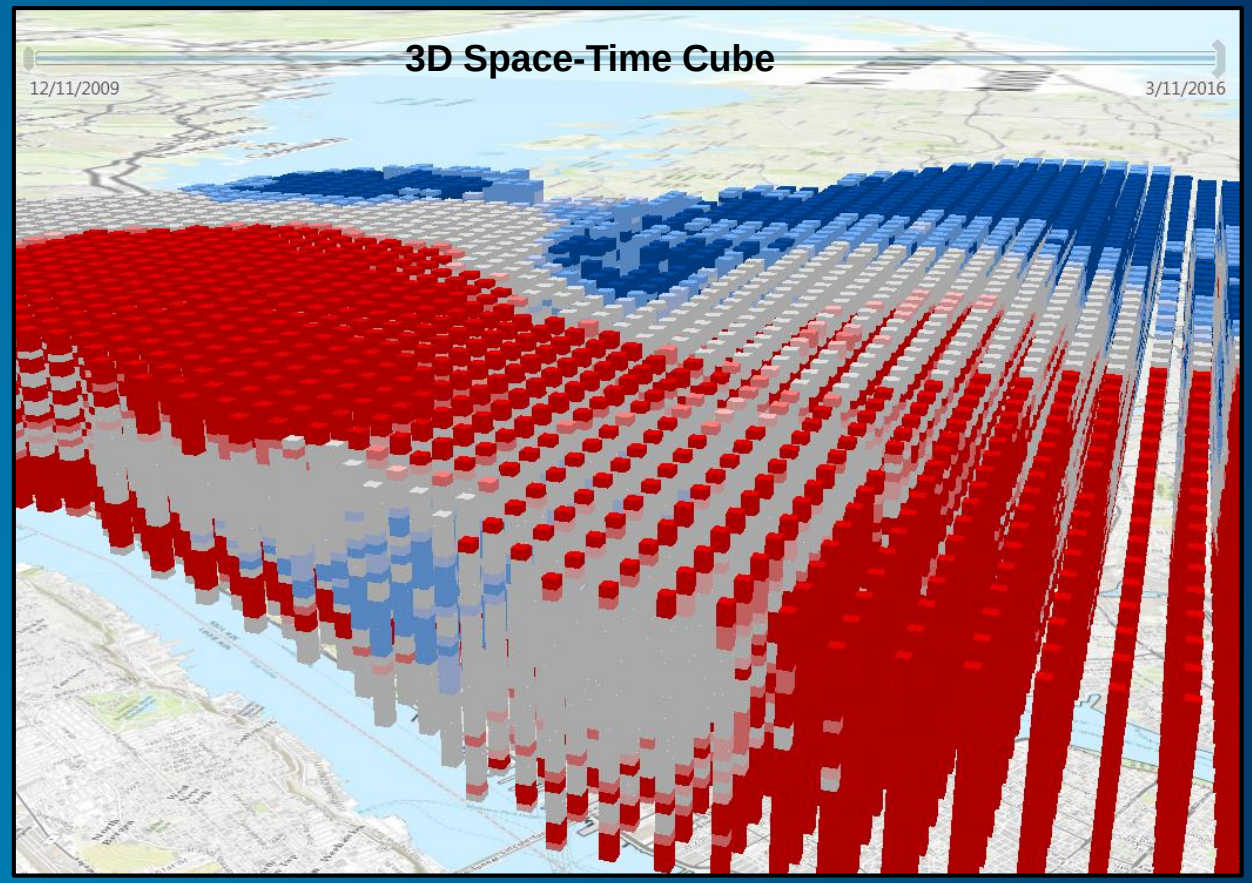


Detecting and quantifying patterns

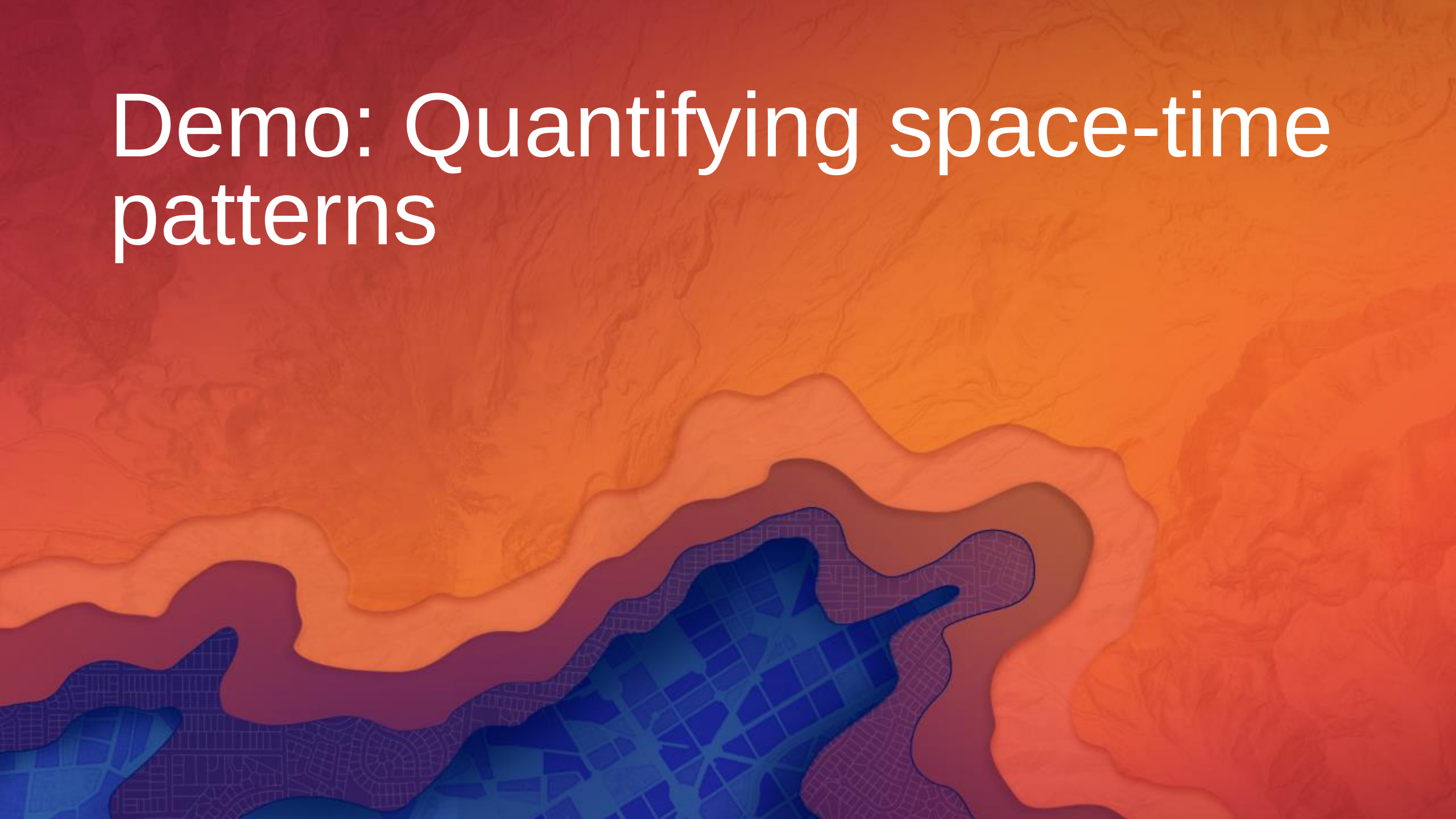
19. Are spatial patterns changing over time?



- New Hot Spot
- Consecutive Hot Spot
- Intensifying Hot Spot
- Persistent Hot Spot
- Diminishing Hot Spot
- Sporadic Hot Spot
- Oscillating Hot Spot
- Historical Hot Spot
- New Cold Spot
- Consecutive Cold Spot
- Intensifying Cold Spot
- Persistent Cold Spot
- Diminishing Cold Spot
- Sporadic Cold Spot
- Oscillating Cold Spot
- Historical Cold Spot
- No trend detected

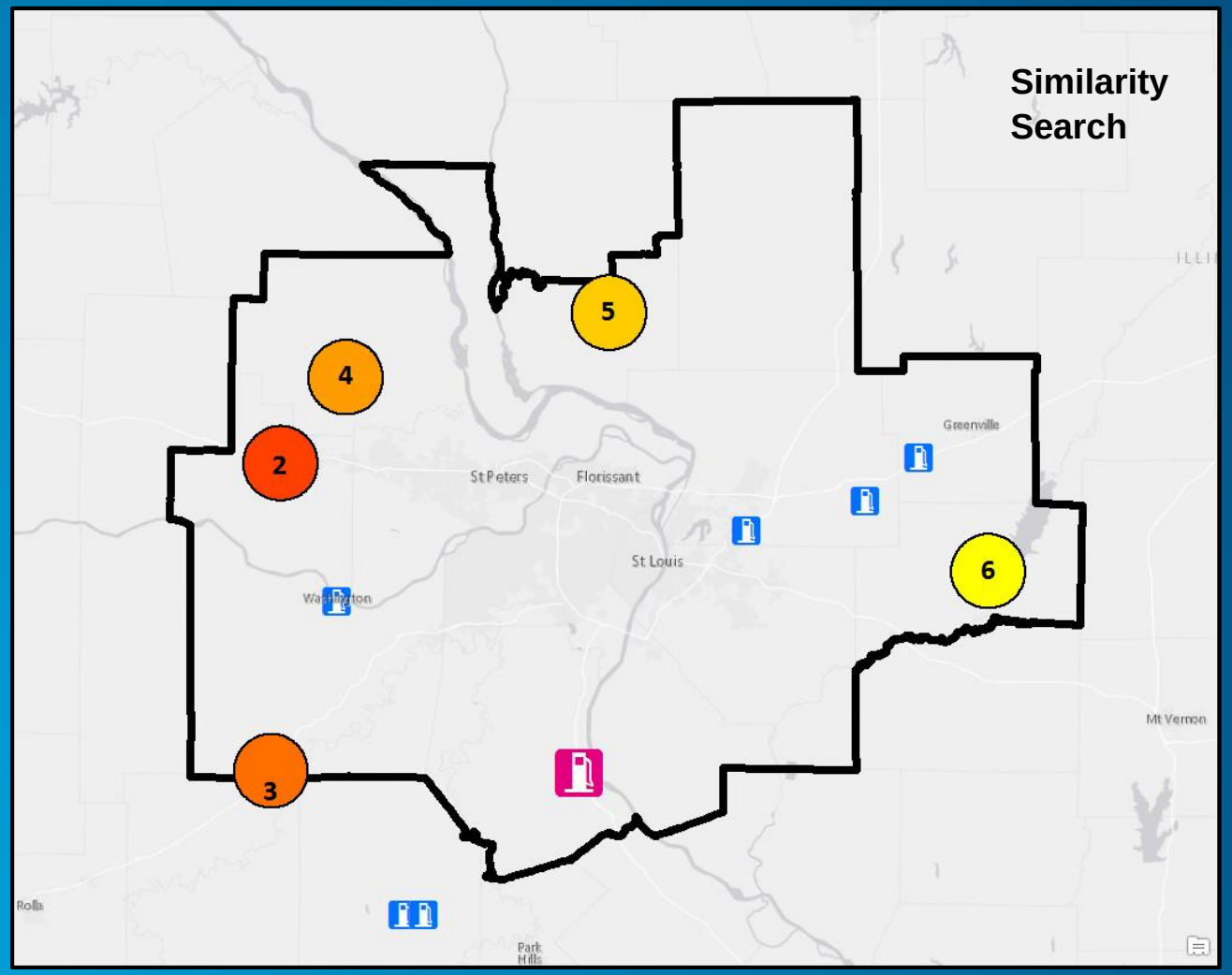


Demo: Quantifying space-time patterns



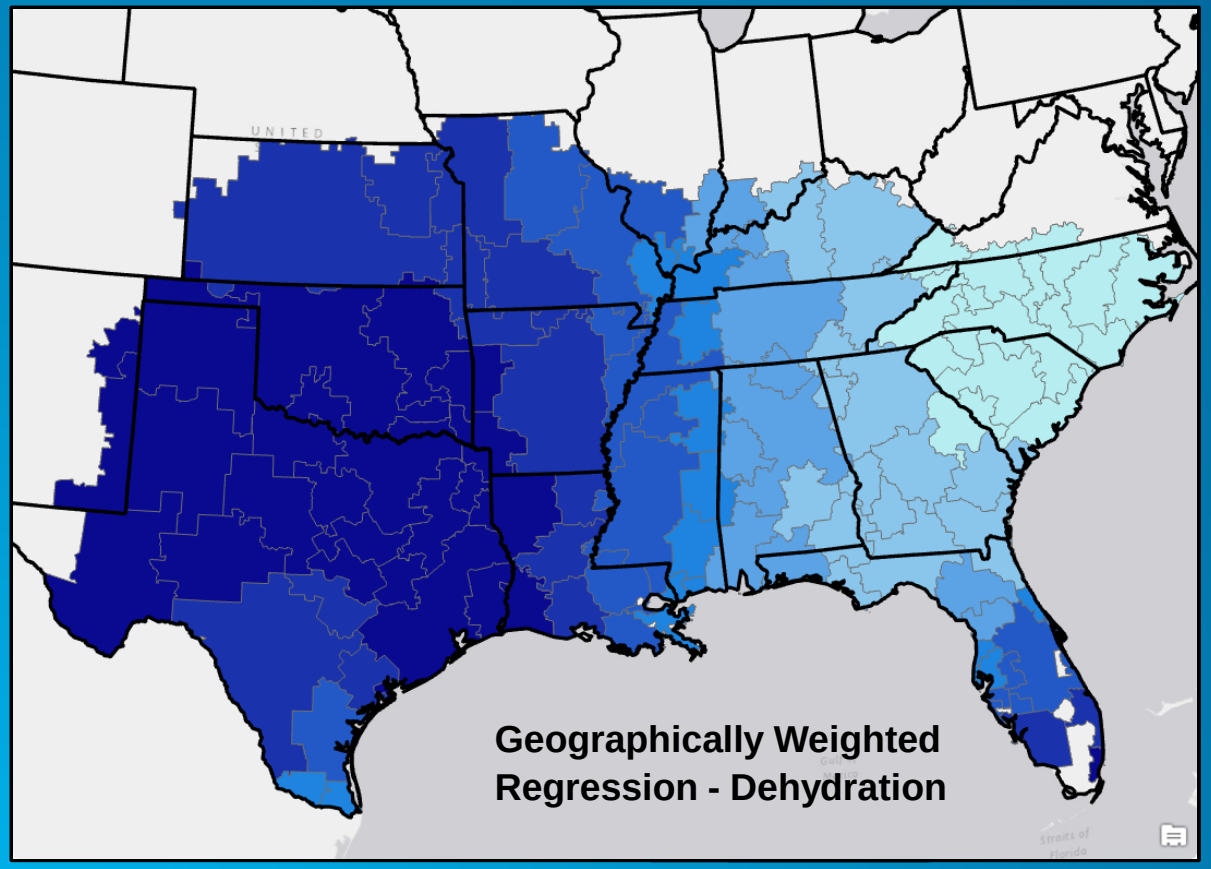
Making predictions

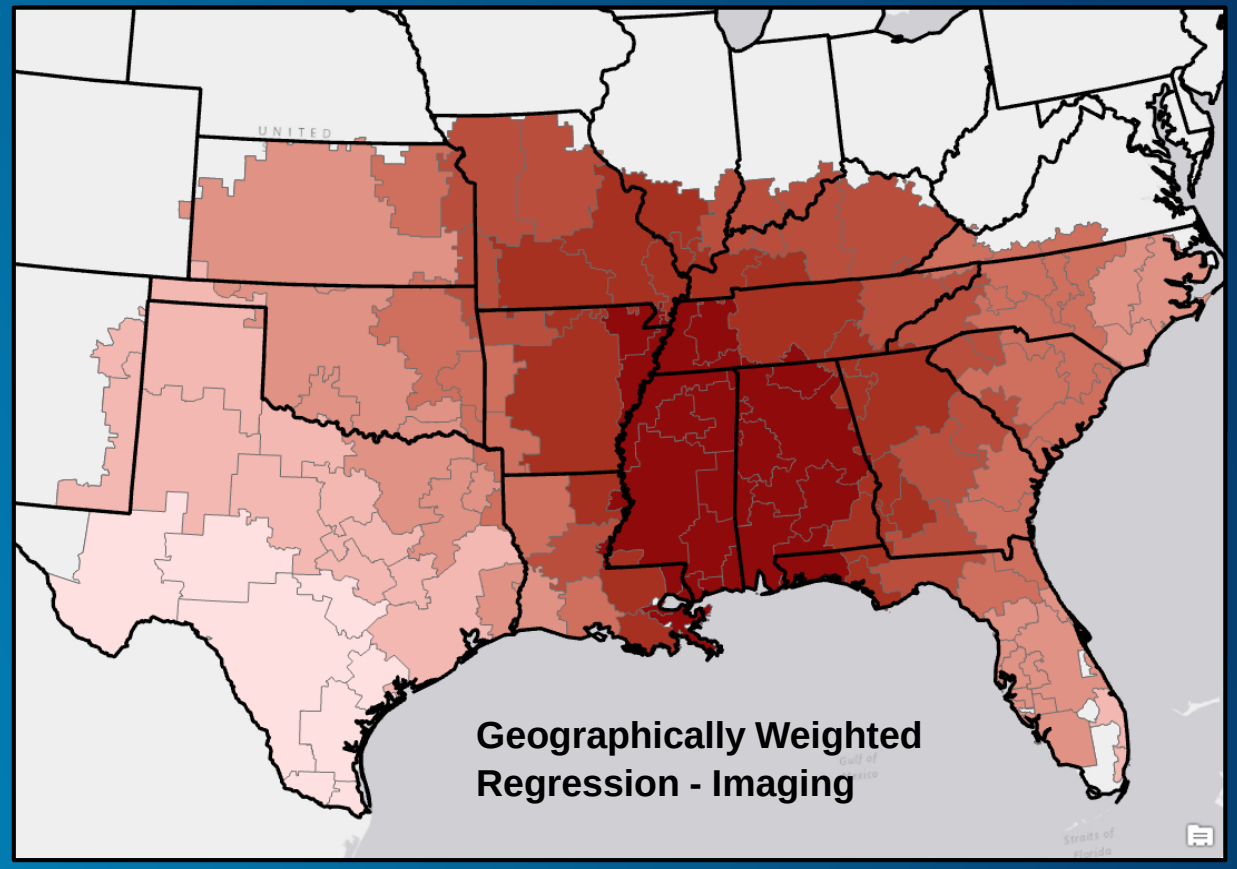
20. Identifying or ranking similar locations?



Making predictions

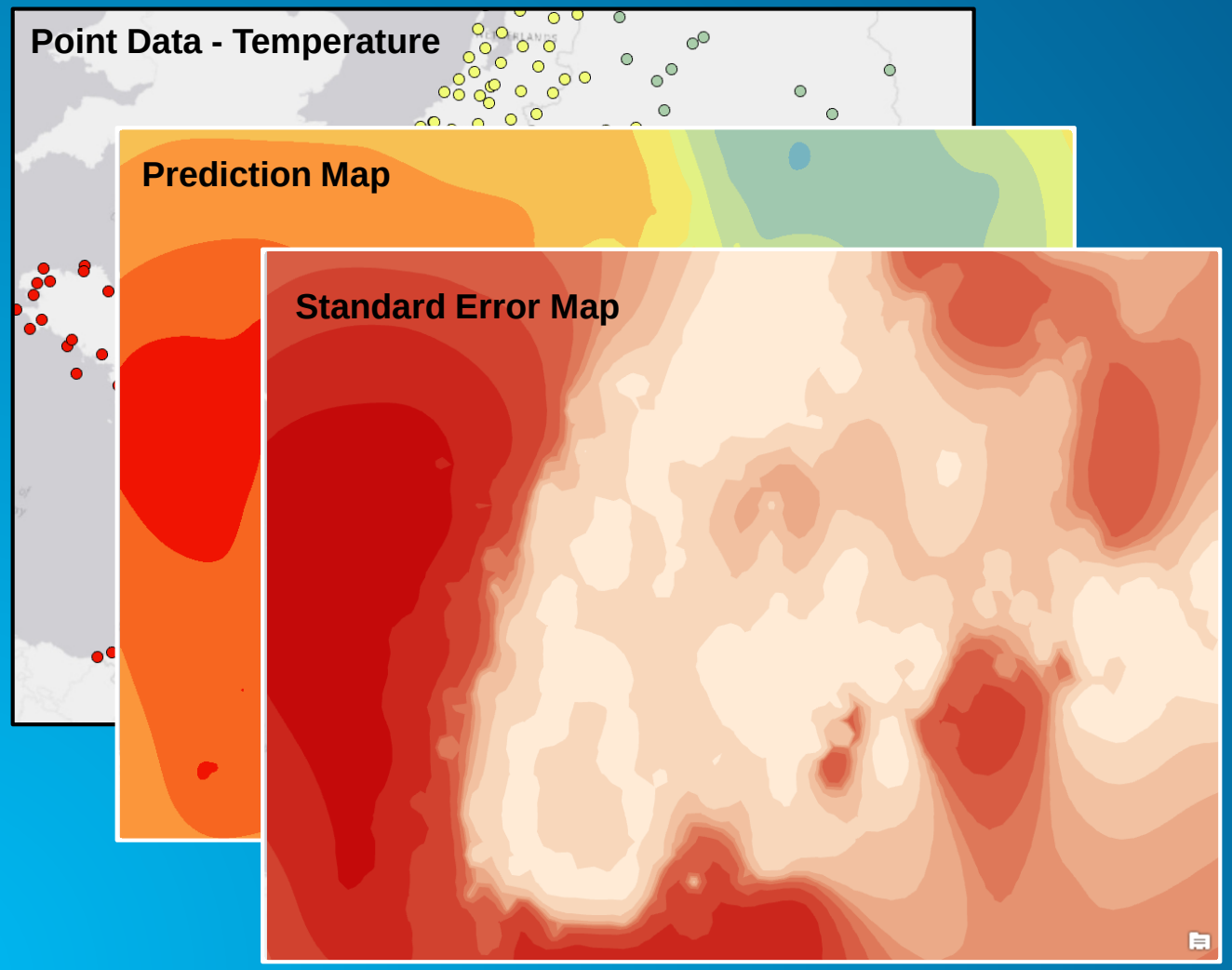
21. What explains or predicts observed spatial patterns?

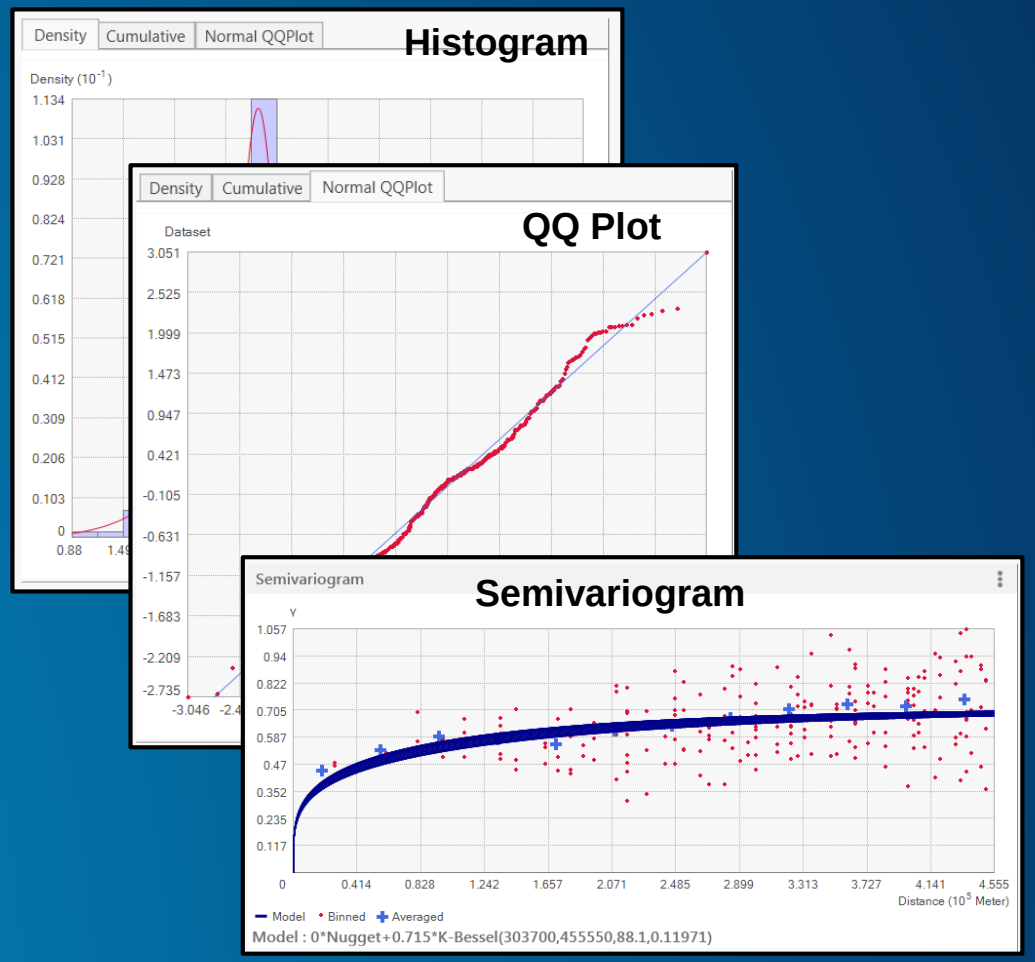




Making predictions

23. Interpolating a continuous surface from discrete sample locations





Demo: Finding similar locations

esri

THE SCIENCE OF WHERE